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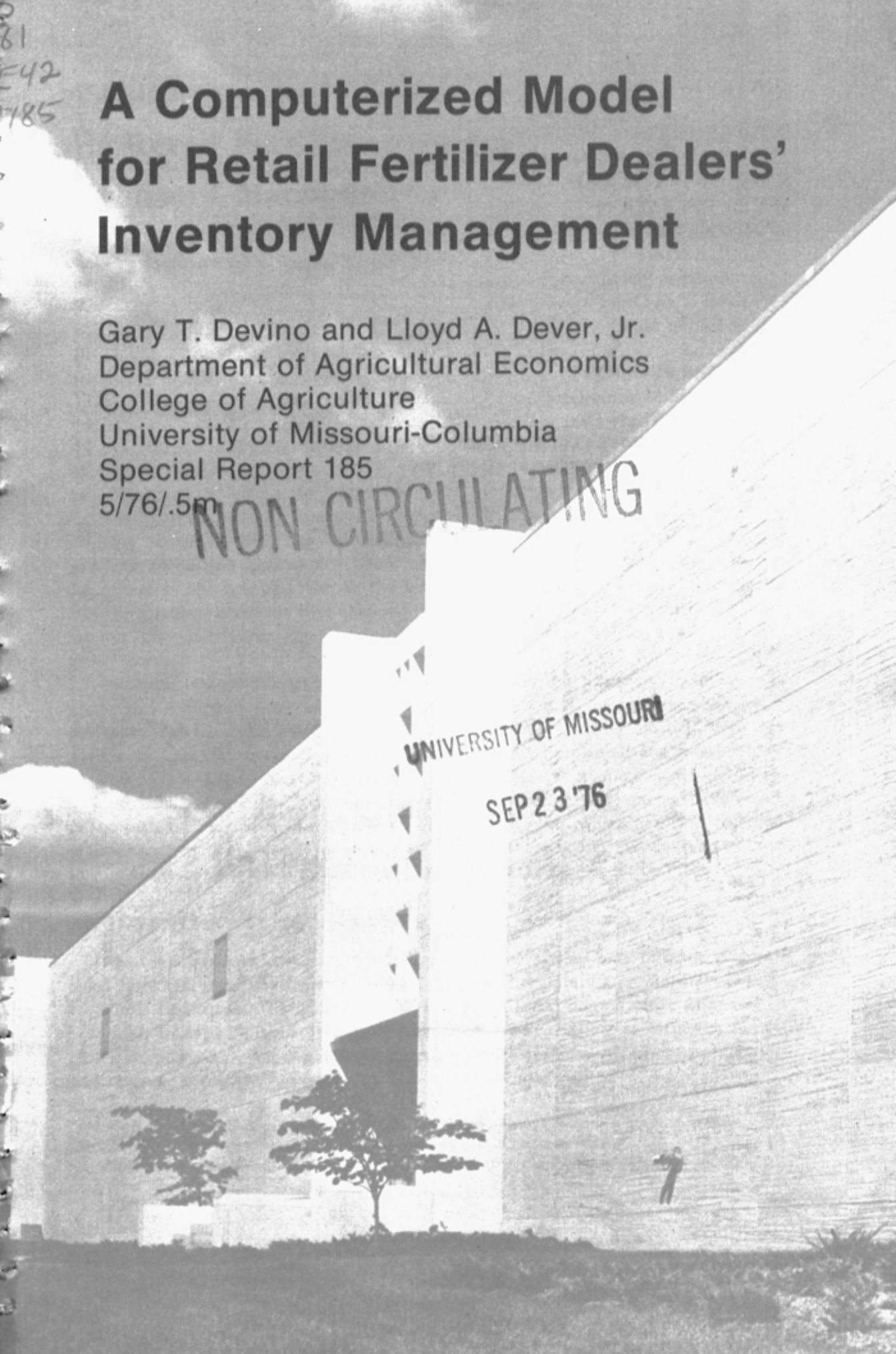
A Computerized Model for Retail Fertilizer Dealers' Inventory Management

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CONTENTS

INTRODUCTION	1
AN INVENTORY PLANNING MODEL	1
SCOPE OF THE MODEL	2
MODEL OPERATION	2
Monthly Demand	2
Clock Advance	6
An Order is Placed	8
Arrival of an Order	8
The End of Month	8
Year End	10
COMPUTER PRINTOUT	10
Printout of Monthly Data	11
Printout of Yearly Data	11
APPENDIX A INPUT DATA FORM	13
APPENDIX B SIMULATION PRINTOUT	20

A Computerized Model for Retail Fertilizer Dealers' Inventory Management

Gary T. Devino and Lloyd A. Dever, Jr.¹

INTRODUCTION

In the late 1960's and early 1970's fertilizer manufacturers were aggressively merchandising their product. Prices were low and credit terms to retailers were extremely lenient. Under the conditions then, prevailing fertilizer retailers had little incentive to limit fertilizer inventories, except as they approached the end of the spring planting season. Filling up all available space resulted in little cash cost and provided protection against not being able to meet customer needs. As economic conditions in the economy and in the fertilizer industry have changed, the costs of carrying fertilizer inventory have changed. With today's restrictive credit terms and high interest charges, filling up all available fertilizer storage will reduce profits for many retailers.

Inventory theory suggests three basic costs. These are carrying costs, shortage costs, and ordering. Carrying costs include capital costs, cost of space occupied, inventory service costs, and inventory risks.² Ordering costs include both the paperwork and the receiving expense associated with the placing and processing of an order. Shortage costs arise from failure to meet customer demand. These include both revenue loss currently and the present value of future revenue which is not realized because of the ill will created by being out of product. The objective of inventory management is to minimize total inventory costs. With this objective in mind, decisions—when to order and how much to order—must be made.

AN INVENTORY PLANNING MODEL

Planning fertilizer inventory levels has to be one of the more difficult problems faced by retail fertilizer dealers. Demand for fertilizer exhibits considerable month-to-month fluctuation. The timing of high and low sales months varies from year to year with weather changes. Inventory costs fluctuate in response to variations in lead time, interest rates, supplier credit terms, product costs, availability of discounts, and revenue loss from shortages.

¹Gary T. Devino is Associate Professor; Lloyd A. Dever, Jr. was formerly a graduate assistant in the Department of Agricultural Economics, University of Missouri-Columbia.

²Johnson, Robert W., *Financial Management*, 4th ed., Allyn and Bason, Boston, 1971, p. 133.

The retail fertilizer dealer has a continuum of inventory management options available. At one extreme he can, by the time the spring season starts, have as much fertilizer in storage as he expects to sell. He will have a lot of money tied up in facilities, in products, and in costs of handling the product. But he will have the product available when his customers want it. At the other extreme he can operate with a minimum level of stock and rely on his suppliers to provide goods as quickly as stock is sold. With this strategy he will undoubtedly have stock-outs, temporary sales loss, dissatisfied customers, and perhaps lose customers. But he will have a low level of carrying cost.

The practical level for a retail dealer's fertilizer inventory is somewhere between the extremes identified. But where? For any set of product demand, carrying cost, order cost, and cost of lost business variables, there is one level of inventory which will result in a minimization of inventory costs for the firm. While determination of minimum cost levels for a few combinations of variable values could be accomplished manually, the need for daily analysis of inventory position, the changing values of variables and the number of possible combinations makes this problem one which can be effectively handled with a computerized simulation model. The purpose of this paper is to describe the scope and characteristics of a model developed to analyze inventory strategies for retail fertilizer firms.

SCOPE OF THE MODEL

A computerized inventory simulation model was developed to allow identification of inventory costs under a variety of conditions. The model is applicable to dry bulk or bagged fertilizer operations. The program written for the model³ is designed to follow the inventory levels of the three major products—nitrogen, phosphorous, and potassium⁴—through several years. Orders are placed when the designated order level is reached and orders are received dependent upon lead time. Inventory diminishes at the rate indicated by a demand subroutine. Inventory levels, shortages, and costs are calculated for the simulated trial. A general flow chart of this procedure is included on page 5.

The model utilizes basic accounting relationships common to most retail fertilizer businesses. The analysis is individualized to the operations of a firm through input of several types of data. Researchers should find this flexibility beneficial in analyzing the potential impact of changing variable values on the operations of typical firms. Extension economists will be able to simulate the operations of client firms.⁵

MODEL OPERATION

Monthly Demand

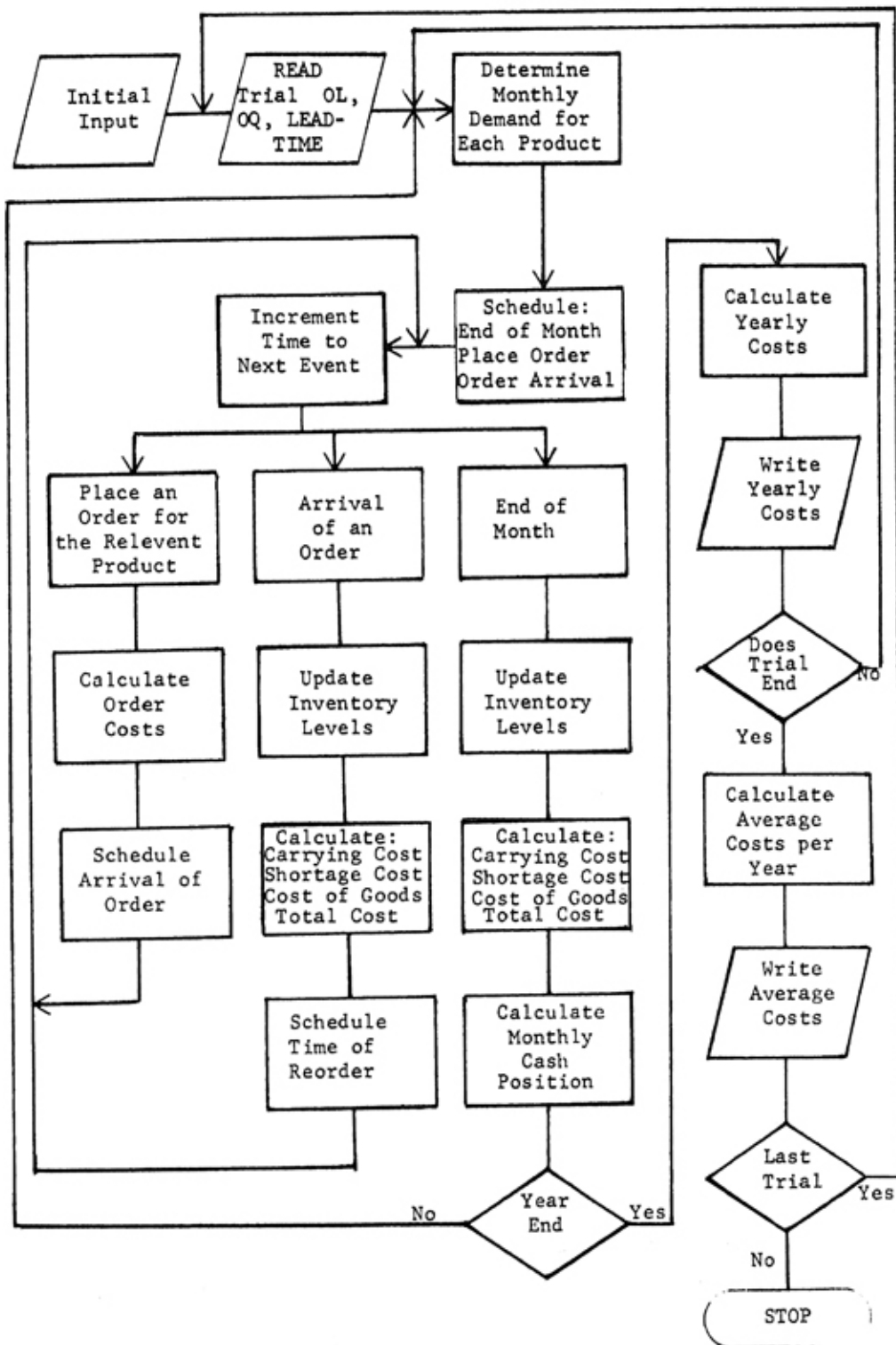
Expected total sales for each year are entered as part of data requirements. Monthly demand for each of the three principal products is determined by the demand subroutine.

³The program is written in Fortran IV language.

⁴The elemental designation refers to all compounds and products composed primarily of the element.

⁵Data requirements and card organization are identified in Appendix A.

GENERAL FLOWCHART OF THE SIMULATION MODEL



The demand subroutine calculates monthly demand based upon the input factors of total demand, the month, the product, the form (bulk or bagged), and the demand pattern. The model is programmed to evaluate each order policy for three different demand patterns.

The three demand patterns were constructed on the basis of statewide shipments of fertilizer in Missouri from 1967 through 1974.⁶ The graph on page 7 illustrates the monthly allocation of total demand for each demand pattern. The first demand pattern is the average monthly demand proportions calculated from the eight observations. Demand pattern two is characterized by an abnormally sharp peak during April reflecting optimal field conditions during the month. The third demand pattern is characterized by a relatively flat spring demand peak resulting from a wet spring. As a consequence, abnormally heavy demand is experienced later in the year.

These demand patterns determine the proportion of total demand which occurs during a particular month. Monthly demand for bulk products is distributed among the three major products in the following proportions depending upon the season:⁷

Spring distribution (January through June)

nitrogen	.370758
phosphorus	.266518
potassium	.342723

Fall distribution (July through December)

nitrogen	.315166
phosphorus	.309315
potassium	.342723

The coefficients vary somewhat for the distribution of bagged demand.

Determination of monthly demand for a specific product is accomplished by multiplying total demand by the relevant monthly factor specified by the demand pattern. Multiplication of monthly demand by the proportion allocated to the particular product determines the demand value returned to the main program by the demand subroutine. Average daily demand is calculated by dividing the monthly demand by the number of days in the month. This procedure is accomplished at the beginning of each month.

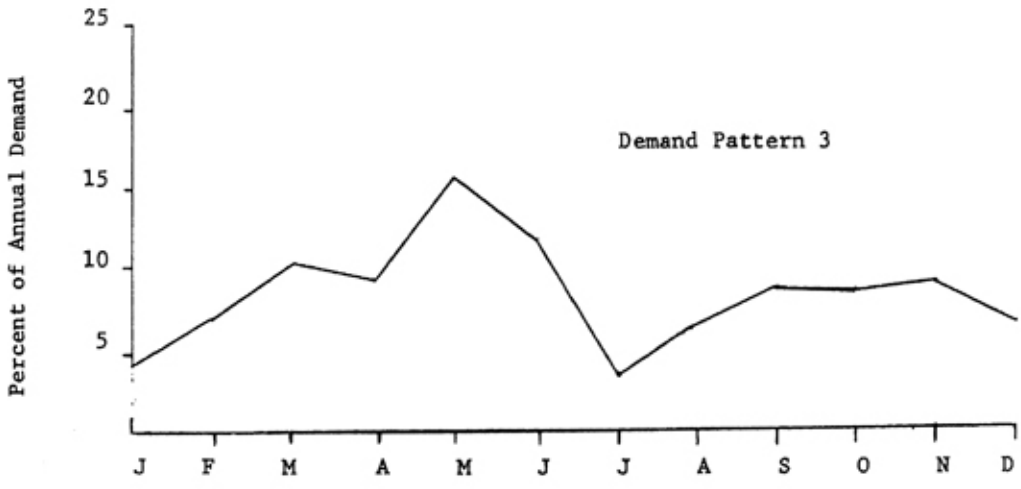
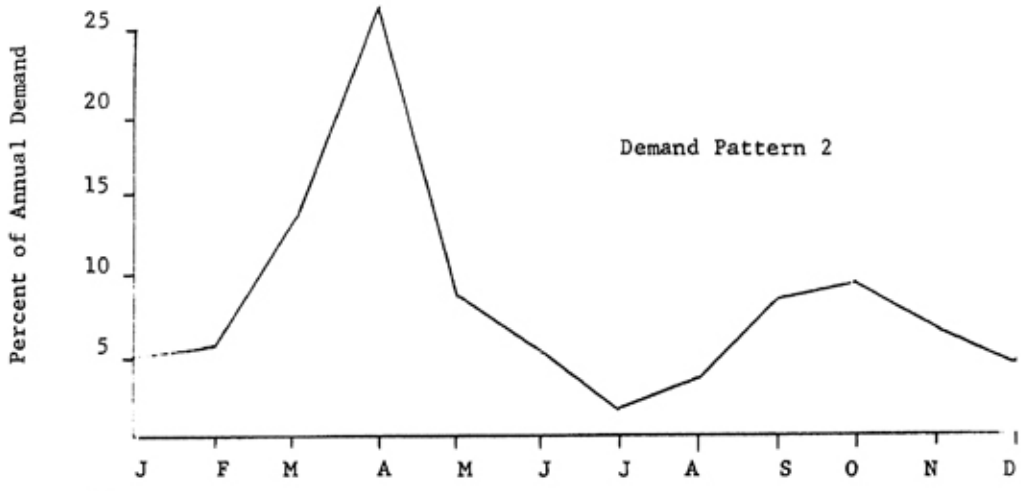
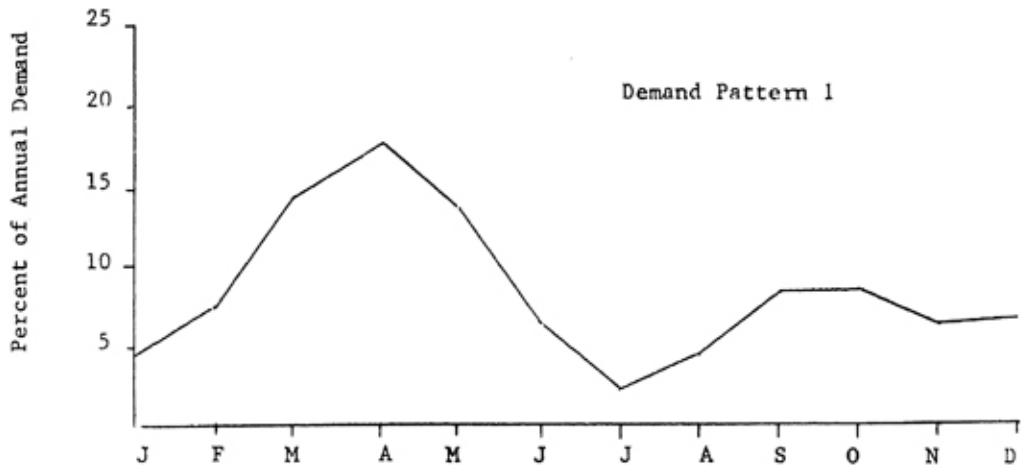
Clock Advance

A variable time increment clock controls progression of the simulation through the year. The clock value registers the day of the month. Each time an important event is scheduled to happen the clock is advanced. A clock advance is triggered when an order is placed, an order is received, or the month ends. Each event is assigned a time value indicating when it is scheduled. A minimization function selects the imminent event and the clock is advanced to the appropriate day. Control proceeds to the section of the program where the event is simulated.

⁶Users of the program may wish to substitute other demand patterns including stochastic patterns for their area. This can be accomplished by adjusting the demand subroutine.

⁷These distributions are based on Missouri use patterns. Substitution of coefficients for other areas would be made in the demand subroutine.

DISTRIBUTION OF MONTHLY DEMAND FOR THE VARIOUS DEMAND PATTERNS



An Order is Placed

After the clock advance, inventory levels for each product are determined. If the order level for any product has been reached, an order for that product is placed. The order is equal to the number of tons specified by the order quantity for the product for the designated month.

Cost per ton is determined by a cost subroutine. If any quantity or seasonal discounts are available, dealer's cost is adjusted by the subroutine to reflect the discount.

Freight costs are included in the cost of goods sold. The assumption is made that any order requires the use of at least one rail car, truck, or other transportation method. Freight must be paid on a capacity shipment or a multiple of this volume. This assumption severely penalizes orders of odd-lot volume.

The ordering cost is calculated next. The yearly ordering cost total is incremented to include processing and handling costs incurred by the order.

The arrival time of the order is scheduled by adding the lead time to the value of the clock variable. This scheduled arrival time, the next order point, and the end of the month are compared to determine what event is to occur next. The clock is then advanced to the appropriate event.

Arrival of an Order

If the arrival of an order was responsible for the clock advance, the following steps are taken. First the shortages, shortage costs, and carrying costs for each product are updated. The monthly and yearly shortages of each product are also calculated. Yearly costs are tabulated.

Upon the simulated order arrival, a test is made to determine if storage is available to accept the entire order. If so, the order is added to current inventory and the program continues. If addition of the entire order to inventory on hand would cause the inventory level of the product to exceed the storage capacity available, storage is filled and the remainder of the order is deferred. The inherent cost of this procedure is the freight charges on the portion of the order which could not be accepted. The cost of goods sold is increased to reflect the cost of the additional inventory.

A new order point is calculated based upon the inventory level of the product and the demand for it. Control is returned to the clock function where the next imminent event is chosen.

The End of a Month

At the end of each simulated month, inventory levels of each product are updated to reflect sales and acquisitions. Shortages and costs are calculated for each product. Year-to-date values are incremented.

The cash position and current ratio of the firm are calculated at the end of each month. The cash balance is increased by the amount of cash sales during the current month and the amount of collections made from accounts receivable. Collections are dependent upon previous monthly sales and a three-month aging schedule. The aging schedule may be included directly as input or it may be approximated from the average collection period by a subroutine.

The collection subroutine consists of several aging schedules assigned to various average collection periods.⁸ Depending upon cash sales and bad debt loss, the collection period under consideration is adjusted to approximate one of the standard aging schedules.^{8a} In this manner, a three-month schedule of collections is determined which will produce an average collection period of the designated length. The aging schedule is then returned to the main program to be used for calculation of cash inflows from previous sales.

Decreases in the cash account result from freight charges, cash expenses, and interest expenses. If a cash payment policy is in effect, the cash balance is decreased by the cost of inventory acquisitions during the month. But if supplier credit is utilized, the cost of goods purchased is added to the accounts payable balance.

If cash transactions result in a cash balance which is below the desired minimal cash level, bank loans are automatically increased to bring the cash balance up to the desired level. If the cash balance is in excess of minimum operating needs, available cash is applied to reduce bank loans or accounts payable, whichever is appropriate. When a supplier credit policy is in effect, available cash is used to reduce any existing bank notes. If a cash payment policy is in effect, available cash is used to reduce bank notes outstanding.

Interest is charged on the balance in the accounts payable account at the end of the month. The rate is determined by the service charge input value. Interest is also payable on bank notes outstanding at month-end. This rate is also designated by an input variable.

The accounts receivable balance is circulated at the end of the month. Collections from previous sales reduce the account. Non-cash sales during the month increase the receivables balance. Bad debt loss is carried for a year before being written off.

The value of inventory on hand is determined by multiplying inventory levels by the per unit cost of the product.

The amount of short term bank credit available to the firm is determined from either credit limit information included in the data input or from calculations conducted by a credit analysis subroutine.

The credit analysis subroutine utilizes information on the firm's current ratio in developing credit limits. The assumption is made that the proportion of inventory value which will be financed depends upon the current ratio of the firm. Additional short-term credit is available to firms with greater total assets. The critical values of the current ratios and the corresponding factors are included as

⁸The average collection period is defined as the average accounts receivable divided by average daily sales.

^{8a}The aging schedules identify the proportion of sales collected in each of the three months following the sales month. Twenty-nine schedules are developed to reflect collection patterns ranging from ones with most accounts receivables collected soon after the sales month to ones where nearly a third of accounts receivable are collected three months after the sales month.

input data. As an example consider the following situation:

a. Sample Input Data

Current ratio exceeding	Proportion of inventory value financed	Additional credit as a proportion of total assets
1.5	.7	.2
2.0	.8	.25
2.5	.9	.3

b. Calculated current ratio for the study firm 1.7.

c. Inventory valued at \$50,000.

d. Total assets \$500,000.

The short term credit limit for the firm is \$135,000, which was calculated as follows: $(.7 \times \$50,000) + (.2 \times \$500,000)$.

If the value of bank loans outstanding at the end of the month exceeds credit limitations, this information is printed out.

With the determination of the cash position of the firm, the end-of-month processes are complete. A test is made to see if the year has ended. If not, control is returned for another clock advance. If the year has ended, the program proceeds.

Year End

The end of the year requires several cost calculations. First the value of inventory on hand is subtracted from the cost of goods sold resulting in the yearly cost of goods sold. The summation of yearly cost of goods sold, yearly carrying costs, yearly order costs, yearly shortage costs, and yearly interest expense is the yearly total cost. This total excluding cost of goods sold is also calculated. The cumulative value of each of these costs is incremented by the relevant yearly cost. This cumulative value includes the annual costs incurred for the aggregate number of simulated years in the trial. It is used at the end of the trial to compute average yearly costs. The cumulative shortage of each product is updated to include yearly shortages.

The number of years simulated is incremented by one. A test is made to see if the number of years simulated is equivalent to the desired number of repetitions. If not, control returns for the beginning of a new year.

If the appropriate number of yearly runs has been made, the program proceeds to calculate the average cost per year for each cost category. This is accomplished by dividing the cumulative cost by the number of years simulated. Average yearly shortages of each product are also calculated.

All three demand patterns are evaluated for each order policy. When this is complete, another order policy is read and evaluated. After all the specified order policies have been evaluated under all three demand alternatives, another set of input data is read. The designated order policies are tested for this data set. When no more data is in the data deck, the simulation run ends. The output may then be used to evaluate the various order policies.

COMPUTER PRINTOUT

The three basic levels of output are monthly, yearly, and average yearly. A sample for a dry bulk fertilizer business with yearly expected sales of 4,000 tons is shown in Appendix B.

Printout of Monthly Data

The monthly printout includes the cash balance, accounts receivable, sales, bank loans, accounts payable, interest expense, the current ratio, the shortages of each product, and the maximum inventory level of each product during the month. This information provides a summary of the current financial status of the firm. If the short-term limits are exceeded, a special message is printed out. Such a message would indicate that the firm was experiencing cash flow difficulties. Inventory levels may need to be reduced to provide more operating capital. Possibly the collection policy is too lenient. The cash flow problem might be the result of charging too little for the product. This monthly printout can be useful in locating cash flow problems and the cause of the problem.

Monthly shortages are printed out in order to determine the minimal efficient order level for each product during each month. For example, a shortage of fifty tons of nitrogen during April would indicate that the order level for that product should be increased to prevent a stockout.

The maximum inventory levels are printed out to evaluate utilization of available storage. This data may also be used to determine how existing storage capacity should be allocated among the various products.

Printout of Yearly Data

The yearly printout provides an overview of the allocation of the various inventory costs. The average value of these yearly costs determines which of the various order policies is least costly over the simulation period. The key figure for comparative purposes is the average total costs excluding cost of goods sold (TC-CGS). Ordering costs, carrying costs, shortage costs, and fixed facilities costs are included in this total. Minimization of this total indicates the optimal order policy. If discounts are available, the total cost figure (YRTC) should be used to compare alternatives. Savings resulting from discounts are reflected in this total.

SUMMARY

Fertilizer retailers face a highly unpredictable demand. Seasonal demand patterns are complicated by unpredictable weather conditions. Lead times are often uncertain especially during the busy season. In addition, storage limitations, cost of borrowed funds, cost of shortages, supplier credit terms, and availability of discounts complicate the inventory decision facing the fertilizer dealer.

Conventional inventory theory lacks the versatility to deal adequately with these fertilizer inventory questions. In order to evaluate alternative order policies, a simulation model was developed to deal with the uncertainty of key variables.

The computer model was designed to calculate annual carrying costs, shortages and shortage costs, cost of goods sold, total inventory costs, and interest expense. In addition the monthly cash position was summarized. Several years were simulated and the average yearly values of the annual costs were computed. This procedure was repeated for each of three demand patterns in order to introduce variability of demand into the model. The data input variables were selected to allow the flexibility to simulate various situations.

The advantage of this simulation lies in its ability to deal with various inventory alternatives without interrupting the retailer's business. Analysis conducted with the model indicates potential cost reductions of \$1000 to \$1500 per year for firms having sales in the 4000 ton per year range.

APPENDIX A—

FERTILIZER INVENTORY CONTROL MODEL DATA FORM

Card 1

Expected sales for the fiscal year		<u>4000</u>	tons
		(1-10)	
Total assets	\$	<u>600,000</u>	
		(11-20)	
Cash sales as proportion of total sales		<u>.10</u>	
		(21-25)	
Bad debt loss as proportion of total sales		<u>.002</u>	
		(26-30)	
Variable cash expense as proportion of total sales		<u>.08</u>	
		(31-35)	
Fixed cash expenses per month	\$	<u>800</u>	
		(36-44)	
Minimum cash level desired	\$	<u>15,000</u>	
		(45-54)	
Service charge on accounts payable		<u>.12</u>	
		(55-59)	
Blank space		<u>.</u>	
		(60-64)	
Interest rate charged on borrowed funds		<u>.10</u>	
		(65-69)	
Cash Discount on purchases		<u>.0</u>	
		(70-74)	
Product type (check one)	bulk	<u>✓</u>	(enter 1)
		(76)	
	bagged	<u>_____</u>	(enter 2)
		(76)	
Payment policy (check one)	cash	<u>✓</u>	(enter 1)
		(78)	
	supplier credit	<u>_____</u>	(enter 2)
		(78)	

Card 2

Expected cost of Nitrogen	\$ $\frac{135.00}{(1-6)}$ / ton
Expected cost of Phosphorous	\$ $\frac{146.00}{(7-12)}$ / ton
Expected cost of Potassium	\$ $\frac{50.26}{(13-18)}$ / ton
Expected selling price of Nitrogen	\$ $\frac{175.00}{(19-24)}$ / ton
Expected selling price of Phosphorous	\$ $\frac{210.00}{(25-30)}$ / ton
Expected selling price of Potassium	\$ $\frac{108.00}{(31-36)}$ / ton
Storage capacity for Nitrogen	$\frac{300}{(37-42)}$ tons
Storage capacity for Phosphorous	$\frac{300}{(43-48)}$ tons
Storage capacity for potassium	$\frac{450}{(49-54)}$ tons
Cost to order Nitrogen	\$ $\frac{0}{(55-60)}$ / ton
Cost to order Phosphorous	\$ $\frac{0}{(61-66)}$ / ton
Cost to order Potassium	\$ $\frac{0}{(67-72)}$ / ton

Card 3

Size of shipment for Nitrogen	$\frac{100}{(1-6)}$ tons
Size of shipment for Phosphorous	$\frac{100}{(7-12)}$ tons
Size of shipment for Potassium	$\frac{100}{(13-18)}$ tons
Freight cost Nitrogen	\$ $\frac{8.00}{(19-24)}$ /ton
Freight cost Phosphorous	\$ $\frac{15.00}{(25-30)}$ /ton
Freight cost Potassium	\$ $\frac{20.00}{(31-36)}$ /ton

Collection Practice (complete either a or b)

a. Average collection period	$\frac{30}{(37-42)}$ days
b. Proportion of sales collected first month	$\frac{.0}{(43-48)}$
Proportion of sales collected second month	$\frac{.0}{(49-54)}$
Proportion of sales collected third month	$\frac{.0}{(55-60)}$

Card 4

Beginning Inventory Nitrogen	$\frac{300}{(1-6)}$ tons
Beginning inventory Phosphorous	$\frac{300}{(7-12)}$ tons
Beginning inventory Potassium	$\frac{450}{(13-18)}$ tons
Shortage cost Nitrogen	\$ $\frac{6.00}{(19-24)}$ / ton
Shortage cost Phosphorous	\$ $\frac{6.00}{(25-30)}$ / ton
Shortage cost Potassium	\$ $\frac{6.00}{(31-36)}$ / ton
Annual fixed cost for facilities	\$ $\frac{1000}{(37-44)}$

Card 5

Credit Availability (complete either a or b)

a. Maximum short term bank credit available	\$ $\frac{300,000}{(1-10)}$			
b. Current ratio values				
1. $\frac{0}{(11-13)}$	2. $\frac{0}{(14-16)}$	3. $\frac{0}{(17-19)}$	4. $\frac{0}{(20-22)}$	5. $\frac{0}{(23-25)}$
Total assets financed				
1. $\frac{0}{(26-29)}$	2. $\frac{0}{(30-33)}$	3. $\frac{0}{(34-37)}$	4. $\frac{0}{(38-41)}$	5. $\frac{0}{(42-45)}$
Inventory values financed				
1. $\frac{0}{(46-49)}$	2. $\frac{0}{(50-53)}$	3. $\frac{0}{(54-57)}$	4. $\frac{0}{(58-61)}$	5. $\frac{0}{(62-65)}$

Card 6

Seasonal Discounts (dollars/ton)

Nitrogen

$$J \frac{0}{(1-4)} \quad F \frac{0}{(5-8)} \quad M \frac{0}{(9-12)} \quad A \frac{0}{(13-16)} \quad M \frac{0}{(17-20)} \quad J \frac{0}{(21-24)}$$

$$J \frac{0}{(25-28)} \quad A \frac{0}{(29-32)} \quad S \frac{0}{(33-36)} \quad O \frac{0}{(37-40)} \quad N \frac{0}{(41-44)} \quad D \frac{0}{(45-48)}$$

Phosphorous

$$J \frac{0}{(49-52)} \quad F \frac{0}{(53-56)} \quad M \frac{0}{(57-60)} \quad A \frac{0}{(61-64)} \quad M \frac{0}{(65-68)} \quad J \frac{0}{(69-72)}$$

$$J \frac{0}{(73-76)} \quad A \frac{0}{(77-80)}$$

Card 7

Seasonal Discount

Phosphorous

$$S \frac{0}{(1-4)} \quad O \frac{0}{(5-8)} \quad N \frac{0}{(9-12)} \quad D \frac{0}{(13-16)}$$

Potassium

$$J \frac{0}{(17-20)} \quad F \frac{0}{(21-24)} \quad M \frac{0}{(25-28)} \quad A \frac{0}{(29-32)} \quad M \frac{0}{(33-36)} \quad J \frac{0}{(37-40)}$$

$$J \frac{0}{(41-44)} \quad A \frac{0}{(45-48)} \quad S \frac{0}{(49-52)} \quad O \frac{0}{(53-56)} \quad N \frac{0}{(57-60)} \quad D \frac{0}{(61-64)}$$

Card 8

Quantity Discounts

Tons qualifying for first discount level	$\frac{0}{(1-6)}$
Discount achieved	\$ $\frac{0}{(7-12)}$ / ton
Tons qualifying for second discount level	$\frac{0}{(13-18)}$
Discount achieved	\$ $\frac{0}{(19-24)}$ / ton
Tons qualifying for third discount level	$\frac{0}{(25-30)}$
Discount achieved	\$ $\frac{0}{(31-36)}$ / ton

Card 10

Lead Time for Nitrogen (days)

J $\frac{7}{(1-6)}$	F $\frac{7}{(7-12)}$	M $\frac{7}{(13-18)}$	A $\frac{7}{(19-24)}$	M $\frac{7}{(25-30)}$	J $\frac{7}{(31-36)}$
J $\frac{7}{(37-42)}$	A $\frac{7}{(43-48)}$	S $\frac{7}{(49-54)}$	O $\frac{7}{(55-60)}$	N $\frac{7}{(61-66)}$	P $\frac{7}{(67-72)}$

Card 11

Lead time for Phosphorous (days)

J $\frac{14}{(1-6)}$	F $\frac{14}{(7-12)}$	M $\frac{14}{(13-18)}$	A $\frac{14}{(19-24)}$	M $\frac{14}{(25-30)}$	J $\frac{14}{(31-36)}$
J $\frac{14}{(37-42)}$	A $\frac{14}{(43-48)}$	S $\frac{14}{(49-54)}$	O $\frac{14}{(55-60)}$	N $\frac{14}{(61-66)}$	D $\frac{14}{(67-72)}$

Card 12

Lead Time for Potassium (days)

J $\frac{21}{(1-6)}$	F $\frac{21}{(7-12)}$	M $\frac{21}{(13-18)}$	A $\frac{21}{(19-24)}$	M $\frac{21}{(25-30)}$	J $\frac{21}{(31-36)}$
J $\frac{21}{(37-42)}$	A $\frac{21}{(43-48)}$	S $\frac{21}{(49-54)}$	D $\frac{21}{(55-60)}$	N $\frac{21}{(61-66)}$	D $\frac{21}{(67-72)}$

Card 13

Order Quantities for Nitrogen (tons)

J $\frac{100}{(1-6)}$	F $\frac{100}{(7-12)}$	M $\frac{100}{(13-18)}$	A $\frac{100}{(19-24)}$	M $\frac{100}{(25-30)}$	J $\frac{100}{(31-36)}$
J $\frac{100}{(37-42)}$	A $\frac{100}{(43-48)}$	S $\frac{100}{(49-54)}$	O $\frac{100}{(55-60)}$	N $\frac{100}{(61-66)}$	D $\frac{100}{(67-72)}$

Card 14

Order Quantities for Phosphorous (tons)

J $\frac{100}{(1-6)}$	F $\frac{100}{(7-12)}$	M $\frac{200}{(13-18)}$	A $\frac{200}{(19-24)}$	M $\frac{100}{(25-30)}$	J $\frac{100}{(31-36)}$
J $\frac{100}{(37-42)}$	A $\frac{100}{(43-48)}$	S $\frac{100}{(49-54)}$	O $\frac{100}{(55-60)}$	N $\frac{100}{(61-66)}$	D $\frac{100}{(67-72)}$

Card 15

Order Quantities for Potassium (tons)

J $\frac{100}{(1-6)}$	F $\frac{200}{(7-12)}$	M $\frac{200}{(13-18)}$	A $\frac{200}{(19-24)}$	M $\frac{100}{(25-30)}$	J $\frac{100}{(31-36)}$
J $\frac{100}{(37-42)}$	A $\frac{100}{(43-48)}$	S $\frac{100}{(49-54)}$	O $\frac{100}{(55-60)}$	N $\frac{100}{(61-66)}$	D $\frac{100}{(67-72)}$

Card 16

Order Level for Nitrogen (tons)

J	$\frac{30}{(1-6)}$	F	$\frac{50}{(7-12)}$	M	$\frac{100}{(13-18)}$	A	$\frac{100}{(19-24)}$	M	$\frac{55}{(25-30)}$	J	$\frac{40}{(31-36)}$
J	$\frac{20}{(37-42)}$	A	$\frac{30}{(43-48)}$	S	$\frac{30}{(49-54)}$	O	$\frac{30}{(55-60)}$	N	$\frac{30}{(61-66)}$	D	$\frac{20}{(67-72)}$

Card 17

Order Level for Phosphorous (tons)

J	$\frac{45}{(1-6)}$	F	$\frac{75}{(7-12)}$	M	$\frac{150}{(13-18)}$	A	$\frac{150}{(19-24)}$	M	$\frac{85}{(25-30)}$	J	$\frac{65}{(31-36)}$
J	$\frac{40}{(37-42)}$	A	$\frac{50}{(43-48)}$	S	$\frac{55}{(49-54)}$	O	$\frac{55}{(55-60)}$	N	$\frac{55}{(61-66)}$	D	$\frac{40}{(67-72)}$

Card 18

Order Level for Potassium (tons)

J	$\frac{75}{(1-6)}$	F	$\frac{135}{(7-12)}$	M	$\frac{260}{(13-18)}$	A	$\frac{260}{(19-24)}$	M	$\frac{150}{(25-30)}$	J	$\frac{115}{(31-36)}$
J	$\frac{70}{(37-42)}$	A	$\frac{95}{(43-48)}$	S	$\frac{100}{(49-54)}$	O	$\frac{100}{(55-60)}$	N	$\frac{100}{(61-66)}$	D	$\frac{75}{(67-72)}$

Card 9

This is a control card which determines how many order policies are to be read and which policies are to be evaluated for each simulated input.

Columns 1-3	This is the number of order policies to be read. This is a right-justified integer. One hundred is the maximum number of order policies which may be read.
Columns 4-6	This is the first order policy to be evaluated for this particular simulation: right-justified integer.
Columns 6-9	This is the last order policy to be evaluated for this particular simulation: right-justified integer.
Columns 10-11	Blank
Column 12	This column must be blank or contain the integer 1. The integer 1 denotes that a series of order quantities and order levels follow in the data deck. A blank in this column indicates that the order policies have been read previously in the deck and these policies are to be used for this trial rather than a new set of order policies to be read. This variable is KEY.

Order Policy Development

Order Policies can be developed to correspond to any operating goal desired. The mechanics of changing policies are accomplished by adding order quantity and order level cards. Cards 13-18 are repeated for the desired number of order policies. Six cards must be present for each order policy specified in columns 1-3 of card 9. Order policies are read if column 12 of card 9 contains the integer 1.

When order quantity and order levels are known this data is entered in the card sequence specified. A special routine in the program can be used to identify order levels and needed adjustments in order quantities when values are not known. Operation of this routine is accomplished by:

1. entering minimum shipment size information for Order Quantity. This data will be the same as card 3, (1-18).
2. entering a negative value in columns 1-6 of the order level data card (card 16).
3. operating the program.

The printout will show the demand during lead time for each demand pattern. These are the minimum order levels needed to prevent stockouts. This data can be utilized directly by rerunning the program or as base data in developing values for different strategies.

APPENDIX B
SIMULATION PRINTOUT

TOTAL DEMAND = 4000.00 TOTAL ASSETS = 600000.00 CASH SALES = 0.100 BAD DEBT LOSS = 0.002 CASH EXPENSES = 0.080
*SALES + 800.00
MINIMUM CASH = 15000.00 INT¹ RATE ON AP² = 0.120 INT RATE ON LOANS = 0.100
CASH DISCOUNT = 0.000 FORM = 1 PAY POLICY = 1 SHORTAGE POLICY = 1 COST OF N² = 135.00
COST OF PH⁴ = 146.00 COST OF POT⁵ = 50.26 PRICE OF N = 175.00 PRICE PH = 210.00
PRICE OF POT = 108.00 STORAGE CAP⁶ OF N = 300. STORAGE CAP OF PH = 300. STORAGE CAP OF POT = 450. OC⁷ OF N = 0.00
OC OF PH = 0.00 OC OF POT = 0.00 MIN⁸ ORDER OF N = 100. MIN ORDER OF PH = 100. MIN ORDER OF POT = 100.
FRCOST⁹ OF N = 8.00 FRCOST OF PH = 15.00 FRCOST OF POT = 20.00 ACP¹⁰ = 30.00 AGING SCHEDULE 0.000 0.000 0.000
BEG INV¹¹ N = 300.00 BEG INV PH = 300.0 BEG INV POT = 450.0 SC¹² PER TON N = 6.00
SC PER TON PH = 6.00 SC PER TON POT = 6.00
FIXED FACILITIES COST = 1000.00 MAX¹³ LOANS = 300000.00 CRITICAL CR¹⁴ = 0.00 0.00 0.00 0.00 0.00
ASSET FACTORS 0.000 0.000 0.000 0.000 0.000 INV FACTORS¹⁵ 0.000 0.000 0.000 0.000 0.000
SEASONAL DISCOUNTS ON NIT 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
SEASONAL DISCOUNTS ON PHS 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
SEASONAL DISCOUNTS ON POT 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
ORDER GT¹⁶ 0. DISCOUNT OF 0.00 ORDER GT 0.00 DISCOUNT 0.00 ORDER GT 0. DISCOUNT OF 0.00
1 OQS¹⁷ AND CLS¹⁸ ARE READ IN 1 TO 1 WILL BE TESTED KEY = 1

THIS IS TRIAL 1

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
THE LEADTIME FOR NITROGEN IS	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
THE LEADTIME FOR PHOSPHOROUS IS	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
THE LEADTIME FOR POTASSIUM IS	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.
THE TRIAL QO.S FOR NITROGEN ARE	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.
THE TRIAL QO.S FOR PHOSPHOROUS ARE	100.	100.	200.	200.	100.	100.	100.	100.	100.	100.	100.	100.
THE TRIAL QO.S FOR POTASSIUM ARE	100.	200.	200.	200.	100.	100.	100.	100.	100.	100.	100.	100.
THE TRIAL QL.S FOR NITROGEN ARE	30.	50.	100.	100.	55.	40.	20.	30.	30.	30.	30.	20.
THE TRIAL QL.S FOR PHOSPHOROUS ARE	45.	75.	150.	150.	85.	65.	40.	50.	55.	55.	55.	40.
THE TRIAL QL.S FOR POTASSIUM ARE	75.	135.	260.	260.	150.	115.	70.	95.	100.	100.	100.	75.

-----THIS IS DEMAND PATTERN 1-----

MONTH	CASH	AR ¹⁹	SALES	LOANS	ACCPAY ²⁰	INTEXP ²¹	CR ²²	SHORTAGE OF			MAXIMUM INVENTORY OF		
								NIT	PHOS	POT	NIT	PHOS	POT
1	54644.66	36565.92	27486.31	0.00	0.00	0.00	*****	0.0	0.0	0.0	300.0	300.0	450.0
2	82116.55	51234.92	46674.88	0.00	0.00	0.00	*****	0.0	0.0	0.0	237.1	251.4	391.9
3	48107.70	95890.94	93803.51	0.00	0.00	0.00	*****	0.0	0.0	0.0	151.5	275.1	325.6
4	48562.15	124989.60	114353.43	0.00	0.00	0.00	*****	0.0	0.0	0.0	139.0	255.7	294.8

21

¹ interest

² accounts payable

³ nitrogen

⁴ phosphorous

⁵ potassium

⁶ capacity

⁷ order cost

⁸ minimum

⁹ freight cost

¹⁰ average collection period

¹¹ beginning inventory

¹² shortage cost

¹³ maximum

¹⁴ current ratio

¹⁵ inventory

¹⁶ greater than

¹⁷ order quantities

¹⁸ order lead time

¹⁹ accounts receivable

²⁰ accounts payable

²¹ interest expense

5	101710.78	110573.00	89330.50	0.00	0.00	0.00	*****	0.0	0.0	0.0	142.7	200.9	330.3
6	154451.49	65040.53	41748.09	0.00	0.00	0.00	*****	0.0	0.0	0.0	130.0	128.8	264.1
7	202417.34	28868.33	13688.76	0.00	0.00	0.00	*****	0.0	0.0	0.0	54.3	69.1	175.8
8	193374.79	32367.19	27891.64	0.00	0.00	0.00	*****	0.0	0.0	0.0	115.1	118.5	143.8
9	141347.45	56018.90	53855.31	0.00	0.00	0.00	*****	0.0	0.0	0.0	105.3	106.6	123.2
10	142211.72	62235.11	53919.54	0.00	0.00	0.00	*****	0.0	0.0	0.0	106.1	108.1	113.2
11	147417.41	51284.63	39138.27	0.00	0.00	0.00	*****	0.0	0.0	0.0	112.1	119.8	136.0
12	211577.81	53014.94	44022.51	0.00	0.00	0.00	*****	0.0	0.0	0.0	100.5	106.3	135.2

YEAR 1	YRTC 495291.77	YRCC 0.00	YRCC 4486.65	YRSC 0.00	YRCGS 489805.13	TC-CGS 5486.65	INT EXP 0.00	0.0	0.0	0.0	300.0	300.0	450.0
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MONTH	CASH	AR	SALES	LOANS	ACCPAY	INTEXP	CR						
1	31518.66	36565.92	27426.31	0.00	0.00	0.00	*****	0.0	0.0	0.0	98.2	110.2	117.1
2	21564.55	51234.92	46674.88	0.00	0.00	0.00	*****	0.0	0.0	0.0	108.6	131.7	101.7
3	15000.00	95490.94	93403.51	42611.91	0.00	361.91	3.49	0.0	0.0	11.4	151.5	215.5	200.0
4	15000.00	124997.60	114353.43	56571.27	0.00	464.97	3.13	0.0	0.0	0.0	139.0	262.3	293.4
5	15000.00	110573.00	89330.50	36787.62	0.00	306.50	4.68	0.0	0.0	0.0	142.2	271.9	323.8
6	47446.60	65040.53	41748.09	0.00	0.00	0.00	*****	0.0	0.0	0.0	129.1	164.5	257.8
7	95412.45	28868.33	13688.76	0.00	0.00	0.00	*****	0.0	0.0	0.0	52.4	90.7	169.5
8	96373.90	32367.19	27891.64	0.00	0.00	0.00	*****	0.0	0.0	0.0	113.2	125.7	137.5
9	90143.06	56018.90	53855.31	0.00	0.00	0.00	*****	0.0	0.0	0.0	105.3	110.6	129.5
10	79206.83	62235.11	53919.54	0.00	0.00	0.00	*****	0.0	0.0	0.0	106.1	108.1	113.0
11	67012.52	51284.63	39138.27	0.00	0.00	0.00	*****	0.0	0.0	0.0	112.1	103.1	136.0
12	194502.92	53014.94	44022.51	0.00	0.00	0.00	*****	0.0	0.0	0.0	100.5	119.1	128.9

YEAR 2	YRTC 494173.39	YRCC 0.00	YRCC 3300.01	YRSC 68.25	YRCGS 489805.13	TC-CGS 4368.27	INT EXP 1133.38	0.0	0.0	11.4	151.5	271.9	328.8
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MONTH	CASH	AR	SALES	LOANS	ACCPAY	INTEXP	CR						
1	31518.66	36565.92	27426.31	0.00	0.00	0.00	*****	0.0	0.0	0.0	96.3	121.1	114.3
2	21564.55	51234.92	46674.88	0.00	0.00	0.00	*****	0.0	0.0	0.0	106.7	133.7	107.2
3	15000.00	95490.94	93403.51	41744.30	0.00	354.54	3.62	0.0	0.0	0.0	151.5	237.0	203.8
4	15000.00	124997.60	114353.43	56566.39	0.00	457.78	3.22	0.0	0.0	0.0	139.0	256.7	290.7
5	15000.00	110573.00	89330.50	35205.54	0.00	299.01	4.86	0.0	0.0	0.0	141.8	277.2	324.5
6	46336.16	65040.53	41748.09	0.00	0.00	0.00	*****	0.0	0.0	0.0	128.1	186.0	240.1
7	96302.01	28868.33	13688.76	0.00	0.00	0.00	*****	0.0	0.0	0.0	50.6	112.2	151.8
8	103163.46	32367.19	27891.64	0.00	0.00	0.00	*****	0.0	0.0	0.0	111.4	85.8	119.8
9	91032.43	56018.90	53855.31	0.00	0.00	0.00	*****	0.0	0.0	0.0	105.3	119.4	147.1
10	89170.34	62235.11	53919.54	0.00	0.00	0.00	*****	0.0	0.0	0.0	106.1	107.3	114.6
11	67902.08	51284.63	39138.27	0.00	0.00	0.00	*****	0.0	0.0	0.0	112.1	112.2	136.0
12	105472.48	53014.94	44022.51	0.00	0.00	0.00	*****	0.0	0.0	0.0	100.5	117.2	111.3

YEAR 3	YRTC 494160.81	YRCC 0.00	YRCC 3355.68	YRSC 0.00	YRCGS 489805.13	TC-CGS 4355.68	INT EXP 1111.33	0.0	0.0	0.0	151.5	277.2	324.5
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MONTH	CASH	AR	SALES	LOANS	ACCPAY	INTEXP	CR						
1	31518.66	36565.92	27426.31	0.00	0.00	0.00	*****	0.0	0.0	0.0	94.5	123.1	106.6
2	21564.55	51234.92	46674.88	0.00	0.00	0.00	*****	0.0	0.0	0.0	104.9	133.7	122.8
3	15000.00	95490.94	93403.51	55796.30	0.00	473.89	2.92	0.0	0.0	0.0	151.5	258.5	312.1
4	15000.00	124997.60	114353.43	56615.74	0.00	458.76	3.25	0.0	0.0	0.0	139.0	255.7	292.5
5	15000.00	110573.00	89330.50	19225.47	0.00	163.29	8.24	0.0	0.0	0.0	141.3	165.4	320.2
6	44451.55	65040.53	41748.09	0.00	0.00	0.00	*****	0.0	0.0	0.0	127.2	107.5	222.4
7	96317.40	28868.33	13688.76	0.00	0.00	0.00	*****	0.0	0.0	0.0	48.8	132.6	134.2
8	96352.05	32367.19	27891.64	0.00	0.00	0.00	*****	0.0	0.0	0.0	109.6	107.3	150.8
9	84022.02	56018.90	53855.31	0.00	0.00	0.00	*****	0.0	0.0	0.0	105.3	105.2	137.0
10	89185.78	62235.11	53919.54	0.00	0.00	0.00	*****	0.0	0.0	0.0	106.1	108.0	114.6
11	97917.47	51284.63	39138.27	0.00	0.00	0.00	*****	0.0	0.0	0.0	112.1	117.6	132.2
12	98461.87	53014.94	44022.51	0.00	0.00	0.00	*****	0.0	0.0	0.0	100.5	101.7	130.9

YEAR	YRTC	YRDC	YRCC	YRSC	YRCGS	TC-CGS	INT_EXP	151.5	258.5	320.2
4	493955.C7	0.00	3184.95	0.00	489805.13	4184.95	1095.93	0.0	0.0	0.0
MONTH	CASH	AR	SALES	LOANS	ACCPAY	INTEXP	CR	0.0	86.0	135.6
1	47614.66	36565.92	27486.31	0.00	0.00	0.00	0.00	0.0	110.4	258.6
2	16314.55	51234.92	46674.88	0.00	0.00	0.00	0.00	0.0	241.6	299.5
3	15002.00	95892.94	93833.51	48770.30	0.00	411.21	3.38	0.0	255.7	297.1
4	15002.00	124989.60	114353.43	48730.07	0.00	401.52	3.76	0.0	186.9	315.8
5	19010.04	105733.50	89339.50	0.00	0.00	0.00	0.00	0.0	121.6	204.8
6	17158.75	65040.53	41748.09	0.00	0.00	0.00	0.00	0.0	146.7	116.5
7	103624.05	28868.33	13684.76	0.00	0.00	0.00	0.00	0.0	128.8	140.3
8	103624.05	32367.19	27831.64	0.00	0.00	0.00	0.00	0.0	106.6	117.3
9	91329.22	56318.90	53855.31	0.00	0.00	0.00	0.00	0.0	108.1	114.4
10	96472.94	62335.11	53919.54	0.00	0.00	0.00	0.00	0.0	119.4	127.8
11	105244.67	51244.63	39139.27	0.00	0.00	0.00	0.00	0.0	119.4	127.8
12	121864.07	53014.94	44022.51	0.00	0.00	0.00	0.00	0.0	92.3	132.4
YEAR	YRTC	YRDC	YRCC	YRSC	YRCGS	TC-CGS	INT_EXP	151.5	258.5	315.8
5	49306A.62	0.00	3159.50	0.00	489805.13	4159.50	814.73	0.0	0.0	0.0
MONTH	CASH	AR	SALES	LOANS	ACCPAY	INTEXP	CR	0.0	104.2	134.8
1	31582.66	16565.92	27486.31	0.00	0.00	0.00	0.00	0.0	104.2	134.8
2	15002.00	51234.92	46674.88	14761.45	0.00	113.24	7.09	0.0	241.6	281.8
3	15002.00	95892.94	93833.51	48883.54	0.00	415.18	3.12	0.0	265.0	311.7
4	15002.00	124989.60	114353.43	48844.27	0.00	401.46	3.50	0.0	265.0	311.7
5	15002.00	105733.50	89339.50	28257.10	0.00	240.33	5.74	0.0	140.4	268.5
6	15300.00	65040.53	41748.09	0.00	0.00	0.00	0.00	0.0	125.3	190.5
7	55303.24	28868.33	13684.76	0.00	0.00	0.00	0.00	0.0	150.5	187.1
8	62433.13	32367.19	27831.64	0.00	0.00	0.00	0.00	0.0	125.7	166.8
9	47294.58	56018.90	53855.31	0.00	0.00	0.00	0.00	0.0	125.7	166.8
10	40337.51	62335.11	53919.54	0.00	0.00	0.00	0.00	0.0	106.1	113.9
11	29769.20	51284.63	39139.27	0.00	0.00	0.00	0.00	0.0	112.1	119.8
12	105413.60	53014.94	44022.51	0.00	0.00	0.00	0.00	0.0	113.8	134.0
YEAR	YRTC	YRDC	YRCC	YRSC	YRCGS	TC-CGS	INT_EXP	151.5	268.5	311.5
6	494076.26	0.00	3271.13	0.00	489805.13	4271.13	1170.20	0.0	0.0	0.0
MONTH	CASH	AR	SALES	LOANS	ACCPAY	INTEXP	CR	0.0	113.4	127.1
1	31518.66	16565.92	27486.31	0.00	0.00	0.00	0.00	0.0	113.4	127.1
2	15002.00	51234.92	46674.88	14761.45	0.00	111.24	7.22	0.0	123.3	223.2
3	15002.00	95892.94	93833.51	48883.54	0.00	415.18	3.16	0.0	151.5	264.2
4	15002.00	124989.60	114353.43	48844.27	0.00	401.46	3.54	0.0	139.0	306.3
5	15002.00	105733.50	89339.50	28297.10	0.00	240.33	5.81	0.0	140.0	307.2
6	15300.00	65040.53	41748.09	0.00	0.00	0.00	0.00	0.0	124.3	169.4
7	55303.24	28868.33	13684.76	0.00	0.00	0.00	0.00	0.0	143.2	171.3
8	62433.13	32367.19	27831.64	0.00	0.00	0.00	0.00	0.0	98.2	149.2
9	47204.58	56018.90	53855.31	0.00	0.00	0.00	0.00	0.0	111.4	125.7
10	40337.51	62335.11	53919.54	0.00	0.00	0.00	0.00	0.0	105.3	118.2
11	104869.20	51284.63	39139.27	0.00	0.00	0.00	0.00	0.0	106.1	113.9
12	105413.60	53014.94	44022.51	0.00	0.00	0.00	0.00	0.0	112.1	119.0
YEAR	YRTC	YRDC	YRCC	YRSC	YRCGS	TC-CGS	INT_EXP	100.5	118.5	135.6
7	494126.69	0.00	3321.57	0.00	489805.13	4321.57	1170.20	0.0	0.0	0.0
MONTH	CASH	AR	SALES	LOANS	ACCPAY	INTEXP	CR	0.0	123.1	119.4
1	31518.66	16565.92	27486.31	0.00	0.00	0.00	0.00	0.0	123.1	119.4
2	15002.00	51234.92	46674.88	14761.45	0.00	113.24	7.36	0.0	133.7	205.5
3	15002.00	95892.94	93833.51	48883.54	0.00	415.18	3.20	0.0	151.5	246.5
4	15002.00	124989.60	114353.43	48844.27	0.00	401.46	3.58	0.0	139.0	293.8
5	15002.00	105733.50	89339.50	12197.10	0.00	103.59	12.45	0.0	139.5	302.9

6	55440.02	65040.53	41749.79	3.00	0.00	0.00	*****	0.0	0.0	0.0	123.4	130.6	151.8
7	46379.37	28468.33	13688.76	0.00	0.00	0.00	*****	0.0	0.0	0.0	41.4	119.7	159.9
8	103441.32	32367.19	27891.64	0.00	0.00	0.00	*****	0.0	0.0	0.0	113.3	93.4	131.5
9	71110.49	56018.90	53855.31	0.00	0.00	0.00	*****	0.0	0.0	0.0	105.3	111.9	135.5
10	85744.25	62235.11	53919.54	0.00	0.00	0.00	*****	0.0	0.0	0.0	106.1	107.5	114.6
11	97579.94	51284.63	39138.27	0.00	0.00	0.00	*****	0.0	0.0	0.0	112.1	114.1	136.0
12	125550.34	53014.94	44022.51	0.00	0.00	0.00	*****	0.0	0.0	0.0	100.5	101.7	122.9

YEAR	YRTC	YROC	YRCC	YRSC	YRCGS	TC-CGS	INT EXP						
8	493885.47	0.00	3080.34	0.00	489805.13	4080.34	1033.47	0.0	0.0	0.0	151.5	255.7	302.9

MONTH	CASH	AR	SALES	LOANS	ACCPAY	INTEXP	CP						
1	47418.66	36565.92	27485.31	0.00	0.00	0.00	*****	0.0	0.0	0.0	85.3	72.1	111.7
2	23364.55	51234.92	46674.88	0.00	0.00	0.00	*****	0.0	0.0	0.0	123.3	122.7	112.5
3	15000.00	95490.94	93903.51	55796.30	0.00	473.89	2.93	0.0	0.0	0.0	151.5	253.0	283.9
4	15000.00	124969.60	114353.43	55015.74	0.00	458.76	3.26	0.0	0.0	0.0	139.0	255.7	290.7
5	15000.00	110573.00	89330.50	3125.87	0.00	26.55	46.15	0.0	0.0	0.0	139.1	173.0	323.0
6	64588.29	65040.53	41749.09	0.00	0.00	0.00	*****	0.0	0.0	0.0	122.4	114.4	234.1
7	82154.14	28468.33	13688.76	0.00	0.00	0.00	*****	0.0	0.0	0.0	133.6	137.5	145.8
8	96489.59	32367.19	27891.64	0.00	0.00	0.00	*****	0.0	0.0	0.0	112.7	114.9	150.8
9	91184.76	56018.90	53855.31	0.00	0.00	0.00	*****	0.0	0.0	0.0	105.3	106.6	148.6
10	89722.52	62235.11	53919.54	0.00	0.00	0.00	*****	0.0	0.0	0.0	106.1	108.1	114.6
11	98374.21	51284.63	39138.27	0.00	0.00	0.00	*****	0.0	0.0	0.0	112.1	119.5	135.2
12	98598.61	53014.94	44022.51	0.00	0.00	0.00	*****	0.0	0.0	0.0	100.5	101.7	105.3

YEAR	YRTC	YROC	YRCC	YRSC	YRCGS	TC-CGS	INT EXP						
9	494038.55	0.00	3233.43	0.00	489805.13	4233.43	959.19	0.0	0.0	0.0	151.5	255.7	323.0

MONTH	CASH	AR	SALES	LOANS	ACCPAY	INTEXP	CP						
1	54644.66	36565.92	27485.31	0.00	0.00	0.00	*****	0.0	0.0	0.0	83.5	93.6	102.4
2	17338.55	51234.92	46674.88	0.00	0.00	0.00	*****	0.0	0.0	0.0	123.3	103.8	254.0
3	15000.00	95490.94	93903.51	48770.30	0.00	414.21	3.39	0.0	0.0	0.0	151.5	235.4	311.2
4	15000.00	124969.60	114353.43	63032.07	0.00	518.06	3.13	0.0	0.0	0.0	139.2	255.7	294.1
5	18900.51	110573.00	89330.50	0.00	0.00	0.00	*****	0.0	0.0	0.0	137.6	194.5	318.7
6	71641.22	65040.53	41749.09	0.00	0.00	0.00	*****	0.0	0.0	0.0	121.5	125.5	216.4
7	89297.07	28468.33	13688.76	0.00	0.00	0.00	*****	0.0	0.0	0.0	132.3	151.6	128.2
8	103542.58	32367.19	27891.64	0.00	0.00	0.00	*****	0.0	0.0	0.0	110.9	136.4	150.8
9	91211.63	56018.90	53855.31	0.00	0.00	0.00	*****	0.0	0.0	0.0	105.3	106.6	131.0
10	96375.45	62235.11	53919.54	0.00	0.00	0.00	*****	0.0	0.0	0.0	106.1	108.1	114.6
11	105107.14	51284.63	39138.27	0.00	0.00	0.00	*****	0.0	0.0	0.0	112.1	119.8	130.7
12	121751.54	53014.94	44022.51	0.00	0.00	0.00	*****	0.0	0.0	0.0	100.5	99.8	131.4

YEAR	YRTC	YROC	YRCC	YRSC	YRCGS	TC-CGS	INT EXP						
10	494084.80	0.00	3279.67	0.00	489805.13	4279.67	932.27	0.0	0.0	0.0	151.5	255.7	318.7

AVG	494174.24	0.00	3167.29	6.83	489805.13	374.17	942.07	0.0	0.0	1.1	166.4	267.3	330.3
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-----THIS IS DEMAND PATTERN 2-----

MONTH	CASH	AR	SALES	LOANS	ACCPAY	INTEXP	CP	NIT	SHORTAGE OF PHOS	POT	MAXIMUM INVENTORY OF NIT	PHOS	POT
1	46649.49	37630.40	30922.10	0.00	0.00	0.00	*****	0.0	0.0	0.0	300.0	300.0	450.0
2	75397.62	39333.68	33968.93	0.00	0.00	0.00	*****	0.0	0.0	0.0	229.3	245.3	384.6
3	31436.27	87560.94	86867.12	0.00	0.00	0.00	*****	0.0	0.0	0.0	155.1	280.6	335.6
4	15000.00	176541.10	174317.65	2123.99	0.00	17.46	105.90	0.0	0.0	0.0	152.8	231.7	329.1
5	74764.47	91927.94	56787.75	0.00	0.00	0.00	*****	0.0	0.0	0.0	139.2	286.5	292.2
6	132285.54	57456.48	34293.06	0.00	0.00	0.00	*****	0.0	0.0	0.0	124.1	223.1	240.4

24