IMPACTS OF PACKING FACILITY COST ALLOCATION
AND REVENUE DISTRIBUTION RULES
ON PRODUCER RETURNS UNDER
CONDITIONS OF STOCHASTIC
PRICES AND YIELDS

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CHAPTER I

PROBLEM SITUATION

Introduction

Many farmers in depressed sectors of the U.S. agricultural economy are seeking alternatives to traditional enterprises and production practices. Researchers and political leaders are combining forces to explore and promote new farming opportunities. A 1987 regional conference on farming alternatives in the south featured discussions of farmers' experiences with such diverse options as blueberries, catfish, quail, rabbits, muscadines and shiitake mushrooms (Southern Rural Development Center). The most popular farming alternatives identified in a recent survey of 14 southern states were fruit and vegetable enterprises (Estes).

The search for new crops coincides with increased consumer preferences for fresh fruits and vegetables due to nontraditional demand determinants such as concern for health and nutrition (Capps). Per capita U.S. consumption of fresh fruits and vegetables, excluding melons and citrus, rose from 193.3 to 209.3 pounds from 1970 to 1981 (U.S. Department of Agriculture). Even if changes in consumer preferences were not considered, demand for fresh produce should increase due to anticipated changes in the composition of the population, according to a 1986 study in which food demands were projected (Blaylock and Smallwood). Assuming the historical income growth rate of 2%, moderate population growth, and age, regional and racial demographic changes, the study estimated that U.S. demand for fresh vegetables would increase 18 percent by 1990 and

36 percent by the year 2000 over 1980 consumption levels (Figure 1).

Although vegetable production has traditionally been dominated by western states, the last decade has seen significant increases in the production of vegetables such as broccoli and tomatoes in other regions (Love). From 1978 to 1982, the percentage of fresh broccoli produced in the west dropped from 95 to 88 percent. Texas annual production of fresh broccoli and cauliflower has grown 38 and 23 percent, respectively. In Florida, production of tomatos and lettuce for the fresh market has increased at an average annual rate of 8 percent.

The shifts in production regions can be attributed to both changes in comparative advantage and fondness for local produce. Evidence from Tennessee suggests that consumers prefer particular produce grown locally over out-of-state produce when available (Eastwood, Orr and Brooker). The Tennessee study found that 36 percent of the consumers interviewed were willing to pay higher prices to obtain locally grown tomatoes, but not apples and cabbage.

Interest in fresh fruit and vegetable production is particularly high in southern U.S. states not only because of changes in consumer demands and pressure to find alternatives to traditional field crops but also because the climate and soils are generally suitable for horticultural production. In Oklahoma, agronomic and climatological factors as well as market windows have been studied to determine whether Southeastern Oklahoma has the potential to become a commercial fresh produce production region (Sleper, et al.). A feasibility study that examined consumption trends concluded that fresh vegetable production and marketing is a better alternative than production for canning or processing for improving the incomes of small (limited resource) farmers in Southeastern Oklahoma (Tilley, et al., 1984).

Southeastern Oklahoma Project Background

In 1981 RedArk Development Authority, a coordinating agency, was organized as a

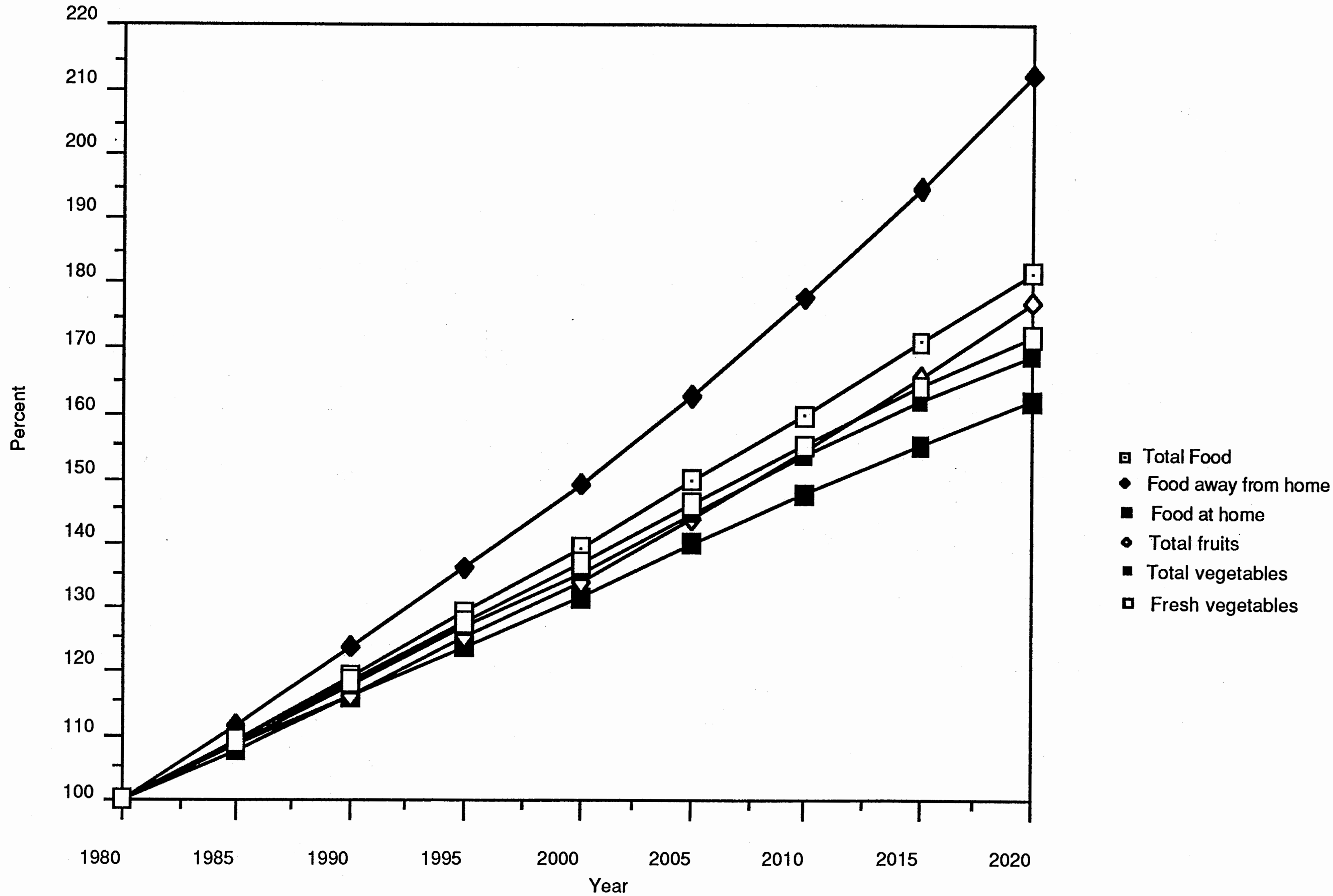


Figure 1. Projected Food Consumption Trends
Source: Blaylock and Smallwood

public trust by the State of Oklahoma to conduct a preliminary resource analysis and oversee the development of a comprehensive multi-purpose regional natural resource program. Agriculture is one of the major sectors addressed by the program.

In pursuance of its primary agricultural objective, which is to develop a fruit and vegetable industry in the area, RedArk opened in 1985 the Three Rivers Produce Company, a fresh produce packing facility (RedArk Development Authority). Once Three Rivers is able to pack a sufficient volume of produce to operate profitably, it will be sold or leased by RedArk to private operators or to a cooperative of vegetable growers (Dayvault, et al.).

Three Rivers faces several obstacles to reaching a profitable level of operation and making a smooth transition from being a subsidized development project to a privately or cooperatively run facility. Projected production levels for 1987 were not achieved due to weather and market conditions, setting back the 1989 goal for profitable operation (Sears). The variability in prices and yields has contributed to Three Rivers' inability to establish a fixed timetable for reaching self-sufficiency. The project has also had problems motivating growers to increase acreage levels. Grower reluctance to expand production could be due to the perceived market and production risks involved.

As the next chapter outlines, there are relatively few methods available to fresh produce growers to shift or reduce price or yield risk to other marketing channel participants or to speculators. The impact that the packing facility can have on the riskiness of the returns to the producers is particularly critical in light of the limited risk management options available to fresh produce growers. It is the hypothesis of this thesis that the packing facility can affect the riskiness of the returns to producers through selection of the policies which govern how revenues are distributed and costs are allocated. These policies need to be examined because inequitable policies could discourage growers or inadvertantly favor production of particular crops.

Objectives of the Study

The general objective of this study is to analyze the impacts on returns to producers of alternative revenue distribution and cost allocation rules of a multi-product fresh produce packing facility operated as a cooperative. Analysis of these rules is conducted under conditions of uncertain yields and prices.

To satisfy these objectives a simulation model is developed. The simulation uses Three Rivers packing facility data as a case study to provide an empirical exercise with a realistic framework. Specifically, the objectives are to:

1. Measure the impact of different combinations of cost allocation and revenue distribution policies under stochastic yield and price conditions on producer returns to fixed resources for Three Rivers producers.
2. Specify the risk efficient set of policies for the different classes of Three Rivers producers using a mean-variance criterion (EV). Farmer classess are based on the crop mix planted.
3. Analyze grower preferences for specific policies for different levels of risk aversion using stochastic dominance with respect to a function analysis (SDRF).
4. Compare the results from the EV and SDRF approaches.
5. Formulate managerial recommendations for Three Rivers based on the results of the study.

Characteristics of the Study Area

The RedArk project area consists of 24 counties bordered by the Arkansas River on the north and the Red River on the south. Three Rivers Produce is located in Atoka County. Slightly less than one-half of the growers who market their produce at Three Rivers reside in Bryan and Atoka counties (Figure 2).

Growing conditions, major crops, soils, and socioeconomic characteristics vary

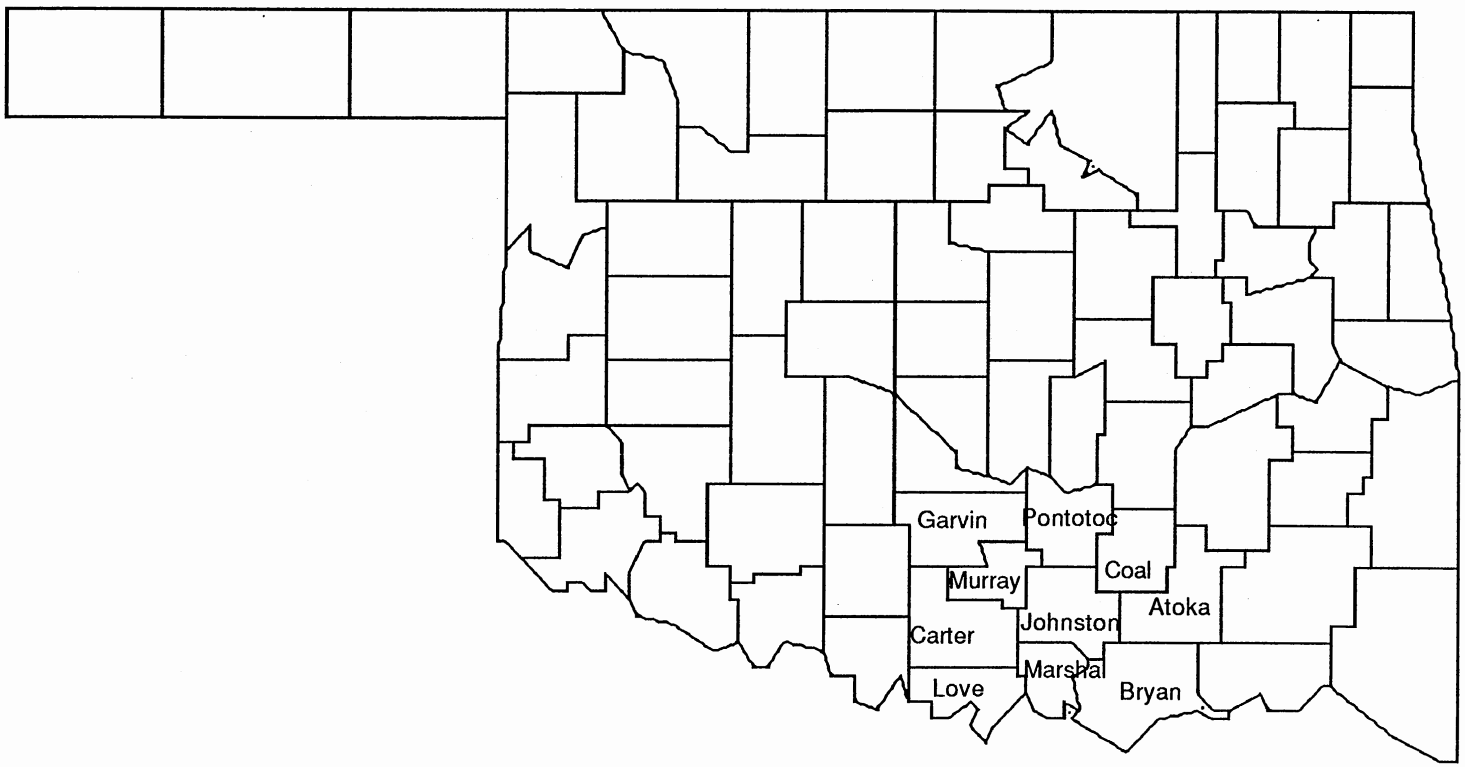


Figure 2. Map of Study Area.

widely over the 24-county region. The characteristics of the study region will be confined to Atoka, Bryan, Carter, Coal, Garvin, Johnston, Love, Marshall, Murray, and Pontotoc Counties where most Three Rivers growers reside.

Per capita income in the study region in 1982 averaged $8,340, and ranged from a low of $5,371 in Atoka County to a high of $11,083 in Carter County, which are 48% and 98% of statewide levels, respectively (Center for Economic and Management Research). Population density is low, averaging 31 people per square mile, compared to a statewide average of 48. Atoka, Coal, and Love Counties have 15 or less people per square mile. Seventy-five percent of the land in the study area is devoted to agricultural purposes.

Statewide agricultural production in 1982 was valued at approximately $3.3 billion. With 6.3% of the population and 9.7% of the land, the study region contributed 6.5% of the value of agricultural output in 1982. Roughly one-half of the total value of state agricultural production in 1986 was from the sale of cattle and calves. As of the beginning of 1987, the inventory of cattle in the study region represented 14% of the state total.

Major field crops in the study region are peanuts, hay, corn, soybeans, and oats (Oklahoma Agricultural Statistics, 1986). Bryan County ranks 7th in the state in oats production, 4th in corn, and 10th in soybeans. Five of the top ten counties in peanut production are located in the study region. Atoka County ranks 5th statewide in hay production.

Average annual precipitation in the south central district is 36.75 inches, slightly higher than the annual state average of 33.32 inches. Considering the climatic and agronomic factors of Atoka County, it has been estimated that vegetables can be successfully grown there for a period of eight to nine months (Sleper, et al.). Average annual rainfall is sufficient for vegetable production, but due to irregular rainfall patterns in the summer, irrigation is necessary for successful vegetable production. Soils suitable for vegetable production are the sandy loam soils with less than 5% slope and good drainage. In Atoka County alone, an estimated 95,000 acres, or 15% of the county, are suitable for vegetable production (Sleper, et al).

Organization of Study

In the following chapter, the theoretical background for the study is provided as is an overview of the relevant literature. Chapter II has three major focuses: (1) the concept of risk in agriculture, with particular emphasis on risk in fresh produce production, (2) the tools used to analyze decisions under risk, and (3) an overview of studies focusing on cost allocation and revenue distribution rules in the cooperative management literature. Chapter III explains the fixed cost and packing allocation rules used and provides an overview of the simulation model constructed and employed in the analysis. Chapter IV provides the results of the simulation modeling and stochastic dominance analysis. Chapter V summarizes the results, discusses managerial recommendations for the packing facility, and suggests areas for further research.

CHAPTER II

THEORETICAL BACKGROUND AND LITERATURE REVIEW

The purpose of this chapter is to review the literature relevant to decisionmaking under risk in order to establish the basis for the analysis that follows. The review includes basic risk concepts, risk management strategies, criteria for selecting the risk efficient alternative among several choices, and packing facility management strategies that influence the risk of fresh produce enterprises.

The first section provides an overview of the risk concepts in agricultural economic analysis as well as the sources of risk. Responses available to agricultural producers to mitigate the adverse impacts of risk are examined. Discussion of risk sources and responses is made with special emphasis on the production and marketing environment of fresh vegetable growers in a new production region. The second section of this chapter reviews optimization and simulation, the two primary approaches to analysis of risk strategies in agriculture. In addition, the use of stochastic dominance criteria to order risky alternatives is covered in the second section.

The third and final section reviews the literature concerning cooperative management and decisionmaking, and focuses on empirical studies which have examined operating strategies such as the ones considered in this analysis. The final section is relevant because the cooperative form of organization is a feasible alternative for Three Rivers growers to pursue when RedArk relinquishes control of the packing facility. In addition, the bulk of the literature concerning packing facility management occurs within the context of cooperatively owned facilities.

Risk in Agriculture

Basic Concepts of Risk

The two basic concepts or measures of risk are (1) the "chance of loss" or safety first concept in which the decision maker's goals give highest priority to avoiding some "disaster" level of income before profit maximization is considered and (2) measures of variation from expected values. In Figure 3, the concept of chance of loss is compared to the mean-variance measure of risk. The probability that profits will fall below the disaster level of income is greater for distribution 1 than for distribution 2 in both figures 3a and 3b so distribution 1 is considered riskier than distribution 2 in both figures under the chance of loss concept. In Figure 3a distribution 2 has a higher variance and is considered riskier than distribution 1 under the mean-variance concept of risk. Distributions 1 and 2 in Figure 3b cannot be ordered because both have equal means and variances. Both chance of loss and mean-variance concepts have been used extensively in agricultural applications (Young).

Three different safety-first rules (Telser; Kataoka; Roy) are described in Robison, et al. (1984) and Hazel and Norton. Since safety-first rules involve sequential ordering of goals, they are referred to as lexicographic ordering. Research involving multiple goals in firm level studies includes efforts to determine the impact of multiple goals and alternative specifications of multiple goal objective functions on optimal production patterns and farm growth and survival (Dobbins and Mapp; Harmon; Hatch; Candler and Boehlje).

The second and more widely used concept of risk uses some measure of variation from expected values such as the mean-variance (EV) model (Markowitz) or the mean-absolute deviation (EA) model (Hazell). The EA model measures risk in terms of total absolute deviations from the expected level of income or returns and is a modification of the EV model which dates back to Markowitz's work in the 1950s on portfolio

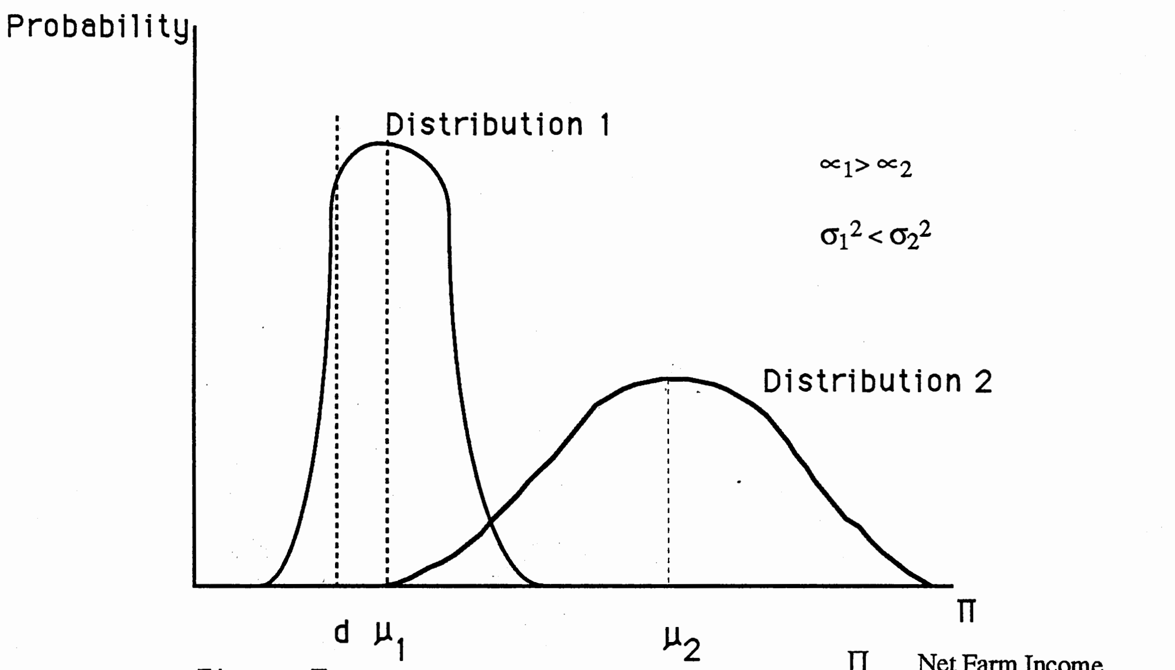


Figure 3a.

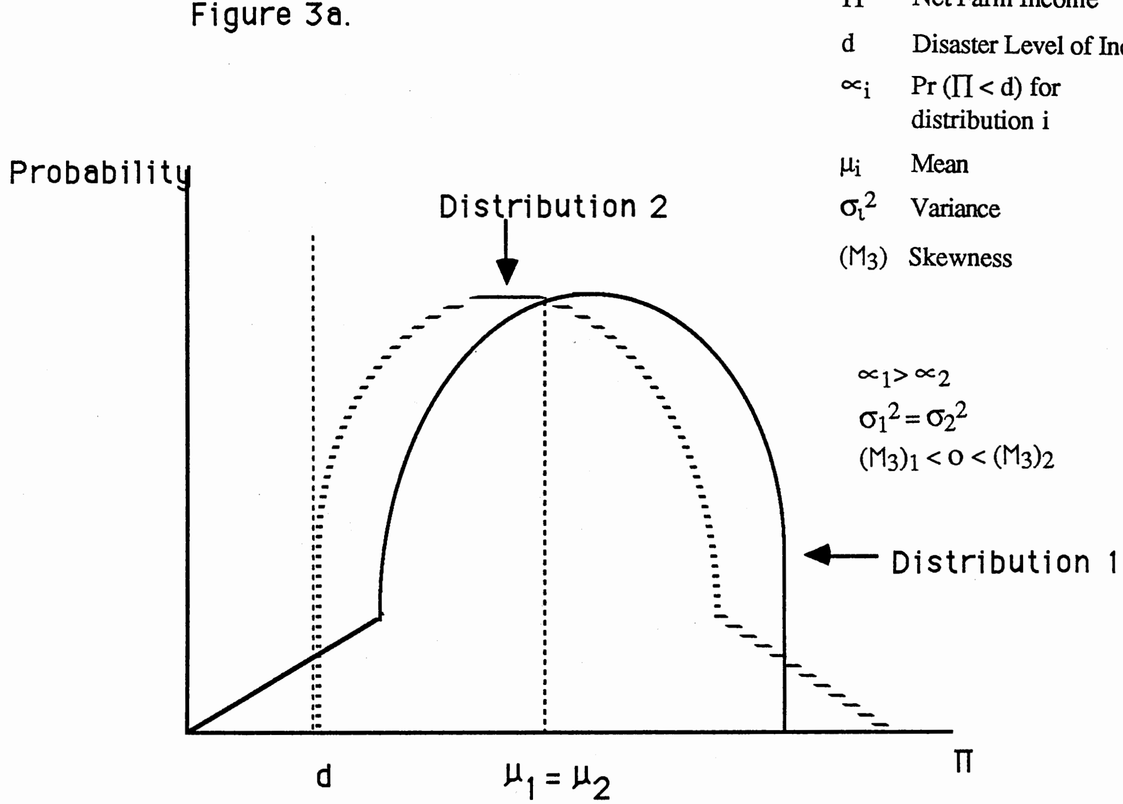


Figure 3b.

Figure 3. Risk Measures
Source: Young

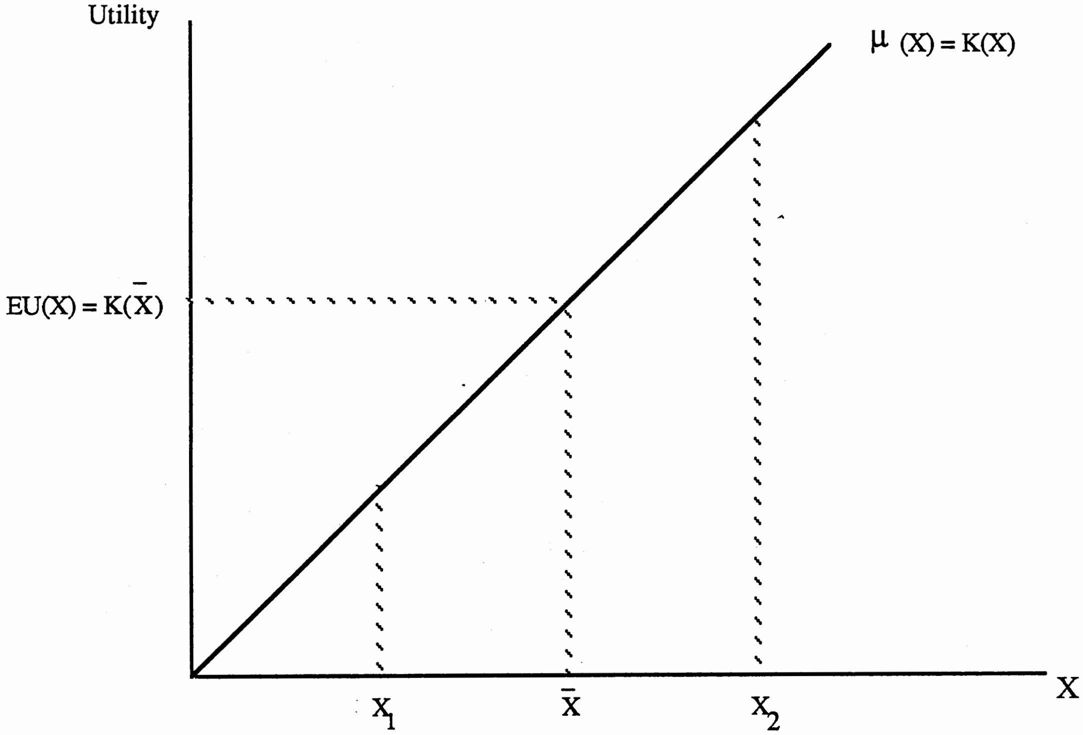
diversification. Markowitz showed how investors can reduce investment risk by choosing stocks which do not move together, or have lower correlation coefficients.

The EV model is consistent with the expected utility model which has been the major paradigm of the theory of decision making since World War II (Shoemaker). The expected utility model (EUM) infers that decision makers who obey the axioms of ordering, transitivity, choice substitution and certainty equivalents (von Neumann and Morgenstern) will select alternatives that maximize their utility. The concept of expected utility developed from the 18th century work of Daniel Bernoulli who observed people in gambling situations unwilling to pay much to play a game of chance with infinite expected monetary outcomes, the "Petersburg paradox" (Shoemaker). Bernoulli considered that people maximize utility rather than monetary outcomes.

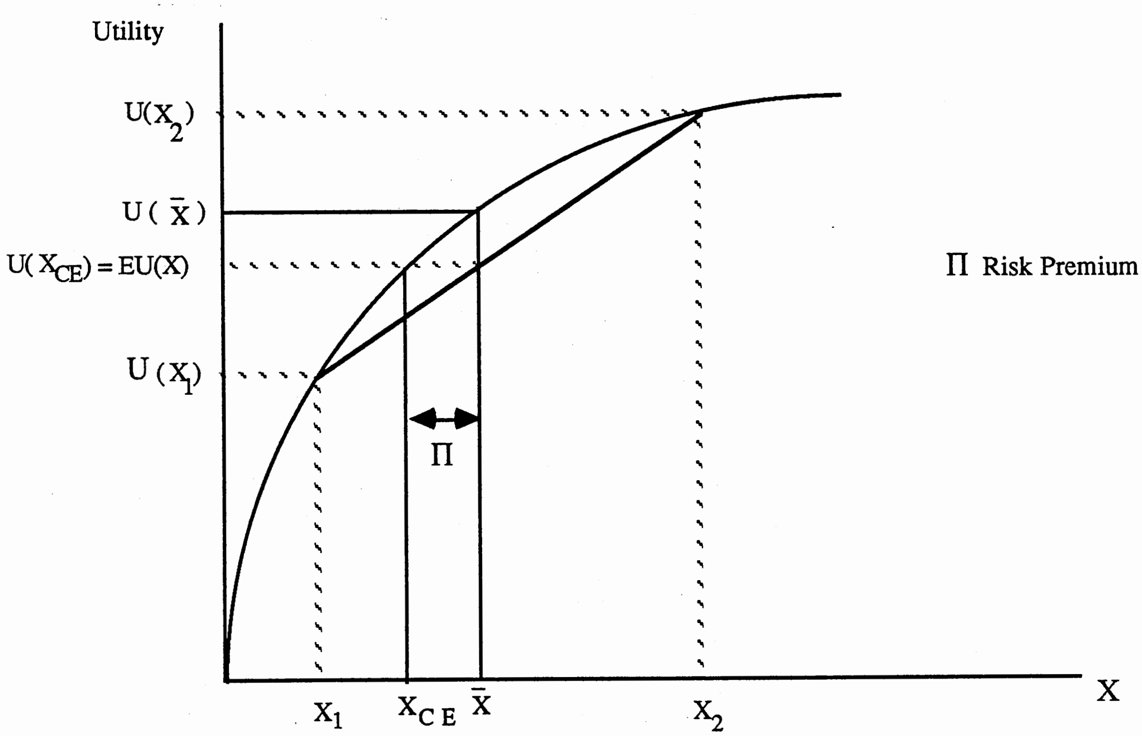
Only when decision makers are risk neutral does maximization of utility and monetary outcomes produce the same results. Risk averse decision makers have diminishing marginal utility for successive increases in income (Robison and Barry). Graphically, the risk attitudes of the risk averse (neutral) decision makers are represented by concave (linear) utility functions. In Figure 4a the linear utility function of a risk neutral decision maker is illustrated. The expected utility of the outcome (EU(X)) is equivalent to the expected monetary or mean outcome.

Figure 4b shows the concave utility function of the risk averse decision maker. The expected utility of the outcome (EU(X)) is equal to the utility of the certainty equivalent (CE). The certainty equivalent (CE) is the outcome which is certain and is preferred to the uncertain expected value of the outcome variable. This is true because decreases in utility due to monetary losses exceed utility gains which are of the same magnitude and and have the same probability of occurring. The difference between the certainty equivalent and expected monetary outcome is the risk premium, what the decision maker would have to be compensated in order to take the risky alternative.

Within the framework of the EV model, risk averse decision makers minimize



4a. Constant Marginal Utility
Risk Neutral Risk Attitude



4b. Diminishing Marginal Utility
Risk Averse Risk Attitude

Figure 4. Utility Functions
Source: Robison, et al.

variance of returns for a given level of mean returns. Risk neutral decision makers maximize returns regardless of their variance.

Sources of Risk

Firms face both financial and business risks. Financial risks are associated with increased leverage or debt to equity ratios as firms finance investments with borrowed capital. As leverage increases, the need for cash to service the debt increases and credit reserves decrease. When both cash and credit reserves are reduced, a firm's ability to respond to unexpected and adverse events is diminished. When economic conditions deteriorate for prolonged periods, a decline in the valuation of the firm's assets may occur, which may lead to an erosion of the firm's debt to equity position. Restrained borrowing capacity and insolvency are often the results.

Five sources of business risk have been identified: production, marketing, technology, legal and social issues, and human sources (Sonka and Patrick). The business risks that affect producers of fresh vegetables can be translated into uncertainty at the packing facility level. The major sources of production and marketing risk are examined in the context of the relationship between the fresh produce grower and packer.

Production Risk. Production risk, normally measured in terms of yield variability, is the result of uncontrollable factors such as weather, insect infestations, or natural disasters. In the case of a new fresh fruit and vegetable production region, yield variability at the farm level can also be affected by growers' relative inexperience with varieties and cultural practices. Such yield uncertainty is translated into a source of risk at the packing level (Tilley, Falk, and Schatzer). Lower yields lead to higher per unit packing costs because fixed packing costs are distributed over a smaller volume. In addition, decreases in the quality of fresh produce received at the packing facility have an even more significant effect on per unit packing costs than do equivalent levels of yield variation due to the labor costs incurred when unmarketable crops must be handled at the packing facility.

Variations in yield and quality thus affect both directly and indirectly the returns to farmers. Lower yields and quality mean less product to market and lower prices received, a direct effect. But lower yields and quality also increase packing costs and hence also adversely affect farmer profits.

Marketing Risk. Marketing risk can occur due to volatility in input prices, availability of inputs, or swings in output prices. In the case of fresh produce, variable production costs are higher than for traditional field crops and in new production regions local lenders may be reluctant to lend money for such projects. Variable per acre production costs for the crops analyzed in this study and traditional field crops grown in Southeastern Oklahoma are shown in Table I.

Fluctuations in input prices may cause cash flow problems for the limited resource farmer. Variability in interest and inflation rates, and uncertainty over labor supplies during the labor intensive periods such as planting and harvesting also contribute to marketing risk. In addition, supply and demand relationships are sensitive: vegetable prices can change dramatically in a given market due to one extra truckload of produce (Runyan, et al.).

Although the packing facility can insulate itself from price risk in the short term by covering its costs before paying the producer, the continued viability of the packing facility depends on the packer passing on high enough prices such that the producer earns a profit and has an incentive to continue growing. The packing facility may assume the price risk by paying a predetermined price to the growers in order to stimulate production and consequently reduce unit packing costs through increased volume. This strategy could stimulate production, but increase the chances that the packing facility becomes insolvent due to exposure to price risk.

TABLE I

PER ACRE VARIABLE COSTS OF PRODUCTION FOR FRESH PRODUCE AND TRADITIONAL FIELD CROPS IN SOUTHEASTERN OKLAHOMA

Fresh Produce	Variable Cost	Traditional Field Crops	Variable Cost
	Dollars Per Acre		Dollars Per Acre
Spring Broccoli*	1,244.48	Alfalfa Hay	
		Dryland, O.E.**	92.27
Spring Cabbage*	1,284.45	Bottomland	124.82
		Dryland, C. H.***	153.12
Cucumber	696.70		
		Soybeans	
Staked Tomatos	3,079.30	Upland, O.E.	70.21
		Botomland, O.E.	62.87
Cantaloupe	962.98		
		Bottomland, C.H.	73.84
		Upland, C.H.	79.72
Okra	1,576.43		
		Peanuts, Dryland	179.03
Turnips	750.00		
		Oats for Hay, O.E.	54.18
Fall Cabbage*	1,304.20		
Fall Broccoli*	1,241.14		

Source: Oklahoma State University Enterprise Budgets
All produce is assumed to be irrigated.
Marketing and packing costs are not included.
*Transplanted varieties.
**Owned Equipment
***Custom Harvest

In the context of operating a packing facility as a marketing cooperative, regardless who initially assumes the price risk, the producers and the packer as a system are subject to price risk. Unlike other commodity sectors such as grains and livestock, the fresh produce industry has relatively limited alternatives to reduce risk or mitigate the effects of risk, particularly price risk.

Responses to Risk

Production responses to risk generally involve diversification through enterprise selection or geographic dispersion, substitution of capital inputs for labor, and technical production practices. Marketing responses to risk include hedging on the futures market, forward contracting, storage, sales spreading and government program participation. Financial responses to risk include methods to maintain liquidity positions such as asset leasing, share rental and insurance (Sonka and Patrick). Fresh vegetable producers do not have available the range of risk management tools that field crop and livestock producers can employ to minimize or transfer risk. The tools that do exist can be grouped according to the production, marketing and financial aspects of business organization (Boehlje and Trede).

Production responses to risk generally involve diversification through enterprise selection or geographic dispersion, substitution of capital inputs for labor, and technical production practices. Marketing responses to risk include hedging on the futures market, forward contracting, storage, sales spreading and government program participation. Financial responses to risk include methods to maintain liquidity positions such as asset leasing, share rental and insurance (Sonka and Patrick).

The processing or packing facility can also affect the riskiness of crop production. Guaranteed prices reduce risk to the producers but increase it for the packing facility. The first handler can also contract to buy the crop as long as prescribed cultural practices are followed and crop failures are due solely to uncontrollable weather patterns. The latter strategies are used in the vegetable processing industry. Packing or processing facilities can reduce yield variability by employing field technicians to provide technical assistance. In addition, within the context of a cooperatively managed packing or processing facility in which revenues are pooled, the selection of these pooling rules can affect the distribution of returns to producers (Buccola and Subaei).

The following discussion identifies production and marketing risk response alternatives which are available to the grower engaged in fresh produce production.

Production Responses to Risk. In the case of fresh vegetables, viable production responses to risk include enterprise diversification, although selection is limited to the crop varieties that local climate, soils and conditions permit and market analysis determines feasible. For example, sweet corn has the potential to be a profitable alternative in southeastern Oklahoma if infestation by the corn ear worm can be brought under control. Until such time this alternative is excluded from the "vegetable portfolio". Moreover, the risk reduction gains possible through diversification are limited by the total number of enterprises, covariation of returns between enterprises, and economies of scale gained through specialization. Portfolio theory has been used to explain the limitations imposed by number of enterprises and covariances or correlations between enterprises. Risk reduction through diversification is negligible beyond a specific number of investments. The existence of high positive covariances of returns for investments or crops planted also translates into minimal gains from diversification.

Perhaps the greatest obstacle that commercial farms face in using diversification as a risk management tool is the economies of scale achievable from large scale production of fewer crops. Diversification is most effective when economies of scale in production are not available. The trade-off between specialization and diversification also applies to packing facilities. Within the context of small farms in a new production region, product line and seasonal diversification would seem the most appropriate risk management tools for the packing facility, given that production levels are low and crop mixes are fluctuating. In Oklahoma, seasonal diversification means planting crops such as broccoli, cabbage, and cauliflower in both spring and fall.

Because vegetable production requires the use of specialized planting and harvesting equipment, investment in such assets can increase financial risk. Recognizing the capital investment needed to produce and harvest vegetables, RedArk has provided Three Rivers with equipment that first- time producers can use until they determine whether they are willing to commit more resources to vegetable production.

Wide geographic dispersion is usually not an alternative available to small scale vegetable farmers due to the highly management intensive nature of vegetable production. In many cases, labor cannot be replaced with equipment because no suitable mechanical means exist to transplant or harvest. Sometimes the machinery available is not used, as in the case of fresh market tomatoes which are harvested by hand to prevent bruising. In addition, the small size of fresh vegetable operations may not justify the investment in expensive specialized equipment.

One production risk response that vegetable producers can use is to employ cultural practices that reduce yield variability. In the case of Three Rivers a field manager is employed to establish production management guidelines and help growers follow them to achieve maximum yields and quality. Southeastern Oklahoma growers can also take advantage of the research on applicable cultural practices and recommended varieties conducted at the Wes Watkins Agricultural Research and Extension Center in Atoka County.

Examples of production practices which have been adopted to reduce risk in the Florida tomato industry include laser leveling of fields to provide greater uniformity of soil moisture which reduces yield variability, and the use of sprinkler systems to mitigate frost damage. In addition, Florida tomato growers plant on raised beds covered in plastic which provides greater temperature and humidity uniformity in the root zone (Buckley, et al.). Florida's main competitor in the production of tomatoes for the winter market, Mexico, employs none of these methods.

Marketing Responses to Risk. Marketing responses to risk in vegetable production for the fresh market are also limited. Futures markets do not exist for fresh produce. However, both vertical coordination and integration exist in fresh produce marketing as a response to the difficulties involved in organizing production and packing.

Vertical integration is defined as the participation by one business organization in more than one step in the production and marketing system through ownership (Black and Haskell). Vertical coordination involves a contractual relationship between producers and a processor or packer in which the delivery of a commodity at a future date and pricing method is specified in writing. Forward contracts are involved in more than 50 percent of the produce grown for processors, and between 10 and 50 percent of the produce grown for the fresh market (Sporleder and Holder).

Since vertical coordination involves setting prices in advance of delivery of the product, the packing/processing facility who contracts with producers assumes the price risk. Nevertheless, first handlers are usually the ones who initiate these contracts since most of the benefits accrue to them (Sporleder and Holder). These benefits include being able to plan with some degree of certainty the quality, quantity and timing of delivery. Because they are guaranteed a fixed price, producers may improve their chances for obtaining financing when they forward contract. However, in exchange for price security farmers relinquish some freedom of decision making.

Since most fresh vegetables must be sold and consumed soon after harvest (cabbage and potatoes are exceptions), long term storage is generally not available as a risk management tool. Production and harvest periods are constrained by climatic factors in Oklahoma, limiting sales spreading as a diversification method to reduce variability of returns over time.

Government programs do not exist for fresh produce, except for market orders. Market orders are mandatory programs established with the consent of producers of particular commodities in specific geographic locations. They are requested by producers for such purposes as regulating quality and packing materials, limiting quantities marketed, and generating revenues for generic commodity advertising (Polopolus, et al.).

Analysis of Risk Management Strategies

Two basic approaches, optimization and simulation, are used to analyze decision making under risk, although simulation models with optimization algorithms can be considered a third technique (Baum and Richardson). Optimization uses some form of risk programming model. Simulation is "numerical manipulation of a symbolic model of a system over time" (Anderson). Both optimization and simulation can analyze stochastic (random) variables and dynamic (multi-period) scenarios. The primary difference between optimization and simulation is that the former produces optimal or risk efficient crop mixes and risk management strategies, while the latter predicts the outcome of a given set of decisions and circumstances. Thus, programming models are normative in nature, while simulation, when optimization is not involved, is a positive approach.

Optimization

Techniques for optimization under risk include quadratic programming (QP) which uses the mean-variance (EV) efficiency criterion, MOTAD model which uses total absolute deviations (EA) as a measure of risk, and the Target MOTAD approach (Tauer) which uses a safety-first definition of risk. The QP model requires a non-linear programming algorithm, while MOTAD and Target MOTAD models can be run with linear programming packages. (See Mapp and Helmers; Hazell and Norton; Baum and Schertz for discussions of recent studies of farm level optimization models).

The first application of QP in agriculture was in a study by Freund. Since then, numerous applications of the mean-variance model in whole farm planning have been made, although disagreement exists over the most appropriate method of estimating the parameters (the mean and variance) of probability distributions in EV studies (Young). Moreover, QP has been criticized for its restrictive assumptions: either the returns must be normally distributed or the utility function of the decision maker must be quadratic to ensure that only the first two moments of the distribution are relevant. Empirical studies have demonstrated the significance of higher order moments such as skewness in distribution of crop yields (Day) and in net returns considering participation in government programs (Kramer and Pope). Quadratic utility functions imply increasing risk aversion with increases in wealth, which has little theoretical or empirical support (Kramer and Pope; Pratt). Optimization studies which incorporate various production, marketing or financial risk management strategies have been conducted (Mapp, et al.; Johnson and Boehlje). Programming has also been used in comparisons of the use of forward contracts with hedging on the futures market or other marketing and production strategies (Bolen, et al.; Klinefelter; and Shurley). In a review of these latter programming studies, Sonka and Patrick found that routine hedging and forward contracting may not greatly reduce price risk. Other programming studies analyzing the relative importance of forward contracting and futures trading have reached different conclusions (Nelson; Miller). A multi- period quadratic programming study which investigated the interaction between credit and level of forward contracting for cotton and sorghum producers found that contracting influences income stability and growth, and credit availability (Barry and Willmann).

Simulation

Simulation has several advantages (Law and Kelton) that make it preferable to optimization. These advanges include the ability to estimate the performance of an existing system under a variety of operating conditions. Simulation models can easily account for stochastic variables, multiple time periods, and complex operating environments. Simulation models can have the disadvantages of being complex and time-consuming to develop. The complexity of some models may create unjustified confidence in their results (Law and Kelton). However, to achieve the objectives of this study, simulation is considered the most appropriate methodology, despite its drawbacks.

Extensive reviews of the use of simulation analysis in agricultural economics and characteristics of the models have been made (Anderson; Johnson and Rausser; Baum and Richardson). Anderson reviews both macro and micro level simulation studies conducted up through the early 1970s. At the micro level he distinguishes between farm planning/firm growth studies and process level applications which analyze soil-water-plant systems. Recently, a review of the role of biophysical simulation in production economics has been conducted (Musser and Tew). Farm planning/growth studies have investigated intergenerational transfer of farm firms (Roush), effects of loan arrangements and debt to equity levels (Patrick), and the impacts of government commodity programs and income tax policies. A recent summary of the latter type of study is found in Richardson and Nixon (1986).

Current models to analyze farm planning, growth, and/or risk management strategies are said to be in the third generation of development (Baum and Richardson). The first generation began with the development of the first whole-farm simulation model by Halter and Dean. The second generation includes models which added multiple goal frameworks and financial statement information as simulation output (Patrick and Eisgruber; Hutton and Hinman; Mapp, et al.; Harman; and Hatch). The most recent generation of simulation models includes work by Boehlje and Griffin; Hardin; and Richardson and Condra. This latter generation allows modeling of a richer set of farm level behaviors and constraints such as participation in farm programs, tax laws, and family consumption functions.

Analysis of Simulation Output. In addition to being a flexible tool for specifications of the inputs in a complex environment, simulation has the advantage of flexibility in providing a variety of outputs. Sensitivity analysis can be conducted to determine the impact of key assumptions of the model on the use of inputs. Simulation results can also be output in the form of cumulative distribution functions (CDF) of output variables. The CDFs of output variables such as net returns can be analyzed using decision rules that identify the alternatives preferred by decision makers with different risk attitudes. These decision rules or efficiency criteria are used to classify alternatives into efficient (those preferred by decision makers) and inefficient (those not preferred) sets.

Stochastic dominance criteria have increasingly become the efficiency criteria of choice for analysis of simulation output. These criteria enable consideration of alternative strategies on the basis of more than just the first two moments of the distributions of probable outcomes, overcoming a deficiency of the mean-variance approach described previously. Moreover, stochastic dominance has seen increasing use in empirical studies because its use does not require specification or knowledge of individual utility functions.

First and Second Degree Stochastic Dominance. Stochastic dominance criteria can be used to select the preferred or undominated strategy from a pair-wise comparison of probability distributions using first (FSD) and second (SSD) degree stochastic dominance (Hanoch and Levy; Hadar and Russell). First degree stochastic dominance has low discriminating power because it only requires that decision makers prefer more to less (have positive utility for money). Under SSD, decision makers are assumed to be risk averse; their utility functions have positive, non-increasing slopes at all income levels. SSD provides greater discriminating power than FSD. When the outcome distributions are normally distributed or the decision maker's utility function is quadratic, the SSD efficient set is identical to the EV efficient set.

Under FSD an alternative defined by the cumulative distribution function (CDF) F(y) is preferred to or dominates the alternative with the cumulative distribution function G(y) if $F(y) \leq G(y)$ for all values of y and the inequality is strict for some value (King and Robison, 1984). Graphically this means that the CDF F(y) must lie everywhere to the right of the CDF G(y) in order to dominate. If the distributions cross, no decision can be made under FSD.

Under SSD, an alternative with the CDF F(y) dominates another with the CDF G(y) if $F(y)dy \leq G(y)dy$ for all values of y and the inequality is strict for some value of y. Thus the distributions are compared on the basis of the area under the CDFs. With SSD, CDFs that cross can be compared only if they cross at the top. In Figure 5, F(y) dominates G(y) under SSD and FSD because F(y) lies everywhere to the right of G(y). Under FSD and SSD, H(y) and G(y) cannot be ordered because they cross at the bottom. Under SSD, F(y) dominates H(y) because they cross at the top of the distributions.

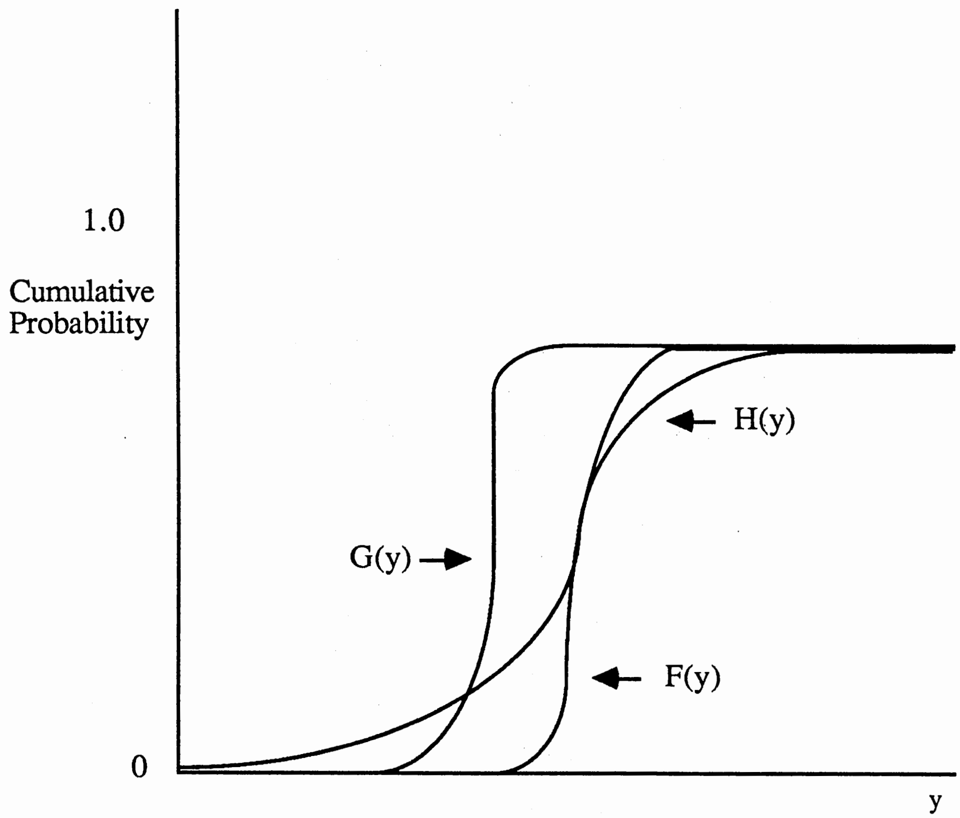
Stochastic Dominance With Respect to a Function. Comparison of alternatives using stochastic dominance with respect to a function (SDRF) has better discriminating power than both FSD and SSD, and does not require the assumption of risk aversion on the part of the decision maker as does EV, EA and SSD (Meyer; King and Robison, 1984). SDRF is based on expected utility theory. It reduces the set of alternatives to a subset that includes strategies with the highest expected utility for decision makers whose Arrow-Pratt coefficient of absolute risk aversion:

$$Ra(y) = -U''(y)/U'(y)$$

lies between specified upper and lower bounds:

$$r_1(y) \leq -U''(y)/U'(y) \leq r_2(y) \text{ for all values of y.}$$

The Arrow-Pratt coefficient is simply the negative of the quotient of the second and first derivatives of the utility function. If Ra(y) is positive, the decision maker's attitude toward risk can be characterized as averse, while if Ra(y) is negative, it can be concluded that the decision maker is risk loving.



FSD: F(y) dominates G(y) only
SSD: F(y) dominates both G(y) and H(y)

Figure 5. First and Second Degree Stochastic Dominance
Source: King and Robison

The appropriate upper and lower boundaries of the absolute risk aversion function can be estimated using an interval approach developed by King and Robison (1981). Both FSD and SSD are special cases of SDRF. The SDRF boundary intervals under FSD criteria are $r_1(y) = -\infty$ and $r_2(y) = \infty$ for all values of y since no restrictions are placed on the risk aversion function. Under SSD criteria the boundary levels are $r_1(y) = 0$ and $r_2(y) = \infty$ for all values of y since SSD requires that marginal utility be positive and decreasing.

Recent farm simulation studies have employed stochastic dominance criteria to order risky alternatives. Kramer and Pope demonstrated that distributions of net returns for representative farms participating in farm programs could not be ranked using EV criteria, but could using stochastic dominance. Following Kramer and Pope's lead, Richardson and Nixon (1982) used stochastic dominance criteria to determine preference of various risk groups of cotton farmers for a cotton farmer owned reserve under 18 different farm programs. Pederson used stochastic dominance criteria to evaluate farmer preferences for five share/cash rental strategies under risky conditions.

For soybean producers in Louisiana, Zacharias, et al. found that forward and futures price distributions dominate distributions of returns based on cash sales at harvest as determined by stochastic dominance criteria. A 1986 study used plant growth simulation models to produce yield estimates and stochastic dominance analysis techniques to identify optimal marketing strategies of a corn, soybean, peanut, and wheat farm in Florida for different levels of risk aversion. The results showed that risk averse farmers should prefer some forward contracting while low risk averse or risk loving farmers should prefer cash sales at harvest (Anaman and Boggess).

Stochastic dominance criteria should be applied with caution in the case where the alternatives being considered, such as marketing plans or tillage options, are not mutually exclusive or less than perfectly correlated (McCarl, et al.). If not mutually exclusive, diversification of the alternatives is a possibility. In a review of thirteen studies, the outcome distributions in eleven were not derived from mutually exclusive alternatives, although only one of the studies investigated diversification directly.

McCarl, et al. provide two rules, empirically tested for non-normal distributions, for determining when stochastic dominance of one alternative over another implies stochastic dominance over all linear combinations of the two. When distributions are normal, EV analysis is equivalent to SSD criteria and thus is the preferred method since the mean-variance criterion explicitly takes diversification into account. The results of the empirical tests for non-normal distributions showed that the rules were quite reliable in identifying the level of correlation coefficient above which diversification can be ignored.

The two rules lead to the conclusion that when correlation is perfect, diversification can be ignored, and when correlation is zero or negative, diversification is always optimal, rules that concur with results obtained previously (McCarl, et al.).

Theory of Cooperatives and Cooperative Management

This section introduces the cooperative form of business organization and reviews the cost allocation and revenue distribution decisions that packing facilities can make which affect the riskiness of producer returns. The emphasis on the cooperative literature reflects the fact that the cooperative is a common form of organization for small fresh produce growers such as those in Southeastern Oklahoma to pursue. Moreover, analyses of cost allocation and revenue distribution rules in a packing facility are concentrated in the cooperative management literature.

Cooperatives are business organizations that are democratically controlled by the member-owners, provide their members with services at cost, and pay limited returns to equity capital (Bar, Abrahamsen). The cooperative is obligated to return to its members any surplus or net margins that are earned above the costs of operation in proportion to the patronage or volume of business transacted with the cooperative. In practice cooperatives can pay a prevailing market price for the products they buy from their patrons. Given that the cooperative operates efficiently, these prices are actually overcharges, and after paying all expenses, the cooperative will have a surplus or net savings to distribute to its members or to retain for investment. The rate of refund to distribute members' savings is based on the following formula:

r = net savings / value of all raw products delivered.

The net savings are the difference between sales and the cost of acquiring and processing the inputs and operating the cooperative facility. Each member receives a patronage refund of r times the value of raw products that the member delivers to the facility.

Another method that cooperatives (and some non-cooperatively organized businesses as well) use to allocate revenues is pooling. Member production is organized into similar groups of products, and payments are based on member participation in the specified pool. This method reduces the need to segregate individual growers' goods and maintain individual member accounts for allocation of returns. Pooling also can affect the variance of returns for growers (Buccola and Subaei).

Pooling has been distinguished from patronage refunds of net margins as methods to distribute cooperative savings. A survey in the 1960s of 107 regional marketing cooperatives revealed that 92 of those cooperatives used a net margins method while the remaining used a pooling method (Davidson). Pooling does not separate payments for market value and savings, while the net margins method separates payments in two parts: a market price for goods delivered to the cooperative and a patronage refund of net savings. In computing patronage refunds, cooperatives can base the refunds on total business operations or compute return rates for different departments or divisions.

The theory of cooperatives as business firms was formalized in a landmark paper by Helmberger and Hoos (H-H) who used organizational theory to define cooperatives as business firms and then assumed surplus maximizing behavior to derive behavioral relations and equilibrium positions using marginal analysis. According to Hardie, the H-H paper based its approach on the theory of derived demand and factor supply to determine what returns members should receive in a marketing cooperative and how well the cooperative performs in the market. The H-H formulations included both short- and long-run specifications of an objective function that maximizes surplus of a cooperative that markets only one homogeneous product. Returns per unit for the homogeneous product are assumed to be equivalent and all the surplus is returned to cooperative members.

Maximum cooperative surplus is defined by the equation:

$$S = (P_y\text{-}ATC_o)Y_o$$

and per unit net returns accruing to members is defined by the equation:

$$P_m = [(P_y - ATC_o)Y_o]/M$$

where S is cooperative surplus, P_m is the per unit member net return, P_y is the price of the product marketed, ATC_o is the average total cost of production, Y_o is the product marketed, and M is the quantity used of the member supplied material. The H-H model explains the equilibrium position for members and the marketing cooperative as the intersection of the net returns (average revenue) function and the supply function.

Hardie generalized the H-H model to several products and grades of products. He introduced the concept of using shadow prices of a linear programming model to allocate the cooperative surplus to member growers according to the surplus earned by each member's products within a given pool by equating marginal costs to marginal revenues. The study does not provide a method by which pooling should be organized but notes that a tradeoff exists between the administrative costs of maintaining additional pools and the inequities caused by operating fewer pools.

This equity/cost tradeoff was explored in a study of optimal pools in an avocado marketing cooperative (Sosnick). Development of an optimal pooling criterion was based on measuring the reduction in costs and increase in inequities due to reducing the number of pools from a more complex structure. Inequities arise when pools are general enough to include categories of product with very different resale value and processing or handling costs. Such pools would act to reduce the incentive of members to deliver the higher value crops.

Pooling structure was of concern in the avocado study due to the large number of pools that could be arranged. With 150 avocado varieties, 10 grades, 11 sizes and seasonal categories which can be as short as one day, the number of conceivable pools that could be arranged is 120,000, according to the study. Another empirical study investigating the impact of pooling arrangements analyzed the preferences of growers in a multi-product fruit and vegetable processing and marketing cooperative for single, multiple and group pools (Buccola and Subaei). The study examined two main features of pooling rules: structure and valuation method. The structure of a pooling rule refers to the diversity of products in a pool and the valuation method is used to determine the contribution that each member makes to a given pool.

Five pooling arrangements for ten classes of almost 200 growers were studied. The ten classes were created such that at least three members produced the products in each class. The study analyzed a multiple pool system which establishes one pool for each different product handled by the facility, single pools in which all products are grouped in one pool, and grouped pools in which member products are pooled in either fruit or vegetable pools.

The two valuation methods used were a local market based pricing system and a three-year moving average of previous net revenues, which is the income received from the sale of the processed product less processing costs. Each of these valuation methods was used in both the grouped and single pools. Using historical records from a freezing and canning cooperative, fifty series of net returns were calculated, one for each of the five pooling arrangements and ten classes of members. The series of returns calculated were evaluated using stochastic dominance criteria. Cooperative member preferences were found to depend on farm enterprise and risk aversion levels.

Farmer payments and profits under multiple and single pooling rules were calculated in this study using the following definitions and equations:

Q_{ij} ith grower's output of jth product

C_{ij} ith grower's per unit production cost for jth product

P_j per unit valuation assigned to the jth product by the cooperative

R_j per unit revenue from jth processed product minus per unit processing costs, including fixed costs

$R_j\Sigma Q_{ij}$ net revenues from jth product delivered to cooperative

<u>Multiple pools</u>

Farmer payment:

$$F_{ij}^m = \frac{Q_{ij}}{\Sigma_i Q_{ij}} [R_j(\Sigma_i Q_{ij})] = Q_{ij}R_j$$

Total farmer profit: $\Pi_i^m = \Sigma_j(F_{ij}^m - Q_{ij}C_{ij}) = \Sigma_j Q_{ij}(R_j - C_{ij})$

Under multiple pools the ith farmer is paid a proportion, expressed in terms of physical volume, of the net revenues of the jth pool in which he/she participates. The farmer's profit then is net revenues less farm production costs.

<u>Single pool</u>

Farmer payment:

$$F_{ij}^s = \frac{Q_{ij}P_j}{\Sigma_j P_j(\Sigma_i Q_{ij})} [\Sigma_j R_j(\Sigma_i Q_{ij})$$

Total farmer profit: $\Pi_i^s = \Sigma_j (F_{ij}^s - Q_{ij}C_{ij}) =$

$$\frac{[P_j \Sigma_j R_j(\Sigma_i Q_{ij})]}{\Sigma_j P_j} - \Sigma_j Q_{ij} C_{ij}$$

Under single pools, the ith farmer is paid a proportion of the total cooperative net revenues, which is expressed in terms of the ith member's percentage of all members' contibutions of all products. Farmer profits are calculated by summing over the J products for the ith member and deducting farm production costs. Between the two extremes falls the grouped pooling arrangement which subdivides the J products into K mutually exclusive subsets and where $1 \leq K \leq J$. When $K = J$, the result is multiple pooling and when $K = 1$ the result is single pools.

In another empirical study focusing on a sugar cane processing cooperative, three payment arrangements were studied in a multi-level programming model (Lopez and Spreen). These payment schemes were based on tonnage of raw material delivered to the cooperative, amount of sugar extracted from deliveries, and a use value basis in which adjustments for cooperative processing and services are made to the value of sugar extracted. A bi-level programming model was used in order to capture the bi-level decision making structure of a processing cooperative: (1) the cooperative determines a payment system and delivery quota system which is "fair" to its members to allocate fixed processing capacity and (2) the members react to the cooperative system established in the first level through their planting decisions to maximize their net returns.

The objective function of the model maximizes total member's profits subject to payment system, mill capacity, members' quotas, and variety selection. Plant capacity was restricted to ensure adequate volume for economic operation while maintaining processing below maximum levels. Quotas were necessary for members because sugar content increases the longer sugar cane is left to mature, which causes members to favor particular periods for delivery to the plant. Member selection of cane varieties depends on the payment schedule and quotas established by the cooperative. The study ignored risk considerations such as freeze tolerance in modeling variety selection.

The use value system was found to result in the highest prices, greatest amount of raw product and sugar. It induced members to individually bear their share of cooperative costs and revenues, follow more efficient harvesting and planting schedules, follow distinct patterns of delivery and select a particular variety.

In the fruit and vegetable pooling study, member preference for pooling arrangements and pricing strategies are analyzed from an ex post position. As such, the strategies have an effect on the distribution but not on the creation of cooperative surplus. In contrast, the sugar cane study used an ex ante approach which assumes that creation of the cooperative surplus for distribution depends on the pricing strategy implemented.

In none of these pooling or payment strategy studies is the issue of allocating fixed costs adequately explored. In the multi-product pooling study, fixed or shared costs are allocated in proportion to the annual sales revenues of the particular pool. The avocado study did acknowledge (but assumed away) the need to decide where (to the pools or to individual members) and how to allocate separable and common costs, profits and losses from nonmember patronage. Separable costs include such costs as harvesting, infreight, outfreight, spoilage, loss in transit and other costs directly related to particular shipments. Common costs are the fixed costs of operation such as depreciation, interest, utilities, supplies and other overhead. A question regarding the assignment of equipment costs to products not handled by that equipment was also posed but left unexamined.

In the sugar cane study, determination of fixed costs was assumed to be predetermined following suggestions made by Zusman in which marginal costs are equated with marginal revenues. However, since the members of the sugar cane cooperative deliver a relatively homogeneous product which is processed into one output, allocation of fixed costs among members does not pose the same equity difficulties as in a multi-input and multi-output cooperative.

Without providing empirical results, Zusman concludes that the cost allocation method is the key determinant influencing the level of output produced by each member. Assuming that cost allocation methods are selected through majority voting, he investigated how the group choice process in a marketing cooperative affects the decision to allocate short run costs of operation among the members to derive the implications for the allocative efficiency of the organization and distribution of income among its members. Zusman found that when the distribution of member growers is asymmetric with respect to the quantity of products marketed through the facility, cost allocation conflicts will arise and the majority will exploit the minority to the extent that outside competition exists.

This study extends the work by Zusman because it takes up the issue of the impact of cost allocation schemes within the context of a specific empirical example. In addition, this study also builds on the optimal pooling analysis done by Buccola and Subaei who allocate costs on the basis of contribution to pooled sales revenues and ignore other possible cost allocation schemes.

CHAPTER III

PROCEDURES AND DATA

Simulation Model

As noted in the previous chapter, there are relatively few ways in which producers who grow fruits and vegetables for the fresh market can shift price or yield risk to other marketing channel participants or to speculators like producers are able to do in the cattle and grain industry. Fresh market producers usually do not even receive any kind of price guarantees from the first handling facility who markets the produce as is common in the processing industry. For this reason any changes in the riskiness of producer returns which results from decisions made by the packing facility are critical. Moreover, the importance of investigating decisions which impact the riskiness of producer returns is of particular concern in a project such as the one in Southeastern Oklahoma where stimulation of a new production region is a policy goal.

In this study, the impacts on producer profits of various cost allocation and revenue distribution rules in a multi-product fresh produce packing facility are modelled to determine whether such rules can significantly impact the riskiness of particular crop mixes being grown. In addition, the effect of crop mix diversification on the sensitivity of producer returns to different cost allocation and revenue distribution rules is analyzed. The impacts of different combinations of rules are simulated under conditions of stochastic yields and stochastic weekly prices to model as closely as possible the risk environment that fresh market producers actually experience. The results of the simulation are analyzed using EV analysis and SDRF.

Four cost allocation methods and three revenue distribution rules are simulated. Costs are allocated on a per crate, tonnage, hours of operation and sales revenues basis. The revenue distribution methods are seasonal pooling, crop pooling and no pooling. The contribution to sales revenue basis of cost allocation is not combined with the no-pooling revenue distribution method, making eleven scenarios simulated. The eleven scenarios are presented in Table II.

The two main activities of the program, cost allocation and revenue distribution impacts on producer returns, are discussed in this chapter. The results of the simulation, and the mean-variance and stochastic dominance analysis are provided in Chapter 4. A flow chart of the computer program is presented in Appendix A.

Cost Allocation

Shared or fixed costs are allocated on a per crate, tonnage of packed crates, percentage of sales volume, or hours of operation basis. Per unit fixed costs under each of these rules are recalculated each iteration since these costs vary as yields change. Fixed or shared costs include administrative salaries, utilities, office supplies, fixed asset maintenance and depreciation, and other overhead expenses. Utilities and machinery maintenance are assumed to grow 10 percent, and office expenses five percent for every 100 acres planted above 500.

Packing equipment is separated into standard and specialty lines. Standard packing equipment consists of those pieces such as forklifts that every crop uses. Specialty equipment is used only by a subset of crops, such as the waxer used for tomatoes and cucumbers, and the buncher used for broccoli. Specialty machinery costs are allocated among only those crops using the machines, but on the same cost allocation basis as the other fixed costs, whether it is per crate, tonnage or hours of operation. Standard line costs are handled like other shared costs. Standard and specialty asset information is presented in Table III.

TABLE II

SCENARIOS MODELLED

Cost Allocation	Revenue Distribution: Crop Pooling	Revenue Distribution: No Pooling	Revenue Distribution: Seasonal Pooling
Per Crate (Crt)	CrtCrp	CrtNop	CrtSea
Percentage of Hours of Operation of Packing Equipment (Hrs)	HrsCrp	HrsNop	HrsSea
Percentage of Tonnage (Ton)	TonCrp	TonNop	TonSea
Contribution to Pool Revenues (Val)	ValCrp	XXXXX	ValSea

TABLE III

STANDARD AND SPECIALTY ASSETS

Asset	Initial Value	Salvage Value	Life	Crops Assigned
	----------dollars--------		years	
Building	312,670	0	30	all crops
Truck	6,000	1,000	5	all crops
Equipment	3,350	0	10	all crops
Van	6,000	1,000	5	all crops
Vehicle	8,000	1,000	3	all crops
Storage	4,000	0	10	all crops
Waxer	2,000	0	10	CUC, TOM, TUR
Ice Machine	40,000	0	20	SPB, FB, CAN
Washer	500	0	10	SPB, FB, CUC
Sizer	1,590	0	10	TOM, TUR
Washer/Absorber	2,500	0	10	CUC, CAN, TUR
Eliminator	795	0	10	TOM
Buncher	2,000	0	10	FB, SPB
Trimmer	2,000	0	10	FB, SPB

*SPB: Spring Broccoli
SPC: Spring Cabbage
CUC: Cucumbers
TOM: Tomatos
CAN: Cantaloupe
OK: Okra
TUR: Turnips
FC: Fall Cabbage
FB: Fall Broccoli

Under a per crate system of allocating costs, shared costs are divided equally between the total number of crates packed, regardless of crate weight. The tonnage method assigns shared costs to each crop based on the percentage of tons each crop represents of the total tonnage handled by the packing facility. The third method allocates shared costs based on the percentage of hours of packing line operation that each crop requires of total packing machinery time.

The fourth cost allocation method assigns costs based on the value of packing sales revenue in each pool after packing revenues have been generated and pooled. In this method, costs are allocated to a revenue pool as a percentage of the pool's contribution to total annual sales revenue of the packing facility. This cost allocation procedure is used by Buccola and Subaei and is described more fully below in the revenue distribution section.

Stochastic yields are generated once each iteration of the program. Because no historical yield data exists for horticultural crops in Oklahoma, simulation of crop yields is conducted using triangular distributions for each crop. Estimates of each crop's maximum, minimum and modal yield values were obtained from the executive director of RedArk Development Authority and reviewed by horticultural extension specialists at Oklahoma State University. The crop mix, yield assumptions, and acres planted are summarized in Table IV. The harvest schedule is shown in Table V. Because the estimated production volume from Southeastern Oklahoma represents a small percentage of the volume sold in the Dallas market, yields were assumed to be uncorrelated with prices. Yields between crops were also assumed to be independent.

Variable packing costs include direct packing materials, such as crates and bands, and direct packing labor. Packing labor is categorized as either labor which handles both packed and rejected crates, packed crates only, or rejected crates only. Costs of handling rejected crates are added to the costs of handling packed crates. The percentage of crates rejected per crop and the yields are assumed uniform across all classes of farmers.

TABLE IV

CROP MIX

Crop	Acres Planted	Yields Maximum	Minimum	Mode	Size Container
		----- Crates per Acre-		-----	Pounds
Spring Broccoli	80	720	200	350	22
Spring Cabbage	100	950	300	400	50
Cucumbers	150	700	200	330	55
Tomatos	100	1500	400	820	25
Cantaloupe	300	632	210	350	40
Okra	20	1000	300	600	15
Turnip	60	1000	400	700	25
Fall Cabbage	100	980	300	500	50
Fall Broccoli	120	720	200	400	22

TABLE V

HARVEST SCHEDULE: PERCENTAGE OF TOTAL CROP HARVESTED EACH WEEK

Week	Cabbage Spring	Cabbage Fall	Cucumber	Tomato	Cantaloupe	Okra	Turnip	Broccoli Spring	Broccoli Fall
				Percentage					
20	25							9	
21	50							10	
22	25							20	
23			2	7				30	
24			3	7				31	
25			3	7				8	
26			3	11					
27			6	11					
28			6	11	9	8			
29			7	11	9	8			
30			7	11	9	8			
31			7	6	8	8			
32			7	6	8	8			
33			7	6	8	8			
34			7	6	8	8			
35			7		8	9			
36			7		11	9			
37			7		11	9			
38			7		11	9			10
39			7						10
40							4		20
41							4		20
42							4		20
43							4		10
44		20					17		10
45		20					17		
46		20					17		
47		20					17		
48		10					16		
49		10							
	100	100	100	100	1000	100	100	100	100

Generation of Prices

After all costs are calculated and allocated for all iterations, the main program calls the subroutine (SEASPR) which generates weekly prices for each crop. Stochastic prices are generated to represent weekly prices paid to the packing facility. The weekly producer prices are estimated to model the system that Three Rivers packing facility uses to pay its producers, which is to quote a price to the producers before knowing the exact price the facility will receive. To model this system, a random deviation from the weekly packing facility prices of a negative or positive 10 percent is generated and multiplied by the simulated producer price. It is assumed that the facility does not commit errors in excess of 10 percent when quoting a price to pay the producer. Producer prices also serve as measures of the value of the produce brought to the facility which are needed for calculation of revenue pools.

Weekly price simulations are based on weekly Dallas wholesale prices for the ten-year period 1977 to 1986. A variance-covariance matrix of the weekly prices was calculated for the number of weeks in the harvest schedule of each of the nine crops. These matrices were factored into upper triangle matrices using the method described by Clements, Mapp and Eidman in a separate program based on code developed by Spence. The variance-covariance matrices are presented in Appendix B and the factored upper triangle matrices are presented in Appendix C.

The upper triangle matrices were multiplied by vectors of random normal deviates to produce error terms for the price equations. The following equation was used to generate weekly packing facility prices:

(1) $P = \overline{P} + AW$

where $\overline{P}$ is a vector of historical weekly price means, A is the factored variance-covariance matrix, and W is a vector of random standard normal deviates.

Once simulated, packing facility prices are reduced 20 percent to account for the markup and handling costs between the packing facility and the wholesale market. Prices equivalent to Dallas wholesale prices can be obtained only if Three Rivers delivers directly to supermarket buyers or can otherwise bypass the wholesale market. Currently Three Rivers does market small quantities of produce to supermarket buyers. However, at the level of more than 1000 acres of produce, as is simulated in this analysis, Three Rivers would have to market almost exclusively through wholesalers unless an investment in trucks beyond what is currently owned is made.

Besides being reduced 20 percent to account for the Dallas markup, producer prices are also reduced by the value of the average cost of packing as calculated under the tonnage, hours of operation, and per crate cost assignment rules. Under the sales revenue cost assignment method, producer prices are not reduced by the cost of packing since costs are determined as a percentage of revenues.

Spring season prices are simulated for broccoli and cabbage, summer prices for cucumbers, tomatoes, okra and cantaloupes, and fall prices for cabbage, turnips and broccoli. Means and standard deviations for the weekly producer and the packing facility prices are calculated for each crop. Weekly prices are converted to weekly revenues for each crop using the harvest schedule, which contains the weekly percentage of the total harvest volume. The resulting revenues can be summed for all crops that a particular class of farmer produces.

Farmer Classes

Producers are grouped into classes in this study according to the crop mixes actually selected by producers who currently market through Three Rivers. Crop mixes of each farmer class, rather than individual crops, were the basic unit of study in this analysis because there are too many possible combinations of the ten crops to analyze. Moreover, the objective of this work is to analyze a specific case rather than provide results which are generalizable to other cropping situations.

In this case, two groups of producers grow one crop only, two produce two crops, three produce three crops, and three produce six of the nine crops. Broccoli and cabbage are grown in two seasons and each season is considered a different crop. Crops grown by individual growers in each class are presented in Table VI. Total crops grown in each class are shown in Table VII. The percentage contribution to crop and seasonal pool production in terms of acres of each class are shown in Tables VIII and IX. These percentages are used to calculate the participation in revenue pools. Since the timing of delivery by class is not known and percentage of rejected crates is assumed constant across classes, calculation of participation rates in revenue pools can be based on acreage planted.

Distribution of Revenues

After weekly prices are generated for the packing facility and estimated for the producers, revenues are calculated for the different classes of farmers. Three revenue distribution rules are simulated: no pooling, crop pooling and seasonal pooling. The seasonal pooling option is equivalent to Buccola and Subaei's "grouped" pooling except that the groups in this analysis consist of spring, summer and fall seasons rather than a fruit-vegetable dichotomy. The crop pooling option is also equivalent to Buccola and Subaei's "multiple" pooling in which revenues are distributed according to participation in a particular crop's pool of revenues.

Under the no-pool rule, producer revenues are the producer prices generated multiplied by the quantity packed and sold in a given week. Neither revenues nor costs are pooled, which is the current payment system at Three Rivers. The effect of such a system is that individual producers do not share price risk with other producers. Although the producers ultimately assume the price risk, in any given week the packing facility assumes the price risk since it does not know the price it will receive when it quotes a market price to the producer.

Per acre producer returns under crop pooling are calculated for each jth class of pro-

TABLE VI

PER FARM CROP ACREAGE BY CLASS

Class	Number of Farms	Number of Crops	SPB	SPC	CUC	TOM	CAN	OK	TUR	FC	FB
			-Acres-								
1	2	1	0	10	0	0	0	0	0	0	0
2	3	1	0	0	0	0	10	0	0	0	0
3	2	2	0	0	0	5	0	5	0	0	0
4	3	2	0	0	0	0	0	0	10	10	0
5	2	3	0	0	10	5	0	5	0	0	0
6	3	3	0	5	5	5	0	0	0	0	0
7	5	3	3	5	0	0	0	0	0	2	0
8	5	6	3	0	8	7	10	0	3	0	8
9	5	6	0	4	8	6	22	0	0	12	8
10	5	6	10	4	7	0	22	0	3	0	8

TABLE VII

TOTAL CROP ACREAGE BY CLASS

Producer Class	SPB	SPC	CUC	TOM	CAN	OK	TUR	FC	FB	Total Acres
	------------------				Acres		-------------------			
1	0	20	0	0	0	0	0	0	0	20
2	0	0	0	0	30	0	0	0	0	30
3	0	0	0	10	0	10	0	0	0	20
4	0	0	0	0	0	0	30	30	0	60
5	0	0	20	10	0	10	0	0	0	40
6	0	15	15	15	0	0	0	0	0	45
7	15	25	0	0	0	0	0	10	0	50
8	15	0	40	35	50	0	15	0	40	195
9	0	20	40	30	110	0	0	60	40	300
10	50	20	35	0	110	0	15	0	40	270
Total Acres	80	100	150	100	300	20	60	100	120	1030

TABLE VIII

PERCENTAGE OF CROP PRODUCTION BY CLASS

Class	SPB	SPC	CUC	TOM	CAN	OK	TUR	FC	FB
	Percent								
1	0.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	10.0	0.0	50.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	50.0	30.0	0.0
5	0.0	0.0	13.3	10.0	0.0	50.0	0.0	0.0	0.0
6	0.0	15.0	10.0	15.0	0.0	0.0	0.0	0.0	0.0
7	18.8	25.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0
8	18.8	0.0	26.7	35.0	16.7	0.0	25.0	0.0	33.3
9	0.0	20.0	26.7	30.0	36.7	0.0	0.0	60.0	33.3
10	62.5	20.0	23.3	0.0	36.7	0.0	25.0	0.0	33.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE IX

PERCENTAGE OF SEASONAL PRODUCTION BY CLASS

	Spring		Summer				Fall		
Class	SPB	SPC	CUC	TOM	CAN	OK	TUR	FC	FB
1	0.0	11.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	5.3	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	1.8	0.0	1.8	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	10.7	10.7	0.0
5	0.0	0.0	3.5	1.8	0.0	1.8	0.0	0.0	0.0
6	0.0	8.3	2.6	2.6	0.0	0.0	0.0	0.0	0.0
7	8.3	13.9	0.0	0.0	0.0	0.0	0.0	3.6	0.0
8	8.3	0.0	7.0	6.1	8.8	0.0	5.4	0.0	14.3
9	0.0	11.1	7.0	5.3	19.3	0.0	0.0	21.4	14.3
10	27.8	11.1	6.1	0.0	19.3	0.0	5.4	0.0	14.3
Total	44.4	55.6	26.3	17.5	52.6	3.5	21.4	35.7	42.9

ducer in the following manner:

(2) $$\pi_j = \sum_{i=1}^{n_j} [PROFIT_{ij} * PCRT_{ij}] / CLACRE_j,$$

where $PROFIT_{ij}$ is the net packing revenues (net of packing costs) less farm level variable production costs of each ith crop in the jth class, $PCRT_{ij}$ is the percentage of total packed crates for each of the ith crop in the jth class, and $CLACRE_j$ is the total acres planted by producers in the jth class. Per acre producer profits under seasonal pooling are calculated for each jth class of producer using the following equation.

(3) $$\pi_j = \sum_{i=1}^{n_j} [(POOL_k * (PYMT_{ij} / SEAS_k)) - (PROD_{ij} * PCRT_{ij})] / CLACREj$$

where $POOL_k$ is the kth seasonal pool of net packing facility revenues (net of packing costs allocated on per crate, tonnage or hours of operation basis), $PYMT_{ij}$ is the ith producer's gross revenues for the jth class , $SEAS_k$ is the kth seasonal pool of gross producer revenues for all crops grown in that season, and $PROD_i$ is the ith crop's farm level variable costs of production for the jth class.

Per acre producer returns under no-pooling are simulated with equation (2) except $PROFIT_{ij}$ in this case is the stochastic producer revenues (rather than the packing facility revenues) reduced by the average cost of packing and the farm level variable costs of production. Using either pooling rule the packing facility is assured of covering all of its costs, but not in the no-pool case.

In the final subroutine (VALCOS) called by the main program, costs are allocated to revenue pools according to each pool's contribution to total sales revenue of the packing facility. Equations (2) and (3) are used to generate crop and seasonal pools, respectively, although several of the variables are defined differently. In equation (2), $PROFIT_{ij}$ is defined using the following equation.

(4) $$PROFIT_{ij} = REVNUE_{ij} - PROD_{ij} - (VARCPC_{ij} * CRATES_{ij}) - FC_{ij}$$

where $REVNUE_{ij}$ is packing facility revenues for the ith crop in the jth class, $VARCPC_{ij}$ is the unit variable packing costs for the ith crop in the jth class, $CRATES_{ij}$ is the total number of crates packed for the ith crop in the jth class, and FC_{ij} is defined by equation (5):

(5) $FC_{ij} = FIXCOS * (REVNUE_{ij}/POOL)$

In equation (5) the variable FIXCOS contains total fixed packing costs for the packing facility and POOL represents total gross annual packing facility revenues.

To calculate returns under seasonal pooling in VALCOS the variable $POOL_k$ in equation (3), is calculated with the following formula:

(6) $POOL_k = REVNUE_k - (FIXCOS*(POOLC_k/POOL))$

where $REVNUE_k$ is the kth seasonal pool of packing facility revenues less total variable costs of packing of each crop in the kth seasonal pool, $POOLC_k$ is the kth seasonal pool of gross annual packing facility revenues, and FIXCOS is the total fixed packing costs for all crops packed.

CHAPTER IV

SIMULATION RESULTS AND STOCHASTIC DOMINANCE ANALYSIS

This chapter presents the results of the price and yield simulation and the analysis of the returns to the producers. The eleven scenarios are first analyzed for ten classes of producers using a mean-variance criterion. The strategies identified using the EV criterion as preferred are compared with the results of the stochastic dominance with respect to a function analysis. The SDRF analysis is conducted for three risk preference intervals. The implications of the results for management of the packing facility are discussed in Chapter V.

Prices and Yields

Prices and yields were simulated in this study due to the lack of sufficient historical data. Weekly Dallas wholesale prices for a ten-year period were used as the basis for generating weekly prices for 75 iterations of the simulation model. No historical yield information is available for Southeastern Oklahoma. Estimates of the maximum, minimum and modal yield values were used to generate the yield data with a triangular distribution.

Weekly prices were generated for the harvest weeks of the nine crops for the packing facility. Producer prices were estimated as deviations from the generated facility prices. A uniformly distributed random error of a maximum 10 percent was generated and used to estimate the producer prices as deviations from the facility prices. The ten percent deviation was selected to represent the maximum error that the packing facility management is expected to commit in estimating prices to pay the producers before knowing the market price that the facility will receive.

Table X presents the means and standard deviations of the simulated weekly prices as well as the historical weekly price means and standard deviations. Table X also presents the results of the t-tests of the means and Chi-Square tests of the variances of the simulated facility prices and historical prices. At the 5 per cent level, significantly different means were generated for two weeks of spring broccoli facility prices, one week of the tomato facility prices, and three weeks of cantaloupe facility prices. Chi-Square tests at the 5 per cent level determined that variances significantly different from historical values were generated for one week of spring broccoli, one week of cucumber prices, and one week of tomato prices. Overall, the simulated facility prices appear to do a good job of representing the historical series of weekly prices.

The means and standard deviations of the generated yields are presented in Table XI. The maximum and minimum generated values are presented as well. The generated values fall within the specified limits, which can be found in Table IV. Using the generated yields, packing costs are calculated each iteration. The means and standard deviations of the per crate packing costs under each of the cost allocation rules are presented in Table XII.

Some differences in means and variability of per crate packing costs can be found across the cost allocation methods. For example, mean per crate packing costs for spring broccoli range from $2.47 under sales value allocation to $3.68 under tonnage allocation. The standard deviations for fall broccoli range from .11 to .53 per crate and spring broccoli standard deviations range from .09 to 1.11 per crate. Other crop means and standard deviations under the four cost allocation methods vary less dramatically. Cucumber per crate packing cost means differ by $.25 between the per crate and sales value allocation methods.

TABLE X

COMPARISON OF GENERATED PRICES AND HISTORICAL DATA

Week	Facility Mean	Facility S.D.	Producer Mean	Producer S.D.	Historical Mean	Historical S.D.	T-test	Chi-Square
				Spring Broccoli				
			-----------------------Dollars per crate-----------------					
20	8.28	1.323	8.29	1.397	7.93	1.20	2.322*	90.22
21	8.26	1.313	8.28	1.387	7.92	1.10	2.275*	106.10**
22	8.04	1.060	8.04	1.181	7.83	1.22	1.755	55.96
23	8.14	1.195	8.07	1.268	8.09	1.34	0.380	58.92
24	8.41	1.367	8.37	1.389	8.27	1.28	0.858	84.40
				Spring Cabbage				
20	5.88	2.019	5.84	2.007	5.98	2.096	-0.43	68.66
21	6.44	2.850	6.50	2.920	6.43	3.190	0.039	59.06
22	6.06	1.830	6.12	1.903	6.09	2.098	-0.11	56.30
				Cucumbers				
23	11.16	2.442	11.09	2.476	11.08	2.057	0.255	104.20**
24	12.51	2.613	12.41	2.742	12.46	2.583	0.157	75.70
25	11.44	2.948	11.41	3.020	11.80	2.799	-1.05	82.12
26	11.61	3.185	11.63	3.375	11.80	3.157	-0.51	75.31
27	11.09	2.110	10.90	2.102	11.35	2.037	-1.06	79.40
28	11.97	2.211	11.98	2.386	11.73	2.211	0.910	74.05
29	11.43	2.107	11.33	2.218	11.52	1.821	-0.39	99.04
30	9.87	1.440	9.81	1.472	9.93	1.378	-0.33	80.83
31	8.96	1.204	8.97	1.317	9.13	1.138	-1.19	82.84
32	8.95	0.930	8.89	1.075	8.95	0.897	0.023	79.55
33	8.51	1.057	8.50	1.141	8.53	0.925	-0.12	96.66
34	8.47	1.218	8.45	1.347	8.35	1.135	0.853	85.10
35	8.64	1.156	8.58	1.287	8.64	1.131	0	77.26
36	9.64	1.645	9.56	1.730	9.55	1.781	0.473	63.11
37	9.42	1.351	9.52	1.400	9.31	1.370	0.688	71.92
38	9.41	1.278	9.52	1.437	9.35	1.319	0.406	69.51
39	9.82	1.814	9.72	1.790	9.78	1.882	0.214	68.76

* Facility price means tested at 5% level significantly different from historical price means

** Facility price variances tested at 5% level significantly different from historical price variances

TABLE X (Continued)

Week	Facility Mean	Facility S.D.	Producer Mean	Producer S.D.	Historical Mean	Historical S.D.	T-test	Chi-Square
				Tomatos				
				Dollars per crate				
23	8.88	1.679	8.77	1.711	8.66	1.739	1.121	68.99
24	9.05	1.980	9.17	2.086	8.70	2.158	1.519	62.29
25	8.86	2.448	8.84	2.523	8.59	2.802	0.972	56.51
26	8.13	1.719	8.14	1.764	7.80	2.067	0.667	51.17**
27	7.55	1.167	7.69	1.300	7.36	1.273	1.387	62.14
28	7.25	0.781	7.30	0.794	7.19	0.721	0.687	86.85
29	7.42	1.204	7.48	1.260	7.48	1.211	-0.43	73.07
30	7.36	2.276	7.44	2.282	7.78	2.340	-1.60	69.97
31	7.08	1.983	7.07	1.993	7.31	2.075	-1.01	67.56
32	7.07	1.980	7.06	2.003	7.51	1.937	-1.93	77.34
33	6.29	1.642	6.34	1.699	6.64	1.656	-1.82	72.72
34	6.01	1.230	5.97	1.274	6.30	1.211	-2.04*	76.33
				Cantaloupe				
28	8.28	0.918	8.25	1.042	8.30	0.849	-0.16	86.46
29	8.25	0.719	8.22	0.857	8.11	0.649	1.679	90.85
30	8.25	0.751	8.41	0.945	8.04	0.705	2.442*	83.98
31	7.98	0.846	7.94	0.922	7.72	0.889	2.633*	67.12
32	7.84	0.834	7.86	1.035	7.64	0.830	2.101*	74.78
33	7.50	1.152	7.43	1.173	7.35	1.256	1.108	62.17
34	7.21	0.800	7.18	0.892	7.20	0.788	0.081	76.11
35	7.59	0.774	7.70	0.914	7.48	0.878	1.258	57.46
36	7.46	0.537	7.49	0.652	7.34	0.626	1.934	54.34
37	7.91	0.729	7.84	0.824	7.75	0.737	1.929	72.39
38	8.09	0.429	8.11	0.715	8.03	0.470	1.210	61.51
				Okra				
27	7.26	1.621	7.22	1.636	7.32	1.469	-0.30	90.03
28	7.36	1.662	7.29	1.714	7.43	1.597	-0.33	80.19
29	7.40	1.388	7.42	1.465	7.43	1.275	-0.15	87.79
30	6.83	1.084	6.88	1.194	6.83	1.049	0.039	79.13
31	6.52	1.143	6.50	1.182	6.45	1.150	0.530	73.11
32	6.69	1.098	6.70	1.165	6.63	1.091	0.512	74.94
33	6.46	1.213	6.38	1.220	6.38	1.147	0.602	82.78
34	6.12	1.169	6.08	1.213	6.01	1.092	0.792	84.80
35	5.95	1.297	6.01	1.375	5.86	1.142	0.580	95.41
36	6.03	1.365	5.98	1.372	5.93	1.245	0.665	89.03
37	6.09	1.541	6.00	1.590	5.98	1.375	0.646	92.82
38	6.46	1.692	6.50	1.724	6.40	1.484	0.306	96.25

TABLE X (Continued)

Week	Facility Mean	Facility S.D.	Producer Mean	Producer S.D.	Historical Mean	Historical S.D.	T-test	Chi-Square
				Turnips				
				----------------------Dollars per crate-------------------				
40	6.24	0.278	6.23	0.429	6.23	0.283	0.020	71.29
41	6.06	0.440	6.06	0.549	6.06	0.466	0	66.10
42	6.03	0.444	6.02	0.552	6.01	0.455	0.024	70.48
43	5.92	0.512	5.81	0.575	5.91	0.515	0.014	73.17
44	5.80	0.464	5.76	0.590	5.83	0.512	-0.03	60.78
45	5.58	0.592	5.61	0.656	5.63	0.673	-0.06	57.40
46	5.50	0.633	5.49	0.690	5.54	0.736	-0.05	54.76
47	5.33	0.754	5.27	0.790	5.37	0.870	-0.06	55.68
48	5.14	0.896	5.13	0.933	5.19	1.025	-0.08	56.56
				Fall Cabbage				
44	5.72	1.033	5.71	1.034	5.65	1.006	0.578	77.93
45	5.60	1.027	5.58	1.040	5.58	1.054	0.210	70.16
46	6.04	1.968	6.06	1.995	5.99	1.875	0.219	81.54
47	5.68	1.588	5.68	1.662	5.65	1.573	0.185	75.39
48	5.52	1.396	5.50	1.387	5.48	1.379	0.260	75.93
49	5.35	1.815	5.38	1.865	5.35	1.830	-0.00	72.82
				Fall Broccoli				
38	8.62	1.028	8.74	1.188	8.45	0.96	1.44	84.18
39	8.63	1.538	8.74	1.489	8.89	1.50	-1.45	77.88
40	8.41	1.364	8.44	1.460	8.55	1.30	-0.86	82.07
41	8.73	1.596	8.70	1.766	8.41	1.49	1.73	85.09
42	9.11	1.902	9.16	2.027	8.97	1.74	0.66	88.47
43	8.28	1.345	8.27	1.394	8.45	1.27	-1.11	83.19
44	8.07	1.168	8.14	1.306	8.07	1.13	0.00	79.03

TABLE XI

GENERATED YIELDS PER ACRE

Crop	Mean	Std Dev	Maximum	Minimum
	-Crates Per Acre-			
SPB	513.12	146.03	711.92	248.42
SPC	708.55	189.69	948.71	321.33
CUC	489.50	158.95	699.61	230.67
TOM	1011.06	312.55	1498.54	543.14
CAN	464.83	125.49	629.99	252.10
OK	707.82	209.21	988.72	341.43
TUR	774.01	170.54	999.17	456.18
FC	769.78	197.14	976.10	339.30
FB	511.69	159.75	719.97	222.86

TABLE XII

PER CRATE PACKING COSTS BY COST ALLOCATION METHOD

	Crates		Tons		Hours		Sales Value*	
Crop	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
				Dollars Per Crate				
SPB	3.34	0.72	3.68	1.11	3.19	0.61	2.47	0.09
SPC	1.49	0.05	1.63	0.08	1.45	0.04	1.48	0.16
CUC	1.82	0.06	2.00	0.09	1.90	0.06	2.07	0.10
TOM	1.64	0.05	1.51	0.04	1.60	0.04	1.75	0.10
CAN	2.02	0.07	2.03	0.08	1.93	0.07	2.07	0.08
OK	1.68	0.05	1.43	0.02	2.75	0.17	1.72	0.09
TUR	2.3	0.05	2.25	0.04	2.44	0.05	2.29	0.06
FC	1.49	0.05	1.63	0.08	1.45	0.04	1.47	0.11
FB	2.79	0.34	2.86	0.53	2.72	0.29	2.53	0.11

*Costs allocated based on the crop's percentage contribution to total packing facility revenues

Analysis of Producer Returns

The means, standard deviations, ranges, skewness and coefficients of variation of the returns simulated for each class of producer under each of the eleven scenarios are presented in Table XIII. A perusal of the means and standard deviations across classes reveals that Class 1 producers experience the highest levels of variation in returns. Class 3 and 5 producers achieve the highest mean returns per acre. Class 1 and 7 producers have the greatest possibility of realizing negative returns, as non-positive returns are possible for each of the cost allocation and revenue distribution strategies. Variability of mean returns differs across strategies most noticeably for Class 2 and 3 producers, whose mean returns vary across strategies by $1100 and $1400 per acre, respectively. In contrast, the mean returns for Class 1 producers do not vary across strategies by more than $125.

With the exception of Class 2 producer returns and one strategy of Class3 producer returns, producer returns are positively skewed. Skewness varies relatively little across strategies for each class of producer, with the exception of Classes 1, 3, 5, and 7. The influence of skewness on expected utility is positive. Other things being equal, higher positive skewness increases expected utility for all risk averse individuals with decreasing or constant absoute risk-aversion for increases in monetary wealth (Tsiang). The implication of this result is that cost allocation and revenue distribution rule combinations that are more positively skewed should be in the efficient sets of the more risk averse decision makers, other things being the same.

According to the minimum return levels, Class 1, 2, 3, 5, and 7 producers face the possibility that in a given year they will face negative returns. Class 1 and 3 producers have the potential of earning a negative return of more than $1000 per acre, depending on the cost allocation and revenue distribution method selected. However, Class 1 producers have the potential to earn the highest maximum returns per acre, in excess of

TABLE XIII

RETURNS TO PRODUCERS: STATISTICS BY CLASS AND STRATEGY*

Strategy	Mean	Std Dev	Maximum	Minimum	Skewness	CV
		Class 1:	Spring Cabbage			
	---------------------Dollars per acre---------------------					
CrtCrp	1620.77	1516.71	7035.40	-727.40	.93	.94
CrtNop	1640.28	1554.69	7484.30	-709.20	1.10	.95
CrtSea	1661.94	1521.32	7356.90	-761.80	.96	.92
HrsCrp	1648.13	1519.94	7062.60	-721.80	.93	.92
HrsNop	1668.59	1559.21	7522.10	-701.20	1.10	.93
HrsSea	1683.85	1523.27	7355.70	-744.20	.96	.90
TonCrp	1528.28	1505.65	6903.70	-751.40	.94	.99
TonNop	1543.93	1539.32	7355.40	-736.40	1.12	1.00
TonSea	1587.31	1514.88	7313.60	-821.30	.95	.95
ValCrp	1585.21	1463.65	6731.00	-1323.00	.79	.92
ValSea	1530.85	1350.47	6488.80	-787.30	.98	.88
		Class 2:	Cantaloupe			
CrtCrp	1462.47	554.73	2417.00	441.80	-.14	.38
CrtNop	1458.54	538.84	2460.60	523.40	-.10	.37
CrtSea	1460.13	547.70	2446.50	505.10	-.11	.38
HrsCrp	1499.92	563.33	2454.00	469.90	-.14	.38
HrsNop	1496.41	548.68	2511.10	545.10	-.11	.37
HrsSea	1497.85	557.05	2492.40	527.50	-.12	.37
TonCrp	1456.45	551.37	2408.00	439.30	-.14	.38
TonNop	1453.05	537.41	2453.20	520.30	-.10	.37
TonSea	1454.36	545.65	2437.00	500.60	-.12	.38
ValCrp	402.70	279.78	1113.10	-173.60	.18	.69
ValSea	475.87	280.69	1250.20	-53.80	.20	.59

*Crt: Per crate basis of cost allocation
Hrs: Hours of packing line operation cost allocation basis
Ton: Contribution to total tonnage cost allocation basis
Val: Contribution to sales value in a revenue pool basis of cost allocation
Crp: Crop pool revenue distribution method
Nop: No pooling revenue distribution method
Sea: Seasonal pool revenue distribution method

TABLE XIII (Continued)

Strategy	Mean	Std Dev	Maximum	Minimum	Skewness	CV
		Class 3:	Tomatos and Okra			
		----------Dollars per acre----------				
CrtCrp	1871.29	876.09	4130.40	429.50	.49	.47
CrtNop	1877.71	862.64	4076.50	446.80	.46	.46
CrtSea	1879.10	881.04	4119.00	396.00	.49	.47
HrsCrp	1552.98	869.34	3779.20	10.90	.49	.56
HrsNop	1556.61	835.76	3646.10	47.60	.44	.54
HrsSea	1558.43	853.16	3692.90	12.00	.47	.55
TonCrp	2007.50	889.91	4292.50	570.40	.49	.44
TonNop	2015.50	885.85	4268.90	582.10	.46	.44
TonSea	2016.17	903.60	4310.80	514.60	.49	.45
ValCrp	598.52	973.96	2731.00	-1872.70	-.04	1.63
ValSea	676.46	878.85	2635.90	-1482.60	.14	1.30
		Class 4:	Turnips and Fall Cabbage			
CrtCrp	1352.57	582.66	2880.50	260.60	.48	.43
CrtNop	1343.48	565.61	2760.00	212.40	.39	.42
CrtSea	1356.12	574.87	2790.70	207.00	.31	.42
HrsCrp	1342.84	583.64	2868.90	250.80	.47	.43
HrsNop	1334.17	566.40	2748.30	215.40	.39	.42
HrsSea	1344.29	574.80	2783.20	208.20	.33	.43
TonCrp	1339.53	578.43	2869.50	245.30	.48	.43
TonNop	1327.80	560.60	2740.40	172.20	.39	.42
TonSea	1348.84	573.09	2759.90	162.00	.25	.42
ValCrp	1377.47	562.47	2841.80	319.50	.46	.41
ValSea	1478.24	535.45	2912.90	421.60	.53	.36
		Class 5:	Cucumbers, Okra, and Tomatos			
CrtCrp	2082.52	676.62	3691.90	538.20	.29	.32
CrtNop	2078.94	659.38	3697.50	545.10	.26	.32
CrtSea	2080.99	681.63	3733.30	505.40	.31	.33
HrsCrp	1906.39	678.28	3499.50	318.80	.28	.36
HrsNop	1900.95	646.75	3461.20	335.10	.24	.34
HrsSea	1903.52	669.08	3501.60	304.50	.29	.35
TonCrp	2111.21	673.11	3731.80	577.60	.31	.32
TonNop	2107.12	657.04	3744.30	588.40	.29	.31
TonSea	2109.36	681.10	3778.60	537.90	.33	.32
ValCrp	1411.33	719.59	3060.80	-621.50	.07	.51
ValSea	1381.23	679.96	2965.40	-445.80	.08	.49

TABLE XIII (Continued)

Strategy	Mean	Std Dev	Maximum	Minimum	Skewness	CV
	Class 6:	Spring Cabbage, Cucumbers, and Tomatos				
	----------------------Dollars per acre---------------------					
CrtCrp	1867.76	783.20	3685.00	291.60	.17	.42
CrtNop	1876.80	776.40	3837.30	281.70	.20	.41
CrtSea	1886.28	799.84	3810.60	291.80	.22	.42
HrsCrp	1876.98	783.39	3697.80	302.60	.17	.42
HrsNop	1886.39	778.41	3858.00	288.50	.20	.41
HrsSea	1893.83	798.79	3813.90	296.70	.21	.42
TonCrp	1849.36	785.13	3674.80	258.60	.17	.42
TonNop	1857.13	775.63	3828.00	262.40	.21	.42
TonSea	1873.82	807.77	3827.80	282.60	.24	.43
ValCrp	1798.62	769.98	3551.70	276.70	.14	.43
ValSea	1716.43	737.43	3377.80	182.10	.17	.43
	Class 7: Spring Cabbage, and Spring and Fall Broccoli					
CrtCrp	1355.58	838.63	4628.00	-307.90	.86	.62
CrtNop	1335.98	845.25	4746.90	-233.00	1.10	.63
CrtSea	1362.58	840.22	4657.60	-308.30	.85	.62
HrsCrp	1392.27	838.36	4657.20	-272.10	.86	.60
HrsNop	1377.35	848.40	4797.20	-208.30	1.09	.62
HrsSea	1398.17	839.59	4684.80	-272.70	.85	.60
TonCrp	1255.28	839.08	4523.80	-423.10	.83	.67
TonNop	1219.69	835.28	4604.70	-300.80	1.13	.68
TonSea	1265.53	841.91	4557.90	-423.30	.80	.67
ValCrp	1435.28	809.18	4529.80	-422.60	.74	.56
ValSea	1393.68	790.42	4415.20	-400.80	.77	.57
	Class 8: Spring and Fall Broccoli, Cucumbers, Tomatos, Cantaloupe and Turnips					
CrtCrp	1539.48	421.82	2929.50	833.50	.90	.27
CrtNop	1524.90	393.39	2790.40	846.30	.90	.26
CrtSea	1535.66	417.34	2890.20	823.00	.90	.27
HrsCrp	1553.96	420.47	2938.30	846.90	.90	.27
HrsNop	1542.05	395.15	2813.00	860.60	.90	.26
HrsSea	1551.22	417.78	2903.20	834.90	.90	.27
TonCrp	1538.08	423.86	2933.80	824.20	.90	.28
TonNop	1515.24	393.57	2774.10	837.30	.90	.26
TonSea	1531.50	418.60	2889.70	823.00	.90	.27
ValCrp	1280.91	404.58	2584.90	525.00	.83	.32
ValSea	1287.05	401.47	2554.30	554.00	.85	.31

TABLE XIII (Continued)

Strategy	Mean	Std Dev	Maximum	Minimum	Skewness	CV
	Class 9: Spring and Fall Cabbage, Cucumbers, Tomatos, Cantaloupe and Fall Broccoli					
	----------------------Dollars per acre---------------------					
CrtCrp	1591.19	398.32	2635.10	812.60	.33	.25
CrtNop	1586.09	381.41	2568.70	839.00	.34	.24
CrtSea	1595.15	400.50	2654.40	800.10	.35	.25
HrsCrp	1615.20	397.64	2654.70	833.00	.33	.25
HrsNop	1611.44	384.04	2599.40	861.80	.34	.24
HrsSea	1618.89	401.60	2677.00	815.70	.34	.25
TonCrp	1562.09	397.70	2607.40	793.50	.33	.25
TonNop	1552.88	378.35	2531.90	804.60	.35	.24
TonSea	1567.31	398.26	2626.50	783.50	.36	.25
ValCrp	1194.52	366.58	2150.10	572.30	.49	.31
ValSea	1153.35	358.69	2107.90	545.00	.51	.31
	Class 10: Spring and Fall Broccoli, Spring Cabbage, Cucumbers, Cantaloupe and Turnips					
CrtCrp	1395.03	326.16	2230.80	673.30	.29	.23
CrtNop	1370.42	302.41	2120.10	707.90	.19	.22
CrtSea	1385.05	318.58	2216.70	677.30	.28	.23
HrsCrp	1419.28	326.55	2248.70	696.00	.28	.23
HrsNop	1398.39	306.08	2156.10	727.10	.18	.22
HrsSea	1410.54	320.44	2239.10	696.90	.27	.23
TonCrp	1357.84	326.04	2204.50	634.30	.29	.24
TonNop	1321.10	297.77	2055.40	662.60	.19	.23
TonSea	1344.21	315.88	2181.60	641.20	.30	.23
ValCrp	1025.81	276.57	1756.20	434.40	.29	.27
ValSea	1060.85	281.58	1774.10	489.20	.22	.27

$7000 under particular strategies.

The difficulty for any class of producer to determine which combination of cost allocation and revenue distribution rules is preferred from the raw statistics is apparent. Potential producers desiring to determine whether they should grow 1, 2, 3 or 6 crops can get an indication from the statistics that one- crop specialists can experience high levels of risk, but that it varies by crop. For example, Class 1 and 2 producers are both one-crop classes, but spring cabbage appears to be much riskier than cantaloupe. In addition, cantaloupe producers are more vulnerable than cabbage producers to the effects of the selection of the cost allocation and revenue distribution rule.

Plots of the means and standard deviations of the per acre producer returns for the ten classes of producers are shown in Figures 6-15. From the plots, many of the combinations of cost allocation and revenue distribution can be easily eliminated from consideration. For example, using the mean-variance criterion , Class 1 producers (Figure 6) prefer HrsSea over HrsNop, CrtNop and TonNop because selection of HrsSea results in the higher mean with a lower level of variability. However, no decision can be made between HrsSea and those strategies located to the left and below it using the mean-variance criteria because the mean returns under the HrsSea strategy are highest but so is its variability of returns, albeit only slightly in the cases of CrtSea, HrsCrp, TonSea, and TonCrp.

In Figure 7, Class 2 producers would prefer hours of operation cost allocation over per crate or tonnage for the same revenue distribution method. For example, HrsCrp would always be preferred over CrtCrp and TonCrp. The mean-variance criteria does not help to select the risk efficient strategy from among HrsNop, HrsSea and HrsCrp however. Strategies using value of sales revenue as a cost allocation strategy do not appear in Figure 7 because the mean values and standard deviations were so low compared to the other strategies (See Table XIII).

Class 3 producers (Figure 8) would prefer TonNop to TonCrp and TonSea, CrtNop

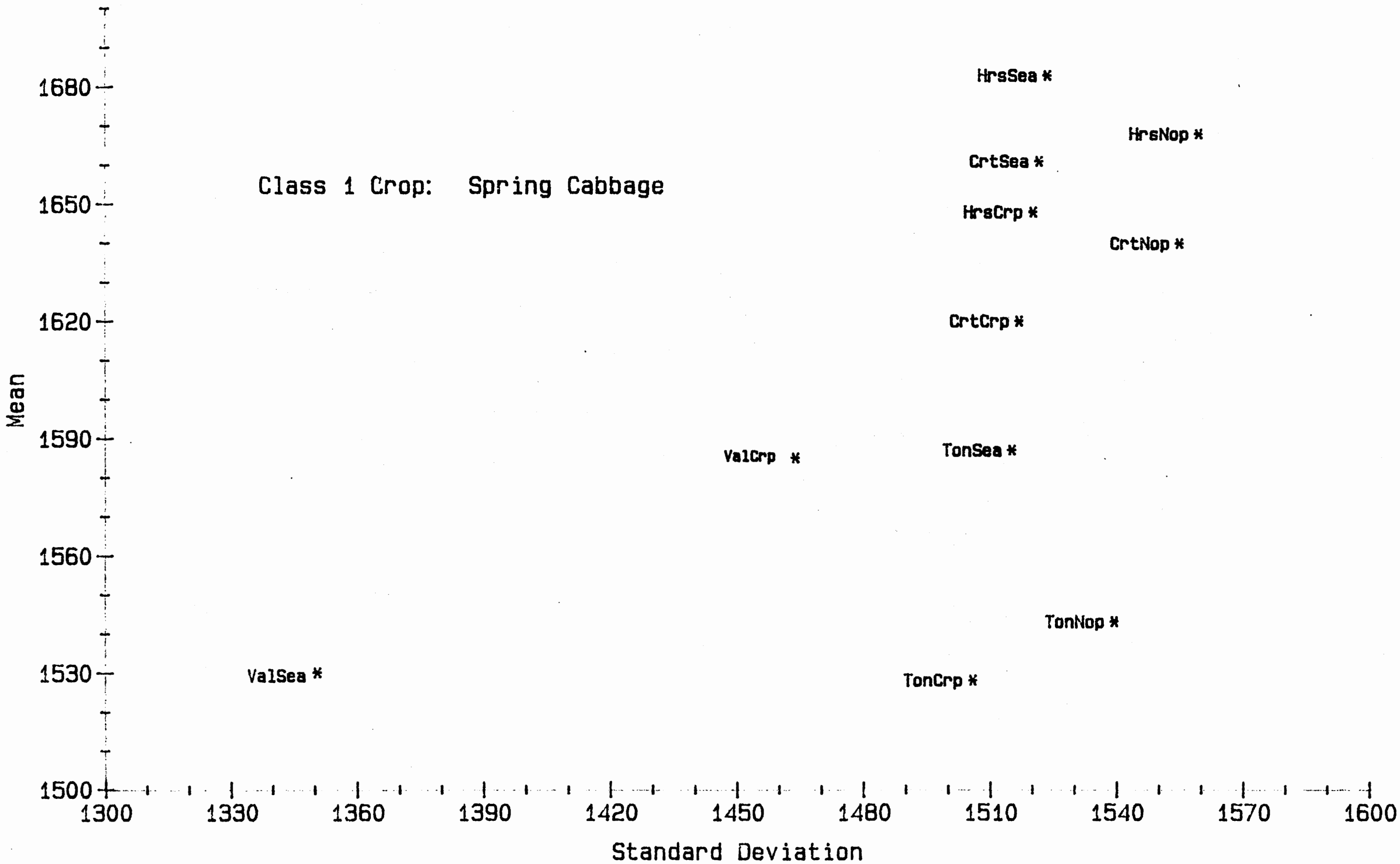


Figure 6. Means and Standard Deviations of Per Acre Producer Returns

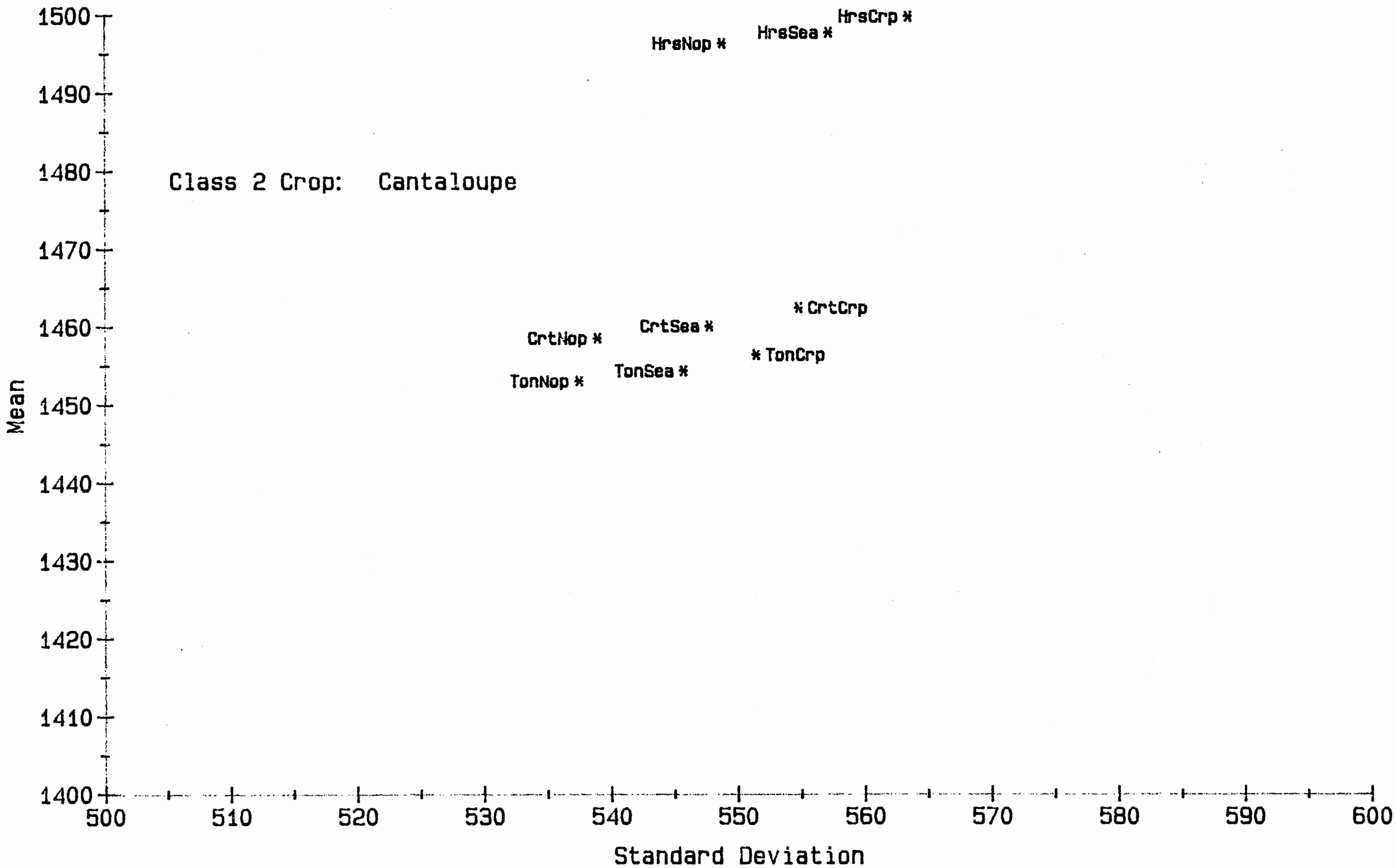


Figure 7. Means and Standard Deviations of Per Acre Producer Returns

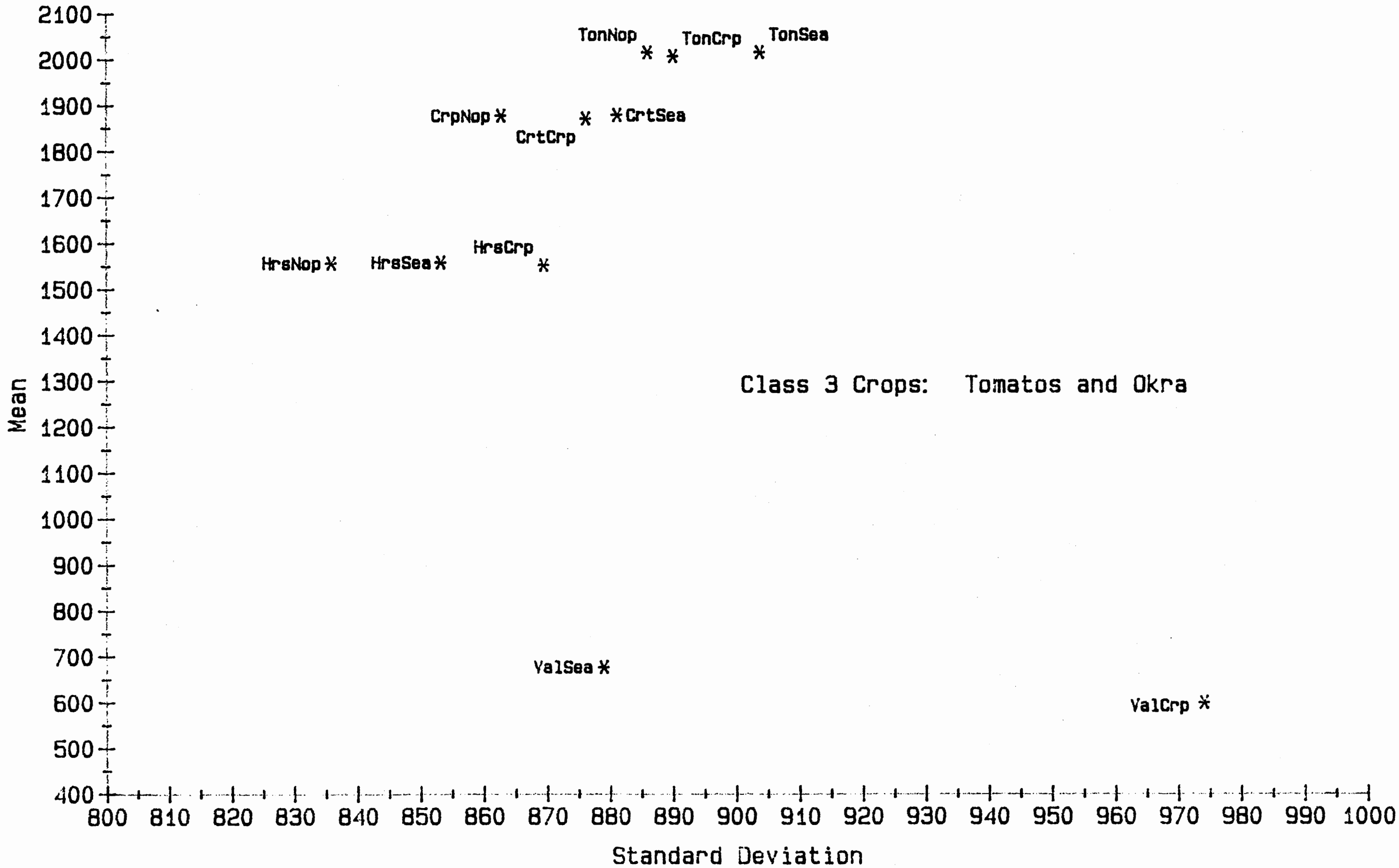


Figure 8. Means and Standard Deviations of Per Acre Producer Returns

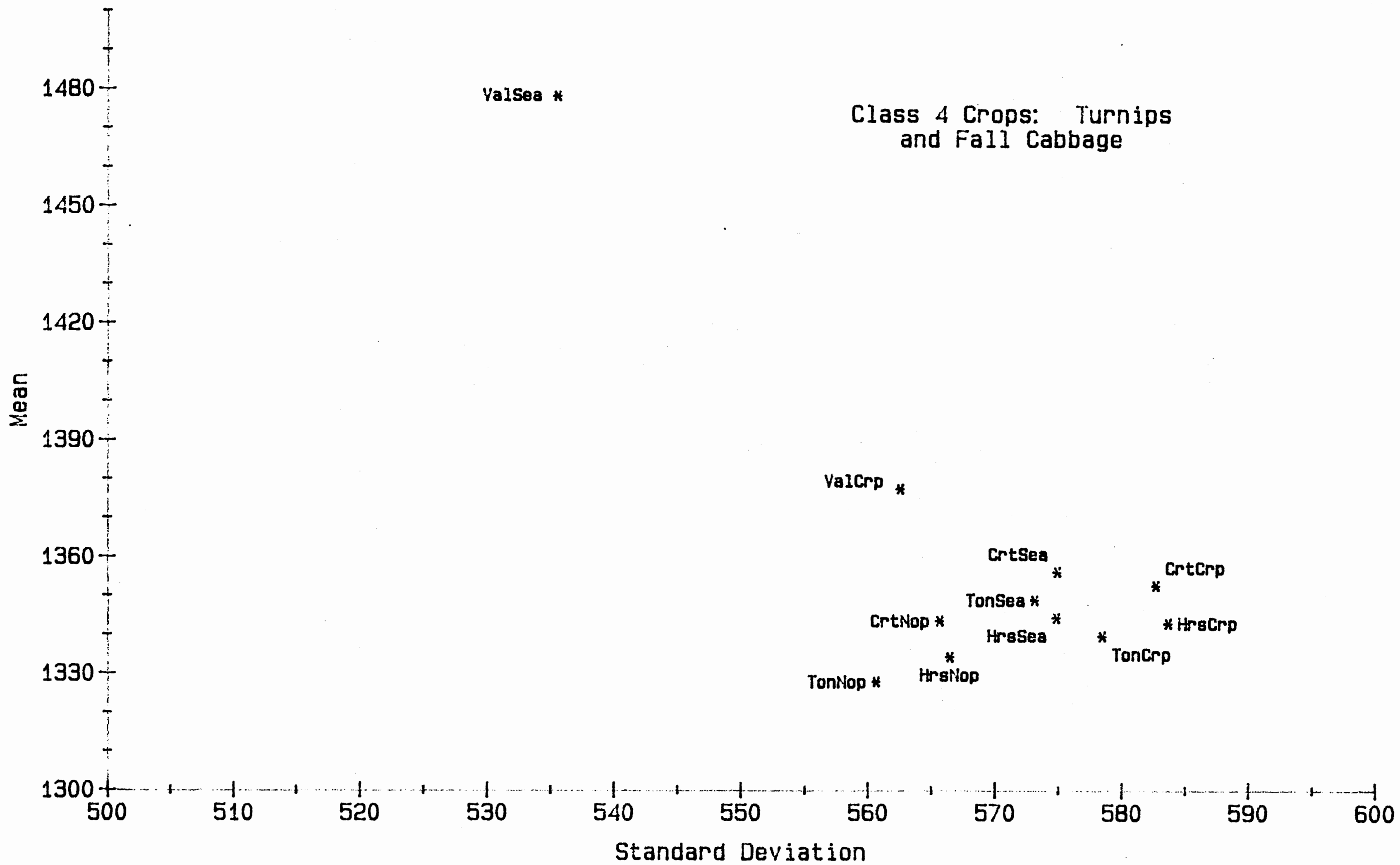


Figure 9. Means and Standard Deviations of Per Acre Producer Returns

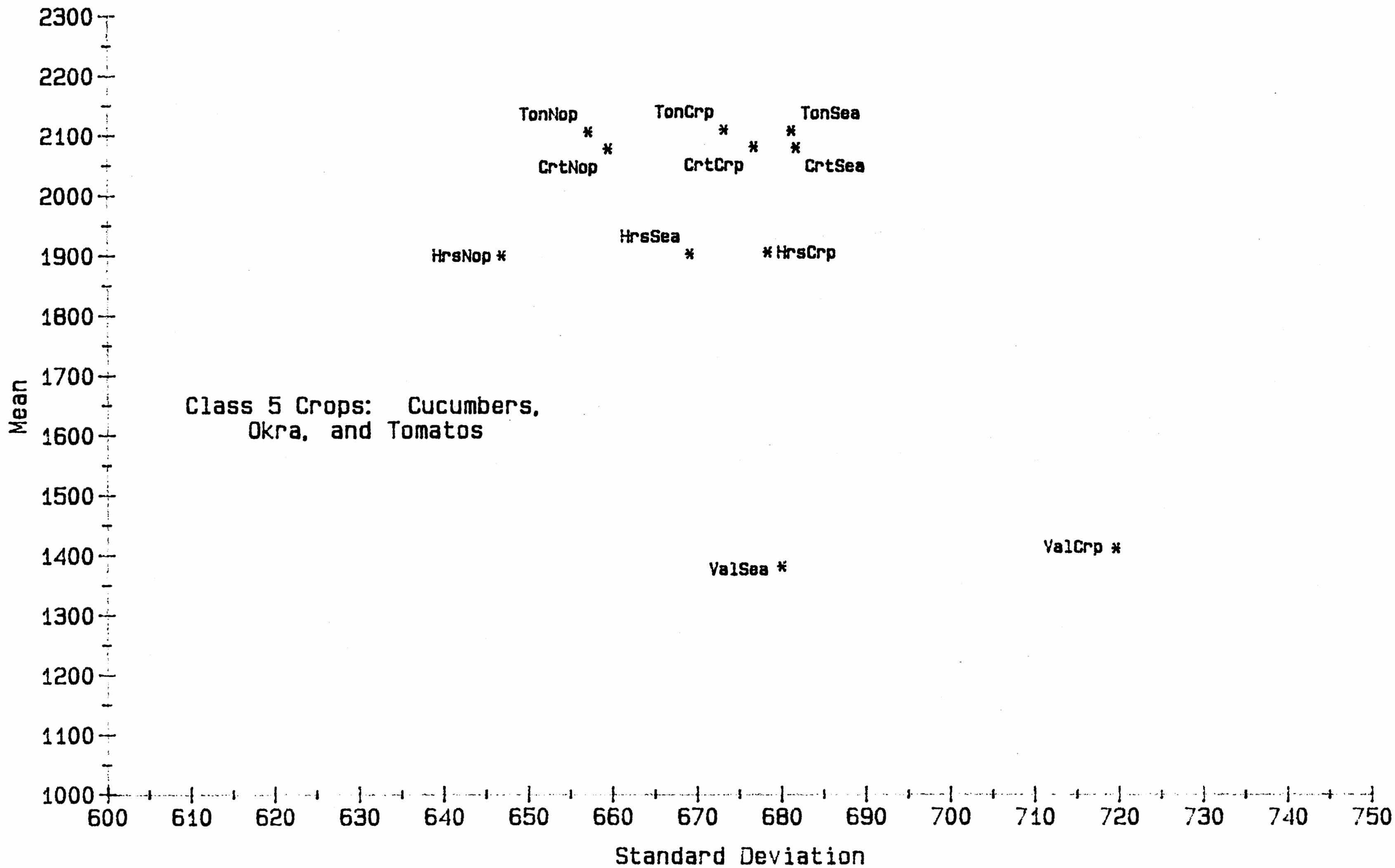


Figure 10. Means and Standard Deviations of Per Acre Producer Returns

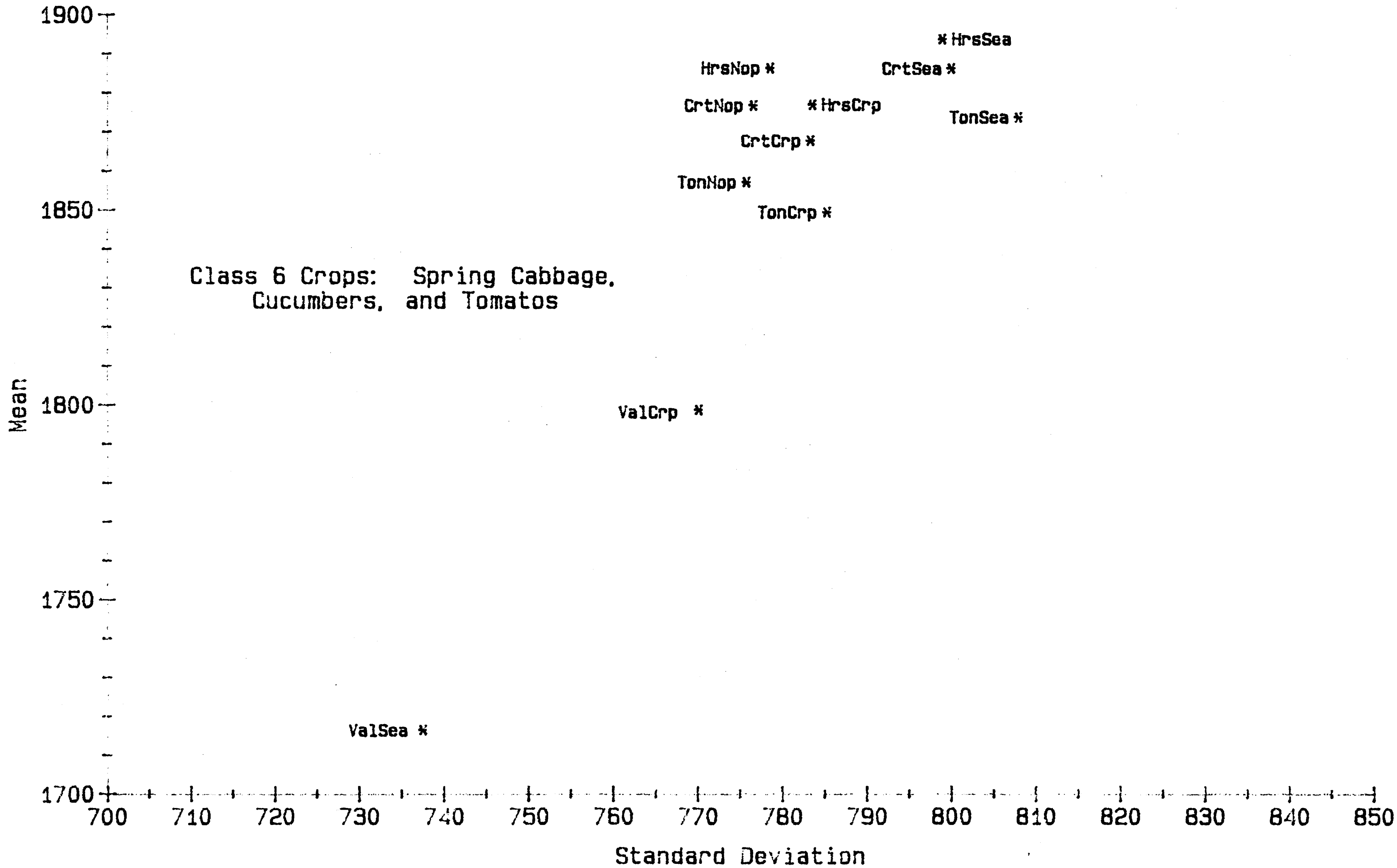


Figure 11. Means and Standard Deviations of Per Acre Producer Returns

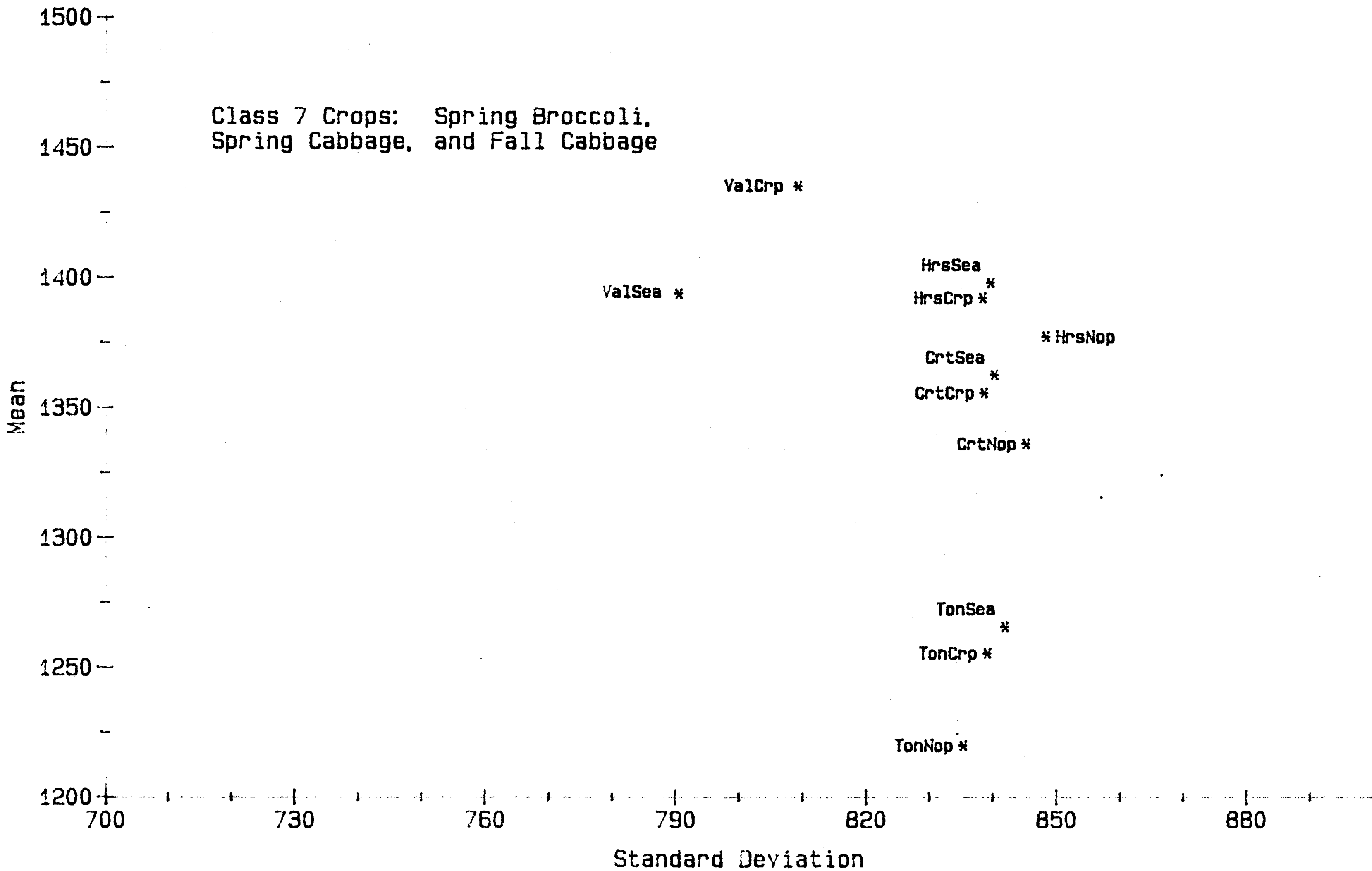


Figure 12. Means and Standard Deviations of Per Acre Producer Returns

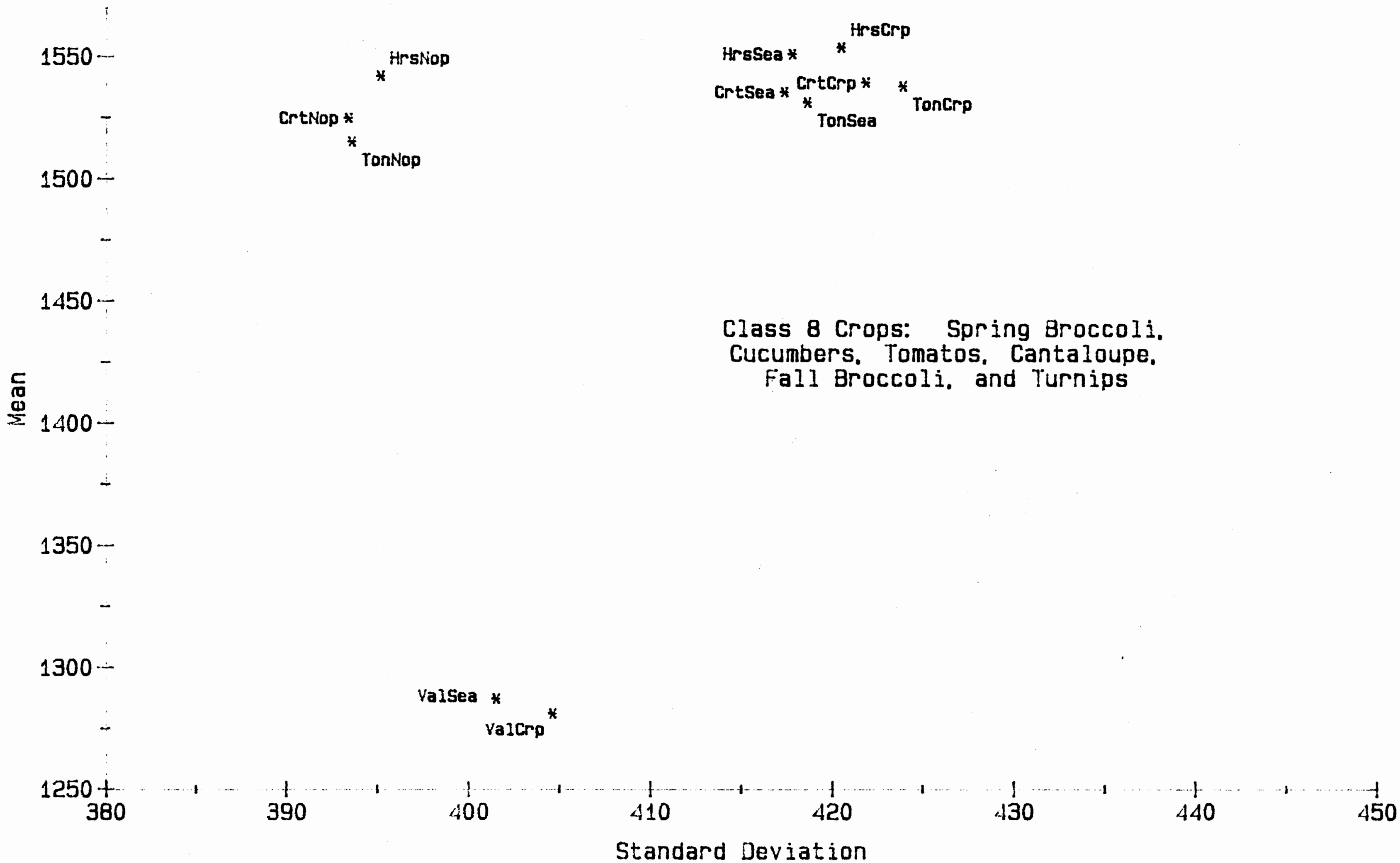


Figure 13. Means and Standard Deviations of Per Acre Producer Returns

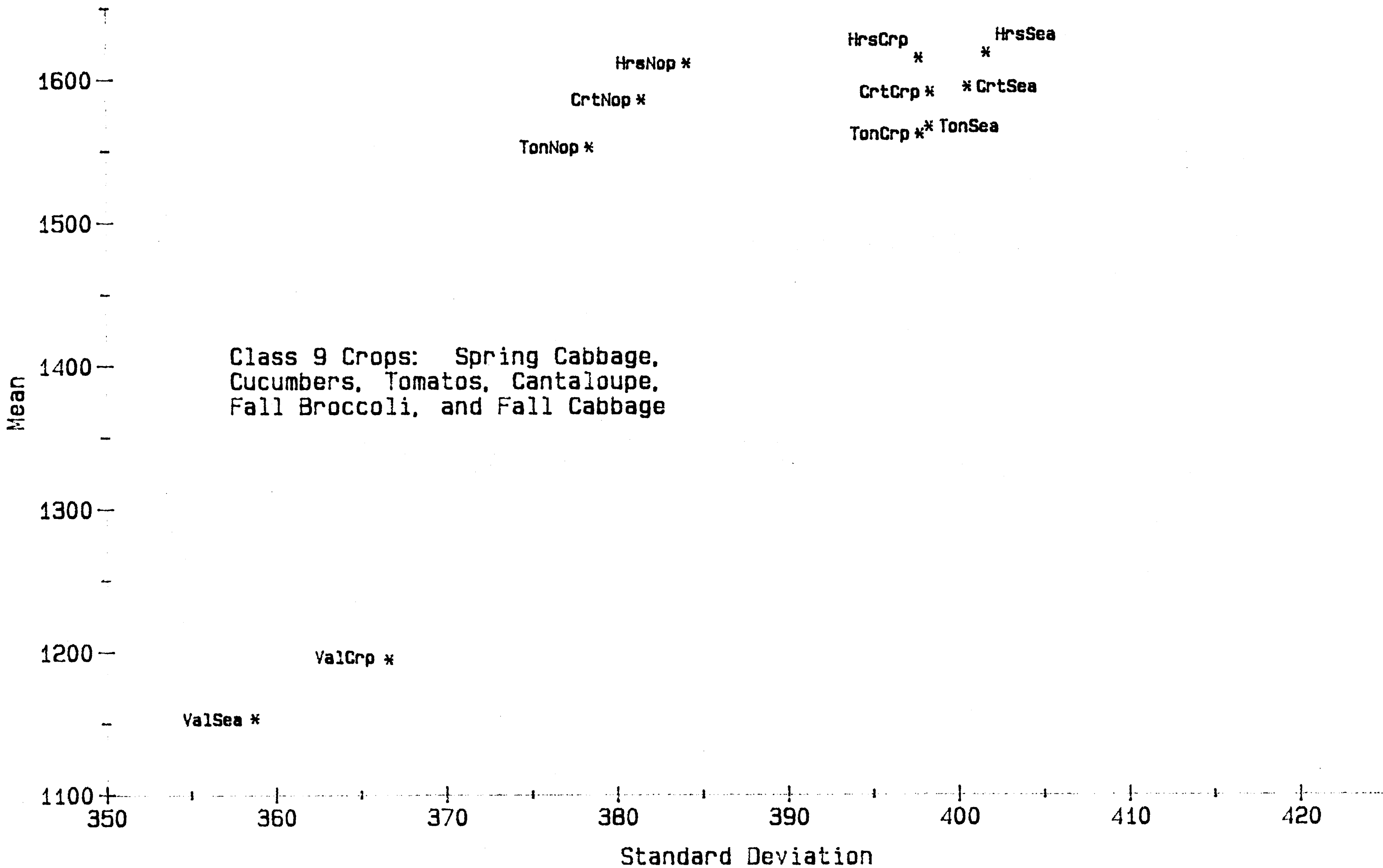


Figure 14. Means and Standard Deviations of Per Acre Producer Returns

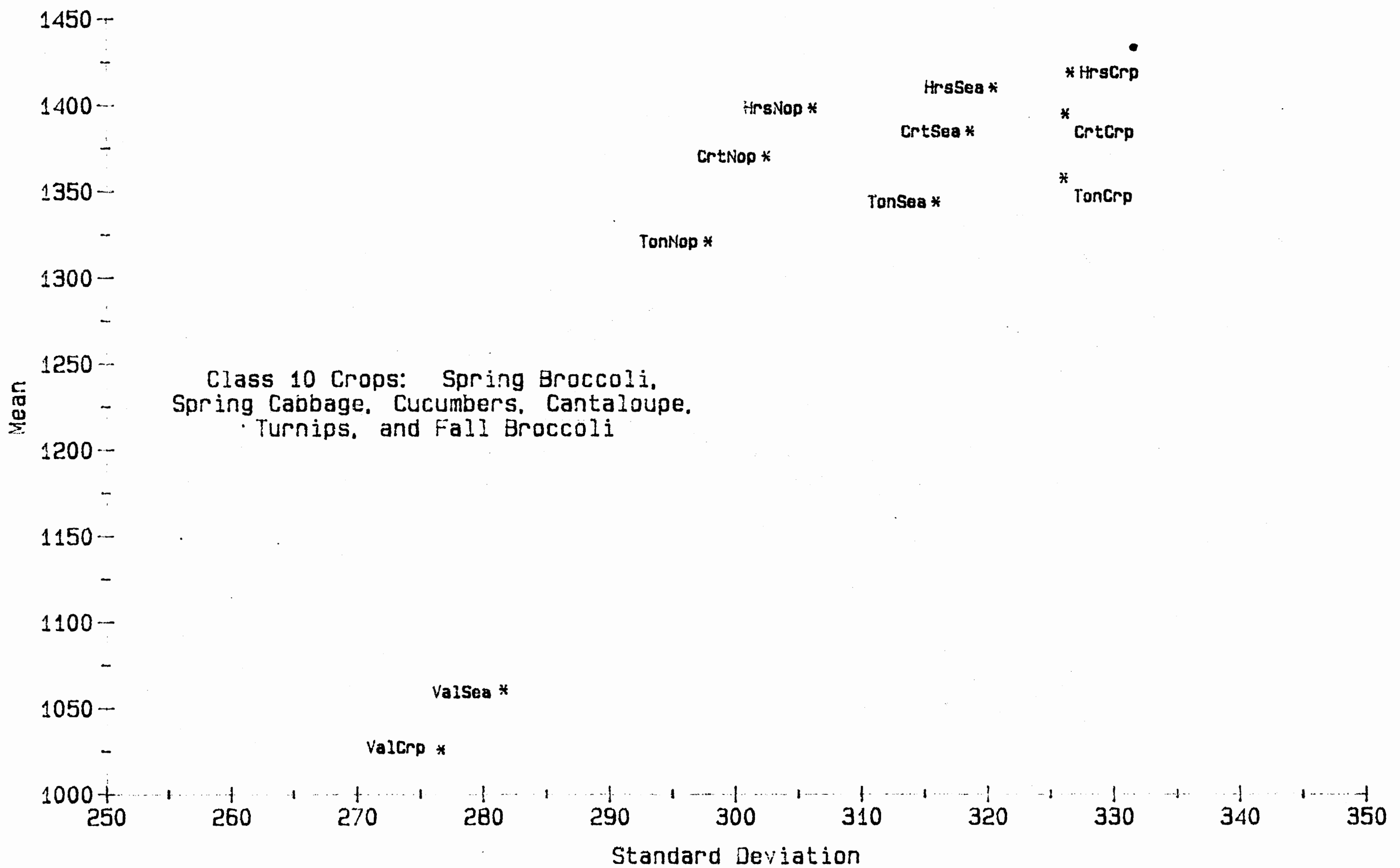


Figure 15. Means and Standard Deviations of Per Acre Producer Returns

to CrtCrp and CrtSea, and HrsNop to HrsSea and HrsCrp using a mean-variance criteria. Which of the three no pooling revenue distribution rules is preferred, however, rests with the risk attitude of the producers, although it seems that considerable mean returns are sacrificed for relatively minor decreases in variation in returns if a producer preferred HrsNop over TonNop.

In the case of Class 4 producers, the preferred strategy using EV analysis is ValSea, which in Figure 9, has the highest mean return with the lowest variability. It would seem that Class 5 (Figure 10) producers would prefer the TonNop strategy over all others given that it has the highest mean return and less variability than all other strategies except HrsNop. In Figure 11, Class 6 producers would prefer HrsNop to CrtCrp, TonCrp, HrsCrp, CrtSea, HrsSea and, TonSea using EV analysis. No decision can be made between HrsNop and the strategies lying below it and to the left using EV analysis.

Class 7 producers (Figure 12) similarly can easily identify ValCrp as the dominant strategy using EV analysis, although no decision can be made between ValCrp and ValSea. Visual inspection of Figure 13 shows that for Class 8 producers HrsNop appears to be the preferred strategy given its position of highest mean returns and almost the lowest standard devation of returns. Certainly no rational producer would prefer CrtSea, TonSea, TonCrp, CrtCrp, HrsSea, or HrsCrp all of which have less or equivalent mean returns and similar or more variability than does HrsNop.

Class 9 (Figure 14) producers would appear to prefer no pooling revenue distribution to either crop or seasonal pooling revenue distribution given its high mean return and relatively low standard deviation of returns compared to the other sets of strategies. It is doubtful that value of sales contribution cost allocation strategies, ValCrp and ValSea, experience enough of a drop in variability to make up for the relatively large decrease in mean returns for either strategy to be a preferred one. Strictly applying the EV criteria, however, leads to the conclusion that HrsNop dominates CrtCrp, CrtSea, TonCrp and TonSea, but no decision can be made regarding HrsNop, CrtNop and TonNop.

Class 10 (Figure 15) producers likewise would prefer the no pooling revenue distribution method over seasonal and crop pooling methods. It would seem that HrsNop is again the preferred strategy with ValSea being a possible alternative depending on producer risk attitudes.

Given the limitations of the mean-variance analysis, the results were analyzed using stochastic dominance with respect to a function (SDRF). The risk intervals used are 0 to .005, .005 to .01, and .01 to .015. The lower limit of each risk interval is represented by R1 and the upper limit is represented by R2 in the results of the the SDRF analysis shown in Appendix D. The first interval includes risk neutral to slightly risk averse attitudes. The second interval encompasses moderate risk aversion, and the third interval includes fairly strongly risk averse producers, according to the Buccola and Subaei study.

These intervals were used by Buccola and Subaei, whose outcome variables were also per acre returns from horticulural crops, and thus can be considered relevant ranges for this study. (See Raskin and Cochran, 1986, for their discussion of the need to exercise caution when Arrow-Pratt intervals from one study are used as secondary data in another study).

The results of the SDRF analysis are presented in Appendix D. For each classs of producer and each risk interval, pairwise comparisons are made between each of the eleven strategies with every other strategy. Identification of the strategies which are undominated by any other strategy for a given risk interval are indicated with a star. Undominated strategies are in the efficient set for producers whose Arrow-Pratt risk coefficient falls in the interval indicated and as such are the preferred strategy. Table XIV lists by class the undominated strategies for each interval.

The undominated strategies as identified by the SDRF analysis can now be compared with the preferred strategies indicated using the EV approach. According to the SDRF results, a Class 1 producer with fairly strong risk aversion would prefer the HrsNop strategy. This result contradicts the EV results which show that HrsSea dominates HrsNop. The SDRF result can be explained somewhat by the statistics in Table XIII. The maximum and minimum values are higher for HrsNop than HrsCrp and so is the skewness, all factors ignored by the EV analysis. Thus, the EV criterion is useful to identify the dominant strategy among a group of strategies with similar variability in returns, but the stochastic dominance analysis results are needed to identify specific undominated strategies for given levels of risk aversion.

In the case of Class 2 producers, the EV criterion performed well in identifying strategies using hourly cost allocation as the potential efficient set. The SDRF analysis confirms these choices, but eliminates HrsCrp and HrSea from the efficient set for fairly strongly to moderately risk averse producers since their standard deviations of returns are higher and maximum and minimum returns are lower than those of HrsNop.

Class 3 producer preference for the no pooling revenue distribution method over crop or seasonal pooling as identified previously by the EV criterion is confirmed by the SDRF analysis. TonNop dominates TonCrp and TonSea because of its lower variability and similar mean return level. Skewness is about the same for the three strategies.

The efficient set identified using EV analysis is confirmed by the SDRF analysis for Class 4 producers at all levels of risk aversion. ValSea has the highest mean, lowest standard deviation and highest skewness of all strategies. Selection of the efficient set for Class 5 producers is similarly straightforward. Inspection of Figure 10 led to the conclusion that TonNop would be preferred to strategies lying to the right and below it on the EV graph. The SDRF analysis confirms this result. .

As previously mentioned, Class 6 producers would seem to prefer HrsNop or possibly ValSea depending on attitudes toward risk aversion (Figure 11). The SDRF analysis does not confirm the choices determined by the EV approach. Moreover, the SDRF results are not easy to explain for Class 6 producers. For producers in the most risk averse category, HrsCrp is the dominant strategy, a curious result considering it has a lower mean, higher standard deviation, lower maximum, and slightly lower skewness than does HrsNop. The only clue as to why HrsCrp dominates HrsNop lies in the fact that the minimum value of HrsNop is lower than that of HrsCrp. Even more curious is the fact that HrsCrp falls out of the efficient set for risk neutral to slightly risk averse producers, leaving HrsSea and HrsNop in the efficient set.

In the case of Class 7, again unexpected SDRF results conflict with what the EV analysis would indicate. As discussed, under the EV approach, ValCrp would appear to dominate all other strategies. However, HrsNop is the dominant strategy for fairly strongly to moderately risk averse producers. This result is understood by noting in Table XIII that HrsNop has a higher maximum and minimum return than either of the other hourly cost allocation strategies or ValCrp. HrsNop also has a higher skewness than does HrsSea, HrsCrp or ValCrp.

In the case of Class 8 producers, HrsNop was previously identified using the EV criterion as dominating the majority of other strategies. The SDRF analysis confirms that HrsNop is in the efficient set for fairly strongly to moderately risk averse producers. For risk neutral producers, HrsCrp and HrsSea enter the efficient set, due to the fact that the higher risk is compensated for by the higher mean and maximum values that these latter two strategies attain.

For Class 9 producers the EV criteria previously identified no pooling as the preferred revenue distribution method for any given cost allocation method. The SDRF analysis shows that (Table XIV) HrsNop is the dominant strategy for the producers falling in the most risk averse categories. HrsNop is preferred because of its lower standard deviation of returns, despite its lower mean. HrsNop also has the highest minimum return of all strategies and the highest maximum return compared to HrsCrp and HrsSea.

As indicated by the EV analysis, HrsNop is the preferred strategy, but only for the fairly strongly risk averse Class 10 producers. As risk aversion decreases the efficient set changes. HrsCrp and HrsSea enter the set at moderate risk aversion levels. With little or

TABLE XIV

UNDOMINATED COMBINATIONS OF COST ALLOCATION AND REVENUE DISTRIBUTION RULES

	Fairly Strongly Risk Averse	Moderately Risk Averse	Risk Neutral to Slightly Risk Averse
Interval	.01 - .015	.005 - .01	0.0 - .005
Class			
1	HrsNop	HrsNop, ValSea	HrsNop, HrsSea, ValSea
2	HrsNop	HrsNop	HrsCrp, HrsNop, HrsSea
3	TonNop	TonNop	TonNop, TonSea
4	ValSea	ValSea	ValSea
5	TonNop	TonNop	TonSea, TonNop
6	HrsCrp	HrsCrp, HrsNop, HrsSea	HrsNop, HrsSea
7	HrsNop	HrsNop	HrsCrp, HrsNop, HrsSea, ValCrp ValSea
8	HrsNop	HrsNop	HrsCrp, HrsNop, HrsSea
9	HrsNop	HrsNop	HrsCrp, HrsNop HrsSea
10	HrsNop	HrsCrp, HrsNop HrsSea	HrsCrp

no risk aversion the rational producer would prefer HrsCrp. This change in the efficient set can be explained by the fact that under HrsCrp the producer who is not averse to higher levels of risk can attain both higher maximum levels of returns and on the average higher mean returns than under HrsNop. The impact of skewness appears to be overwhelmed in this case, since HrsNop has the lowest skewness of the three hourly cost allocation strategies.

The results of the simulation model were analyzed in this chapter. The efficient set of cost allocation and revenue distribution rules differred according to the product mix grown and producers' risk attitudes. The efficient sets were identified using both a mean-variance criterion and stochastic dominance with respect to a function. More precise efficient sets were specified for groups of producers according to their attitude toward risk using SDRF, which is the preferred method if there is reason to suspect that producers have a risk attitude other than risk neutrality. What have not been elicited in this study are the attitudes towards risk that the Southeastern Oklahoma fresh produce growers actually hold.

CHAPTER V

SUMMARY AND CONCLUSIONS

This objective of this study was to examine the impacts on producer returns of alter native cost allocation and revenue distribution rules in a multi-product fresh produce packing facility under conditions of stochastic yields and prices. Preference for specific combinations of rules for a given class of producers was specified using both a mean-variance criterion and stochastic dominance with respect to a function and the results of applying these two criteria were compared. This chapter summarizes the results and provides recommendations for the Three Rivers packing facility management.

The value of using the SDRF approach over the mean-variance method was demonstrated in this thesis. Identification of the risk efficient alternatives at different risk aversion levels is only possible using the SDRF approach. Not only is the mean-variance approach not able to order risky alternatives at different levels of risk aversion, it is not able to take into account other information besides the first two moments of the distribution of returns as is SDRF. For example, Class 7 producers under the EV criterion would seem to select ValCrp as the preferred strategy as it has the highest mean and second to the lowest variance of returns. However, at the two higher risk aversion levels, Class 7 producers preferred HrsNop to ValCrp for its higher maximum and minimum returns, and higher skewness.

The results show that as risk aversion increases, the efficient set of cost allocation and revenue distribution rules narrows from five strategies in the least risk averse category to one strategy in the most risk averse category for each class of producer. In the most risk averse category analyzed, eight of the ten classes of producers preferred no pooling revenue distribution, according to the SDRF results. Seven of the ten classes preferred hourly cost allocation. In addition, the policy selected affects the variability of the returns to the specialized producers more than the returns to the more diversified producers. For example, the standard deviation of returns varied by more than $200 across strategies for Class 1 producers (spring cabbage) and almost $300 for Class 2 producers (cantaloupe). In contrast, the standard deviation of returns varied across strategies by less than $30 for Class 8 producers who grew six crops in all three seasons. Thus, one can conclude from these results that cost allocation and revenue distribution rules can indeed affect producer returns and that sensitivity to the rules selected depends on both the risk attitudes held by the producers and also the diversity of crops grown.

Classes 3, 4 and 5 were the only groups of producers at fairly strong risk aversion levels that did not prefer hourly cost allocation. Class 4 producers who harvested only fall crops preferred percentage of sales value in allocating costs. Not surprisingly, the fall crops were lower value crops. Class 3 and 5 producers who grew summer crops only preferred tonnage cost allocation. Producers in these latter classes are the only two that do not produce cantaloupe or cabbage, two heavy crops. The sensitivity of crop mixes to alternative strategies is demonstrated with Classes 3, 4, and 5.

Seasonal pooling and percentage of value in the seasonal pool for allocation of costs (ValSea) is the risk efficient alternative at all risk aversion levels in the case of Class 4 growers who raise turnips and fall cabbage. However, this same choice in the case of Class 5 producers, who grow cucumbers, okra and tomatoes, rather than seasonal pooling and tonnage cost allocation (TonSea), would lead to a loss of approximately $500 per acre in mean returns and an increase of about $120 in the variability of returns for Class 5 producers. Rules favoring fall growers would be made at the expense of summer growers.

Overall, hourly cost allocation and no pooling revenue distribution were in the efficient set most often at all risk aversion levels and in particular in the more diversified producer classes (Classes 8, 9 and 10 farmers grew 6 crops). However, the apparent consensus of these results does not lead to quick or easy recommendations on the adoption of specific cost allocation and revenue distribution rules. For example, the use of the no pooling revenue distribution rule results in a situation where the packing facility assumes all of the price risk , which may be unacceptable to the packing facilily management. Under no pooling, the producer is paid before the packing facility knows what the facility will be paid. This arrangement is untenable in the long run, particularly after subsidization of the facility is ended. The rationality of spreading the price risk across a pool of revenues rather than allowing the packing facility to assume the price risk might not occur to the growers until they take over management of the facility and are more directly in charge of insuring its survivability.

Taking Class 9 and 10 crops mixes as examples, assuming that the growers decide to spread price risk across a pool of revenues, the decision becomes whether to pool revenues by crop or by season. In the case of Class 9, for any cost allocation method selected, seasonal pooling results in lower variability of returns for the same mean level of returns. In the case of Class 10, for any given cost allocation method, crop pooling results in lower variability of returns for the same mean level of returns. Both Class 9 and 10 crop mixes contain 6 crops. Thus, the composition of the crop mix is critical in determining whether the variance of returns, as one might intuitively expect, is decreased by widening the revenue pool from a crop to a seasonal basis. Moreover, the relative importance that producers attach to reduction of variability versus some other objectives such as minimizing the probability of negative returns is not known. This complicates the task of forming specific revenue distribution rule recommendations for use by the packing facility.

Cost allocation recommendations are less difficult than revenue distribution suggestions. In a multi-product packing facility where the products vary in weight per crate, using tonnage or per crate basis would be hard to justify to producers as means to allocate fixed costs. In addition, contribution to sales revenue might also be difficult for the management to rationalize for allocation of fixed costs, particularly if some relatively low value crops are heavy machine users. Use of hours of operation is more defensible on economic grounds, since machinery costs are more directly tied to the actual users of the equipment. In this regard, it might be the recommended cost allocation method, in addition to the fact that it was the most commonly preferred cost allocation method for the more diversified risk averse producers and at the two highest risk aversion levels.

Since specialized producers can be expected to be more vulnerable to changes in cost allocation and revenue distribution rules than are more diversified producers, a packing facility whose objective is to encourage small producers to adopt new crops will need to carefully consider the rules under which to operate. Otherwise, new producers may be subjected to increased riskiness or reduced mean returns simply by virtue of the rules determined by the packing facility. Such new producers quickly might become discouraged.

Several caveats should be kept in mind regarding these results. This study does not test these results for every individual crop and every combination of crops possible but only examines the specific crop mixes actually handled by Three Rivers packing facility. In addition, this analysis did not capture differences in timing of delivery of produce to the packing facility over the course of the harvest season that occur within a class of producers. These differences may be of particular importance in the summer season which lasts up to seventeen weeks long for cucumbers. In addition, such information might provide the basis for analyzing pooling of revenues from multiple crops during a given time frame, such as a week or two-week period.

Further research efforts in this area might include a more sophisticated yield simulation approach when historical yields become available, and the use of non-normal distributions for simulation of the price equation errors. Direct elicitation of the intervals used in the SDRF analysis is recommended in future work rather than using intervals from other studies in order to facilitate more specific recommendations.

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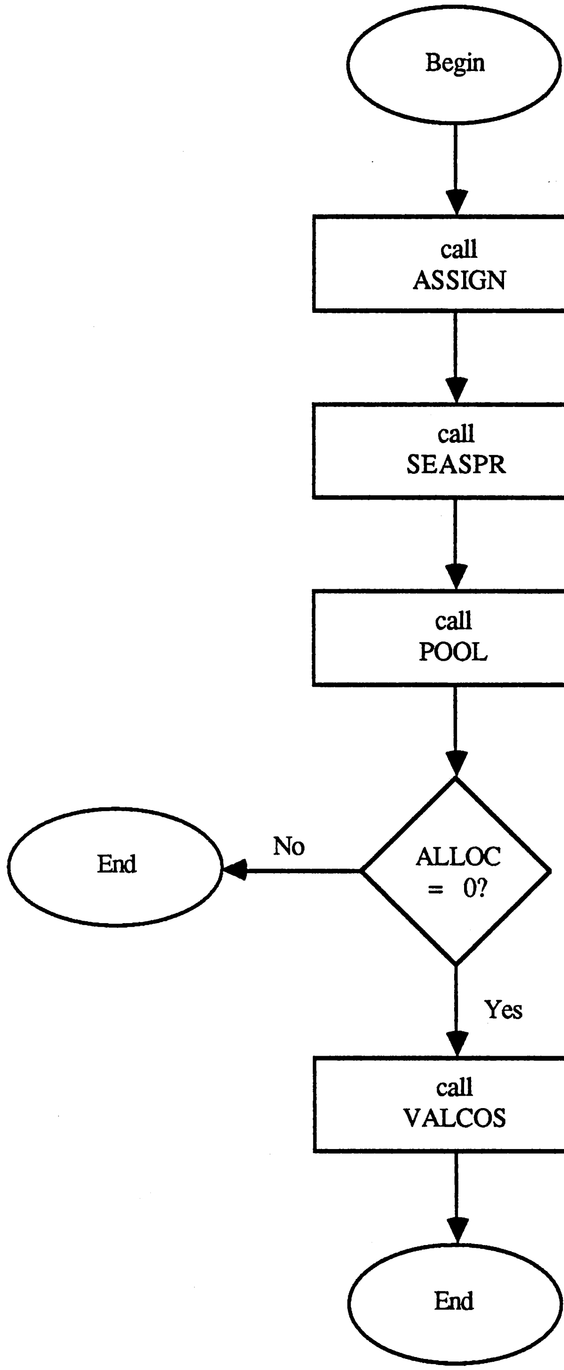
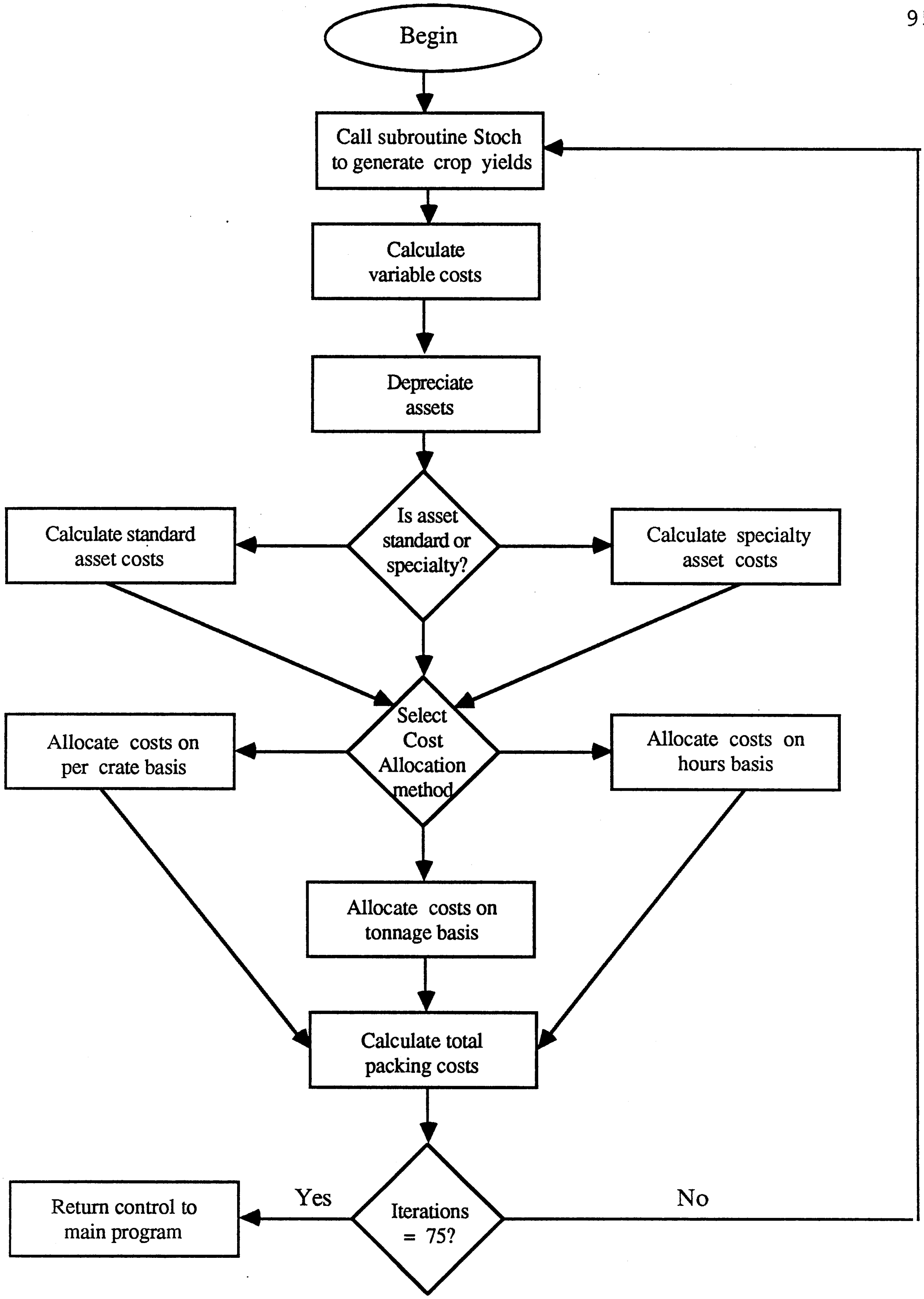
APPENDICES

APPENDIX A

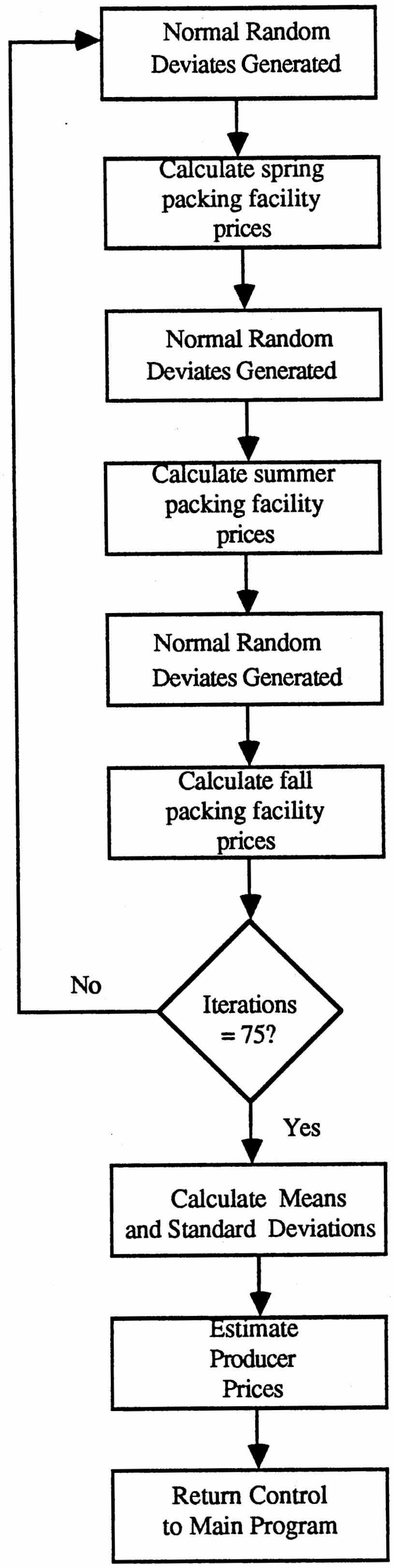
FLOWCHART OF COMPUTER PROGRAM



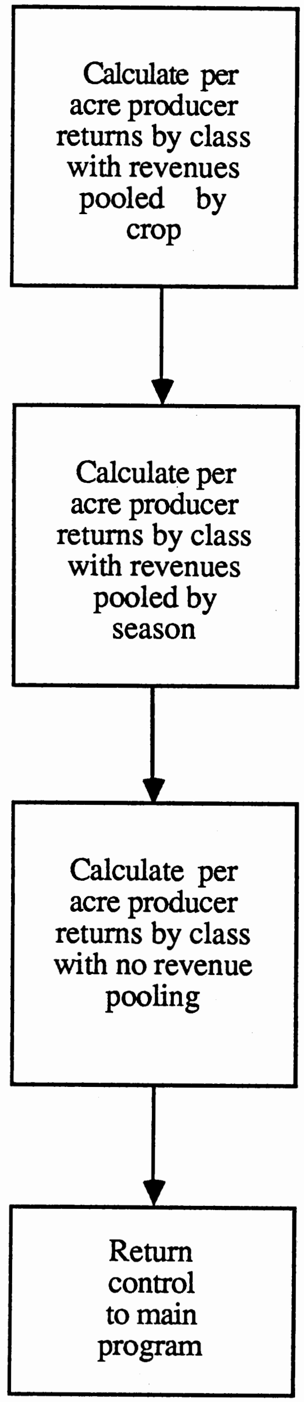
Flowchart of FORTRAN program
Main Calling Program



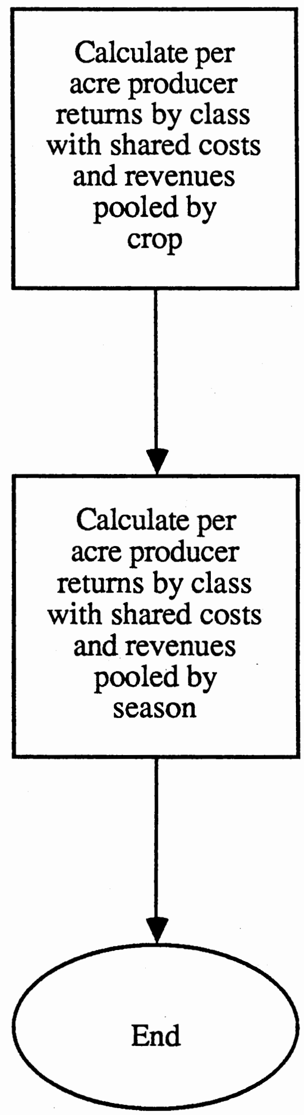
Subroutine ASSIGN



Subroutine SEASPR



Subroutine POOL



Subroutine VALCOS

APPENDIX B

VARIANCE-COVARIANCE MATRICES

VARIANCE-COVARIANCE MATRICES

Spring Crops

Spring	1.4149	1.1438	0.9969	0.7223	1.0036
Broccoli		1.5044	0.9193	0.5887	0.5860
			1.0176	0.9709	0.9928
				1.3971	1.1604
					1.6461

Spring	4.3947	6.1413	4.0484
Cabbage		10.1772	6.5993
			4.4054

Summer Crops

	4.2332	3.0110	2.5056	1.3339	1.5772	2.5231	1.4341	0.0059	0.2139	0.5358	0.8441	0.5530	0.2824	-0.2777	0.8422	0.8210	1.2053
		6.6728	4.8849	3.5721	3.1182	4.4366	1.1089	0.6980	0.7014	1.1961	0.9449	1.8692	1.5914	1.4919	2.3506	2.2032	2.8499
			7.8350	8.0100	5.5075	1.9514	-0.7263	-0.6900	0.4972	0.7189	1.2550	1.2138	1.9205	2.3225	1.9904	2.3450	3.5175
				9.9725	5.9013	0.4541	-2.0263	-1.1275	0.0527	0.5031	1.0425	1.0013	2.1693	3.4913	2.1219	2.5638	3.7050
					4.1525	1.3427	-1.1713	-0.6675	0.1677	0.4987	0.6038	0.4275	1.0023	1.3700	1.0840	1.3525	2.2475
						4.8913	0.2061	0.1919	0.2960	1.1854	0.2653	0.8755	0.1322	-0.5122	1.1280	0.7795	0.7158
Cucumbers							3.3181	1.8019	1.1784	0.4053	0.4744	0.6913	0.5428	0.2800	0.7552	0.6225	0.2494
								1.9006	1.2437	0.7729	0.0894	0.3450	0.3518	0.2100	0.3392	0.2450	0.0269
									1.2945	0.7294	0.3104	0.3169	0.4101	0.2692	0.3906	0.4477	0.5754
										0.8057	0.2263	0.3512	0.2980	0.0271	0.3765	0.3102	0.2123
											0.8556	0.8100	0.7415	0.1675	0.2294	0.3725	0.8494
												1.2900	1.1073	0.8263	0.8685	0.8650	1.1288
													1.2814	1.4180	1.0294	1.1023	1.3290
														3.1725	2.0449	2.0700	2.1238
															1.8802	1.7507	1.5707
																1.7400	1.8975
																	3.5431

	3.0241	3.0452	1.4499	0.8792	0.7604	-0.4691	-0.1737	0.2055	0.8616	0.5870	0.2361	-0.5553
		4.6620	3.7045	2.7222	1.6578	-0.0781	-0.8055	-1.1127	-0.6757	-0.7451	-0.5747	-1.2291
			7.8525	5.1501	1.9956	0.3392	-0.5866	-0.0306	0.0289	-0.7319	0.5324	0.0313
				4.2786	2.0539	0.3827	-0.6346	-0.2035	-0.7179	-0.4833	0.6389	-0.1745
					1.6258	0.2486	-0.3821	-0.7096	-1.0559	-0.9603	-0.0456	-0.6615
						0.5193	0.3713	0.3111	-0.1520	-0.5530	-0.1540	-0.0237
							1.4683	2.1485	1.5919	0.6497	0.5270	0.5074
								5.4764	4.2671	3.2536	3.0572	2.2428
Tomatos									4.3132	3.2315	2.5075	1.8596
										3.7586	2.6933	1.7212
											2.7439	1.6816
												1.4651

	0.7221	0.2154	0.1563	-0.0265	-0.0836	-0.2889	0.2940	0.3424	0.2798	0.3239	0.1668
		0.4218	0.4035	0.2636	0.1530	-0.2602	-0.0312	0.0011	0.0329	0.2669	0.1533
			0.4965	0.4370	0.2475	-0.0845	0.0974	0.1383	0.0991	0.2485	0.2058
				0.7920	0.5674	0.2993	0.1635	0.2499	0.0637	0.1972	0.1649
					0.6904	0.4868	-0.1519	0.0748	0.0579	0.2918	-0.0332
						1.5800	0.1643	0.5674	0.2813	0.2329	0.0334
							0.6231	0.5892	0.2764	0.0478	0.2363
								0.7721	0.4616	0.3187	0.2197
Cantaloupe									0.3928	0.3114	0.0908
										0.5448	0.0486
											0.2219

2.1606	2.0844	1.7139	1.2492	1.0594	1.0163	1.0720	0.8097	0.8279	0.9441	1.0407	1.3556
	2.5506	1.7694	1.4306	1.3775	1.2719	1.1207	0.9252	0.7827	1.0819	1.0919	1.4800
		1.6256	1.2181	1.1900	1.0906	1.1052	0.7910	0.7985	0.8944	0.9856	1.2800
			1.1006	1.1100	1.0469	0.9553	0.7295	0.6783	0.8244	0.7956	1.0138
				1.3225	1.2375	1.1831	0.9904	0.9079	1.1088	1.1050	1.2825
					1.1906	1.1580	1.0069	0.9569	1.1406	1.1344	1.3063
						1.3150	1.0881	1.1100	1.2420	1.2982	1.4949
Okra							1.1935	1.1922	1.3500	1.4306	1.4063
								1.3059	1.3762	1.5331	1.5288
									1.5506	1.6544	1.6613
										1.8931	1.8600
											2.2025

Fall Crops

0.0806	0.1178	0.0971	0.1203	0.1019	0.0969	0.1102	0.1605	0.1860
	0.2174	0.1615	0.1964	0.1830	0.1888	0.2062	0.2953	0.3549
		0.2075	0.2134	0.1830	0.2104	0.2222	0.2795	0.3285
			0.2654	0.2193	0.2450	0.2619	0.3508	0.4146
				0.2631	0.3344	0.3624	0.4385	0.5183
	Turnips				0.4531	0.4885	0.5650	0.6688
						0.5425	0.6265	0.7313
							0.7571	0.8885
								1.0524

1.0138	0.9344	1.3792	1.2390	1.1322	1.3138
	1.1124	1.7968	1.5682	1.3870	1.7950
		3.5166	2.9016	2.5073	3.2410
			2.4772	2.1616	2.8084
Fall Cabbage				1.9017	2.4604
					3.3504

0.9300	0.9830	0.7116	0.9712	1.4444	0.9633	0.8258	1.4781
	2.2497	1.7189	2.0671	2.0008	1.3707	1.3100	1.8459
		1.6785	1.8018	1.6412	0.9704	0.8811	0.9633
			2.2192	2.2640	1.2118	1.0867	1.3707
				3.0275	1.6574	1.3557	0.9704
	Fall Broccoli				1.6100	1.3948	1.2118
						1.2791	1.6574
							1.6100

APPENDIX C

FACTORED UPPER TRIANGLE MATRICES

FACTORED UPPER TRIANGLE MATRICES

Spring Crops

Spring Broccoli	0.4984	0.21797	0.71183	0.01952	0.78224
		0.66419	0.89520	0.23078	0.45673
			0.54033	0.35621	0.77379
				0.76102	0.90442
					1.28299
Spring Cabbage		0.80881	0.14220	1.92881	
			0.53994	3.14414	
				2.09891	

Summer Crops

	0.0000	0.0040	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1032	-0.3601	1.1461	-0.3503	-0.1319	-1.4143	0.4316	0.2062	0.6403
		0.0042	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.2542	-0.3409	-0.2115	-0.9296	0.6850	-0.9077	1.1681	0.7957	1.5141
			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-1.0752	-0.4575	-0.0676	-1.1748	0.2892	-0.8230	-0.7334	0.5421	1.8687
				0.0000	0.0000	0.0000	0.0000	0.0000	-1.5791	-0.0769	0.3556	-1.1964	0.2168	0.1410	-1.2288	0.6812	1.9683
					0.0000	0.0000	0.0000	0.0000	-0.9751	-0.2213	-0.0081	-1.1232	-0.0335	-0.4389	-0.4910	0.1750	1.1940
						0.0000	0.0000	0.0000	-0.6564	0.1981	-0.1608	-0.3907	0.1245	-1.2158	1.5452	0.4656	0.3803
							0.0000	0.0000	1.5590	-0.0623	0.1982	0.0848	0.3488	-0.5879	0.1492	0.5747	0.1325
								0.0000	1.0025	0.6675	-0.1530	-0.4204	0.3728	-0.0530	0.1853	0.2711	0.0143
Cucumber									0.5821	0.6708	-0.3444	-0.1867	0.1245	-0.4217	-0.1966	0.1640	0.3057
										0.6170	-0.0611	-0.3426	0.2428	-0.3850	0.1752	0.2310	0.1128
											0.2030	0.1594	0.6055	-0.4038	-0.2152	-0.0968	0.4512
												0.2519	0.8420	-0.1544	0.2011	0.3062	0.5997
													0.7129	0.0444	-0.2490	0.4590	0.7060
														0.7637	-0.3386	1.0962	1.1283
															0.2025	1.0691	0.8344
																0.8508	1.0081
																	1.8823

	0.0014	0.0000	0.0000	-0.1430	0.1444	-0.3822	-0.9237	-0.2692	0.7508	0.44641	0.9682	-0.4587
		0.0000	0.0000	0.2955	0.6486	0.1320	-1.4170	-0.1632	0.4588	-0.03673	0.9268	-1.0154
			0.0000	0.6318	2.0518	0.3629	-0.9079	-0.6614	0.4764	-1.14870	0.5503	0.02588
				0.1849	1.3555	0.5060	-0.5300	-0.0847	-0.1907	-0.96959	0.9303	-0.1441
					0.2838	0.0910	-0.1108	0.0365	-0.0129	-0.77367	0.7912	-0.5465
Tomato						0.4287	0.0442	0.3559	0.1788	-0.39341	-0.1405	-0.0195
							0.4003	0.7028	0.7906	0.09751	-0.0614	0.41922
								0.9199	0.9362	0.18349	0.5353	1.85292
									1.1467	0.68323	0.41354	1.53636
										1.05044	0.79563	1.42202
											0.90204	1.38931
												1.21039

	0.0005	0.0002	0.1158	-0.4478	-0.0659	-0.2439	0.3784	-0.0760	0.12353	0.39317	0.35407
		0.0001	0.0321	0.09725	0.08865	0.02462	0.1404	-0.2228	-0.3543	0.31925	0.32550
			0.1160	0.18207	0.27848	0.16535	0.0916	-0.1461	-0.2167	0.27838	0.43679
				0.23721	0.66069	0.00179	-0.1071	0.27181	-0.2066	0.2204	0.35001
					0.57823	0.06931	-0.3368	0.15061	-0.2066	0.40911	-0.0705
						0.29105	-0.9418	0.63379	0.32585	0.30864	0.07099
Cantaloupe							0.25406	0.37232	0.4103	-0.00544	0.50150
								0.40285	0.50533	0.37024	0.46625
									0.44345	0.39883	0.19269
										0.73088	0.10316
											0.47111

0.0000	0.0008	0.0011	1.0076	-0.2524	0.2270	0.3319	0.1646	-0.1581	0.0089	-0.1833	0.9134
	0.0014	0.0019	0.8060	-0.0252	0.4738	0.2080	0.0981	-0.6879	0.2788	-0.2782	0.9972
		0.0022	0.6033	0.0797	0.4034	0.4348	0.3520	-0.0862	0.0103	-0.1679	0.8625
			0.3106	-0.0694	0.4900	0.3576	0.1889	-0.0713	0.3357	-0.1065	0.6831
				0.0760	0.3962	0.3905	0.2725	-0.1801	0.3902	0.0386	0.8642
Okra					0.3403	0.3047	0.1705	-0.0777	0.4112	0.0550	0.8802
						0.4304	0.1796	0.0715	0.2717	0.0630	1.0073
							0.1201	-0.0003	0.3131	0.4279	0.9476
								0.2268	0.1078	0.4262	1.0301
									0.3185	0.4429	1.1194
										0.5678	1.2533
											1.4841

Fall Crops

0.03016	-0.03753	0.00569	-0.01546	0.12860	0.04603	-0.15746
	0.06000	0.08415	-0.01554	0.17366	-0.00590	-0.23250
		0.13503	0.15364	0.17368	0.16946	-0.05972
			0.18450	0.10713	0.15310	-0.18172
				0.06204	0.06231	0.00669
		Turnips			0.06344	0.15529
						0.14968
	0.2022	0.2934	-0.0584	-0.2694	0.54372	0.71776
		0.3099	-0.0353	-0.0598	0.22317	0.98068
			0.26708	0.37356	0.41301	1.77063
				0.13896	0.32209	1.53431
		Fall			0.30791	1.34419
		Cabbage				1.83039
0.3478	0.10217	0.1296	-0.21188	0.39920	0.21039	0.73018
	0.35236	-0.00993	0.56130	0.65668	-0.19365	1.15831
		0.3589	0.74622	0.62026	0.03196	0.77909
			0.61455	0.95403	0.08980	0.96088
				1.10933	0.60000	1.19870
		Fall			0.29839	1.23326
		Broccoli				1.13097

APPENDIX D

RESULTS OF STOCHASTIC DOMINANCE WITH RESPECT TO A FUNCTION

RESULTS OF STOCHASTIC DOMINANCE WITH RESPECT TO A FUNCTION*
CLASS 1

R1=	.010000		R2=	.015000								Undominated
CRTCRP	-	0	1	0	0	?	1	1	1	1	1	
CRTNOP	1	-	1	1	0	1	1	1	1	1	1	
CRTSEA	0	0	-	0	0	0	1	?	1	1	1	
HRSCRP	1	0	1	-	0	1	1	1	1	1	1	
HRSNOP	1	1	1	1	-	1	1	1	1	1	1	*
HRSSEA	?	0	1	0	0	-	1	1	1	1	1	
TONCRP	0	0	0	0	0	0	-	0	1	1	?	
TONNOP	0	0	?	0	0	0	1	-	1	1	1	
TONSEA	0	0	0	0	0	0	0	0	-	1	0	
VALCRP	0	0	0	0	0	0	0	0	0	-	0	
VALSEA	0	0	0	0	0	0	?	0	1	1	-	

R1=	.005000		R2=	.010000								
CRTCRP	-	0	1	0	0	0	1	1	1	1	?	
CRTNOP	1	-	1	1	0	1	1	1	1	1	?	
CRTSEA	0	0	-	0	0	0	1	1	1	1	?	
HRSCRP	1	0	1	-	0	?	1	1	1	1	?	
HRSNOP	1	1	1	1	-	1	1	1	1	1	?	*
HRSSEA	1	0	1	?	0	-	1	1	1	1	?	
TONCRP	0	0	0	0	0	0	-	0	1	1	0	
TONNOP	0	0	0	0	0	0	1	-	1	1	?	
TONSEA	0	0	0	0	0	0	0	0	-	1	0	
VALCRP	0	0	0	0	0	0	0	0	0	-	0	
VALSEA	?	?	?	?	?	?	1	?	1	1	-	*

R1=	.000000		R2=	.005000								
CRTCRP	-	?	?	0	0	0	1	1	1	?	?	
CRTNOP	?	-	?	?	0	?	1	1	1	1	?	
CRTSEA	?	?	-	?	?	0	1	1	1	1	?	
HRSCRP	1	?	?	-	?	0	1	1	1	1	?	
HRSNOP	1	1	?	?	-	?	1	1	1	1	?	*
HRSSEA	1	?	1	1	?	-	1	1	1	1	?	*
TONCRP	0	0	0	0	0	0	-	?	?	?	0	
TONNOP	0	0	0	0	0	0	?	-	?	?	?	
TONSEA	0	0	0	0	0	0	?	?	-	?	?	
VALCRP	?	0	0	0	0	0	?	?	?	-	?	
VALSEA	?	?	?	?	?	?	1	?	?	?	-	*

* 1 indicates strategy in left hand column dominates
0 indicates strategy in left hand column is dominated
? indicates no decision is made

RESULTS OF STOCHASTIC DOMINANCE WITH RESPECT TO A FUNCTION*
CLASS 2

R1=	.010000		R2=		.015000							Undominated
CRTCRP	-	0	0	0	0	0	1	0	0	1	1	
CRTNOP	1	-	1	1	0	0	1	1	1	1	1	
CRTSEA	1	0	-	?	0	0	1	0	1	1	1	
HRSCRP	1	0	?	-	0	0	1	0	?	1	1	
HRSNOP	1	1	1	1	-	1	1	1	1	1	1	*
HRSSEA	1	1	1	1	0	-	1	1	1	1	1	
TONCRP	0	0	0	0	0	0	-	0	0	1	1	
TONNOP	1	0	1	1	0	0	1	-	1	1	1	
TONSEA	1	0	0	?	0	0	1	0	-	1	1	
VALCRP	0	0	0	0	0	0	0	0	0	0	0	
VALSEA	0	0	0	0	0	0	0	0	0	1	-	
R1=	.005000		R2=		.010000							
CRTCRP	-	0	0	0	0	0	1	0	0	1	1	
CRTNOP	1	-	1	1	0	0	1	1	1	1	1	
CRTSEA	1	0	-	0	0	0	1	0	1	1	1	
HRSCRP	1	0	1	-	0	0	1	?	1	1	1	
HRSNOP	1	1	1	1	-	1	1	1	1	1	1	*
HRSSEA	1	1	1	1	0	-	1	1	1	1	1	
TONCRP	0	0	0	0	0	0	-	0	0	1	1	
TONNOP	1	0	1	?	0	0	1	-	1	1	1	
TONSEA	1	0	0	0	0	0	1	0	-	1	1	
VALCRP	0	0	0	0	0	0	0	0	0	-	0	
VALSEA	0	0	0	0	0	0	0	0	0	1	-	
R1=	.000000		R2=		.005000							
CRTCRP	-	?	?	0	0	0	1	?	?	1	1	
CRTNOP	?	-	?	?	0	0	1	1	1	1	1	
CRTSEA	?	?	-	0	0	0	1	?	1	1	1	
HRSCRP	1	?	1	-	?	?	1	1	1	1	1	*
HRSNOP	1	1	1	?	-	?	1	1	1	1	1	*
HRSSEA	1	1	1	?	?	-	1	1	1	1	1	*
TONCRP	0	0	0	0	0	0	-	?	?	1	1	
TONNOP	?	0	?	0	0	0	?	-	?	1	1	
TONSEA	?	0	0	0	0	0	?	?	-	1	1	
VALCRP	0	0	0	0	0	0	0	0	0	-	0	
VALSEA	0	0	0	0	0	0	0	0	0	1	-	

RESULTS OF STOCHASTIC DOMINANCE WITH RESPECT TO A FUNCTION CLASS 3

R1= .010000 R2= .015000

												Undominated
CRTCRP	-	0	1	1	1	1	0	0	0	1	1	
CRTNOP	1	-	1	1	1	1	0	0	0	1	1	
CRTSEA	0	0	-	1	1	1	0	0	0	1	1	
HRSCRP	0	0	0	-	0	0	0	0	0	1	1	
HRSNOP	0	0	0	1	-	1	0	0	0	1	1	
HRSSEA	0	0	0	1	0	-	0	0	0	1	1	
TONCRP	1	1	1	1	1	1	-	0	1	1	1	
TONNOP	1	1	1	1	1	1	1	-	1	1	1	*
TONSEA	1	1	1	1	1	1	0	0	-	1	1	
VALCRP	0	0	0	0	0	0	0	0	0	-	0	
VALSEA	0	0	0	0	0	0	0	0	0	1	-	

R1= .005000 R2= .010000

CRTCRP	-	0	?	1	1	1	0	0	0	1	1	
CRTNOP	1	-	1	1	1	1	0	0	0	1	1	
CRTSEA	?	0	-	1	1	1	0	0	0	1	1	
HRSCRP	0	0	0	-	0	0	0	0	0	1	1	
HRSNOP	0	0	0	1	-	1	0	0	0	1	1	
HRSSEA	0	0	0	1	0	-	0	0	0	1	1	
TONCRP	1	1	1	1	1	1	-	0	1	1	1	
TONNOP	1	1	1	1	1	1	1	-	1	1	1	*
TONSEA	1	1	1	1	1	1	0	0	-	1	1	
VALCRP	0	0	0	0	0	0	0	0	0	-	0	
VALSEA	0	0	0	0	0	0	0	0	0	1	-	

R1= .000000 R2= .005000

CRTCRP	-	0	0	1	1	1	0	0	0	1	1	
CRTNOP	1	-	?	1	1	1	0	0	0	1	1	
CRTSEA	1	?	-	1	1	1	0	0	0	1	1	
HRSCRP	0	0	0	-	0	0	0	0	0	1	1	
HRSNOP	0	0	0	1	-	?	0	0	0	1	1	
HRSSEA	0	0	0	1	?	-	0	0	0	1	1	
TONCRP	1	1	1	1	1	1	-	0	?	1	1	
TONNOP	1	1	1	1	1	1	1	-	?	1	1	*
TONSEA	1	1	1	1	1	1	?	?	-	1	1	*
VALCRP	0	0	0	0	0	0	0	0	0	-	0	
VALSEA	0	0	0	0	0	0	0	0	0	1	-	

RESULTS OF STOCHASTIC DOMINANCE WITH RESPECT TO A FUNCTION CLASS 4

R1= .010000 R2= .015000 Undominated

CRTCRP	-	1	1	1	1	1	1	1	1	0	0	
CRTNOP	0	-	1	0	1	1	0	1	1	0	0	
CRTSEA	0	0	-	0	0	1	0	1	1	0	0	
HRSCRP	0	1	1	-	1	1	?	1	1	0	0	
HRSNOP	0	0	1	0	-	1	0	1	1	0	0	
HRSSEA	0	0	0	0	0	-	0	1	1	0	0	
TONCRP	0	1	1	?	1	1	-	1	1	0	0	
TONNOP	0	0	0	0	0	0	0	-	1	0	0	
TONSEA	0	0	0	0	0	0	0	0	-	0	0	
VALCRP	1	1	1	1	1	1	1	1	1	-	0	
VALSEA	1	1	1	1	1	1	1	1	1	1	-	*

R1= .005000 R2= .010000

CRTCRP	-	1	1	1	1	1	1	1	1	0	0	
CRTNOP	0	-	1	0	1	1	0	1	1	0	0	
CRTSEA	0	0	-	0	?	1	0	1	1	0	0	
HRSCRP	0	1	1	-	1	1	0	1	1	0	0	
HRSNOP	0	0	?	0	-	1	0	1	1	0	0	
HRSSEA	0	0	0	0	0	-	0	?	1	0	0	
TONCRP	0	1	1	1	1	1	-	1	1	0	0	
TONNOP	0	0	0	0	0	?	0	-	1	0	0	
TONSEA	0	0	0	0	0	0	0	0	-	0	0	
VALCRP	1	1	1	1	1	1	1	1	1	-	0	
VALSEA	1	1	1	1	1	1	1	1	1	1	-	*

R1= .000000 R2= .005000

CRTCRP	-	?	?	1	1	1	1	1	?	0	0	
CRTNOP	?	-	?	?	1	?	?	1	?	0	0	
CRTSEA	?	?	-	?	1	1	?	1	1	0	0	
HRSCRP	0	?	?	-	?	?	?	?	?	0	0	
HRSNOP	0	0	0	?	-	?	?	?	?	0	0	
HRSSEA	0	?	0	?	?	-	?	?	?	0	0	
TONCRP	0	?	?	?	?	?	-	?	?	0	0	
TONNOP	0	0	0	?	?	?	?	-	?	0	0	
TONSEA	?	?	0	?	?	?	?	?	-	0	0	
VALCRP	1	1	1	1	1	1	1	1	1	-	0	
VALSEA	1	1	1	1	1	1	1	1	1	1	-	*

RESULTS OF STOCHASTIC DOMINANCE WITH RESPECT TO A FUNCTION
CLASS 5

R1= .010000 R2= .015000 Undominated

CRTCRP	-	0	1	1	1	1	0	0	?	1	1	
CRTNOP	1	-	1	1	1	1	0	0	1	1	1	
CRTSEA	0	0	-	1	1	1	0	0	0	1	1	
HRSCRP	0	0	0	-	0	1	0	0	0	1	1	
HRSNOP	0	0	0	1	-	1	0	0	0	1	1	
HRSSEA	0	0	0	0	0	-	0	0	0	1	1	
TONCRP	1	1	1	1	1	1	-	0	1	1	1	
TONNOP	1	1	1	1	1	1	1	-	1	1	1	*
TONSEA	?	0	1	1	1	1	0	0	-	1	1	
VALCRP	0	0	0	0	0	0	0	0	0	-	0	
VALSEA	0	0	0	0	0	0	0	0	0	1	-	

R1= .005000 R2= .010000

CRTCRP	-	0	1	1	1	1	0	0	0	1	1	
CRTNOP	1	-	1	1	1	1	0	0	?	1	1	
CRTSEA	0	0	-	1	1	1	0	0	0	1	1	
HRSCRP	0	0	0	-	0	1	0	0	0	1	1	
HRSNOP	0	0	0	1	-	1	0	0	0	1	1	
HRSSEA	0	0	0	0	0	-	0	0	0	1	1	
TONCRP	1	1	1	1	1	1	-	0	1	1	1	
TONNOP	1	1	1	1	1	1	1	-	1	1	1	*
TONSEA	1	?	1	1	1	1	0	0	-	1	1	
VALCRP	0	0	0	0	0	0	0	0	0	-	0	
VALSEA	0	0	0	0	0	0	0	0	0	1	-	

R1= .000000 R2= .005000

CRTCRP	-	?	?	1	1	1	0	0	0	1	1	
CRTNOP	?	-	?	1	1	1	0	0	0	1	1	
CRTSEA	?	?	-	1	1	1	0	0	0	1	1	
HRSCRP	0	0	0	-	?	?	0	0	0	1	1	
HRSNOP	0	0	0	?	-	?	0	0	0	1	1	
HRSSEA	0	0	0	?	?	-	0	0	0	1	1	
TONCRP	1	1	1	1	1	1	-	?	1	1	1	*
TONNOP	1	1	1	1	1	1	?	-	?	1	1	*
TONSEA	1	1	1	1	1	1	0	?	-	1	1	
VALCRP	0	0	0	0	0	0	0	0	0	-	?	
VALSEA	0	0	0	0	0	0	0	0	0	?	-	

RESULTS OF STOCHASTIC DOMINANCE WITH RESPECT TO A FUNCTION
CLASS 6

R1= .010000 R2= .015000 Undominated

CRTCRP	-	1	0	0	?	0	1	1	1	1	1	
CRTNOP	0	-	0	0	0	0	1	1	?	1	1	
CRTSEA	1	1	-	0	1	0	1	1	1	1	1	
HRSCRP	1	1	1	-	1	1	1	1	1	1	1	*
HRSNOP	?	1	0	0	-	0	1	1	1	1	1	
HRSSEA	1	1	1	0	1	-	1	1	1	1	1	
TONCRP	0	0	0	0	0	0	-	0	0	0	1	
TONNOP	0	0	0	0	0	0	1	-	0	?	1	
TONSEA	0	?	0	0	0	0	1	1	-	1	1	
VALCRP	0	0	0	0	0	0	1	?	0	-	1	
VALSEA	0	0	0	0	0	0	0	0	0	0	-	

R1= .005000 R2= .010000

CRTCRP	-	?	0	0	0	0	1	1	1	1	1	
CRTNOP	?	-	?	0	0	0	1	1	1	1	1	
CRTSEA	1	?	-	0	?	0	1	1	1	1	1	
HRSCRP	1	1	1	-	?	?	1	1	1	1	1	*
HRSNOP	1	1	?	?	-	?	1	1	1	1	1	*
HRSSEA	1	1	1	?	?	-	1	1	1	1	1	*
TONCRP	0	0	0	0	0	0	-	0	0	?	1	
TONNOP	0	0	0	0	0	0	1	-	?	1	1	
TONSEA	0	0	0	0	0	0	1	?	-	1	1	
VALCRP	0	0	0	0	0	0	?	0	0	-	1	
VALSEA	0	0	0	0	0	0	0	0	0	0	-	

R1= .000000 R2= .005000

CRTCRP	-	0	0	0	0	0	1	?	?	1	1	
CRTNOP	1	-	?	?	0	?	1	1	1	1	1	
CRTSEA	1	?	-	?	?	0	1	1	1	1	1	
HRSCRP	1	?	?	-	0	0	1	1	1	1	1	
HRSNOP	1	1		1	-	?	1	1	1	1	1	*
HRSSEA	1	?	1	1	?	-	1	1	1	1	1	*
TONCRP	0	0	0	0	0	0	-	0	0	1	1	
TONNOP	?	0	0	0	0	0	1	-	?	1	1	
TONSEA	?	0	0	0	0	0	1	?	-	1	1	
VALCRP	0	0	0	0	0	0	0	0	0	-	1	
VALSEA	0	0	0	0	0	0	0	0	0	0	-	

RESULTS OF STOCHASTIC DOMINANCE WITH RESPECT TO A FUNCTION CLASS 7

R1= .010000 R2= .015000 Undominated

CRTCRP	-	0	1	0	0	0	1	0	1	1	1	
CRTNOP	1	-	1	1	0	1	1	1	1	1	1	
CRTSEA	0	0	-	0	0	0	1	0	1	1	1	
HRSCRP	1	0	1	-	0	1	1	1	1	1	1	
HRSNOP	1	1	1	1	-	1	1	1	1	1	1	*
HRSSEA	1	0	1	0	0	-	1	1	1	1	1	
TONCRP	0	0	0	0	0	0	-	0	1	0	0	
TONNOP	1	0	1	0	0	0	1	-	1	1	1	
TONSEA	0	0	0	0	0	0	0	0	-	0	0	
VALCRP	0	0	0	0	0	0	1	0	1	-	0	
VALSEA	0	0	0	0	0	0	1	0	1	1	-	

R1= .005000 R2= .010000

CRTCRP	-	0	1	0	0	0	1	?	1	1	1	
CRTNOP	1	-	1	1	0	1	1	1	1	1	1	
CRTSEA	0	0	-	0	0	0	1	?	1	1	1	
HRSCRP	1	0	1	-	0	1	1	1	1	1	1	
HRSNOP	1	1	1	1	-	1	1	1	1	1	1	*
HRSSEA	1	0	1	0	0	-	1	1	1	1	1	
TONCRP	0	0	0	0	0	0	-	0	1	0	0	
TONNOP	?	0	?	0	0	0	1	-	1	1	?	
TONSEA	0	0	0	0	0	0	0	0	-	0	0	
VALCRP	0	0	0	0	0	0	1	0	1	-	0	
VALSEA	0	0	0	0	0	0	1	?	1	1	-	

R1= .000000 R2= .005000

CRTCRP	-	?	?	0	0	0	1	1	1	?	?	
CRTNOP	?	-	?	?	0	?	1	1	1	?	?	
CRTSEA	?	?	-	0	0	0	1	1	1	?	?	
HRSCRP	1	?	1	-	?	?	1	1	1	?	?	*
HRSNOP	1	1	1	?	-	?	1	1	1	?	?	*
HRSSEA	1	?	1	?	?	-	1	1	1	?	?	*
TONCRP	0	0	0	0	0	0	-	?	?	0	0	
TONNOP	0	0	0	0	0	0	?	-	?	?	0	
TONSEA	0	0	0	0	0	0	?	?	-	0	0	
VALCRP	?	?	?	?	?	?	1	?	1	-	?	*
VALSEA	?	?	?	?	?	?	1	1	1	?	-	*

RESULTS OF STOCHASTIC DOMINANCE WITH RESPECT TO A FUNCTION CLASS 8

R1= .010000 R2= .015000 Undominated

CRTCRP	-	0	?	0	0	0	1	0	1	1	1	
CRTNOP	1	-	1	?	0	1	1	1	1	1	1	
CRTSEA	?	0	-	0	0	0	1	0	1	1	1	
HRSCRP	1	?	1	-	0	1	1	1	1	1	1	
HRSNOP	1	1	1	1	-	1	1	1	1	1	1	*
HRSSEA	1	0	1	0	0	-	1	1	1	1	1	
TONCRP	0	0	0	0	0	0	-	0	1	1	1	
TONNOP	1	0	1	0	0	0	1	-	1	1	1	
TONSEA	0	0	0	0	0	0	0	0	-	1	1	
VALCRP	0	0	0	0	0	0	0	0	0	-	0	
VALSEA	0	0	0	0	0	0	0	0	0	1	-	

R1= .005000 R2= .010000

CRTCRP	-	0	0	0	0	0	1	0	1	1	1	
CRTNOP	1	-	1	?	0	?	1	1	1	1	1	
CRTSEA	1	0	-	0	0	0	1	0	1	1	1	
HRSCRP	1	?	1	-	0	?	1	1	1	1	1	
HRSNOP	1	1	1	1	-	1	1	1	1	1	1	*
HRSSEA	1	?	1	?	0	-	1	1	1	1	1	
TONCRP	0	0	0	0	0	0	-	0	1	1	1	
TONNOP	1	0	1	0	0	0	1	-	1	1	1	
TONSEA	0	0	0	0	0	0	0	0	-	1	1	
VALCRP	0	0	0	0	0	0	0	0	0	-	0	
VALSEA	0	0	0	0	0	0	0	0	0	1	-	

R1 = .000000 R2= .005000

CRTCRP	-	?	?	0	0	0	1	?	1	1	1	
CRTNOP	?	-	?	0	0	0	?	1	?	1	1	
CRTSEA	?	?	-	0	0	0	?	?	1	1	1	
HRSCRP	1	1	1	-	?	?	1	1	1	1	1	*
HRSNOP	1	1	1	?	-	?	1	1	1	1	1	*
HRSSEA	1	1	1	?	?	-	1	1	1	1	1	*
TONCRP	0	?	?	0	0	0	-	?	1	1	1	
TONNOP	?	0	?	0	0	0	?	-	?	1	1	
TONSEA	0	?	0	0	0	0	0	?	-	1	1	
VALCRP	0	0	0	0	0	0	0	0	0	-	0	
VALSEA	0	0	0	0	0	0	0	0	0	0	-	

RESULTS OF STOCHASTIC DOMINANCE WITH RESPECT TO A FUNCTION CLASS 9

R1= .010000 R2= .015000 Undominated

CRTCRP	-	0	1	0	0	0	1	1	1	1	1	
CRTNOP	1	-	1	1	0	1	1	1	1	1	1	
CRTSEA	0	0	-	0	0	0	1	?	1	1	1	
HRSCRP	1	0	1	-	0	1	1	1	1	1	1	
HRSNOP	1	1	1	1	-	1	1	1	1	1	1	*
HRSSEA	1	0	1	0	0	-	1	1	1	1	1	
TONCRP	0	0	0	0	0	0	-	0	0	1	1	
TONNOP	0	0	?	0	0	0	1	-	1	1	1	
TONSEA	0	0	0	0	0	0	1	0	-	1	1	
VALCRP	0	0	0	0	0	0	0	0	0	-	1	
VALSEA	0	0	0	0	0	0	0	0	0	0	-	

R1= .005000 R2= .010000

CRTCRP	-	0	?	0	0	0	1	1	1	1	1	
CRTNOP	1	-	1	?	0	?	1	1	1	1	1	
CRTSEA	?	0	-	0	0	0	1	1	1	1	1	
HRSCRP	1	?	1	-	0	1	1	1	1	1	1	
HRSNOP	1	1	1	1	-	1	1	1	1	1	1	*
HRSSEA	1	?	1	0	0	-	1	1	1	1	1	
TONCRP	0	0	0	0	0	0	-	0	0	1	1	
TONNOP	0	0	0	0	0	0	1	-	1	1	1	
TONSEA	0	0	0	0	0	0	1	0	-	1	1	
VALCRP	0	0	0	0	0	0	0	0	0	-	1	
VALSEA	0	0	0	0	0	0	0	0	0	0	-	

R1= .000000 R2= .005000

CRTCRP	-	?	0	0	0	0	1	1	1	1	1	
CRTNOP	?	-	?	0	0	0	1	1	1	1	1	
CRTSEA	1	?	-	0	0	0	1	1	1	1	1	
HRSCRP	1	1	1	-	?	?	1	1	1	1	1	*
HRSNOP	1	1	1	?	-	?	1	1	1	1	1	*
HRSSEA	1	1	1	?	?	-	1	1	1	1	1	*
TONCRP	0	0	0	0	0	0	-	?	0	1	1	
TONNOP	0	0	0	0	0	0	?	-	?	1	1	
TONSEA	0	0	0	0	0	0	1	?	-	1	1	
VALCRP	0	0	0	0	0	0	0	0	0	-	1	
VALSEA	0	0	0	0	0	0	0	0	0	0	-	

RESULTS OF STOCHASTIC DOMINANCE WITH RESPECT TO A FUNCTION CLASS 10

R1= .010000 R2= .015000

												Undominated
CRTCRP	-	0	0	0	0	0	1	1	1	1	1	
CRTNOP	1	-	1	0	0	0	1	1	1	1	1	
CRTSEA	1	0	-	0	0	0	1	1	1	1	1	
HRSCRP	1	1	1	-	0	0	1	1	1	1	1	
HRSNOP	1	1	1	1	-	1	1	1	1	1	1	*
HRSSEA	1	1	1	1	0	-	1	1	1	1	1	
TONCRP	0	0	0	0	0	0	-	?	0	1	1	
TONNOP	0	0	0	0	0	0	?	-	?	1	1	
TONSEA	0	0	0	0	0	0	1	?	-	1	1	
VALCRP	0	0	0	0	0	0	0	0	0	-	0	
VALSEA	0	0	0	0	0	0	0	0	0	1	-	

R1= .005000 R2= .010000

CRTCRP	-	?	?	0	0	0	1	1	1	1	1	
CRTNOP	?	-	?	0	0	0	1	1	1	1	1	
CRTSEA	?	?	-	0	0	0	1	1	1	1	1	
HRSCRP	1	1	1	-	?	?	1	1	1	1	1	*
HRSNOP	1	1	1	?	-	?	1	1	1	1	1	*
HRSSEA	1	1	1	?	?	-	1	1	1	1	1	*
TONCRP	0	0	0	0	0	0	-	1	?	1	1	
TONNOP	0	0	0	0	0	0	0	-	0	1	1	
TONSEA	0	0	0	0	0	0	?	1	-	1		
VALCRP	0	0	0	0	0	0	0	0	0	-	0	
VALSEA	0	0	0	0	0	0	0	0	0	1	-	

R1= .000000 R2= .005000

CRTCRP	-	1	1	0	0	0	1	1	1	1	1	
CRTNOP	0	-	0	0	0	0	1	1	1	1	1	
CRTSEA	0	1	-	0	0	0	1	1	1	1	1	
HRSCRP	1	1	1	-	1	1	1	1	1	1	1	*
HRSNOP	1	1	1	0	-	0	1	1	1	1	1	
HRSSEA	1	1	1	0	1	-	1	1	1	1	1	
TONCRP	0	0	0	0	0	0	-	1	1	1	1	
TONNOP	0	0	0	0	0	0	0	-	0	1	1	
TONSEA	0	0	0	0	0	0	0	1	-	1	1	
VALCRP	0	0	0	0	0	0	0	0	0	-	0	
VALSEA	0	0	0	0	0	0	0	0	0	1	-	

APPENDIX E

COMPUTER PROGRAM CODE

```
C A MULTIPRODUCT PACKING FACILITY IS MODELLED UNDER STOCHASTIC YIELD AND PRICE
C CONDITIONS. ASSETS ARE CLASSIFIED AS STANDARD OR SPECIALTY.  COSTS ARE
C ALLOCATED TO UNIT CROP COSTS ON THE BASIS  OF  PERCENTAGE OF TOTAL TONNAGE,
C HOURS OF OPERATION, OR VALUE OF OF SALES, OR PER CRATE. REVENUES ARE
C DISTRIBUTED ON THE BASIS OF SEASONAL POOLING, CROP
C POOLING OR NO POOLING.
C
            PROGRAM PACKSIM
            CHARACTER*6 NAME(9)
            REAL AVGCOS(9),ACRE(9),TCRTS(9,75)
            REAL ARPER(9,17),TCPC(9,75),TOTFX(9,75),VARCP(9)
            REAL PRING(5,2,75),UMMER(17,4,75),ALL(10,3,75),CRATE(9,75)
            REAL ARSPR(5,2,75),ARSUM(17,4,75),ARFAL(10,3,75)
            REAL ARSP(5,2,75),ARS(17,4,75),ARF(10,3,75) INTEGER ALLOC
            DATA TCPC/675*0.0/VALC/0/TOTFX/675*0.0/
            CALL ASSIGN(TCPC,NAME,ARPER,AVGCOS,CRATE,ACRE,TCRTS,TOTFX,VARCP)
            CALL SEASPR(PRING,UMMER,ALL,ARSPR,ARSUM,ARFAL,AVGCOS,NAME,
          1 ARSP,ARS,ARF)
            OPEN(1,FILE='OPTIONS')
            OPEN(6,FILE='PRN')
            READ(1,42,END=93) ALLOC
            CLOSE(1)
42          FORMAT(I2)
            CALL POOL(PRING,UMMER,ALL,ARSPR,ARSUM,ARFAL,TCPC,
          1 ARPER,NAME,CRATE,ACRE,TCRTS)
            IF(ALLOC .EQ.0) THEN CALL VALCOS(PRING,UMMER,ALL,ARSP,ARS,ARF,
          1 ARPER,NAME,CRATE,ACRE,TCRTS,TOTFX,VARCP)
            ELSE
               GOTO 78
            ENDIF
               GOTO 78
93          WRITE(6,94)
94          FORMAT('END OF FILE ENCOUNTERED IN OPTIONS FILE IN PRG1.FOR')
            CLOSE (6)
78          END
C
            SUBROUTINE STOCH (YIELD,NUMCR,MAX,MIN,MODE,K)
C  YIELD DATA IS GENERATED IN THIS SUBROUTINE AND RETURNED TO SUBROUTINE
C  ASSIGN. THIS SUBROUTINE GENERATES A RANDOM UNIFORM DEVIATE AND
C  THEN USING THE TRIANGULAR DISTRIBUTION, CALCULATES A
C  RANDOM YIELD BASED ON MINIMUM, MAXIMUM AND MODAL VALUES
C
            REAL UN,MAX(9),MIN(9),MODE(9),YIELD(9),PERC(9),RANNO(9) REAL*8 K
            INTEGER NUMCR
            DO 220 L=1,NUMCR
            PERC(L) = (MODE(L)-MIN(L))/(MAX(L)-MIN(L)) UN=RANF(K)
            IF (UN .GT. PERC(L)) GO TO 200
C LEFT OF MODE
            RANNO(L)=MIN(L) + SQRT((MODE(L)-MIN(L))*(MAX(L)-MIN(L))*UN)
            GOTO 210
200       CONTINUE
C           RIGHT OF MODE
            RANNO(L)=MODE(L)+SQRT((((MAX(L)-MIN(L))*UN)-(MODE(L)-MIN(L)))
          1 *(MAX(L)-MODE(L)))
210     CONTINUE
C STORE RANDOM NUMBER IN YIELD
100       YIELD(L)=RANNO(L)
220         CONTINUE
```

```
          RETURN
          END
C RETURNS A UNIFORM DEVIATE BETWEEN 0 AND 1.0.
          REAL FUNCTION RANF(DL)
          REAL*8 DL
          INTRINSIC DMOD
10        DL=DMOD(16807D0*DL,2147483647D0)
          RANF=DL/2147483648D0
          IF (RANF .LE. 0D0 .OR. RANF .GE. 1.00D0) GOTO 10 RETURN
          END
C
          SUBROUTINE PRICES (AK,A,R)
C
C THIS SUBROUTINE GENERATES THE RANDOM NORMAL DEVIATES AND
C GENERATES THE CORRELATED EVENTS USING A COFACTORED C VAR-COVARIANCE
C MATRIX. THIS SUBROUTINE IS BASED ON WORK BY CLEMENTS, MAPP, AND
C EIDMAN, 1971. THE INPUT ARGUMENTS ARE:
C   A -THE FACTORED VARIANCE-COVARIANCE MATRIX
C   CRNUM -THE NUMBER OF CROP PRICES CORRELATED AND RANDOMIZED.
C THE OUTPUT ARGUMENTS ARE:
C   P -THE MATRIX OF RANDOM AND CORRELATED PRICES
C
          REAL A(17,17)
          REAL X(17),AK(17)
          REAL DI(17,17),UN1,UN2,NOR
          REAL*8 R
C INITIALIZE ARRAYS TO ZERO
          DO 4 I=1,17
             X(I)=0.0
             AK(I)=0.0
             DO 41 K=1,17
                DI(I,K)=0.0
41        CONTINUE
4         CONTINUE
C GENERATE RANDOM NORMAL DEVIATES
          DO 61 I=1,17
             UN1=RANF(R)
             UN2=RANF(R)
             NOR=(-2*ALOG(UN1))**.5*(COS(2*3.1415926536*UN2))
              X(I)=NOR
61        CONTINUE
          DO 71 I=1,17
             DO 72 K=1,17
                DI(I,K)=A(I,K)*X(K)
                AK(I)=AK(I)+DI(I,K)
72        CONTINUE
71      CONTINUE
          RETURN
          END
```

```
C ASSIGN CALCULATES VARIABLE AND FIXED PACKING COSTS FOR
C A MULTIPRODUCT PACKING FACILITY UNDER STOCHASTIC YIELD CONDITIONS
C ASSETS ARE CLASSIFIED AS EITHER STANDARD OR SPECIALTY AND THEIR
C RESPECTIVE COSTS ARE ALLOCATED TO UNIT CROP COSTS ON THE BASIS
C OF EITHER PERCENTAGE OF TOTAL TONNAGE, HOURS OF OPERATION OR  NUMBER OF CRATES
C
        SUBROUTINE ASSIGN(CPC,AME,HARPER,AVGPC,CRATES,ACRES,TCRT,   TOTF,VARCPC)
        CHARACTER*6 ASSET,AME(9)
        REAL WAGE, FED, STATE, FICA, GENEXP, ADMIN, MININ
        REAL LIFE,INIT,SALV,OTHER(14),PERPAK(9),LABPR(9),LABR(9)
        REAL LABP(9),CAPAC(9),PAKOUT(9),DMPCC(9),ACRES(9)
        REAL ACTPAK(9),COSTPR(9),COSTP(9),COSTR(9),TCRT(9,75)
        REAL PCRT(9),RCRT,YGEN(9),POUNDS(9),TOTCRT(9),TOTF(9,75)
        REAL YMAX(9),YMIN(9),YMODE(9),HARPER(9,17),PER,YIELDS(9,75)
        REAL*8 P
        REAL TLCPR, TLCP,TLCR,TOTLAB,TOTDMC,TOTVAR,VARCPC(9)
        REAL EFFWAG,LABOR(9),ACRTOT,SEMIFX,SUMPC(9),AVGPC(9)
        INTEGER COSTAR(14,9),NCROP,ALLOC,STD,NMACH,NWEEK,NIT
        INTEGER I,DBUG,K
        REAL HOURS(9,17),HRS(9),PACCRT,CRATES(9,75),ADPER(9)
        REAL TOTHRS,ALLPER(9),STDFIX(9),TONS(9),TOTTON,DEPREC(14)
        REAL STDEPR,TOTFIX(9),FIXCPC(9),TOTCPC(9),CPC(9,75)
        REAL SPMACH(14),SPEC(14),VOLUME(9,17),VOL(9)
        REAL PERMAC(14,9),SPCOST(14,9),OFFICE,UTMAIN
        DATA TOTTON/0.0/HRS/9*0.0/TOTHRS/0.0/STDEPR/0.0/
        DATA VOL/9*0.0/SPMACH/14*0.0/DBUG/0/K/0/NCROP/9/
        DATA WAGE/3.50/FED/0.062/STATE/0.031/FICA/0.751/
        DATA GENEXP/62000.00/ADMIN/113200.00/MININ/21960.00/
        DATA NMACH/14/NWEEK/17/ACRTOT/0/OFFICE/6720.0/UTMAIN/35460.0/
        DATA NIT/75/SUMPC/9*0.0/P/121819D0/
C BEGIN READING DATA FILES
        OPEN(9,FILE='PRN')
        OPEN(1,FILE='OPTIONS')
        READ(1,42,END=93) ALLOC
        CLOSE (1)
        OPEN(5,FILE='HARVEST')
        READ(5,40,END=91) I,PER
        K=I
        J=1
        GOTO 10
20      READ (5,40,END=30) I,PER
        IF (I .EQ. K) GOTO 10
        K=I
        J=1
10      HARPER(I,J)=PER
        J=J+1
        GOTO 20
40      FORMAT(I1,1X,F4.2)
30      CLOSE(5)
        OPEN(3,FILE='COST')
        DO 34 M=1,NMACH
         READ(3,60,END=66) ASSET,INIT,SALV,LIFE,STD,OTHER(M),
     1     (COSTAR(M,I),I=1,NCROP)
         DEPREC(M)=(INIT-SALV)/LIFE
          IF (STD .EQ. 1) GOTO 44
           SPEC(M)=DEPREC(M)+OTHER(M)
           GOTO 34
44         STDEPR=STDEPR+DEPREC(M)
```

```
34        CONTINUE
60        FORMAT(A6,1x,F8.1,2x,F6.1,1x,F4.1,1x,I1,2x,F6.1,1X,9I1)
C  THE NEXT SECTION READS IN CROP DEPENDENT VARIABLES AND
C  CALCULATES MATERIALS AND LABOR COSTS PER CRATE FOR
C  EACH CROP AND SUMS THEM FOR THE PER CRATE VARIABLE COST
C  FOR EACH CROP.
          EFFWAG = WAGE + (WAGE*(FED+STATE+FICA))
          DO 71 I=1, NCROP
           READ (3,15,END=66) AME(I),CAPAC(I),PAKOUT(I),PERPAK(I),
      1      ACRES(I),DMPCC(I),LABPR(I), LABP(I),LABR(I),POUNDS(I)
           ACTPAK(I) = CAPAC(I)*PAKOUT(I)
           COSTPR(I) = (EFFWAG*LABPR(I))/ACTPAK(I)
           COSTP(I) = (EFFWAG*LABP(I))/ACTPAK(I)
           COSTR(I) = (EFFWAG*LABR(I))/ACTPAK(I)
           ACRTOT=ACRTOT+ACRES(I)
71        CONTINUE
          SEMIFX=((ACRTOT-500)/100)*((.05*OFFICE)+(.10*UTMAIN))
C CHECK TO SEE IF HARVEST PERCENTAGES ADD TO 1?
          DO 181 I=1,NCROP
           DO 183 J=1,NWEEK
            ADPER(I)=ADPER(I)+HARPER(I,J)
183        CONTINUE
           IF (ADPER(I) .NE. 1.00) WRITE(*,182) AME(I),ADPER(I)
181       CONTINUE
182        FORMAT('0',6X,A7,2X, 'WEEKLY PERCENTAGES ADD TO ',F10.5)
          DO 251 I=1,NCROP
           READ(3,25,END=66) YMAX(I),YMIN(I),YMODE(I)
251       CONTINUE
          CLOSE (3)
25        FORMAT(2F6.1,F7.1)
          GOTO 401
C END OF FILE STATEMENTS
91        WRITE(9,94)
          GOTO 77
94        FORMAT('END OF FILE ENCOUNTERED IN HARVEST FILE')
66        WRITE(9,67)
          GOTO 77
67        FORMAT('END OF FILE ENCOUNTERED IN COST FILE')
93        WRITE(9,88)
          GOTO 77
88        FORMAT('END OF FILE ENCOUNTERED IN THE OPTIONS FILE')
 C BEGIN OUTER LOOP CONTROLLING NUMBER OF ITERATIONS
401       DO 500 L=1,NIT
           CALL STOCH (YGEN,NCROP,YMAX,YMIN,YMODE,P)
           DO 70 I=1,NCROP
            YIELDS(I,L)=YGEN(I)
            TOTCRT(I)=ACRES(I)*YGEN(I)
            TCRT(I,L)=TOTCRT(I)
            PCRT(I) = TOTCRT(I)*PERPAK(I)
            PACCRT=PACCRT+PCRT(I)
            RCRT = TOTCRT(I) - PCRT(I)
            TLCPR = (PCRT(I)*COSTPR(I)) + (RCRT*COSTPR(I))
            TLCP = (PCRT(I)*COSTP(I))
            TLCR = (RCRT*COSTR(I))
            TOTLAB = TLCPR + TLCP + TLCR
            TOTDMC = PCRT(I) * DMPCC(I)
            TOTVAR = TOTDMC + TOTLAB
            VARCPC(I) = TOTVAR/PCRT(I)
```

```
          LABOR(I) = LABPR(I)+LABP(I)+LABR(I)
          TONS(I) = (PCRT(I)*POUNDS(I))/2000.0
          TOTTON=TOTTON+TONS(I)
          CRATES(I,L)=PCRT(I)
70       CONTINUE
C THIS PROGRAM SEGMENT ANALYZES SPECIALTY AND STANDARD LINE C ASSETS COSTS.
C
C STANDARD AND SPECIALTY COSTS ARE CALCULATED
        IF (ALLOC) 63,64,65
C ALLOCATION ON PER CRATE BASIS
63      DO 400 M=1,NMACH
         DO 420 I=1,NCROP
          IF(COSTAR(M,I).EQ.1) THEN
           VOLUME(M,I)=PCRT(I)
          ELSE
           VOLUME(M,I)=0.0
          ENDIF
         VOL(M)=VOL(M)+VOLUME(M,I)
420      CONTINUE
400     CONTINUE
        GOTO 95
C ALLOCATION ON HOURS OF OPERATION BASIS
64      DO 31 I=1,NCROP
         DO 32 J=1,NWEEK
          HOURS(I,J)=(PCRT(I)*HARPER(I,J))/ACTPAK(I) HRS(I)=HRS(I)+HOURS(I,J)
32       CONTINUE
         TOTHRS=TOTHRS+HRS(I)
31      CONTINUE
46      FORMAT(17F4.2)
        DO 200 M=1,NMACH
         DO 220 I=1,NCROP
          IF (COSTAR(M,I).EQ.1) THEN
           VOLUME(M,I)=HRS(I)
          ELSE
           VOLUME(M,I)=0.0
          ENDIF
          VOL(M)=VOL(M)+VOLUME(M,I)
220      CONTINUE
200     CONTINUE
        GOTO 95
C  STANDARD AND SPECIALTY COSTS ARE CALCULATED ON A TONNAGE BASIS
 65     DO 300   M=1,NMACH
         DO 320 I=1,NCROP
          IF (COSTAR(M,I) .EQ. 1)  THEN
           VOLUME(M,I)=TONS(I)
          ELSE
           VOLUME(M,I)=0.0
          ENDIF
          VOL(M)=VOL(M)+VOLUME(M,I)
320      CONTINUE
300     CONTINUE
C THIS SET OF LOOPS ALLOCATES OVERHEAD COSTS ON THE BASIS OF
C TONNAGE OR HOURS OF OPERATION AND CALCULATES UNIT TOTAL PACKING
C COSTS FOR EACH CROP.
95      DO 299 I=1,NCROP
         IF (ALLOC) 96,296,297
297      ALLPER(I)=TONS(I)/TOTTON
         GOTO 295
```

```
296     ALLPER(I)=HRS(I)/TOTHRS
        GOTO 295
96      ALLPER(I)=PCRT(I)/PACCRT
295     STDFIX(I)=(ADMIN+GENEXP+MININ+STDEPR+SEMIFX)*ALLPER(I)
       DO 298 M=1,NMACH
        IF (VOLUME(M,I) .EQ. 0.0) THEN
         PERMAC(M,I)=0.0
        ELSE
         PERMAC(M,I)=VOL(M)/VOLUME(M,I)
        ENDIF
        SPCOST(M,I)=SPEC(M)*PERMAC(M,I)
        SPMACH(I)=SPMACH(I)+SPCOST(M,I)
298    CONTINUE
       TOTFIX(I)=STDFIX(I)+SPMACH(I)
       TOTF(I,L)=TOTF(I,L)+TOTFIX(I)
       FIXCPC(I)=TOTFIX(I)/PCRT(I)
       TOTCPC(I)=VARCPC(I)+FIXCPC(I)
       CPC(I,L)=TOTCPC(I)
299    CONTINUE
       TOTHRS=0.0
       PACCRT=0.0
       TOTTON=0.0
       ACRTOT=0.0
       DO 550 M=1,NMACH
        VOL(M)=0.0
550    CONTINUE
       DO 551 I=1,NCROP
        HRS(I)=0.0
        SPMACH(I)=0.0
        TONS(I)=0.0
551    CONTINUE
500    CONTINUE
       DO 5 I=1,NCROP
        DO 6 L=1,NIT
         SUMPC(I)=SUMPC(I)+CPC(I,L)
6       CONTINUE
        AVGPC(I)=SUMPC(I)/NIT
5      CONTINUE
       OPEN(8,FILE='YLD')
       OPEN(7,FILE='PACKING')
       DO 901 I=1,NCROP
        WRITE(8,902) AME(I),(YIELDS(I,L),L=1,NIT)
901    CONTINUE
902    FORMAT(2X,'YIELDS',A8,2X,75F8.2)
       WRITE(7,900) (AVGPC(I),I=1,9)
900    FORMAT(1x,'AVERAGE PACKING COSTS',9f6.2)
       WRITE(7,526)
526    FORMAT('TOTAL PACKING COSTS FOR EACH CROP')
C WRITE OUT METHOD OF ALLOCATING COSTS: CRATES,TONNAGE OR HOURS
       IF (ALLOC) 135,136,137
137     WRITE(7,176)
       GOTO 89
136     WRITE(7,177)
       GOTO 89
135     WRITE(7,178)
89     CLOSE(8)
       DO 521 I=1,NCROP
        WRITE(7,523) AME(I),(CPC(I,L),L=1,75)
```

```
521     CONTINUE
        CLOSE(7)
523     FORMAT(A8,75F8.2)
178     FORMAT('0',4X,'FIXED COSTS ALLOCATED BY CRATES, ALLOC=NEG')
176     FORMAT('0',4X,'FIXED COSTS ALLOCATED BY TONNAGE, ALLOC=POS')
177     FORMAT('0','FIXED COSTS ALLOCATED BY HOURS OF OPER,ALLOC=ZERO')
15      FORMAT(A6,1X,F4.2,1X,F5.2,1X,F4.2,F6.1,1X,F4.2,1X,F5.2, 1    2F6.2,1X,F4.1)
42      FORMAT(I2)
77      RETURN
78      END
```

```
C THIS SUBROUTINE GENERATES THE PRICES FOR EACH OF THE CROPS
C
         SUBROUTINE SEASPR(SPRING,SUMR,FALL,FARSPR,FARSUM,FARFAL,
      1    AVGPC,AME,FARSP,FARS,FARF)
         REAL SUMR(17,4,75),FALL(10,3,75),SPRING(5,2,75)
         REAL DUMY(17,4,75),AVGPC(9)
         REAL*8 Q
         INTRINSIC INT
         REAL FARSUM(17,4,75),FARFAL(10,3,75),FARSPR(5,2,75)
         REAL PRSB(17),PRFC(17),PRSC(17),PRCUC(17),PRTOM(17),PRCAN(17)
         REAL PROK(17),PRTUR(17),PRFB(17),APRSB(17,17),APRFC(17,17)
         REAL APRCUC(17,17),APRTOM(17,17),APRCAN(17,17),APROK(17,17)
         REAL APRFB(17,17),APRSC(17,17),APRTUR(17,17)
         INTEGER NCROP,NWEEK,NIT,NCSP,NCS,NCF
         INTEGER I,W,DBUG,K
         CHARACTER*6 NAMES(4),NAMEF(3),NAMESP(2),AME(9)
         REAL MEANS(9,17)
         REAL FARS(17,4,75),FARF(10,3,75),FARSP(5,2,75)
         DATA DBUG/1/NCROP/9/NWEEK/17/NWKSP/5/NWKFAL/10/
         DATA NIT/75/Q/1218192D0/NCS/4/NCF/3/NCSP/2/
C THE FOLLOWING PROGRAM SEGMENT GENERATES THE RANDOM PRICES FOR
 C EACH OF THE WEEKS OF THE HARVEST SEASON FOR NINE CROPS.
C PUT SEASONAL AVERAGE PACKING COSTS IN SEPARATE ARRAYS
         OPEN(8,FILE='MEANS')
         DO 8 I=1,2
          NAMESP(I)=AME(I)
8        CONTINUE
         DO 9 I=3,6
          NAMES(I-2)=AME(I)
9        CONTINUE
         DO 10 I=7,9
          NAMEF(I-6)=AME(I)
10       CONTINUE
C READ MEANS
C BEGIN OUTER LOOP CONTROLLING NUMBER OF ITERATIONS
         OPEN(3,FILE='MEAN')
         DO 65 I=1,NCROP
          READ(3,70,END=71) (MEANS(I,J),J=1,NWEEK)
65       CONTINUE
         CLOSE(3)
C READ FACTORED VARIANCE-COVARIANCE MATRICES
         OPEN(1,FILE='AMATRIX')
         DO 186 I=1,5
          READ(1,11,END=188) (APRSB(I,J),J=1,5)
186      CONTINUE
         DO 187 I=1,3
          READ(1,12,END=188) (APRSC(I,J),J=1,3)
187      CONTINUE
         DO 190 I=1,17
          READ(1,13,END=188) (APRCUC(I,J),J=1,17)
190      CONTINUE
         DO 191 I=1,12
          READ(1,14,END=188) (APRTOM(I,J),J=1,12)
191      CONTINUE
         DO 192 I=1,11
          READ(1,15,END=188) (APRCAN(I,J),J=1,11)
192      CONTINUE
         DO 193 I=1,12
```

```
        READ(1,16,END=188) (APROK(I,J),J=1,12)
193     CONTINUE
        DO 194 I=1,9
         READ(1,17,END=188) (APRTUR(I,J),J=1,9)
194     CONTINUE
        DO 195 I=1,6
         READ(1,18,END=188) (APRFC(I,J),J=1,6)
195     CONTINUE
        DO 196 I=1,7
         READ(1,19,END=188) (APRFB(I,J),J=1,7)
196     CONTINUE
        CLOSE(1)
        DO 500 L=1,NIT
         DO 268 J=1,17
          PRCUC(J)=0.0
          PRTOM(J)=0.0
          PRCAN(J)=0.0
          PROK(J)=0.0
268      CONTINUE
C NOW CALCULATE THE 17 WEEKS OF SUMMER PRICES FOR THE PACKING FACILITY
         CALL PRICES(PRCUC,APRCUC,Q)
         SUMR(1,1,L)=PRCUC(1)+MEANS(3,1)
         DO 20 J=2,17
          SUMR(J,1,L)=PRCUC(J)+MEANS(3,J)
20       CONTINUE
         CALL PRICES(PRTOM,APRTOM,Q)
         SUMR(1,2,L)=PRTOM(1)+MEANS(4,1)
         DO 21 J=2,12
          SUMR(J,2,L)=PRTOM(J)+MEANS(4,J)
21        CONTINUE
         CALL PRICES(PRCAN,APRCAN,Q)
         SUMR(1,3,L)=PRCAN(1)+MEANS(5,1)
         DO 22 J=2,11
          SUMR(J,3,L)=PRCAN(J)+MEANS(5,J)
22       CONTINUE
         CALL PRICES(PROK,APROK,Q)
         SUMR(1,4,L)=PROK(1)+MEANS(6,1)
         DO 23 J=2,12
          SUMR(J,4,L)=PROK(J)+MEANS(6,J)
23       CONTINUE
C NOW ESTIMATE FALL PRICES FOR THE PACKING FACILITY
         DO 269 J=1,NWKFAL
          PRTUR(J)=0.0
          PRFC(J)=0.0
          PRFB(J)=0.0
269      CONTINUE
         CALL PRICES(PRTUR,APRTUR,Q)
         FALL(1,1,L)=PRTUR(1)+MEANS(7,1)
         DO 40 J=2,9
          FALL(J,1,L)=PRTUR(J)+MEANS(7,J)
40       CONTINUE
         CALL PRICES(PRFC,APRFC,Q)
         FALL(1,2,L)=PRFC(1)+MEANS(8,1)
         DO 41 J=2,6
          FALL(J,2,L)=PRFC(J)+MEANS(8,J)
41       CONTINUE
         CALL PRICES(PRFB,APRFB,Q)
         FALL(1,3,L)=PRFB(1)+MEANS(9,1)
```

```
          DO 42 J=2,7
           FALL(J,3,L)=PRFB(J)+MEANS(9,J)
42        CONTINUE
C NOW CALCULATE THE SPRING PRICES
          DO 44 J=1,NWKSP
           PRSB(J)=0.0
           PRSC(J)=0.0
44        CONTINUE
          CALL PRICES(PRSB,APRSB,Q)
          SPRING(1,1,L)=PRSB(1)+MEANS(1,1)
          DO 45 J=2,5
           SPRING(J,1,L)=PRSB(J)+MEANS(1,J)
45        CONTINUE
          CALL PRICES(PRSC,APRSC,Q)
          SPRING(1,2,L)=PRSC(1)+MEANS(2,1)
          DO 46 J=2,3
           SPRING(J,2,L)=PRSC(J)+MEANS(2,J)
46        CONTINUE
C END OF OUTER LOOP CONTROLLING NUMBER OF INTERATIONS
500      CONTINUE
C
C CALL COR SUBROUTINE TO PRINT WEEKLY MEANS AND STD DEV. CALL
         COR(SUMR,NIT,NCS,NWEEK,NAMES)
         DO 150 L=1,NIT
          DO 150 J=1,NWKFAL
           DO 150 I=1,NCF
            DUMY(J,I,L)=FALL(J,I,L)
150      CONTINUE
         CALL COR(DUMY,NIT,NCF,NWKFAL,NAMEF)
         DO 151 L=1,NIT
          DO 151 J=1,NWKSP
           DO 151 I=1,NCSP
            DUMY(J,I,L)=SPRING(J,I,L)
151      CONTINUE
         CALL COR(DUMY,NIT,NCSP,NWKSP,NAMESP)
C THE FOLLOWING PROGRAM SEGMENT GENERATES THE RANDOM PRICES FOR
C EACH OF THE WEEKS OF THE HARVEST SEASON FOR NINE CROPS. THESE
C PRICES ARE PAID TO THE PRODUCERS.
         DO 36 L=1,NIT
          DO 368 J=1,NWEEK
           PRCUC(J)=0.0
           PRTOM(J)=0.0
           PRCAN(J)=0.0
           PROK(J)=0.0
368       CONTINUE
C NOW CALCULATE THE 17 WEEKS OF SUMMER PRICES FOR THE FARMER
          CALL PRICES(PRCUC,APRCUC,Q)
          FARS(1,1,L)=PRCUC(1)+MEANS(3,1)
          DO 220 J=2,17
           FARS(J,1,L)=PRCUC(J)+MEANS(3,J)
220       CONTINUE
          CALL PRICES(PRTOM,APRTOM,Q)
          FARS(1,2,L)=PRTOM(1)+MEANS(4,1)
          DO 221 J=2,12
           FARS(J,2,L)=PRTOM(J)+MEANS(4,J)
221       CONTINUE
          CALL PRICES(PRCAN,APRCAN,Q)
          FARS(1,3,L)=PRCAN(1)+MEANS(5,1)
```

```
      DO 222 J=2,11
       FARS(J,3,L)=PRCAN(J)+MEANS(5,J)
222   CONTINUE
      CALL PRICES(PROK,APROK,Q)
      FARS(1,4,L)=PROK(1)+MEANS(6,1)
      DO 223 J=2,12
       FARS(J,4,L)=PROK(J)+MEANS(6,J)
223   CONTINUE
C
      DO 369 J=1,NWKFAL
       PRFB(J)=0.0
       PRTUR(J)=0.0
       PRFC(J)=0.0
369   CONTINUE
C NOW CALCULATE THE 10 WEEKS OF FALL PRICES
      CALL PRICES(PRTUR,APRTUR,Q)
      FARF(1,1,L)=PRTUR(1)+MEANS(7,1)
      DO 240 J=2,9
       FARF(J,1,L)=PRTUR(J)+MEANS(7,J)
240   CONTINUE
      CALL PRICES(PRFC,APRFC,Q)
      FARF(1,2,L)=PRFC(1)+MEANS(8,1)
      DO 241 J=2,6
       FARF(J,2,L)=PRFC(J)+MEANS(8,J)
241   CONTINUE
      CALL PRICES(PRFB,APRFB,Q)
      FARF(1,3,L)=PRFB(1)+MEANS(9,1)
      DO 242 J=2,7
       FARF(J,3,L)=PRFB(J)+MEANS(9,J)
242   CONTINUE
C NOW CALCULATE THE 3 WEEKS OF SPRING PRICES FOR THE FARMER
      DO 344 J=1,NWKSP
      PRSC(J)=0.0
      PRSB(J)=0.0
344   CONTINUE
      CALL PRICES(PRSB,APRSB,Q)
      FARSP(1,1,L)=PRSB(1)+MEANS(1,1)
      DO 245 J=2,5
       FARSP(J,1,L)=PRSB(J)+MEANS(1,J)
245   CONTINUE
      CALL PRICES(PRSC,APRSC,Q)
      FARSP(1,2,L)=PRSC(1)+MEANS(2)
      DO 246 J=2,3
       FARSP(J,2,L)=PRSC(J)+MEANS(2,J)
246   CONTINUE
36    CONTINUE
C CALL COR SUBROUTINE TO PRINT WEEKLY MEANS AND STD DEV.
C FOR FARMER PRICES
      CALL COR(FARS,NIT,NCS,NWEEK,NAMES)
      DO 850 L=1,NIT
       DO 850 J=1,NWKFAL
        DO 850 I=1,NCF
         DUMY(J,I,L)=FARF(J,I,L)
850   CONTINUE
       CALL COR(DUMY,NIT,NCF,NWKFAL,NAMEF)
      DO 851 L=1,NIT
       DO 851 J=1,NWKSP
        DO 851 I=1,NCSP
```

```
          DUMY(J,I,L)=FARSP(J,I,L)
851     CONTINUE
        CALL COR(DUMY,NIT,NCSP,NWKSP,NAMESP)
C WRITE OUT FACILITY PRICES,FARM PRICES BEFORE COSTS ARE SUBTRACTED
C AND FARM PRICES AFTER COSTS ARE SUBTRACTED
C NOW REDUCE DALLAS PRICES BY 20%
        DO 140 L=1,NIT
         DO 141 J=1,NWEEK
          DO 142 I=1,NCS
           SUMR(J,I,L)=SUMR(J,I,L)*.8
           FARSUM(J,I,L)=(FARS(J,I,L)*.8)-AVGPC(I+2)
142       CONTINUE
141      CONTINUE
         DO 143 J=1,NWKFAL
          DO 144 I=1,NCF
           FALL(J,I,L)=FALL(J,I,L)*.8
           FARFAL(J,I,L)=(FARF(J,I,L)*.8)-AVGPC(I+6)
144       CONTINUE
143      CONTINUE
         DO 145 J=1,NWKSP
          DO 146 I=1,NCSP
           SPRING(J,I,L)=SPRING(J,I,L)*.8
            FARSPR(J,I,L)=(FARSP(J,I,L)*.8)-AVGPC(I)
146       CONTINUE
145      CONTINUE
140     CONTINUE
        OPEN(7,FILE='PRN')
2       FORMAT(23F6.3)
225     FORMAT(F11.9,F13.9)
3       FORMAT(F8.6,3F9.6)
4       FORMAT(F8.6,2F9.6)
5       FORMAT(F8.6)
11      FORMAT(F8.6,4F9.6)
12      FORMAT(F8.6,2F9.6)
13      FORMAT(F8.6,16F9.6)
14      FORMAT(F8.6,11F9.6)
15      FORMAT(F8.6,10F9.6)
16      FORMAT(F8.6,11F9.6)
17      FORMAT(F8.6,8F9.6)
18      FORMAT(F8.6,5F9.6)
19      FORMAT(F8.6,6F9.6)
25      FORMAT(F8.6,F9.6)
70      FORMAT(F6.3,6F7.3,10F6.3)
        GOTO 78
188     WRITE(7,189)
        GOTO 78
189     FORMAT('END OF FILE ENCOUNTERED IN FILE AMATRIX')
71      WRITE(7,73)
        GOTO 78
73      FORMAT('END OF FILE ENCOUNTERED IN FILE MEAN')
78      CLOSE(8)
        CLOSE(7)
        RETURN
        END
```

```
SUBROUTINE COR(PRC,NMT,NCROP,NWKS,NAME)
C  THIS PROGRAM SEGMENT VERIFIES CALCULATION OF CORRELATED
C  OUTCOMES BY CALCULATING THE MEANS AND STANDARD DEVIATIONS
        REAL BI(4),YM(4),CORCOL(4,75),SQ(75),SSQ(4),VAR(4),STD(4) CHARACTER*6 NAME(4)
        REAL PRC(17,4,75),MEANPR(17,4),STDEV(17,4)
        INTEGER TN,NMT
        DATA BI/4*0.0/SSQ/4*0.0/YM/4*0.0/VAR/4*0.0/SQ/75*0.0/
        DATA STD/4*0.0/
        TN=NMT
        DO 145 L=1,NWKS
         DO 146 I=1,NCROP
          MEANPR(L,I)=0.0
          STDEV(L,I)=0.0
146      CONTINUE
145     CONTINUE
        DO 401 L=1,NWKS
13       DO 14 J=1,NMT
          DO 114 I=1,NCROP
           BI(I)=BI(I)+PRC(L,I,J)
114       CONTINUE
14       CONTINUE
         DO 15 I=1,NCROP
          YM(I)=BI(I)/TN
          MEANPR(L,I)=MEANPR(L,I)+YM(I)
15       CONTINUE
         DO 16 I=1,NCROP
          DO 116 J=1,NMT
           CORCOL(I,J)=PRC(L,I,J)-YM(I)
           SQ(J)=CORCOL(I,J)*CORCOL(I,J)
           SSQ(I)=SSQ(I)+SQ(J)
           SQ(J)=0.0
116       CONTINUE
16       CONTINUE
         DO 17 I=1,NCROP
          VAR(I)=SSQ(I)/(TN-1)
          STD(I)=VAR(I)**.5
          STDEV(L,I)=STD(I)
17        CONTINUE
400      DO 101 I=1,4
          BI(I)=0.0
          SSQ(I)=0.0
          VAR(I)=0.0
          YM(I)=0.0
          STD(I)=0.0
101      CONTINUE
401     CONTINUE
        WRITE(8,408)(NAME(I),I=1,NCROP)
408     FORMAT(2X,'CROP MEANS AND STD DEV',/4A19)
        WRITE(8,19)
19      FORMAT(1X,'WK#',4(3X,'MEANS',3X,'STD. DEV'))
        DO 18 L=1,NWKS
         WRITE(8,219) L,(MEANPR(L,I),STDEV(L,I),I=1,NCROP)
 18     CONTINUE
219     FORMAT(1X,I3,4(3X,F6.2,3X,F7.4))
        RETURN
        END
```

```
      SUBROUTINE POOL(SPRING,SUMMER,FALL,FARSPR,FARSUM,FARFAL,CPC,
     1  HARPER,AME,CRATES,ACRES,TCRT)
      REAL SPRING(5,2,75),SUMMER(17,4,75),FALL(10,3,75)
      REAL FARSPR(5,2,75),FARSUM(17,4,75),FARFAL(10,3,75)
      CHARACTER*6 AME(9)
      INTEGER NIT,CLACRE(10)
      REAL CPC(9,75),HARPER(9,17),REFUND(17,9,75),CRATES(9,75)
      REAL ACRES(9),TCRT(9,75),PCRT(10,9),PROD(9,75)
      REAL FIX(9),VAR(9),REVNUE(17,9,75)
      REAL POOLF(75),POOLS(75),POOLSP(75)
      REAL FARSP(5,2,75),FARS(17,4,75),FARF(10,3,75)
      REAL PYMTSP(2,75),PYMTS(4,75),PYMTF(3,75),SEASF(75)
      REAL CLSQ(10,75),SUMSQ(10),SUM(10),MEAN(10),STDEV(10)
      INTEGER FALWKS,SUMWKS,SPRWKS,NC,WKS
      REAL PROFIT(9,75),CLASS(10,75),SEASSP(75),SEASS(75)
      DATA PROFIT/675*0.0/WKS/17/SEASSP/75*0.0/
      DATA SEASS/75*0.0/SEASF/75*0.0/
      DATA PYMTSP/150*0.0/PYMTS/300*0.0/PYMTF/225*0.0/
      DATA POOLF/75*0.0/POOLS/75*0.0/NC/9/SPRWKS/5/FALWKS/10/
      DATA POOLSP/75*0.0/NIT/75/SUMWKS/17/SUMSQ/10*0.0/SUM/10*0.0/
C THIS SEGMENT CREATES A POOL FOR EACH WEEK AND
C INCLUDES ALL THE REVENUES IN THAT WEEK TO BE DISTRIBUTED
      OPEN(4,FILE='PROD')
      DO 199 I=1,NC
       READ(4,200,END=201) FIX(I),VAR(I)
199   CONTINUE
      DO 198 I=1,10
       READ(4,202,END=201) CLACRE(I)
198   CONTINUE
      DO 197 I=1,10
       READ(4,203,END=201) (PCRT(I,J),J=1,NC)
197   CONTINUE
      CLOSE(4)
202   FORMAT(I3)
200   FORMAT(F6.1,F5.2)
203   FORMAT(F4.3,8F5.3)
C OUTER LOOP CONTROLLING NUMBER OF ITERATIONS
      DO 8 L=1,NIT
C FIRST THE SPRING CROPS
       DO 7 I=1,2
        DO 9 J=1,SPRWKS
         REFUND(J,I,L)=SPRING(J,I,L)-CPC(I,L)
         REVNUE(J,I,L)=REFUND(J,I,L)*(CRATES(I,L)*HARPER(I,J))
         PROFIT(I,L)=PROFIT(I,L)+REVNUE(J,I,L)
         FARSP(J,I,L)=FARSPR(J,I,L)*(CRATES(I,L)*HARPER(I,J))
         PYMTSP(I,L)=PYMTSP(I,L)+FARSP(J,I,L)
9       CONTINUE
        SEASSP(L)=SEASSP(L)+PYMTSP(I,L)
7      CONTINUE
C NOW FOR THE SUMMER CROPS
       DO 13 I=1,4
        DO 14 J=1,SUMWKS
         REFUND(J,I+2,L)=SUMMER(J,I,L)-CPC(I+2,L)
         REVNUE(J,I+2,L)=(REFUND(J,I+2,L)*(CRATES(I+2,L)
     1    *HARPER(I+2,J)))
         PROFIT(I+2,L)=PROFIT(I+2,L)+REVNUE(J,I+2,L)
         FARS(J,I,L)=FARSUM(J,I,L)*(CRATES(I+2,L)*HARPER(I+2,J))
         PYMTS(I,L)=PYMTS(I,L)+FARS(J,I,L)
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```
14          CONTINUE
            SEASS(L)=SEASS(L)+PYMTS(I,L)
13           CONTINUE
C NOW FOR THE FALL CROPS
             DO 16 I=1,3
              DO 18 J=1,FALWKS
               REFUND(J,I+6,L)=FALL(J,I,L)-CPC(I+6,L)
               REVNUE(J,I+6,L)=(REFUND(J,I+6,L)*(CRATES(I+6,L) *HARPER(I+6,J)))
               PROFIT(I+6,L)=PROFIT(I+6,L)+REVNUE(J,I+6,L)
               FARF(J,I,L)=FARFAL(J,I,L)*(CRATES(I+6,L)*HARPER(I+6,J))
               PYMTF(I,L)=PYMTF(I,L)+FARF(J,I,L)
18            CONTINUE
              SEASF(L)=SEASF(L)+PYMTF(I,L)
16           CONTINUE
C NOW COMPUTE 1 POOL OF PACKING FACILITY REVENUES FOR EACH SEASON
            DO 20 I=1,3
             POOLF(L)=POOLF(L)+PROFIT(I+6,L)
20          CONTINUE
           DO 22 I=1,4
            POOLS(L)=POOLS(L)+PROFIT(I+2,L)
22         CONTINUE
           DO 24 I=1,2
            POOLSP(L)=POOLSP(L)+PROFIT(I,L)
24         CONTINUE
C FARM PRODUCTION COSTS CALCULATED FOR ALL ACRES PLANTED OF THAT CROP
C FOLLOWED BY FARMER NET PROFITS FOR ALL ACRES PLANTED OF THAT CROP
           DO 257 I=1,2
            PROD(I,L)=(VAR(I)*TCRT(I,L))+(FIX(I)*ACRES(I))
            PROFIT(I,L)=(PROFIT(I,L)-PROD(I,L))
257        CONTINUE
           DO 255 I=1,4
            PROD(I+2,L)=(VAR(I+2)*TCRT(I+2,L))+(FIX(I+2)*ACRES(I+2))
            PROFIT(I+2,L)=(PROFIT(I+2,L)-PROD(I+2,L))
255        CONTINUE
           DO 256 I=1,3
            PROD(I+6,L)=(VAR(I+6)*TCRT(I+6,L))+(FIX(I+6)*ACRES(I+6))
            PROFIT(I+6,L)=(PROFIT(I+6,L)-PROD(I+6,L))
256        CONTINUE
C
C COMPUTE PER ACRE PROFITS BY CLASS WHEN NET PACKING REVENUE
C ARE POOLED BY CROP. NET PACKING REVENEUS ARE FACILITY PRICE
C LESS COSTS OF PACKING.
          CLASS(1,L)=(PROFIT(2,L)*PCRT(1,2))/CLACRE(1)
          CLASS(2,L)=(PROFIT(5,L)*PCRT(2,5))/CLACRE(2)
          CLASS(3,L)=((PROFIT(4,L)*PCRT(3,4))+(PROFIT(6,L)*PCRT(3,6)))
        1  /CLACRE(3)
          CLASS(4,L)=((PROFIT(7,L)*PCRT(4,7))+(PROFIT(8,L)*PCRT(4,8)))
        1  /CLACRE(4)
          CLASS(5,L)=((PROFIT(3,L)*PCRT(5,3))+(PROFIT(4,L)*PCRT(5,4))
        1  +(PROFIT(6,L)*PCRT(5,6)))/CLACRE(5)
          CLASS(6,L)=((PROFIT(2,L)*PCRT(6,2))+(PROFIT(3,L)*PCRT(6,3))
        1  +(PROFIT(4,L)*PCRT(6,4)))/CLACRE(6)
          CLASS(7,L)=((PROFIT(1,L)*PCRT(7,1))+(PROFIT(2,L)*PCRT(7,2))
        1  +(PROFIT(8,L)*PCRT(7,8)))/CLACRE(7)
          CLASS(8,L)=((PROFIT(1,L)*PCRT(8,1))+(PROFIT(3,L)*PCRT(8,3))
        1  +(PROFIT(4,L)*PCRT(8,4))+(PROFIT(5,L)*PCRT(8,5))
        2  +(PROFIT(7,L)*PCRT(8,7))+(PROFIT(9,L)*PCRT(8,9)))/CLACRE(8)
          CLASS(9,L)=((PROFIT(2,L)*PCRT(9,2))+(PROFIT(3,L)*PCRT(9,3))
```

```
     1    +PROFIT(4,L)*PCRT(9,4)+(PROFIT(5,L)*PCRT(9,5))
     2    +(PROFIT(8,L)*PCRT(9,8))+(PROFIT(9,L)*PCRT(9,9)))/CLACRE(9)
      CLASS(10,L)=((PROFIT(1,L)*PCRT(10,1))+(PROFIT(2,L)*PCRT(10,2))
     1    +(PROFIT(3,L)*PCRT(10,3))+(PROFIT(5,L)*PCRT(10,5))
     2    +PROFIT(7,L)*PCRT(10,7)+(PROFIT(9,L)*PCRT(10,9)))/CLACRE(10)
8     CONTINUE
C NOW CALCULATE MEAN AND STANDARD DEVIATION OF PROFITS FOR EACH CLASS
      DO 140 I=1,10
       DO 141 L=1,NIT
        CLSQ(I,L)=CLASS(I,L)**2
        SUMSQ(I)=SUMSQ(I)+CLSQ(I,L)
        SUM(I)=SUM(I)+CLASS(I,L)
141    CONTINUE
       MEAN(I)=SUM(I)/NIT
       STDEV(I)=((SUMSQ(I)-(NIT*(MEAN(I)**2)))/(NIT-1))**.5
140   CONTINUE
C NOW WRITE FARMER PROFITS,MEANS & STD DEV BY CLASS WHEN
C REVENUES ARE POOLED BY CROP
      OPEN(9,FILE='POOLAS')
      WRITE(9,220)
220   FORMAT(1X,'FARMER PROFITS PER ACRE WITH REVENUES POOLED BY CROP')
      DO 222 I=1,10
       WRITE(9,221) I,(CLASS(I,L),L=1,NIT),MEAN(I),STDEV(I)
222   CONTINUE
221   FORMAT(1X,'FARMER CLASS',I2,75F10.1,2X,'MEAN PROFIT',2X,F8.2,
     1   2X,'STANDARD DEVIATION OF PROFITS',2X,F8.2)
C NOW CALCULATE FARMER PROFITS BY CLASS WHEN NET PACKING REVENUES
C ARE POOLED BY SPRING, SUMMER AND FALL SEASONS
      DO 223 I=1,10
       DO 224 L=1,NIT
        CLASS(I,L)=0.0
        CLSQ(I,L)=0.0
224    CONTINUE
       SUMSQ(I)=0.0
       SUM(I)=0.0
       MEAN(I)=0.0
       STDEV(I)=0.0
223   CONTINUE
      DO 236 L=1,NIT
       CLASS(1,L)=((((POOLSP(L)*(PYMTSP(2,L)/SEASSP(L)))-PROD(2,L))
     1   *PCRT(1,2)))/CLACRE(1)
       CLASS(2,L)=((((POOLS(L)*(PYMTS(3,L)/SEASS(L)))-PROD(5,L))
     1   *PCRT(2,5)))/CLACRE(2)
       CLASS(3,L)=((((POOLS(L)*(PYMTS(2,L)/SEASS(L)))-PROD(4,L))
     1    *PCRT(3,4))+(((POOLS(L)*(PYMTS(4,L)/SEASS(L)))-PROD(6,L))
     2   *PCRT(3,6)))/CLACRE(3)
       CLASS(4,L)=((((POOLF(L)*(PYMTF(1,L)/SEASF(L)))-PROD(7,L))
     1   *PCRT(4,7))+(((POOLF(L)*(PYMTF(2,L)/SEASF(L)))-PROD(8,L))
     2   *PCRT(4,8)))/CLACRE(4)
       CLASS(5,L)=((((POOLS(L)*(PYMTS(1,L)/SEASS(L)))-PROD(3,L))
     1   *PCRT(5,3))+(((POOLS(L)*(PYMTS(2,L)/SEASS(L)))-PROD(4,L))
     2   *PCRT(5,4))+(((POOLS(L)*(PYMTS(4,L)/SEASS(L)))-PROD(6,L))
     3   *PCRT(5,6)))/CLACRE(5)
       CLASS(6,L)=((((POOLSP(L)*(PYMTSP(2,L)/SEASSP(L)))-PROD(2,L))
     1   *PCRT(6,2))+(((POOLS(L)*(PYMTS(1,L)/SEASS(L)))-PROD(3,L))
     2   *PCRT(6,3))+(((POOLS(L)*(PYMTS(2,L)/SEASS(L)))-PROD(4,L))
     3    *PCRT(6,4)))/CLACRE(6)
       CLASS(7,L)=((((POOLSP(L)*(PYMTSP(1,L)/SEASSP(L)))-PROD(1,L))
```

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     1   *PCRT(7,1))+(((POOLSP(L)*(PYMTSP(2,L)/SEASSP(L)))-PROD(2,L))
     2   *PCRT(7,2))+(((POOLF(L)*(PYMTF(2,L)/SEASF(L)))-PROD(8,L))
     3   *PCRT(7,8)))/CLACRE(7)
        CLASS(8,L)=((((POOLSP(L)*(PYMTSP(1,L)/SEASSP(L)))-PROD(1,L))
     1   *PCRT(8,1))+(((POOLS(L)*(PYMTS(1,L)/SEASS(L)))-PROD(3,L))
     2   *PCRT(8,3))+(((POOLS(L)*(PYMTS(2,L)/SEASS(L)))-PROD(4,L))
     3   *PCRT(8,4))+(((POOLS(L)*(PYMTS(3,L)/SEASS(L)))-PROD(5,L))
     4   *PCRT(8,5))+(((POOLF(L)*(PYMTF(1,L)/SEASF(L)))-PROD(7,L))
     5   *PCRT(8,7))+(((POOLF(L)*(PYMTF(3,L)/SEASF(L)))-PROD(9,L))
     6   *PCRT(8,9)))/CLACRE(8)
        CLASS(9,L)=((((POOLSP(L)*(PYMTSP(2,L)/SEASSP(L)))-PROD(2,L))
     1   *PCRT(9,2))+(((POOLS(L)*(PYMTS(1,L)/SEASS(L)))-PROD(3,L))
     2    *PCRT(9,3))+(((POOLS(L)*(PYMTS(2,L)/SEASS(L)))-PROD(4,L))
     3   *PCRT(9,4))+(((POOLS(L)*(PYMTS(3,L)/SEASS(L)))-PROD(5,L))
     4   *PCRT(9,5))+(((POOLF(L)*(PYMTF(2,L)/SEASF(L)))-PROD(8,L))
     5   *PCRT(9,8))+(((POOLF(L)*(PYMTF(3,L)/SEASF(L)))-PROD(9,L))
     6   *PCRT(9,9)))/CLACRE(9)
        CLASS(10,L)=((((POOLSP(L)*(PYMTSP(1,L)/SEASSP(L)))-PROD(1,L))
     1   *PCRT(10,1))+(((POOLSP(L)*(PYMTSP(2,L)/SEASSP(L)))-PROD(2,L))
     2   *PCRT(10,2))+(((POOLS(L)*(PYMTS(1,L)/SEASS(L)))-PROD(3,L))
     3   *PCRT(10,3))+(((POOLS(L)*(PYMTS(3,L)/SEASS(L)))-PROD(5,L))
     4   *PCRT(10,5))+(((POOLF(L)*(PYMTF(1,L)/SEASF(L)))-PROD(7,L))
     5   *PCRT(10,7))+(((POOLF(L)*(PYMTF(3,L)/SEASF(L)))-PROD(9,L))
     6   *PCRT(10,9)))/CLACRE(10)
236     CONTINUE
C NOW CALCULATE MEAN AND STANDARD DEVIATION OF PROFITS FOR EACH CLASS
       DO 144 I=1,10
        DO 145 L=1,NIT
         CLSQ(I,L)=CLASS(I,L)**2
         SUMSQ(I)=SUMSQ(I)+CLSQ(I,L)
         SUM(I)=SUM(I)+CLASS(I,L)
145     CONTINUE
        MEAN(I)=SUM(I)/NIT
        STDEV(I)=((SUMSQ(I)-(NIT*(MEAN(I)**2)))/(NIT-1))**.5
144    CONTINUE
C NOW WRITE FARMER PROFITS,MEANS & STD DEV BY CLASS WHEN
C REVENUES ARE POOLED BY SEASON
       WRITE(9,226)
226    FORMAT(1X,'FARMER PROFITS PER ACRE: REVENUES POOLED BY SEASON')
       DO 228 I=1,10
        WRITE(9,227) I,(CLASS(I,L),L=1,NIT),MEAN(I),STDEV(I)
228    CONTINUE
227    FORMAT(1X,'FARMER CLASS',I2,75F10.1,2X,'MEAN PROFIT',2X,F8.2,
     1   2X,'STANDARD DEVIATION OF PROFITS',2X,F8.2)
C NOW CALCULATE FARMER PROFITS BY CLASS WHEN FARMERS ARE PAID A
C STOCHASTIC PRICE AND NO POOLING OCCURS
       DO 142 I=1,10
        DO 143 L=1,NIT
         CLASS(I,L)=0.0
         CLSQ(I,L)=0.0
         PROFIT(I,L)=0.0
143     CONTINUE
        SUMSQ(I)=0.0
        SUM(I)=0.0
        MEAN(I)=0.0
        STDEV(I)=0.0
142    CONTINUE
       DO 151 L=1,NIT
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         DO 152 I=1,2
          PROFIT(I,L)=PYMTSP(I,L)-PROD(I,L)
152      CONTINUE
         DO 153 I=1,4
          PROFIT(I+2,L)=PYMTS(I,L)-PROD(I+2,L)
153      CONTINUE
         DO 154 I=1,3
          PROFIT(I+6,L)=PYMTF(I,L)-PROD(I+6,L)
154      CONTINUE
151     CONTINUE
        DO 165 L=1,NIT
        CLASS(1,L)=(PROFIT(2,L)*PCRT(1,2))/CLACRE(1)
        CLASS(2,L)=(PROFIT(5,L)*PCRT(2,5))/CLACRE(2)
        CLASS(3,L)=((PROFIT(4,L)*PCRT(3,4))+(PROFIT(6,L)*PCRT(3,6)))
      1  /CLACRE(3)
        CLASS(4,L)=((PROFIT(7,L)*PCRT(4,7))+(PROFIT(8,L)*PCRT(4,8)))
      1   /CLACRE(4)
        CLASS(5,L)=((PROFIT(3,L)*PCRT(5,3))+(PROFIT(4,L)*PCRT(5,4))
      1  +(PROFIT(6,L)*PCRT(5,6)))/CLACRE(5)
        CLASS(6,L)=((PROFIT(2,L)*PCRT(6,2))+(PROFIT(3,L)*PCRT(6,3))
      1  +(PROFIT(4,L)*PCRT(6,4)))/CLACRE(6)
        CLASS(7,L)=((PROFIT(1,L)*PCRT(7,1))+(PROFIT(2,L)*PCRT(7,2))
      1  +(PROFIT(8,L)*PCRT(7,8)))/CLACRE(7)
        CLASS(8,L)=((PROFIT(1,L)*PCRT(8,1))+(PROFIT(3,L)*PCRT(8,3))
      1  +(PROFIT(4,L)*PCRT(8,4))+(PROFIT(5,L)*PCRT(8,5))
      2  +(PROFIT(7,L)*PCRT(8,7))+(PROFIT(9,L)*PCRT(8,9)))/CLACRE(8)
        CLASS(9,L)=((PROFIT(2,L)*PCRT(9,2))+(PROFIT(3,L)*PCRT(9,3))
      1  +PROFIT(4,L)*PCRT(9,4)+(PROFIT(5,L)*PCRT(9,5))
      2  +(PROFIT(8,L)*PCRT(9,8))+(PROFIT(9,L)*PCRT(9,9)))/CLACRE(9)
        CLASS(10,L)=((PROFIT(1,L)*PCRT(10,1))+(PROFIT(2,L)*PCRT(10,2))
      1  +(PROFIT(3,L)*PCRT(10,3))+(PROFIT(5,L)*PCRT(10,5))
      2  +PROFIT(7,L)*PCRT(10,7)+(PROFIT(9,L)*PCRT(10,9)))/CLACRE(10)
165     CONTINUE
C NOW CALCULATE MEAN AND STANDARD DEVIATION OF PROFITS FOR EACH CLASS
        DO 162 I=1,10
         DO 163 L=1,NIT
          CLSQ(I,L)=CLASS(I,L)**2
          SUMSQ(I)=SUMSQ(I)+CLSQ(I,L)
          SUM(I)=SUM(I)+CLASS(I,L)
163      CONTINUE
         MEAN(I)=SUM(I)/NIT
         STDEV(I)=((SUMSQ(I)-(NIT*(MEAN(I)**2)))/(NIT-1))**.5
 162    CONTINUE
C NOW WRITE FARMER PROFITS,MEANS & STD DEV BY CLASS WHEN
C NO POOLING IS USED AND PRODUCER ARE PAID STOCHASTIC PRICES
        WRITE(9,326)
326     FORMAT(1X,'FARMER PROFITS PER ACRE: NO POOLING')
        DO 328 I=1,10
         WRITE(9,327) I,(CLASS(I,L),L=1,NIT),MEAN(I),STDEV(I)
328     CONTINUE
327     FORMAT(1X,'FARMER CLASS',I2,75F10.1,2X,'MEAN PROFIT',2X,F8.2,
      1  2X,'STANDARD DEVIATION OF PROFITS',2X,F8.2)
        CLOSE(9)
        GOTO 235
201     OPEN(6,FILE='PRN')
        WRITE(6,219)
219     FORMAT(1X,'END OF FILE ENCOUNTERED IN PROD FILE')
235     RETURN
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      SUBROUTINE VALCOS(SPRING,SUMMER,FALL,FARSP,FARS,FARF,
     1 HARPER,AME,CRATES,ACRES,TCRT,TOTFIX,VARCPC)
      REAL SPRING(5,2,75),SUMMER(17,4,75),FALL(10,3,75)
      REAL FARSPR(5,2,75),FARSUM(17,4,75),FARFAL(10,3,75)
      REAL UNPC(9,75) CHARACTER*6 AME(9)
      INTEGER NIT,CLACRE(10)
      REAL HARPER(9,17),FC(9,75),POOLSS(4,75),POOLFF(3,75)
      REAL POOLPP(2,75),SS(75),PP(75),FF(75),CRATES(9,75)
      REAL ACRES(9),TCRT(9,75),PCRT(10,9),PROD(9,75)
      REAL FIX(9),VAR(9),REVNUE(17,9,75),TOTFIX(9,75),VARCPC(9)
      REAL POOLF(75),POOLS(75),POOLSP(75),FIXCOS(75)
      REAL FARSP(5,2,75),FARS(17,4,75),FARF(10,3,75),SEASF(75)
      REAL PYMTSP(2,75),PYMTS(4,75),PYMTF(3,75),POOL(75)
      REAL CLSQ(10,75),SUMSQ(10),SUM(10),MEAN(10),STDEV(10)
      INTEGER FALWKS,SUMWKS,SPRWKS,NC,WKS
      REAL PROFIT(9,75),CLASS(10,75),SEASSP(75),SEASS(75)
      DATA PROFIT/675*0.0/WKS/17/SEASSP/75*0.0/
      DATA SEASS/75*0.0/SEASF/75*0.0/
      DATA PYMTSP/150*0.0/PYMTS/300*0.0/PYMTF/225*0.0/
      DATA POOLF/75*0.0/POOLS/75*0.0/NC/9/SPRWKS/5/FALWKS/10/
      DATA POOLSP/75*0.0/NIT/75/SUMWKS/17/SUMSQ/10*0.0/SUM/10*0.0/
C THIS SEGMENT CREATES A POOL FOR EACH WEEK
      OPEN(4,FILE='PROD')
      DO 199 I=1,NC
        READ(4,200,END=201) FIX(I),VAR(I)
199   CONTINUE
      DO 198 I=1,10
        READ(4,202,END=201) CLACRE(I)
198   CONTINUE
      DO 197 I=1,10
        READ(4,203,END=201) (PCRT(I,J),J=1,NC)
197   CONTINUE
      CLOSE(4)
202   FORMAT(I3)
200   FORMAT(F6.1,F5.2)
203   FORMAT(F4.3,8F5.3)
C OUTER LOOP CONTROLLING NUMBER OF ITERATIONS
      DO 8 L=1,NIT
        DO 4 I=1,NC
          FIXCOS(L)=FIXCOS(L)+TOTFIX(I,L)
4       CONTINUE
C FIRST THE SPRING CROPS
        DO 7 I=1,2
          DO 9 J=1,SPRWKS
            REVNUE(J,I,L)=SPRING(J,I,L)*(CRATES(I,L)*HARPER(I,J))
            PROFIT(I,L)=PROFIT(I,L)+REVNUE(J,I,L)
            FARSPR(J,I,L)=(FARSP(J,I,L)*.8)*(CRATES(I,L)*HARPER(I,J))
            PYMTSP(I,L)=PYMTSP(I,L)+FARSPR(J,I,L)
9         CONTINUE
          SEASSP(L)=SEASS(L)+PYMTSP(I,L)
        CONTINUE
C NOW FOR THE SUMMER CROPS
        DO 13 I=1,4
          DO 14 J=1,SUMWKS
            REVNUE(J,I+2,L)=(SUMMER(J,I,L)*(CRATES(I+2,L)*HARPER(I+2,J)))
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                PROFIT(I+2,L)=PROFIT(I+2,L)+REVNUE(J,I+2,L)
                FARSUM(J,I,L)=(FARS(J,I,L)*.8)*(CRATES(I+2,L)*HARPER(I+2,J))
                PYMTS(I,L)=PYMTS(I,L)+FARSUM(J,I,L)
14           CONTINUE
             SEASS(L)=SEASS(L)+PYMTS(I,L)
13        CONTINUE
C NOW FOR THE FALL CROPS
          DO 16 I=1,3
             DO 18 J=1,FALWKS
                REVNUE(J,I+6,L)=(FALL(J,I,L)*(CRATES(I+6,L)*HARPER(I+6,J)))
                PROFIT(I+6,L)=PROFIT(I+6,L)+REVNUE(J,I+6,L)
                FARFAL(J,I,L)=(FARF(J,I,L)*.8)*(CRATES(I+6,L)*HARPER(I+6,J))
                PYMTF(I,L)=PYMTF(I,L)+FARFAL(J,I,L)
18           CONTINUE
             SEASF(L)=SEASF(L)+PYMTF(I,L)
16        CONTINUE
C NOW COMPUTE 1 POOL OF PACKING FACILITY REVENUES FOR EACH SEASON
          DO 20 I=1,3
             POOLFF(I+6,L)=PROFIT(I+6,L)-(VARCPC(I+6)*CRATES(I+6,L))
             POOLF(L)=POOLF(L)+PROFIT(I+6,L)
             FF(L)=FF(L)+POOLFF(I+6,L)
20        CONTINUE
          DO 22 I=1,4
             POOLSS(I+2,L)=PROFIT(I+2,L)-(VARCPC(I+2)*CRATES(I+2,L))
             POOLS(L)=POOLS(L)+PROFIT(I+2,L)
             SS(L)=SS(L)+POOLSS(I+2,L)
22        CONTINUE
          DO 24 I=1,2
             POOLPP(I,L)=PROFIT(I,L)-(VARCPC(I)*CRATES(I,L))
             POOLSP(L)=POOLSP(L)+PROFIT(I,L)
             PP(L)=PP(L)+POOLPP(I,L)
24        CONTINUE
          DO 26 I=1,NC
             POOL(L)=POOL(L)+PROFIT(I,L)
26        CONTINUE
          DO 27 I=1,NC
             FC(I,L)=FIXCOS(L)*(PROFIT(I,L)/POOL(L))
27        CONTINUE
          POOLF(L)=FF(L)-(FIXCOS(L)*(POOLF(L)/POOL(L)))
          POOLS(L)=SS(L)-(FIXCOS(L)*(POOLS(L)/POOL(L)))
          POOLSP(L)=PP(L)-(FIXCOS(L)*(POOLSP(L)/POOL(L)))
C FARM PRODUCTION COSTS CALCULATED FOR ALL ACRES PLANTED OF THAT CROP
C FOLLOWED BY FARMER NET PROFITS FOR ALL ACRES PLANTED OF THAT CROP
          DO 257 I=1,2
             PROD(I,L)=(VAR(I)*TCRT(I,L))+(FIX(I)*ACRES(I))
          PROFIT(I,L)=(PROFIT(I,L)-PROD(I,L)-(VARCPC(I)*CRATES(I,L))-FC(I,L))
        UNPC(I,L)=(FC(I,L)/CRATES(I,L))+VARCPC(I)
257       CONTINUE
          DO 255 I=1,4
             PROD(I+2,L)=(VAR(I+2)*TCRT(I+2,L))+(FIX(I+2)*ACRES(I+2))
             PROFIT(I+2,L)=(PROFIT(I+2,L)-PROD(I+2,L)-(VARCPC(I+2)*CRATES(I+2,L))
     1          -FC(I+2,L))
             UNPC(I+2,L)=(FC(I+2,L)/CRATES(I+2,L))+VARCPC(I+2)
255       CONTINUE
```

```
          DO 256 I=1,3
            PROD(I+6,L)=(VAR(I+6)*TCRT(I+6,L))+(FIX(I+6)*ACRES(I+6))
            PROFIT(I+6,L)=(PROFIT(I+6,L)-PROD(I+6,L)
     1      -(VARCPC(I+6)*CRATES(I+6,L))-FC(I+6,L))
            UNPC(I+6,L)=(FC(I+6,L)/CRATES(I+6,L))+VARCPC(I+6)
256       CONTINUE
C
C COMPUTE PER ACRE PROFITS BY CLASS WHEN NET PACKING REVENUE
C ARE POOLED BY CROP. NET PACKING REVENEUS ARE FACILITY PRICE
C LESS COSTS OF PACKING.
          CLASS(1,L)=(PROFIT(2,L)*PCRT(1,2))/CLACRE(1)
          CLASS(2,L)=(PROFIT(5,L)*PCRT(2,5))/CLACRE(2)
          CLASS(3,L)=((PROFIT(4,L)*PCRT(3,4))+(PROFIT(6,L)*PCRT(3,6)))
     1    /CLACRE(3)
          CLASS(4,L)=((PROFIT(7,L)*PCRT(4,7))+(PROFIT(8,L)*PCRT(4,8)))
     1    /CLACRE(4)
          CLASS(5,L)=((PROFIT(3,L)*PCRT(5,3))+(PROFIT(4,L)*PCRT(5,4))
     1      +(PROFIT(6,L)*PCRT(5,6)))/CLACRE(5)
          CLASS(6,L)=((PROFIT(2,L)*PCRT(6,2))+(PROFIT(3,L)*PCRT(6,3))
     1      +(PROFIT(4,L)*PCRT(6,4)))/CLACRE(6)
          CLASS(7,L)=((PROFIT(1,L)*PCRT(7,1))+(PROFIT(2,L)*PCRT(7,2))
     1    +(PROFIT(8,L)*PCRT(7,8)))/CLACRE(7)
          CLASS(8,L)=((PROFIT(1,L)*PCRT(8,1))+(PROFIT(3,L)*PCRT(8,3))
     1      +(PROFIT(4,L)*PCRT(8,4))+(PROFIT(5,L)*PCRT(8,5))
     2      +(PROFIT(7,L)*PCRT(8,7))+(PROFIT(9,L)*PCRT(8,9)))/CLACRE(8)
          CLASS(9,L)=((PROFIT(2,L)*PCRT(9,2))+(PROFIT(3,L)*PCRT(9,3))
     1      +PROFIT(4,L)*PCRT(9,4)+(PROFIT(5,L)*PCRT(9,5))
     2    +(PROFIT(8,L)*PCRT(9,8))+(PROFIT(9,L)*PCRT(9,9)))/CLACRE(9)
      CLASS(10,L)=((PROFIT(1,L)*PCRT(10,1))+(PROFIT(2,L)*PCRT(10,2))
     1      +(PROFIT(3,L)*PCRT(10,3))+(PROFIT(5,L)*PCRT(10,5))
     2      +PROFIT(7,L)*PCRT(10,7)+(PROFIT(9,L)*PCRT(10,9)))/CLACRE(10)
8         CONTINUE
          OPEN(7,FILE='UNPCOS')
          DO 95 I=1,9
            WRITE(7,109)  AME(I),(UNPC(I,L),L=1,NIT)
95        CONTINUE
109       FORMAT(1x,'PACKING COSTS',a8,2x,75f8.2)
          CLOSE(7)
C NOW CALCULATE MEAN AND STANDARD DEVIATION OF PROFITS FOR EACH CLASS
          DO 140 I=1,10
            DO 141 L=1,NIT
              CLSQ(I,L)=CLASS(I,L)**2
              SUMSQ(I)=SUMSQ(I)+CLSQ(I,L)
              SUM(I)=SUM(I)+CLASS(I,L)
141         CONTINUE
            MEAN(I)=SUM(I)/NIT
            STDEV(I)=((SUMSQ(I)-(NIT*(MEAN(I)**2)))/(NIT-1))**.5
140       CONTINUE
C NOW WRITE FARMER PROFITS,MEANS & STD DEV BY CLASS WHEN
C REVENUES ARE POOLED BY CROP
          OPEN(5,FILE='POOLVAL')
          WRITE(5,220)
220       FORMAT(1X,'ACRE FARMER PROFITS W/ CROP REVENUE AND COST POOLS')
          DO 222 I=1,10
```

```
      WRITE(5,221) I,(CLASS(I,L),L=1,NIT),MEAN(I),STDEV(I)
222   CONTINUE
221   FORMAT(1X,'FARMER CLASS',I2,75F10.1,2X,'MEAN PROFIT',2X,F8.2,
     1  2X,'STANDARD DEVIATION OF PROFITS',2X,F8.2)
C NOW CALCULATE FARMER PROFITS BY CLASS WHEN NET PACKING REVENUES
C ARE POOLED BY SPRING, SUMMER AND FALL SEASONS
      DO 223 I=1,10
        DO 224 L=1,NIT
          CLASS(I,L)=0.0
          CLSQ(I,L)=0.0
224     CONTINUE
        SUMSQ(I)=0.0
        SUM(I)=0.0
        MEAN(I)=0.0
        STDEV(I)=0.0
223   CONTINUE
      DO 236 L=1,NIT
      CLASS(1,L)=((((POOLSP(L)*(PYMTSP(2,L)/SEASSP(L)))-PROD(2,L))
     1 *PCRT(1,2)))/CLACRE(1)
      CLASS(2,L)=((((POOLS(L)*(PYMTS(3,L)/SEASS(L)))-PROD(5,L))
     1 *PCRT(2,5)))/CLACRE(2)
      CLASS(3,L)=((((POOLS(L)*(PYMTS(2,L)/SEASS(L)))-PROD(4,L))
     1 *PCRT(3,4))+(((POOLS(L)*(PYMTS(4,L)/SEASS(L)))-PROD(6,L))
     2 *PCRT(3,6)))/CLACRE(3)
      CLASS(4,L)=((((POOLF(L)*(PYMTF(1,L)/SEASF(L)))-PROD(7,L))
     1 *PCRT(4,7))+(((POOLF(L)*(PYMTF(2,L)/SEASF(L)))-PROD(8,L))
     2 *PCRT(4,8)))/CLACRE(4)
      CLASS(5,L)=((((POOLS(L)*(PYMTS(1,L)/SEASS(L)))-PROD(3,L))
     1 *PCRT(5,3))+(((POOLS(L)*(PYMTS(2,L)/SEASS(L)))-PROD(4,L))
     2 *PCRT(5,4))+(((POOLS(L)*(PYMTS(4,L)/SEASS(L)))-PROD(6,L))
     3 *PCRT(5,6)))/CLACRE(5)
      CLASS(6,L)=((((POOLSP(L)*(PYMTSP(2,L)/SEASSP(L)))-PROD(2,L))
     1 *PCRT(6,2))+(((POOLS(L)*(PYMTS(1,L)/SEASS(L)))-PROD(3,L))
     2 *PCRT(6,3))+(((POOLS(L)*(PYMTS(2,L)/SEASS(L)))-PROD(4,L))
     3 *PCRT(6,4)))/CLACRE(6)
      CLASS(7,L)=((((POOLSP(L)*(PYMTSP(1,L)/SEASSP(L)))-PROD(1,L))
     1 *PCRT(7,1))+(((POOLSP(L)*(PYMTSP(2,L)/SEASSP(L)))-PROD(2,L))
     2 *PCRT(7,2))+(((POOLF(L)*(PYMTF(2,L)/SEASF(L)))-PROD(8,L))
     3 *PCRT(7,8)))/CLACRE(7)
      CLASS(8,L)=((((POOLSP(L)*(PYMTSP(1,L)/SEASSP(L)))-PROD(1,L))
     1 *PCRT(8,1))+(((POOLS(L)*(PYMTS(1,L)/SEASS(L)))-PROD(3,L))
     2 *PCRT(8,3))+(((POOLS(L)*(PYMTS(2,L)/SEASS(L)))-PROD(4,L))
     3 *PCRT(8,4))+(((POOLS(L)*(PYMTS(3,L)/SEASS(L)))-PROD(5,L))
     4 *PCRT(8,5))+(((POOLF(L)*(PYMTF(1,L)/SEASF(L)))-PROD(7,L))
     5 *PCRT(8,7))+(((POOLF(L)*(PYMTF(3,L)/SEASF(L)))-PROD(9,L))
     6 *PCRT(8,9)))/CLACRE(8)
      CLASS(9,L)=((((POOLSP(L)*(PYMTSP(2,L)/SEASSP(L)))-PROD(2,L))
     1 *PCRT(9,2))+(((POOLS(L)*(PYMTS(1,L)/SEASS(L)))-PROD(3,L))
     2 *PCRT(9,3))+(((POOLS(L)*(PYMTS(2,L)/SEASS(L)))-PROD(4,L))
     3 *PCRT(9,4))+(((POOLS(L)*(PYMTS(3,L)/SEASS(L)))-PROD(5,L))
     4 *PCRT(9,5))+(((POOLF(L)*(PYMTSF2,L)/SEASF(L)))-PROD(8,L))
     5 *PCRT(9,8))+(((POOLF(L)*(PYMTF(3,L)/SEASF(L)))-PROD(9,L))
     6 *PCRT(9,9)))/CLACRE(9)
      CLASS(10,L)=((((POOLSP(L)*(PYMTSP(1,L)/SEASSP(L)))-PROD(1,L))
```

```
     1   *PCRT(10,1))+(((POOLSP(L)*(PYMTSP(2,L)/SEASSP(L)))-PROD(2,L))
     2   *PCRT(10,2))+(((POOLS(L)*(PYMTS(1,L)/SEASS(L)))-PROD(3,L))
     3   *PCRT(10,3))+(((POOLS(L)*(PYMTS(3,L)/SEASS(L)))-PROD(5,L))
     4   *PCRT(10,5))+(((POOLF(L)*(PYMTF(1,L)/SEASF(L)))-PROD(7,L))
     5   *PCRT(10,7))+(((POOLF(L)*(PYMTF(3,L)/SEASF(L)))-PROD(9,L))
     6   *PCRT(10,9)))/CLACRE(10)
236      CONTINUE
C NOW CALCULATE MEAN AND STANDARD DEVIATION OF PROFITS FOR EACH CLASS
         DO 144 I=1,10
           DO 145 L=1,NIT
              CLSQ(I,L)=CLASS(I,L)**2
              SUMSQ(I)=SUMSQ(I)+CLSQ(I,L)
              SUM(I)=SUM(I)+CLASS(I,L)
145        CONTINUE
           MEAN(I)=SUM(I)/NIT
           STDEV(I)=((SUMSQ(I)-(NIT*(MEAN(I)**2)))/(NIT-1))**.5
144      CONTINUE
C NOW WRITE FARMER PROFITS,MEANS & STD DEV BY CLASS WHEN
C REVENUES ARE POOLED BY SEASON
         WRITE(5,226)
226      FORMAT(1X,'ACRE FARMER PROFITS: SEASONAL REVENUE & COST POOLS')
         DO 228 I=1,10
           WRITE(5,227) I,(CLASS(I,L),L=1,NIT),MEAN(I),STDEV(I)
228      CONTINUE
227      FORMAT(1X,'FARMER CLASS',I2,75F10.1,2X,'MEAN PROFIT',2X,F8.2,
     1   2X,'STANDARD DEVIATION OF PROFITS',2X,F8.2)
         CLOSE(5)
         GOTO 235
         OPEN(6,FILE='PRN')
         WRITE(6,219)
219      FORMAT(1X,'END OF FILE ENCOUNTERED IN PROD FILE')
235      RETURN
         END
```

```
C THIS PROGRAM IS BASED ON CODE WRITTEN BY SPENCE TO
C COFACTOR VARIANCE COVARIANCE MATRICES.
C INPUT INFORMATION:
C             M, THE SIZE OF THE INPUT MATRIX
C             SIG(M,M)=THE INPUT MATRIX UPPER TRIANGLE
C OUTPUT INFORMATION:
C             SIG(M,M)=THE INPUT MATRIX FOR VERIFICATION
C             A(M,M)=THE UPPER TRIANGLE
C             AP(M,M)=THE LOWER TRIANGLE
C
        PROGRAM COFACTOR
        REAL*8 SIG(17,17,9),SMALDIF
        REAL A(17,17),AP(17,17),CHEKLL
        INTRINSIC DSQRT
        DATA SMALDIF/0.000000001/
        OPEN(8,FILE='FACTOR')
        DO 6 K=1,9
          DO 7 I=1,17
             READ(8,1,END=100)(SIG(I,J,K),J=1,17)
7         CONTINUE
6       CONTINUE
C REPRODUCE THE INPUT FOR VERIFICATION
C
        DO 41 K=1,9
          write(*,401)
          IF(K.EQ.9) THEN
             M=7
             write(*,333) ((sig(i,j,k),j=1,m),i=1,m)
          ELSE IF(K.EQ.8) THEN
             M=6
             write(*,300) ((sig(i,j,k),j=1,m),i=1,m)
          ELSE IF(K.EQ.7) THEN
             M=9
             write(*,345) ((sig(i,j,k),j=1,m),i=1,m)
          ELSE IF(K.EQ.6) THEN
             M=12
             write(*,346) ((sig(i,j,k),j=1,m),i=1,m)
          ELSE IF(K.EQ.5) THEN
             M=11
             write(*,347) ((sig(i,j,k),j=1,m),i=1,m)
          ELSE IF(K.EQ.4) THEN
             M=12
             write(*,348) ((sig(i,j,k),j=1,m),i=1,m)
          ELSE IF(K.EQ.3) THEN
             M=17
             write(*,349) ((sig(i,j,k),j=1,m),i=1,m)
          ELSE IF(K.EQ.2) THEN
             M=3
             write(*,350) ((sig(i,j,k),j=1,m),i=1,m)
          ELSE
             M=5
             write(*,330) ((sig(i,j,k),j=1,m),i=1,m)
          ENDIF
          DO 44 I=1,17
             DO 45 J=1,17
                A(I,J)=0.0
                AP(I,J)=0.0
45           CONTINUE
```

```
44          CONTINUE
C CALCULATE THE MTH COLUMN
            ICOL=M
            IROW=M
            ISTOP=M-1
            CHEKLL=0.0
            A(M,M)=DSQRT(SIG(M,M,K))
            DO 50 I=1,ISTOP
               A(I,M)=SIG(I,M,K)/A(M,M)
50          CONTINUE
C NEXT DIAGONAL ELEMENT
            WRITE(6,902)
90          ICOL=ICOL-1
            IROW=ICOL
            IROWP1=IROW+1
            SUM=0.0
            DO 101 L=IROWP1,M
               WRITE(*,901)SUM
               SUM=SUM+A(IROW,L)**2
101         CONTINUE
            WRITE(*,900) SIG(IROW,ICOL,K),SUM,IROW,ICOL
            IF(SUM.GT.SIG(IROW,ICOL,K)) THEN
               WRITE(*,904) IROW,ICOL
               A(IROW,ICOL)=0.00000001
            ELSE
               A(IROW,ICOL)=DSQRT(SIG(IROW,ICOL,K)-SUM)
            ENDIF
            IF(ICOL.EQ.1) THEN
               WRITE (*,903)
               GOTO 220
            ENDIF
            ICOLP1=ICOL+1
            ISTOP=ISTOP-1
            DO 200 J=1,ISTOP
               IROW=IROW-1
               IF(IROW.EQ.0) THEN
                  GOTO 210
               ELSE
                  SUM=0.0
               ENDIF
               DO 150 L=ICOLP1,M
                  SUM=SUM+A(IROW,L)*A(ICOL,L)
150         CONTINUE
               IF (A(ICOL,ICOL).EQ.0.00000001) THEN
                  A(IROW,ICOL)=0.0
               ELSE
                  A(IROW,ICOL)=(SIG(IROW,ICOL,K)-SUM)/A(ICOL,ICOL)
               ENDIF
200      CONTINUE
210      GOTO 90
C
220   CONTINUE
C
         DO 500 I=1,M
           DO 501 J=1,M
              AP(I,J)=A(J,I)
501      CONTINUE
500   CONTINUE
```

```
          DO 600 I=1,M
            CHEKLL=CHEKLL+A(1,I)*AP(I,1)
600     CONTINUE
C CHECK THE OUTPUT NOW
          OPEN(5,FILE='AMATRIX')
          IF(K.EQ.9) THEN
            M=7
            write(5,333) ((a(i,j),j=1,m),i=1,m)
          ELSE IF(K.EQ.8) THEN
            M=6
            write(5,300) ((a(i,j),j=1,m),i=1,m)
          ELSE IF(K.EQ.7) THEN
            M=9
            write(5,345) ((a(i,j),j=1,m),i=1,m)
          ELSE IF(K.EQ.6) THEN
            M=12
            write(5,346) ((a(i,j),j=1,m),i=1,m)
          ELSE IF(K.EQ.5) THEN
            M=11
            write(5,347) ((a(i,j),j=1,m),i=1,m)
          ELSE IF(K.EQ.4) THEN
            M=12
            write(5,348) ((a(i,j),j=1,m),i=1,m)
          ELSE IF(K.EQ.3) THEN
            M=17
            write(5,349) ((a(i,j),j=1,m),i=1,m)
          ELSE IF(K.EQ.2) THEN
            M=3
            write(5,350) ((a(i,j),j=1,m),i=1,m)
          ELSE
            M=5
            write(5,330) ((a(i,j),j=1,m),i=1,m)
          ENDIF
          WRITE(5,250) K
          WRITE(5,650) CHEKLL
41      CONTINUE
C
1       FORMAT(F8.6,16F10.6)
300     FORMAT(1X,F8.6,5F9.6)
330     format(1X,f8.6,4f9.6)
333     format(1X,f8.6,6f9.6)
345     FORMAT(1X,F8.6,8F9.6)
346     FORMAT(1X,F8.6,11F9.6)
347     FORMAT(1X,F8.6,10F9.6)
348     FORMAT(1X,F8.6,11F9.6)
349     FORMAT(1X,F8.6,16F9.6)
350     FORMAT(1X,F8.6,2F9.6)
250     FORMAT(2X,'THE UPPER AND LOWER TRIANGLE MATRICS,CROP: ',I2)
401     FORMAT(2X,'YOUR INPUT MATRIX')
650     FORMAT(2X,'MULTIPLYING THE FIRST ROW OF "A" BY THE FIRST
        1  COLUMN OF "APRIME" YIELDS',F10.5//' THIS SHOULD BE THE SAME
        2  AS ELEMENT (1,1) OF YOUR INPUT MATRIX'//' CHECK TO SEE ')
900     FORMAT(' SIG AND SUM:',2F12.7,2I5)
901     FORMAT(' IN LOOP SUM',F12.7)
902     FORMAT(' DIAGNOSTICS ON THE CALCULATION OF THE DIAGONAL
        1  ELEMENTS. 1'/' IF "SUM" EXCEEDS "SIG", THE PROGRAM ABORTS.'/'
        2  IT HAS ATTEMPTED TO TAKE SQUARE ROOT OF NEGATIVE NUMBER.')
903     FORMAT(2x,'TERMINATION REACHED')
```

```
904   FORMAT(2x,'PREMATURE TERMINATION REACHED WHEN CALCULATING
     1  ELEMENT',I3,',',I3)
        GOTO 106
100   WRITE(6,105)
105   FORMAT('END OF FILE ENCOUNTERED IN FILE COFAC')
106   CLOSE(8)
        CLOSE(6)
        STOP
        END
```

APPENDIX F

DEFINITIONS OF VARIABLES USED IN COMPUTER PROGRAM

PROGRAM PACKSIM FILE=PRG1.FOR

NAME	CROP NAMES
AVGCOS(I)	AVERAGE COST OF PACKING PER CROP
ACRE(I)	NUMBER OF ACRES PLANTED FOR EACH CROP
TCRTS(I,L)	CROP BY ITERATION MATRIX OF TOTAL CRATES HARVESTED
TCPC(I,L)	CROP BY ITERATION MATRIX OF TOTAL COSTS OF SPACKING
UMMER(J,I,L)	WEEK BY CROP BY ITERATION MATRIX OF PRICES PAID TO PACKING FACILITY FOR SUMMER CROPS
ALL(J,I,L)	WEEK BY CROP BY ITERATION MATRIX OF PRICES PAID TO PACKING FACILITY FOR FALL CROPS
PRING(J,I,L)	WEEK BY CROP BY ITERATION MATRIX OF PRICES PAID TO PACKING FACILITY FOR SPRING CROPS
ARSUM(J,I,L)	WEEK BY CROP BY ITERATION MATRIX OF PRICES PAID TO PRODUCERS FOR SUMMER CROPS
ARFAL(J,I,L)	WEEK BY CROP BY ITERATION MATRIX OF PRICES PAID TO PRODUCERS FOR FALL CROPS
ARSPR(J,I,L)	WEEK BY CROP BY ITERATION MATRIX OF PRICES PAID TO PRODUCERS OF SPRING CROPS
CRATE(I,L)	CROP BY ITERATION MATRIX OF NUMBER OF CRATES PACKED
ARPER(I,J)	CROP BY WEEK MATRIX OF WEEKLY PERCENTAGES OF CROP HARVESTED
TOTFX(I,L)	TOTAL FIXED PACKING COSTS FOR ALL CRATES PACKED OF A PARTICULAR CROP BY ITERATION
VARCP(I)	UNIT OR PER CRATE VARIABLE COST OF PACKING BY CROP
ALLOC	DETERMINES HOW COSTS ARE ALLOCATED. A POSITIVE VALUE FOR ALLOC: TONNAGE BASIS; NEGATIVE VALUE FOR ALLOC: CRATES BASIS; A VALUE OF 0 FOR ALLOC: HOURS OF OPERATION AND VALUE OF NET PACKING REVENUES ARE BOTH USED FOR BASIS OF ALLOCATION

SUBROUTINE ASSIGN(CPC,P,AME,ARPER,AVGPC,CRATES,ACRES,TCRT)
FILE=ASSIGN.FOR

I # NUMBER OF CROPS	p packed crates
J # of Weeks	p/r packed and rejected crates
M # of Assets	r rejected crates
L # of Iterations	

AME(I)	CROP NAME
PERPAK(I)	PERCENTAGE OF DELIVERY TO FACILITY THAT IS PACKED
LABPR(I)	# WORKERS PER HOUR HANDLING PACKED/REJECTED CRATES
LABR(I)	# WORKERS PER HOUR HANDLING REJECTED CRATES ONLY
LABP(I)	# WORKERS PER HOUR HANDLING PACKED CRATES ONLY
CAPAC(I)	PERCENTAGE CAPACITY OF PLANT OPERATION
PAKOUT(I)	# CRATES PER HOUR MAXIMUM THAT CAN BE PACKED
YMAX(I)	YIELD MAXIMUM
YMIN(I)	YIELD MINIMUM
YMODE(I)	YIELD MODAL VALUE
DMPCC(I)	DIRECT PACKING MATERIAL COSTS PER CRATE
ACRES(I)	# ACRES PLANTED
ACRTOT	TOTAL ACRES PLANTED FOR ALL CROPS
POUNDS(I)	PER CRATE WEIGHT IN POUNDS
COSTAR(M,I)	AN ARRAY OF 1'S AND 0'S ASSIGNING SPECIALTY ASSETS TO CROPS. 1=CROP USED MACHINE, 0=DID NOT USE IT
LABOR(I)	TOTAL # LABORERS FOR R,P/R,P CRATES
ACTPAK(I)	ACTUAL # OF CRATES PACKED PER HOUR
COSTPR(I)	PER CRATE LABOR COST OF HANDLING P/R CRATES
COSTP(I)	PER CRATE LABOR COST OF HANDLING P CRATES
COSTR(I)	PER CRATE LABOR COST OF HANDLING R CRATES
YGEN(I)	YIELDS GENERATED FOR EACH CROP
YIELDS(I,L)	CROP BY ITERATION MATRIX OF YIELDS GENERATED
NCROP	NUMBER OF CROPS
PCRT(I)	# OF PACKED CRATES
CRATES(I,L)	# OF PACKED CRATES FOR EACH ITERATION
TOTCRT(I)	TOTAL # CRATES DELIVERED TO PACKING FACILITY
TCRT(I,L)	TOTAL # CRATES DELIVERED TO FACILITY EACH ITERATION
PACCRT	TOTAL # PACKED CRATES ALL CROPS
RCRT	# OF REJECTED CRATES
TONS(I)	TOTAL TONS PACKED
TOTTON	TOTAL TONS PACKED INCLUDING ALL CROPS
TLCPR	TOTAL LABOR COSTS OF HANDLING P/R CRATES
TLCP	TOTAL LABOR COSTS OF HANDLING P CRATES
TLCR	TOTAL LABOR COSTS OF HANDLING R CRATES

TOTLAB	TOTAL LABOR COST OF HANDLING ALL CRATES BY CROP
TOTDMC	TOTAL DIRECT MATERIALS COST BY CROP
TOTVAR	TOTAL VARIABLE COSTS FOR EACH CRATE (MATERIALS + LABOR)
VARCPC	VARIABLE COSTS PER PACKED CRATE BY CROP
HOURS(I,J)	CROP BY HARVEST WEEK MATRIX OF PACKING HOURS
HRS(I)	WEEKLY HOURS OF PACKING SUMMED ACROSS WEEKS FOR EACH CROP
OURPER(I)	PERCENTAGE OF TOTAL PACKING HOUSE HOURS FOR EACH CROP
STDFIX(I)	STANDARD LINE AND OVERHEAD COSTS ALLOC. TO CROPS
SPMACH(I)	SPECIALTY LINE COSTS SUMMED FOR EACH CROP
TOTFIX(I)	SUM OF STD AND SPEC COSTS FOR EACH CROP
FIXCPC(I)	FIXED COSTS PER CRATE FOR EACH CROP
TOTCPC(I)	TOTAL (VAR+FIX) COSTS PER CRATE FOR EACH CROP
CPC(I,L)	CROP BY ITERATION MATRIX OF TOTAL UNIT PACKING COSTS
SUMPC(I)	SUM OF PACKING COSTS ACROSS ALL ITERATIONS
AVGPC(I)	AVERAGE PACKING COST BY CROP
HARPER(I,J)	CROP BY WEEK MATRIX OF HARVEST PERCENTAGES
ADPER(I)	VERIFIES IF ALL %'S ADD TO 1 FOR EACH CROP

CROP INDEPENDENT VARIABLES

WAGE	HOURLY WAGE PAID PACKING FACILITY LABORERS
EFFWAG	EFFECTIVE WAGE OR LABOR COST PER HOUR INCLUDING TAXES
FED	FEDERAL UNEMPLOYMENT TAX RATE
STATE	STATE UNEMPLOYMENT TAX RATE
FICA	SOCIAL SECURITY TAX RATE
ASSET(M)	NAME OF ASSET
LIFE(M)	LIFE OF ASSET
OWNED(M)	NUMBER OF YEARS ASSET IS OWNED
INIT(M)	INITIAL VALUE OF ASSET
SALV(M)	SALVAGE VALUE OF ASSET
GENEXP	ANNUAL EXPENSES (UTIL,PH,FUEL,SUPPLIES,PROMO)
ADMIN	ANNUAL ADMINISTRATIVE SALARIES
MININ	BUILDING MAINTENANCE AND INSURANCE
OFFICE	OFFICE SUPPLIES
UTMAIN	UTILITIES AND MACHINE MAINTENANCE
SEMIFX	OFFICE AND UTMAIN COST INCREASES AS ACREAGE INCREASES

OTHER(R)	FOR EACH SPECIALTY ASSETS, OTHER COSTS BESIDES DEPRECIATION.
STD	AN ARRAY OF 1'S AND 0'S DISTINGUISHING STANDARD FROM SPECIALTY ASSETS. 1=STD, 0=SPEC
TOTHRS	TOTAL PACKING HOURS FOR ENTIRE PACKING FACIL-
ITY ALLOC	=1 IF COSTS ARE ALLOC BY TONNAGE, =0 IF BY HOURS
DEPREC(M)	DEPRECIATION CALCULATED FOR EACH ASSET
STDEPR	TOTAL OF DEPRECIATION FOR ALL STANDARD ASSETS
SPEC(M)	SUM OF DEPRECIATION AND OTHER SPECIALTY COSTS BY ASSET
VOLUME(M,I)	ASSET BY CROP MATRIX OF VOLUME OF CROP HANDLED
VOL(M)	VOLUME OF CROP HANDLED SUMMED FOR EACH ASSET
PERMAC(M,I)	ASSET BY CROP MATRIX OF %'s OF SPEC ASSET COSTS
SPCOST(M,I)	ASSET BY CROP MATRIX OF TOTAL COSTS OF SPECIALTY ASSETS
NIT	NUMBER OF ITERATIONS
NMACH	NUMBER OF ASSETS
NWEEK	NUMBER OF WEEKS
P	SEED VALUE USED IN GENERATION OF STOCHASTIC YIELDS, PASSED IN FROM MAIN PROGRAM AND PASSED ON TO STOCH SUBROUTINE

SUBROUTINE PRICES(AK,A,R,) FILE=PRG1.FOR

A(I,I)	THE UPPER TRIANGULAR "A" MATRIX, FACTORED OUTSIDE OF PROGRAM.
X(I)	THE MATRIX THAT RECEIVES AND RETAINS THE NORMAL DEVIATES.
DI(I,I)	CONTAINS THE PRODUCE OF THE A AND X MATRICES.
AK(I)	THE MATRIX OF ERROR TERMS RETURNED TO SUBROUTINE SEASPR.
UN1,UN2	UNIFORM RANDOM DEVIATES
NOR	NORMAL RANDOM DEVIATE
R	SEED VALUE FOR GENERATION OF UNIFORM DEVIATES

SUBROUTINE COR(PRC,NMT,NCROP,NWKS,NAME) FILE=CORR.FOR

J	NUMBER OF ITERATIONS
L	NUMBER OF WEEKS
BI(I)	CONTAINS THE SUM OF EACH COLUMN OF OUTCOMES
YM(I)	CONTAINS THE CALCULATED MEAN PRICES FOR EACH CROP FOR ALL ITERATIONS
MEANPR(L,I)	WEEK BY CROP MATRIX OF MEAN PRICES
TN	NUMBER OF OUTCOMES GENERATED BY CORRELATION PROGRAM (NUMBER OF ITERATIONS).
NUMT	NUMBER OF ITERATIONS
CORCOL(I,J)	CROP BY ITERATION MATRIX OF OUTCOMES CORRECTEDFOR THE MEAN.
SQ(J)	STORES THE SQUARE OF EACH OUTCOME CORRECTED FOR THE MEAN.
SSQ(I)	CONTAINS THE SUM OF SQUARES FOR EACH EVENT AFTER CORRECTION FOR THE MEAN.
VAR(I)	CONTAINS UNBIASED ESTIMATE OF THE VARIANCE OF EACH EVENT.
STD(I)	CONTAINS THE STANDARD DEVIATION OF THE OUT COMES OF EACH EVENT.
STDEV(L,I)	WEEK BY CROP MATRIX OF STANDARD DEVIATIONS
SUM1(J)	THESE ARRAYS CONTAIN THE VALUES RESULTING
FROM THE	
PRC(L,I,J)	WEEK BY CROP BY ITERATION MATRIX OF PRICES GENERATED IN SEASPR AND TRANSFERRED INTO SUBROUTINE COR FOR VERIFICATION (SUMMER, FALL, AND SPRING SEASONS)
NAME(I)	NAMES OF CROPS IN A PARTICULAR SEASON.

SUBROUTINE SEASPR(SPRING,SUMR,FALL,FARSPR,FARSUM,FARFAL, AVGPC,AME) FILE=SEASPR.FOR

SUMR(J,I,L)	SUMMER PACKING FACILITY PRICES
FALL(J,I,L)	FALL PACKING FACILITY PRICES
SPRING(J,I,L)	SPRING PACKING FACILITY PRICES
DUMY(J,I,L)	MATRIX OF PACKING FACILITY PRICES TRANSFERRED TO COR SUBROUTINE
AVGPC(I)	AVERAGE PACKING COSTS
FARSUM(J,I,L)	PRODUCER SUMMER PRICES (AFTER PACKING COSTS ARE SUBTRACTED)
FARFAL(J,I,L)	PRODUCER FALL PRICES (AFTER PACKING COSTS ARE SUBTRACTED)
FARSPR(J,I,L)	PRODUCER SPRING PRICES (AFTER PACKING COSTS ARE SUBTRACTED)

APRSB(I,I) APRSC(I,I)	FACTORED VARIANCE-COVARIANCE MATRICES READ SEASPR SUBROUTINE AND TRANSFERRED INTO PRICES
APRCUC(I,I) APRTOM(I,I) APRCAN(I,I) APROK(I,I) APRTUR(I,I) APRFC(I,I) APRFB(I,I)	SUBROUTINE TO GENERATE ERROR TERMS FOR PRICE EQUATIONS. THERE IS ONE VARIANCE-COVARIANCE MATRIX FOR EACH OF THE NINE CROPS. THE DIMENSIONS OF EACH MATRIX IS DETERMINED BY THE NUMBER OF WEEKS EACH CROP IS HARVESTED.
PRSB(J) PRSC(J) PRCUC(J) PRTOM(J) PRCAN(J) PROK(J) PRTUR(J) PRFC(J) PRFB(J)	VECTORS OF ERROR TERMS GENERATED IN SUBROUTINE PRICES AND TRANSFERRED INTO SUBROUTINE SEASPR TO GENERATE PRICE EQUATIONS. A NEW SET OF ERROR TERMS IS GENERATED EACH ITERATION FOR EACH OF THE WEEKS EACH CROP IS HARVESTED.
NCROP	NUMBER OF CROPS
NWEEK	NUMBER OF WEEKS, SUMMER
NIT	NUMBER OF ITERATIONS
NCSP	NUMBER OF SPRING CROPS
NAMES(I)	NAMES OF SUMMER CROPS
NAMEF(I)	NAMES OF FALL CROPS
NAMESP(I)	NAMES OF SPRING CROPS
AME(I)	NAMES OF ALL NINE CROPS
MEANS(I)	MEANS OF PRICE EQUATIONS READ IN FROM FILE MEAN
FARS(J,I,L)	PRODUCER SUMMER PRICES BEFORE PACKING COSTS ARE SUBTRACTED
FARF(J,I,L)	FALL PRODUCER PRICES BEFORE PACKING COSTS ARE SUBTRACTED
FARSP(J,I,L)	SPRING PRODUCER PRICES BEFORE PACKING COSTS ARE SUBTRACTED

SUBROUTINE POOL (SPRING,SUMMER,FALL,FARSPR,FARSUM, FARFAL,CPC,ARPER,AME,CRATES,ACRES,TCRT) FILE=REFUND.FOR

SPRING(J,I,L)	WEEK X CROP X ITERATION MATRIX OF SPRING PRICES RECEIVED BY PACKING FACILITY
SUMMER(I,J,L)	CROP X WEEK X ITERATION MATRIX OF SUMMER PRICES RECEIVED BY PACKING FACILITY

FALL(I,J,L)	CROP X WEEK X ITERATION MATRIX OF FALL PRICES RECEIVED BY PACKING FACILITY
FARPSR(J,I,L)	PER CRATE SPRING PRICES RECEIVED BY PRODUCERS
FARSUM(J,I,L)	PER CRATE SUMMER PRICES RECEIVED BY PRODUCERS
FARFAL(J,I,L)	PER CRATE FALL PRICES RECEIVED BY PRODUCERS
AME(I)	NAMES OF CROPS
CPC(I,L)	CROP X ITERATION MATRIX OF TOTAL PACKING COSTS PER CRATE
ARPER(I,J)	CROP BY WEEK MATRIX OF % HARVESTED EACH WEEK
CLACRE(K)	TOTAL ACRES PLANTED FOR EACH CLASS OF PRODUCER. THERE ARE 10 CLASSES.
REFUND(J,I,L)	WEEK BY CROP BY ITERATION MATRIX OF NET PACKING REVENUES ON PER CRATE BASIS
ACRES(I)	TOTAL ACRES PLANTED
TCRT(I,L)	TOTAL CRATES HARVESTED AND DELIVERED TO PACK ING FACILITY BY ITERATION
CRATES(I,L)	TOTAL CRATES PACKED AND SOLD BY ITERATION
FIX(I)	PER ACRE FARM LEVEL FIXED COST OF PRODUCTION
VAR(I)	PER CRATE FARM LEVEL VARIABLE COST OF PRODUCTION
REVNUE(J,I,L)	TOTAL NET PACKING REVENUES FOR ALL CRATES PACKED
POOLF(L)	FALL POOL OF NET PACKING REVENUES
POOLS(L)	SUMMER POOL OF NET PACKING REVENUES
POOLSP(L)	SPRING POOL OF NET PACKING REVENUES
FARSP(J,I,L)	TOTAL PRODUCER REVENUES FOR ALL CRATES PACKED IN SPRING BY WEEK, CROP AND ITERATION
FARS(J,I,L)	TOTAL PRODUCER REVENUES FOR ALL CRATES PACKED IN SUMMER BY WEEK, CROP AND ITERATION
FARF(J,I,L)	TOTAL PRODUCER REVENUES FOR ALL CRATES PACKED IN FALL BY WEEK, CROP AND ITERATION
PYMTSP(I,L)	FARSP SUMMED OVER THE WEEKS
PYMTS(I,L)	FARS SUMMED OVER THE WEEKS
PYMTF(I,L)	FARF SUMMED OVER THE WEEKS
PROD(I,L)	CROP BY ITERATION MATRIX OF TOTAL COSTS OF FARM LEVEL PRODUCTION AND HARVESTING FOR ALL ACRES HARVESTED
PCRT(K,I)	PERCENTAGE OF CRATES EACH CLASS OF PRODUCER GROWS BY CLASS AND CROP
FALWKS	NUMBER OF WEEKS IN FALL SEASON
SUMWKS	NUMBER OF WEEKS IN SUMMER SEASON
SPRWKS	NUMBER OF WEEKS IN SPRING SEASON
NC	NUMBER OF CROPS

PROFIT(I,L)	NET PACKING REVENUES MINUS TOTAL FARM LEVEL COSTS OF PRODUCTION FOR ALL ACRES PLANTED OF EACH CROP
CLASS(K,L)	PER ACRE PRODUCER PROFITS BY CLASS OF PRODUCER FOR DIFFERENT POOLING METHODS
SEASSP(L)	SPRING POOL OF PRODUCER PAYMENTS FOR ALL CRATES SOLD IN THE SPRING
SEASS(L)	SUMMER POOL OF PRODUCER PAYMENTS FOR ALL CRATES SOLD IN THE SUMMER
SEASF(L)	FALL POOL OF PRODUCER PAYMENTS FOR ALL CRATES SOLD IN THE FALL
CLSQ(I,L)	CLASS(I,L) SQUARED. (CLASS IS PRODUCER RETURNS PER ACRE)
SUMSQ(I)	SUM OF THE PER ACRE FARMER RETURNS SQUARED
SUM(I)	SUM OF CLASS(I,L), SUMMED OVER THE ITERATIONS FOR EACH CLASS
MEAN(I)	MEAN OF THE PER ACRE FARMER RETURNS OVER ALL ITERATIONS BY CLASS
STDEV(I)	STANDARD DEVIATION OF PER ACRE FARMER RETURNS OVER ALL ITERATIONS BY CLASS

SUBROUTINE VALCOS (SPRING, SUMMER, FALL, FARSPR, FARSUM, FARFAL, HARPER, AME, CRATES, ACRES, TCRT, TOTFIX, VARCPC)
FILE=VALCOS.FOR

SPRING(J,I,L)	WEEK BY CROP BY ITERATION MATRIX OF PER CRATE SPRING PRICES RECEIVED BY PACKING FACILITY
SUMMER(I,J,L)	CROP BY WEEK BY ITERATION MATRIX OF PER CRATE SUMMER PRICES RECEIVED BY PACKING FACILITY
FALL(I,J,L)	WEEK BY CROP BY ITERATION MATRIX OF PER CRATE FALL PRICES RECEIVED BY PACKING FACILITY
FARSP(J,I,L)	PER CRATE PRODUCER SPRING PRICES BY WEEK, CROP AND ITERATION
FARS(J,I,L)	PER CRATE PRODUCER SUMMER PRICES BY WEEK, CROP AND ITERATION
FARF(J,I,L)	PER CRATE PRODUCER FALL PRICES BY WEEK, CROP AND ITERATION
FARSPR(J,I,L)	WEEK BY CROP BY ITERATION MATRIX OF SPRING PRODUCER GROSS REVENUES
FARSUM(J,I,L)	WEEK BY CROP BY ITERATION MATRIX OF SUMMER PRODUCER GROSS REVENUES
FARFAL(J,I,L)	CROP BY WEEK BY ITERATION MATRIX OF FALL

	PRODUCER GROSS REVENUES
PYMTSP(I,L)	FARSPR SUMMED OVER THE WEEKS
PYMTS(I,L)	FARSUM SUMMED OVER THE WEEKS
PYMTF(I,L)	FARFAL SUMMED OVER THE WEEKS
SEASSP(L)	SPRING POOL OF PRODUCER GROSS REVENUES FOR ALL CRATES SOLD IN THE SPRING
SEASS(L)	SUMMER POOL OF PRODUCER GROSS REVENUES FOR ALL CRATES SOLD IN THE SUMMER
SEASF(L)	FALL POOL OF PRODUCER GROSS REVENUES FOR ALL CRATES SOLD IN THE FALL
REVNUE(J,I,L)	TOTAL GROSS PACKING REVENUES FOR ALL CRATES PACKED
POOLSS(I,L)	CROP BY ITERATION MATRIX OF SUMMER PACKING FACILITY GROSS REVENUES MINUS TOTAL VARIABLE COSTS OF PACKING
POOLPP(I,L)	CROP BY ITERATION MATRIX OF SPRING GROSS PACKING FACILITY REVENUES MINUS TOTAL VARI ABLE COSTS OF PACKING
POOLFF(I,L)	CROP BY ITERATION MATRIX OF FALL GROSS PACKING FACILITY REVENUES MINUS TOTAL VARI ABLE COSTS OF PACKING
SS(L)	POOLSS SUMMED OVER ALL CROPS
PP(L)	POOLPP SUMMED OVER ALL CROPS
FF(L)	POOLFF SUMMED OVER ALL CROPS
POOL(L)	TOTAL GROSS PACKING REVENUES FOR ALL CROPS BY ITERATION
POOLF(L)	FALL POOL OF NET PACKING REVENUES. FALL POOL'S SHARE OF FIXED PACKING COSTS MEASURED AS A PERCENTAGE OF GROSS PACKING REVENUES
POOLS(L)	SUMMER POOL OF NET PACKING REVENUES. SUMMER POOL'S SHARE OF FIXED PACKING COSTS MEASURED AS A PERCENTAGE OF GROSS PACKING REVENUES
POOLSP(L)	SPRING POOL OF NET PACKING REVENUES. SPRING POOL SHARE OF GROSS PACKING FIXED PACKING COSTS MEASURED AS A PERCENTAGE OF GROSS PACKING REVENUES OF SPRING
PROFIT(I,L)	NET PACKING REVENUES, NET OF PACKING AND FARM LEVEL COSTS OF PRODUCTION FOR ALL ACRES PLANTED OF EACH CROP
CLASS(K,L)	PER ACRE PRODUCER PROFITS BY CLASS OF PRODUCER FOR DIFFERENT POOLING METHODS
PROD(I,L)	CROP BY ITERATION MATRIX OF TOTAL COSTS OF FARM LEVEL PRODUCTION AND HARVESTING FOR ALL ACRES HARVESTED

TOTFIX(I,L)	CROP BY ITERATION MATRIX OF TOTAL FIXED COSTS OF PACKING
FIXCOS(L)	TOTFIX SUMMED OVER ALL CROPS TO ELIMINATE ALLOCATION METHOD FROM SUBROUTINE ASSIGN
FC(I,L)	CROP BY ITERATION MATRIX OF TOTAL FIXED COSTS OF PACKING WITH FIXED COSTS ALLOCATED TO CROPS BASED ON EACH CROP'S CONTRIBUTION TO GROSS PACKING REVENUES
PCRT(K,I)	PERCENTAGE OF CRATES EACH CLASS OF PRODUCER GROWS BY CLASS AND CROP
FALWKS	NUMBER OF WEEKS IN FALL SEASON
SUMWKS	NUMBER OF WEEKS IN SUMMER SEASON
SPRWKS	NUMBER OF WEEKS IN SPRING SEASON
NC	NUMBER OF CROPS
AME(I)	NAMES OF CROPS
HARPER(I,J)	CROP BY WEEK MATRIX OF % HARVESTED EACH WEEK
CLACRE(K)	TOTAL ACRES PLANTED FOR EACH CLASS OF PRODUCER. THERE ARE 10 CLASSES.
ACRES(I)	TOTAL ACRES PLANTED BY CROP
TCRT(I,L)	TOTAL CRATES HARVESTED AND DELIVERED TO PACKING FACILITY BY ITERATION
CRATES(I,L)	TOTAL CRATES PACKED AND SOLD BY ITERATION
FIX(I)	PER ACRE FARM LEVEL FIXED COST OF PRODUCTION
VAR(I)	PER CRATE FARM LEVEL VARIABLE COST OF PRODUCTION
CLSQ(I,L)	CLASS(I,L) SQUARED. (CLASS IS FARMER RETURNS PER ACRE)
SUMSQ(I)	SUM OF THE PER ACRE FARMER RETURNS SQUARED
SUM(I)	SUM OF CLASS(I,L), SUMMED OVER THE ITERATIONS FOR EACH CLASS
MEAN(I)	MEAN OF THE PER ACRE NET FARMER PROFITS OVER ALL ITERATIONS BY CLASS
STDEV(I)	STANDARD DEVIATION OF PER ACRE NET FARMER PROFITS OVER ALL ITERATIONS BY CLASS

APPENDIX G

DATA INPUT AND OUTPUT FILES

DATA INPUT FILES

CALLING SUBROUTINE	FILE NAME	VARIABLES
MAIN PROGRAM	PRG1	ALLOC
ASSIGN	OPTIONS	ALLOC
ASSIGN	HARVEST	I,PER
ASSIGN	COST	ASSET, INIT, SALV, LIFE, STD, OTHER(M),M=1,14 COSTAR(M,I),M=1,14,I=1,9 NAME(I), CAPAC(I), PAKOUT(I), PERPACK(I), ACRES(I), DMPCC(I), LABPR(I), LABP(I), LABR(I), POUNDS(I),I=1,9 YMAX(I),YMIN(I),YMODE(I),I=1,9
SEASPR	AMATRIX	APRSB(I,I),I=1,5 APRSC(I,I),I=1,3 APRCUC(I,I),I=1,17 APRTOM(I,I),I=1, APRCAN(I,I) APROK(I,) APRTUR(I,I) APRFC(I,I) APRFB(I,)
SEASPR	MEAN	MEANS(I),I=1,23
REFUND	PROD	FIX(I),VAR(I),I=1,9 CLACRE(I),I=1,10 PCRT(I,J),I=1,10,J=1,9
SPENSE	FACTOR	SIG(I,J,K),I=1,17, J=1,17,K=1,9

DATA OUPUT FILES

CALLING SUBROUTINE	FILE	VARIABLES
COR	MEANS	NAME(I),I=1,NCROP MEANPR(L,I),STDEV(L,I), I=1,9,L=1,NWKS
VALCOS	POOLVAL	CLASS(I,L),I=1,10, L=1,75 MEAN(I),STDEV(I),I=1,10
VALCOS	UNPCOS	UNPC(I,L),I=1,9,L=1,75
POOL	POOLAS	CLASS(I,L),I=1,10 L=1,75 MEAN(I),STDEV(I),I=1,10
ASSIGN	PACKING	AVGPC(I),I=1,9 AME(I),I=1,9 CPC(I,L),I=1,9,L=1,75
ASSIGN	YLD	AME(I),I=1,9 YIELDS(I,L),I=1,9,L=1,75
SPENSE	AMATRIX	A(I,J),I=1,M,J=1,M_

VITA

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