FRUITS AND VEGETABLES

FOR THE DELTA

A STUDY OF ECONOMIC FEASIBILITY OF COMMERCIAL PRODUCTION AND PROCESSING OF THE PRODUCTS IN SOUTHEAST MISSOURI

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THE ECONOMIC FEASIBILITY OF COMMERCIAL FRUIT AND VEGETABLE PRODUCTION AND PROCESSING IN THE MISSOURI DELTA

By

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PREFACE

This research report presents the results of a study of the economic feasibility of processing fruits and vegetables in the Missouri Delta of Southeastern Missouri. The study was conducted in cooperation with the Economic Research Service, U. S. Department of Agriculture, as a result of a request for technical assistance made by the Missouri Commerce and Industrial Development Commission, Jefferson City, Mo., to the Economic Development Administration, U. S. Department of Commerce. The Economic Development Administration provided a substantial share of the costs of conducting the study.

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SUMMARY

An abundance of level productive land, unlimited water for irrigation, and large, well financed farm units provide the needed resources for vegetable production. The seven county Missouri Delta is undergoing rapid changes as a result of new agricultural technology and governmental farm programs. The area has traditionally been a cotton, cash grain producing area. Cotton acreage has declined 20 percent since 1950. Rapid adoption of mechanical cotton pickers and improved herbicides have greatly reduced the labor required on this declining cotton acreage. Therefore, fewer jobs are available in the area, particularly for the seasonal day labor.

Vegetable production and processing require the resources which the Missouri Delta appears to have in relatively large quantities. The purpose of this study was to determine the economic feasibility of producing fruits and vegetables and the practicability of establishing one or more processing plants in the area.

The production of green beans, leafy greens (spinach, mustard, kale, collards, and turnips), lima beans, and southern peas would be practical on many of the farms. Sufficient quantity of the raw products necessary to support a modern low cost processing plant would seem assured.

An expanded research and extension program in the area could increase yields above the conservative levels used in this analysis. This would contribute to the profitability of vegetable production and expand the potential quantity of raw product to meet the requirements of additional plants.

The feasibility of operating a freezing or canning plant was studied. Annual output of the freezing plant would be 14,475,000 pounds while the output of the canning plant would be 966,287 case equivalents of 24 number 303 cans. Capital requirements for the freezing plant are $1,530,872 for buildings and equipment and $1,165,000 for operating needs. The canning plant would require $693,148 for buildings and equipment and $855,000 for operating capital.

An analysis of costs and revenues for each plant indicates that net profit after taxes would be $126,943 for the freezing plant and $56,846 for the canning plant. The freezing plant would employ approximately 62 seasonal laborers and 33 full-time employees, including management, with an annual payroll of $258,990. The canning plant would employ 88 seasonal laborers and 18 full-time employees, including management, with an annual payroll of $244,398. In man-year equivalents, the freezing and canning plants employ 72 and 70 workers, respectively, in labor and management positions.

Production of the necessary vegetable raw materials would increase net and gross farm income of the area by almost $75,000 and $595,000, respectively.

Seasonal day laborers currently underemployed on farms in the area would be able to work an additional 102,000 hours in the production of vegetable crops. This would increase their income $61,200 annually.

The results of this study show that production and processing of vegetables are economically feasible. However, prospective processing plant investors should carefully reexamine all factors considered in this report before investing. Management capable of handling the problems of market entry, raw product procurement, and efficient plant operation is essential to the success of this investment.

THE ECONOMIC FEASIBILITY OF COMMERCIAL FRUIT AND VEGETABLE PRODUCTION AND PROCESSING IN THE MISSOURI DELTA

By James L. Pearson and Thomas G. Brown 1/

INTRODUCTION

The economy of the Missouri Delta is based primarily on agricultural production. Cotton is the main income producing crop. Cotton acreage has been declining since 1950 because of reductions in acreage allotments. Employment opportunities have declined with shrinking cotton acreage. Furthermore, the rapid adoption of mechanical cotton pickers, herbicides, and other new technology has sharply reduced the need for seasonal farm labor. The realization of these changes and their impact on the local economy prompted this study.

Characteristics of Area

The Missouri Delta is composed of seven counties -- Pemiscot, Dunklin, Butler, Stoddard, Scott, Mississippi, and New Madrid (Figure 1). These counties form a fairly homogeneous economic area in terms of soil, cropping patterns, and general socio-economic features. There are 2,119,000 acres of land in farms in the area, 83 percent of which is cropland. In 1959, the 13,239 farms had an average of 160 acres of land and 134 acres of cropland. Thirty-two percent of the farms had gross sales of $10,000 or more in 1959. 2/

The soils in the area are alluvial having been formed by the Mississippi, Ohio, and St. Francis Rivers. Approximately 50 percent of the soil is fine sandy loam and the other half ranges from light blow sand to heavy gumbo clays. The entire area is underlain with excellent water for irrigation at depths of less than 60 feet.

1/ Pearson is an agricultural economist, Marketing Economics Division, Economic Research Service, and assistant agricultural economist, Florida Agricultural Experiment Stations, Gainesville. Brown is an associate professor of agricultural economics, University of Missouri.

2/ U. S. Department of Commerce, Bureau of the Census, U. S. Census of Agriculture: 1959, Washington, D. C., 1961.

Figure 1. The Missouri Delta Area of Southeast Missouri

The region is a relatively new agricultural area, having been cleared from timber and drained during this century. Present land ownership patterns vary from large plantation type farms to small owner operated farms. Farm tenancy varies from 15.8 percent in Butler County to 64.2 percent in New Madrid County, but tenancy has been dropping rapidly during the past 20 years.

Total cropland has been expanding due to the clearing of additional land; however, further increases will be very small. Table 1 gives the acreage of cropland in total and for the major crops for selected years from 1930 to 1963. Amount of land devoted to cotton, corn, and hay production has declined significantly while soybean and wheat acreage has expanded materially.

Objectives of Study

This study had as one of its objectives the determination of the economic feasibility of commercial fruit and vegetable production for processing. Another objective was to ascertain the economic feasibility of establishing one or more canning or freezing plants to process fruits and vegetables grown commercially in the Missouri Delta area.

Research Methods

The approach used in this study was to bring together data from various informational sources relative to the production, processing, and marketing of fruits and vegetables. Based on this information, a group of products was selected for further analysis as to the economic feasibility of production and processing.

In the processing plant analysis, specifications for a freezing plant and canning plant were developed. Buildings, equipment, and variable input requirements were obtained in considerable detail. Costs and returns for the annual operation of each plant were computed, and after the deduction of corporate income taxes, the resultant profits provided the necessary measurement of processing feasibility, assuming sufficient quantity of raw product would be provided.

The production analysis was designed to determine if enough raw product could be produced in the area to supply the needs of the proposed processing plant. Linear programming was used to estimate the amount of raw product that could be produced on typical farms when operated most profitably.

SELECTION OF A FEASIBLE PRODUCT MIX

Fruits and vegetables have been grown in the Southeast Missouri Delta counties for several years. In general, the production has been for the fresh market; however, on various occasions producers have grown products for processors, both

TABLE 1.--ACREAGE OF MAJOR CROPS GROWN IN THE SEVEN SOUTHEAST MISSOURI DELTA COUNTIES, 1930-1963.

Year	Total Cropland	Cotton	Soybeans	Corn	Wheat	Hay	Other 1/
	1000 acres						
1930	1,253	2/	2/	469	90	99	595
1940	1,498	403	2/	374	82	208	430
1950	1,718	431	500	370	41	90	285
1960	1,775	410	840	300	167	46	13
1963	1,775	341	924	237	162	34	78

1/ Includes oats, pasture, fruits, vegetables, idle, etc.

2/ Not available.

Source: U. S. Census of Agriculture, 1930-1960, and the Missouri Farm Census - 1963.

with and without contracts. No fruit and vegetable processing facilities are located in the area at present.

Fruit and vegetable crops grown in and around the area in the last few years include the following:

asparagus	kale	squash
cantaloupes	lima beans	strawberries
cabbage	mustard	sweet corn
cauliflower	okra	sweet potatoes
collards	peaches	turnip greens
cucumbers	green beans	tomatoes
green peas	southern peas	watermelons
Irish potatoes	spinach	

To tentatively ascertain the feasibility of producing and processing each of the above products, various economic factors relating to production, processing, and marketing were considered. Information relevant for an evaluation of these products was obtained from growers, processors, horticultural specialists of the University of Missouri, and county agents in the Missouri Delta and adjoining areas of Arkansas, Tennessee, and Kentucky, in addition to published research reports. The major criteria used in evaluating each of these fruit and vegetable crops were:

1. Net returns per acre.
2. Amount of hand labor required to produce.
3. Susceptibility to climatic hazards.
4. Current production in the area.
5. Compatibility of the fruit and vegetable crops with cotton.
6. Experiences in nearby areas.
7. Harvest dates.
8. Similarities of processing operations.
9. Demand for finished product.

These criteria led to the elimination of almost two-thirds of the fruit and vegetable crops. Those remaining were green beans, lima beans, southern peas 1/, leafy greens (collards, kale, mustard, spinach, and turnip), and strawberries. These products were considered economically feasible to produce based on a fairly cursory evaluation. The products meet the selection criteria for processing reasonably well. However, strawberry and leafy greens harvest dates conflict. Since a considerable quantity of unused strawberry processing capacity was available close to the area, the decision was made to omit strawberries from the processing portion of the analysis.

1/ Southern peas are also referred to as field peas and cow peas. Included in the southern pea category are blackeye, crowder, cream, and purple hull peas.

The proposed product mix fits very nicely into the cropping system of the area. Vegetable crops can be double-cropped with wheat, soybeans, or another vegetable. Since only the vegetable crops are to be considered in the processing plant analysis, the product mix is well suited for canning or freezing. A processing plant of either type will require three preparation equipment lines. Lima beans and southern peas can be processed on the same equipment. All of the leafy greens can be run on one line, leaving green beans to be run on the third line. If it is not essential that each line be independent in its operation from all other lines, part of the equipment may be utilized more fully by using it in processing more than one product. This provides a means of reducing the size of investment and processing costs.

An important determinant of processing feasibility is the length of operating season. The proposed product mix affords an eight-month processing season. Approximate harvest dates are as follows:

Crop	Harvest Date
Spring leafy greens	March 16 - June 30
Spring green beans	June 1 - June 30
Green lima beans	July 1 - August 31
Southern peas	August 1 - September 15
Fall green beans	October 1 - October 31
Fall leafy greens	September 1 - November 15

Harvest dates overlap and operating time must be allocated if the processing lines are not designed to operate independently.

Each of the products has a fairly strong demand either nationally or regionally. Green beans, lima beans, and some of the leafy greens are more closely identified with the national market. Southern peas and leafy greens, such as collards, are identified more closely with the southern market and are important consumer items in this region. Green beans, lima beans, southern peas, and most of the leafy greens are also very strong items in the institutional trade. A plant located in the Missouri Delta should concentrate its primary sales efforts in Missouri and the nearby states of Arkansas, Mississippi, Alabama, Tennessee, Kentucky, and Illinois. These states offer the greatest market potential from the standpoint of transfer costs and location of other processors.

PRODUCTION ANALYSIS

General Approach

The success of a commercial fruit and vegetable processing plant is dependent to a large degree on the stable production of the raw fruit and vegetable products in the area. These crops must provide returns which are competitive with other enterprise alternatives available to the region's farmers.

To determine if it would be profitable for farmers in the Missouri Delta to grow the fruit and vegetable crops which were included in the processing mix, a linear program analysis was conducted. 1/ Profit-maximizing organizations were computed for representative farms in the area with the alternatives of growing cotton, corn, soybeans, wheat, fruits, and vegetables.

The amount of fruits and vegetables included in the profit-maximizing farm organization for these representative farms was expanded into an aggregate production for the area. This aggregate production represents the theoretical maximum quantity of fruits and vegetables that would be produced if each farm was operated to maximize profits under the assumed price relationships. Recognition must be given to the fact that many farms would not produce fruits and vegetables while those that produced might not grow the profit-maximizing quantities. But this aggregate production of each fruit and vegetable can serve as a basis for estimating whether an adequate quantity of raw product would be available to meet the needs of the proposed plant.

Selection of Study Area

Not all of the 1,775,479 acres of cropland in the Missouri Delta is suited to the growing of fruits and vegetables. A detailed study was made to determine the townships which contained soils of which at least 75 percent of the acreage was suited to the production of the fruits and vegetables in the proposed processing mix. Soil specialists of the University of Missouri, Soil Conservation Service personnel, and County Extension Staffs assisted in selecting the townships for the study. The criteria used were:

1. Soil exchange capacity greater than six. 2/
2. Light to medium textured soils.
3. Open, permeable, well-drained subsoil.
4. Land protected from over-flow.
5. Soils that can be satisfactorily irrigated.

Eleven townships were selected. They were Buffalo, Cotton Hill, Freeborn, and Salem, in Dunklin County; Long Prairie and St. James in Mississippi County; Big Prairie and Le Sieur in New Madrid County; Cooter and Little Prairie in Pemiscot County; and Sandywood in Scott County (Figure 2).

In the eleven townships there are 343,692 acres of farm land; 310,234 acres are cropland. There are 1,699 farms, but 894

1/ Linear programming is a formal method of allocating farm resources among various enterprise alternatives in order to maximize returns to the owned resources.

2/ A measure of a soils capacity to hold cations.

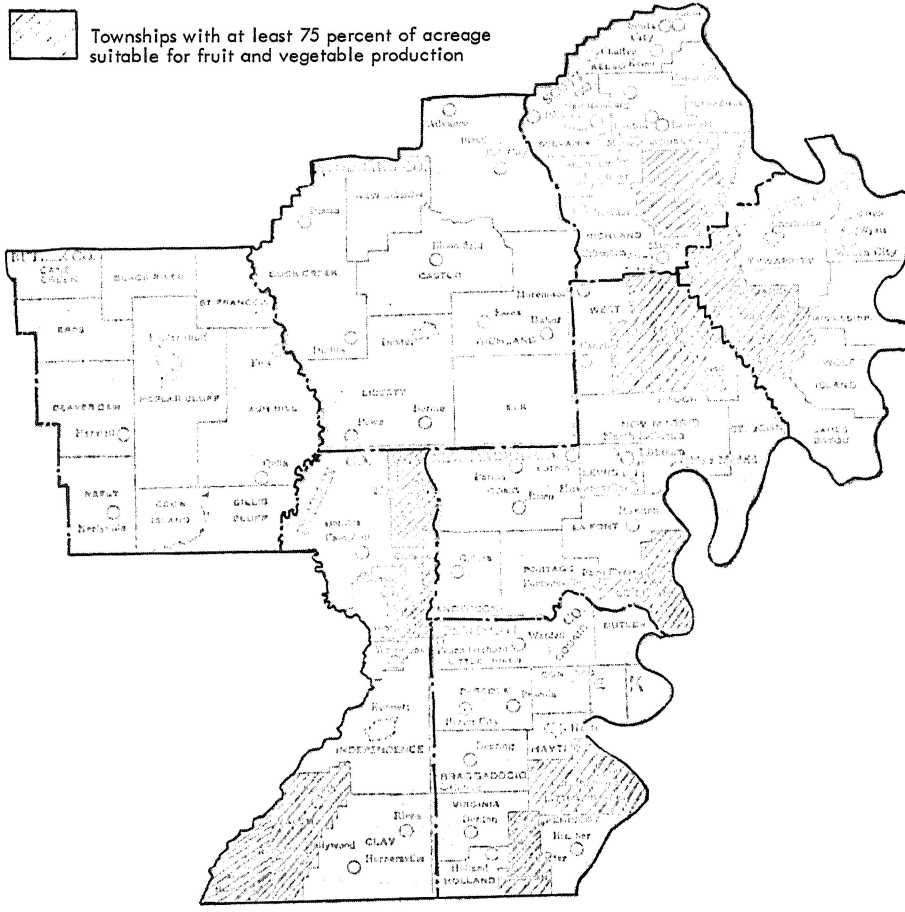

Figure 2. Missouri Delta Area Townships

farms with 100 or more acres of cropland contain 89 percent of the cropland. It is hypothesized that commercial fruit and vegetable production will be concentrated on larger farms. The reasons for this are:

1. The vegetables in the processing mix will require expensive harvesting machines which can be justified only on large acreage.
2. Processing firms must exercise strict control over varieties, planting and harvesting dates, cultural practices, and insecticides used.

Three representative farm situations were developed to be typical of the 894 farms in the 11 townships that had more than 100 crop acres. Table 2 gives a description of the resources available for each of three sizes of representative farm situations.

Programming Optimal Farm Plans

Optimal farm plans were computed for the three different sizes of representative farms. Enterprise activities were limited to the major field crops grown in the area and the selected fruits and vegetables included in the processing mix. The different enterprise alternatives which were included in the programming model were:

Corn
Cotton
Soybeans
Wheat
Wheat and double-crop soybeans
Spring greens and fall green beans
Spring green beans and fall greens
Spring green beans and soybeans
Spring greens and lima beans
Wheat and southern peas
Strawberries
Lima beans
Spring greens and southern peas
Spring and fall greens
Spring green beans and lima beans
Spring and fall green beans

Livestock activities have not been included in the programming model because the farms in the study area are almost exclusively cash crop farms. Resources necessary for producing the vegetable crops are now allocated to the production of field crops.

Capital restrictions, both operating and investment, were established for each farm. Borrowing was permitted to supplement both kinds of capital. The amount of borrowing was limited by the equity position of the farm's real estate for investment capital and machinery, and cash for operating capital.

TABLE 2.--AVERAGE AMOUNTS OF RESOURCES AVAILABLE ON THREE SIZES OF FARMS IN SELECTED TOWNSHIPS, MISSOURI DELTA, 1964.

Resource	Unit	Farm Size Groups		
		Small third	Medium third	Large third
Cropland	Acres	147.0	308.1	612.7
Operator's labor:				
Jan-Mar	Hours	533.2	1,045.4	1,180.8
Apr-May	Hours	695.1	1,127.6	1,742.8
June-July	Hours	916.6	1,609.0	1,836.3
Aug-Sept	Hours	776.6	1,379.0	1,512.3
Oct-Nov	Hours	723.5	1,582.4	1,747.2
Dec	Hours	135.7	284.0	278.0
Seasonal labor per month	Hours	338.5	733.5	1,660.6
Cotton allotment	Acres	26.4	77.5	159.2
Wheat allotment	Acres	19.6	34.9	47.3
Corn base	Acres	50.2	61.3	102.1
Irrigated cropland	Acres	9.3	23.9	12.2
Operating capital available	Dollars	15,818.00	22,304.41	51,446.00
Limit on borrowing operating capital	Dollars	7,137.00	7,127.20	21,142.18
Investment capital available	Dollars	19,206.00	26,375.63	64,196.88

Two kinds of labor restrictions were set -- operator and seasonal. Each kind of labor was divided into the following six time periods:

1. January, February, March
2. April, May
3. June, July
4. August, September
5. October, November
6. December

The operator labor classification included operator, family, and regular hired labor. The seasonal labor classification included day labor usually employed for chopping and irrigating. Seasonal labor could be hired but could not exceed the amount hired in 1964.

The raw product prices used in the study were average prices received by farmers in the area during 1964. If a commodity was not produced in the area in 1964, typical prices received by farmers in nearby producing areas were used (Table 3).

Detailed cost and return budgets were prepared for each crop enterprise included in the programming model. Growers in the area were interviewed to obtain this information. Since lima beans and greens were not produced in large quantities in the area, growers in West Tennessee were interviewed to obtain the needed information. Appendix Tables I through VI give enterprise budgets for these crops.

Optimal Farm Organization

The results of the linear programming analysis are reported in Tables 4, 5, and 6, showing the optimum farm organizational plans for the different representative farms.

The optimal farm organization for the small farm contained 26.4 acres of cotton (Table 4), the maximum acreage that could be grown under allotment. Three of the vegetable crops were included. These were spring and fall green beans, 89.2 acres; spring and fall greens, 29.3 acres; and spring greens and lima beans, 2.0 acres. The addition of the vegetable crop alternatives increased the net revenue $2,684 or 29 percent above the 1964 level.

The optimal plan for the medium size farm included 77.5 acres of cotton. Vegetable crops replaced the other field crops (Table 5). Spring and fall green beans came in very strong at 155.5 acres. Spring and fall greens used 72.5 acres and spring greens and fall green beans filled in the last 2.6 acres. The optimal organization with vegetables increased the net revenue on the medium size farm by $5,053 or 24 percent above the 1964 level.

The optimal plan for the large farm increased net revenue $8,074 or 18 percent above the 1964 level (Table 6). This resulted

TABLE 3.--PRICES USED IN THE FARM PRODUCTION ANALYSIS, MISSOURI DELTA, 1964.

Item	Unit	Price
Corn	Bushel	$ 1.19 1/
Wheat	Bushel	1.32 1/
Soybeans	Bushel	2.60 1/
Cotton lint	Pound	.303 1/
Cotton seed	Pound	.0225 1/
Strawberries	Pound	.148 1/
Green beans	Ton	110.00 2/, 3/
Lima beans	Ton	140.00 2/, 4/
Southern peas	Ton	85.00 1/
Greens (kale, turnip, collard, mustard)	Ton	25.00 2/
Spinach	Ton	45.00 2/

1/ Average price received by farmers from local dealers and nearby processors.

2/ Typical price received by farmers in nearby producing areas.

3/ The price of $110 per ton for green beans represents the gross cost to the processor. Growers are customarily paid a cash price plus being provided some of the inputs of production, e.g., seed and harvesting services, by the processor. In these budgets, the payments to growers per ton were cash $69, seed $21, and harvesting $20.

4/ Price paid growers was $140 per ton shelled basis; however, cost per ton for the processor was estimated at $160 since approximately $20 of the harvesting costs were borne by the processor.

TABLE 4.--CURRENT AND OPTIMAL FARM ORGANIZATION WITH VEGETABLE ALTERNATIVES FOR THE SMALL SIZE REPRESENTATIVE FARM, MISSOURI DELTA.

	Current	Optimal
Net revenue 1/	$9,045	$11,729
	acres	
Crops produced:		
Cotton	26.4	26.4
Corn - participating in feed grain program	39.2	--
Corn - idle acres diverted under feed grain program	9.8	--
Wheat	9.3	--
Wheat and double-crop soybeans	31.8	--
Single-crop soybeans	30.4	--
Spring and fall greens	--	29.3
Spring and fall green beans	--	89.2
Spring greens and lima beans	--	2.0
Total acres	146.9	146.9

1/ Net revenue is the return to the fixed factors of land, all labor except seasonal labor, management, and investment capital.

TABLE 5.--CURRENT AND OPTIMAL FARM ORGANIZATION WITH VEGETABLE ALTERNATIVES FOR THE MEDIUM SIZE REPRESENTATIVE FARM, MISSOURI DELTA.

	Current	Optimal
Net revenue 1/	$20,409	$25,462
	acres	
Crops produced:		
Cotton	77.5	77.5
Corn - participating in feed grain program	49.0	--
Corn - idle land diverted under feed grain program	12.3	--
Wheat	16.7	--
Wheat and double-crop soybeans	81.8	--
Single-crop soybeans	70.4	--
Spring greens and fall green beans	--	2.6
Spring and fall greens	--	72.5
Spring and fall green beans	--	155.5
Total acres 2/	307.7	308.1

1/ Net revenue is the return to the fixed factors of land, all labor except seasonal labor, management, and investment capital.

2/ Difference in total acres due to rounding.

TABLE 6.--CURRENT AND OPTIMAL FARM ORGANIZATION WITH VEGETABLE ALTERNATIVES FOR THE LARGE SIZE REPRESENTATIVE FARM, MISSOURI DELTA.

	Current	Optimal
Net revenue 1/	$42,514	$50,588
	acres	
Crops produced:		
Cotton	159.2	159.2
Corn - participating in feed grain program	84.1	--
Corn - idle acres diverted under feed grain program	21.0	--
Wheat	9.4	--
Wheat and double-crop soybeans	153.1	--
Single-crop soybeans	185.9	--
Spring and fall greens	--	85.1
Spring and fall green beans	--	357.3
Spring greens and lima beans	--	11.1
Total acres	612.7	612.7

1/ Net revenue is the return to the fixed factors of land, all labor except seasonal labor, management, and investment capital.

from switching all acreage in field crops, except cotton, to vegetables. Cotton remained at the allotment of 159.2 acres. Spring and fall green beans came in to the plan at 357.3 acres, spring and fall greens at 85.1 acres, and spring greens and lima beans at 11.1 acres.

Acreage and Production of Vegetables

The total acreage of vegetables which could be grown on the 894 farms in the study area, if they were all organized optimally, would be quite large. The reader should be cautioned that the linear programming analysis provides an estimate of the theoretical maximum. This is very useful in evaluating the potential of an alternative in an area because it gives the maximum attainable goal. If the needs of a plant are near this attainable goal, it would be questionable whether the alternative would be feasible. On the other hand, if the maximum attainable goal greatly exceeds the needs of a processing plant, we can be much more confident that the supply of raw product can be maintained.

Spring and fall leafy greens and green beans were included in the optimal plans of all three sizes of representative farms in very large amounts. The theoretical maximum acreages were: leafy greens, 116,071 acres; green beans, 359,567 acres; and lima beans, 3,904 acres. Lima beans, unlike the leafy greens and green beans, were not included in the optimal plans in large quantities. This can be easily explained. Lima beans require approximately 33 hours of seasonal labor per acre during the May to August period. This is also the period when cotton requires seasonal labor for chopping. Since cotton proved to be a more profitable crop, the quantity of seasonal labor which was available on the farm in 1964 was used in producing cotton first. Only surplus seasonal labor above that needed for cotton was available for lima beans.

The acreage of lima beans included in the optimal plan for medium size farms varies considerably when the amount of seasonal labor is varied (Table 7). Lima beans did not come into the optimal farm organization for medium size farms until seasonal labor was increased above the 1964 levels by 20 percent. With this amount of seasonal labor, 11.8 acres of limas were included. When seasonal labor was increased 50 percent, lima bean acreage rose to 24.2 acres; and with unlimited seasonal labor, 210.5 acres of lima beans were in the most profitable farm organization.

The inclusion of lima beans in the optimal plan depends on the quantity of seasonal labor available. There must be seasonal labor in excess of the amount needed by cotton. The medium size farm could have paid $1.44 per hour for additional seasonal labor during June and July. The going rate was $0.60 in 1964.

Indications are that an adequate amount of local seasonal labor is available in the area. During 1964, a total of 59,573 seasonal worker placements were made by the Missouri State

TABLE 7.--OPTIMAL FARM ORGANIZATION FOR MEDIUM SIZE FARMS WITH VARYING LEVELS OF SEASONAL LABOR, MISSOURI DELTA.

Product	Seasonal Labor Availability Based on 1964 Rates of Use				
	None used	Same as 1964	20 Percent increase	50 Percent increase	Unlimited
Net revenue 1/	$16,267	$25,462	$25,738	$26,043	$31,688
	acres				
Crops produced:					
Cotton		77.5	77.5	77.5	77.5
Corn	51.1	--	--	--	--
Wheat and double-crop soybeans	246.5	--	--	--	--
Spring and fall green beans	--	155.5	132.7	107.6	--
Spring greens and lima beans	--	--	1.9	--	22.4
Spring and fall greens	--	72.5	85.8	98.5	6.8
Spring green beans and lima beans	--	--	9.9	24.2	188.1
Spring greens and fall green beans	--	2.6	--	--	--
Soybeans	--	--	--	--	13.6
Idle acres	10.5	--	--	--	--
Total acres 2/	308.1	308.1	307.8	307.8	308.4

1/ Net revenue is the return to the fixed factors of land, labor, management, and investment capital.

2/ Differences in total acres due to rounding.

Employment Service. The number was approximately one-third below 1963. This reduction was primarily attributed to mechanization of cotton chopping and picking. As a result of there being fewer jobs available in the area, 6,000 workers were placed in other states. This number compares with 1,050 placed in other states during 1963. 1/

Consideration of Crops not in Optimal Plans

Two of the five fruit and vegetable crops in the selected processing mix were not included in any of the optimal plans. These were strawberries and southern peas. One of the advantages of a linear programming analysis is that you are able to ascertain the additional income needed per acre from a crop before it would be included in the optimal plan.

Strawberries would require a large increase in income before they would be included in the profit maximizing plans. An increase of $177.55 per acre would be needed on the small farms, while $202.48 and $198.18 would be required on the medium and large farms, respectively. Price and/or yield would have to be increased considerably above the levels used in the study before they would be profitable. It appears from this analysis that no major expansion of strawberry production for processing could be expected from the area.

The additional net income per acre needed from southern peas before they could have been included was $12.02, $7.98, and $7.51 on small, medium, and large farms. This would be equivalent to 168 pounds of southern peas per acre or a 14 percent increase in yield for the large farms.

Southern pea production for processing has been expanding recently in the Missouri Delta. The estimated production was 350 acres in 1963, 550 acres in 1964, and 750 acres in 1965. The apparent inconsistency between the programming analysis and what is happening in the area can easily be explained. The more productive soils predominated in the study area. On these soils, double-crop soybeans prove to be a more profitable alternative. Yet, on the lighter sand, southern peas are more profitable than soybeans. The production coefficients for southern peas used in the analysis were developed on farms located almost entirely on the lighter sandy soils; therefore, the coefficients underestimate production on the better soils.

1/ 1964 Missouri Annual Farm Labor Report.

PROCESSING ANALYSIS

General Approach

The approach used was to select hourly capacity rates for the freezing and canning plants based upon information available from the industry and related studies by other researchers. Next step was to develop specifications for the buildings and equipment necessary to process the proposed product mix into the various container sizes and types of finished products. Input requirements were then determined on an hourly and annual basis. Costs of inputs and prices of finished products were obtained. Investment in buildings and equipment, along with annual operating costs and returns for the expected outputs, were then estimated. After deduction of state and federal corporate income taxes, the amount and rates of profits were obtained for each type of plant.

Plant Specifications

Assumptions.--Input requirements and cost estimates for processing the proposed product mix in a freezing plant and a canning plant were subject to the following assumptions:

1. The three basic product lines are not operated independently; consequently, only one product can be processed at a time.
2. All of the vegetable raw products are delivered to the plant.
3. Lima beans, southern peas, and green beans are harvested with a green and lima bean harvester using bulk pallet boxes for plant delivery.
4. When the harvest period for leafy greens conflicts with green beans, no processing time is allocated to leafy greens during the conflicting period.
5. Plant capacity and labor are used efficiently.
6. Plants operate on a seven-day week basis when product is available and average five days per week during the harvest season. Two 10-hour shifts can be used when practical from a production and marketing standpoint.
7. Fixed costs can be allocated equitably to individual products on a proportion of pack basis.
8. Total output is divided among container sizes in accordance with current market demand of approximately 75 percent retail and 25 percent institutional.
9. Finished product sales are uniformly distributed throughout the year with adequate storage provided for the inventory.

Size.--Equipment manufacturers, processors, engineers, and other industry representatives, along with related research reports

were consulted in arriving at hourly capacity rates for each of the plants. Factors affecting this decision included the product mix, container sizes, and expected annual hours of operation in total and by individual product.

The expected hourly output of the freezing plant was set at 6,000 pounds for lima beans, southern peas, and green beans, while the leafy greens line was set at 4,500 pounds. Expected hourly rate of output for the canning plant in 24 number 303 can case equivalents was set at 365 cases for lima beans and southern peas, 475 cases for green beans, and 265 cases for leafy greens. Each of these output rates reflects at least a 10 percent allowance for unavoidable delays and abnormal product quality.

Freezing Plant Costs and Returns

Operation.--The freezing plant considered in this study is designed to receive lima beans, southern peas, and green beans in bulk pallet boxes (Figure 3). These products pass through standard preparation equipment and are frozen I.Q.F. (individually quick-frozen). Freezing of these products actually begins in a refrigerated flume as they are being conveyed from the preparation line to the fluidized bed freezer. After freezing, the I.Q.F. product is conveyed pneumatically to any of the packaging lines or dumped directly into bulk pallet containers that hold 1,200 to 1,400 pounds of product. The products are then placed in freezer storage.

Packaging of I.Q.F. is done by taking the product direct from the freezer or by removing it in bulk containers from storage. I.Q.F. products may be packaged in institutional cartons, retail cartons, and polyethelene bags. The carton lines are completely automatic except that the case filling operation is manual. The poly bag line is a manual operation intended to meet minimal market requirements of 10 to 15 percent of the retail pack.

Leafy greens are received in bulk and manually unloaded directly onto the processing line. Processing is done on standard preparation equipment. The product moves directly from the preparation line to the packaging line in leaf or chopped form. Most of the equipment used in the packaging line is taken from the I.Q.F. institutional package line. Cartons are formed, closed, check weighed, and overwrapped by automatic machines but are filled by hand. This line can handle retail or institutional cartons except that an additional overwrap machine is required for the retail carton.

The filled cartons of leafy greens are placed in racks manually and then transported to the tunnel or blast freezer. After they are frozen, the racks of greens are transported to the casing line where they are emptied and the product cased and palletized for freezer storage.

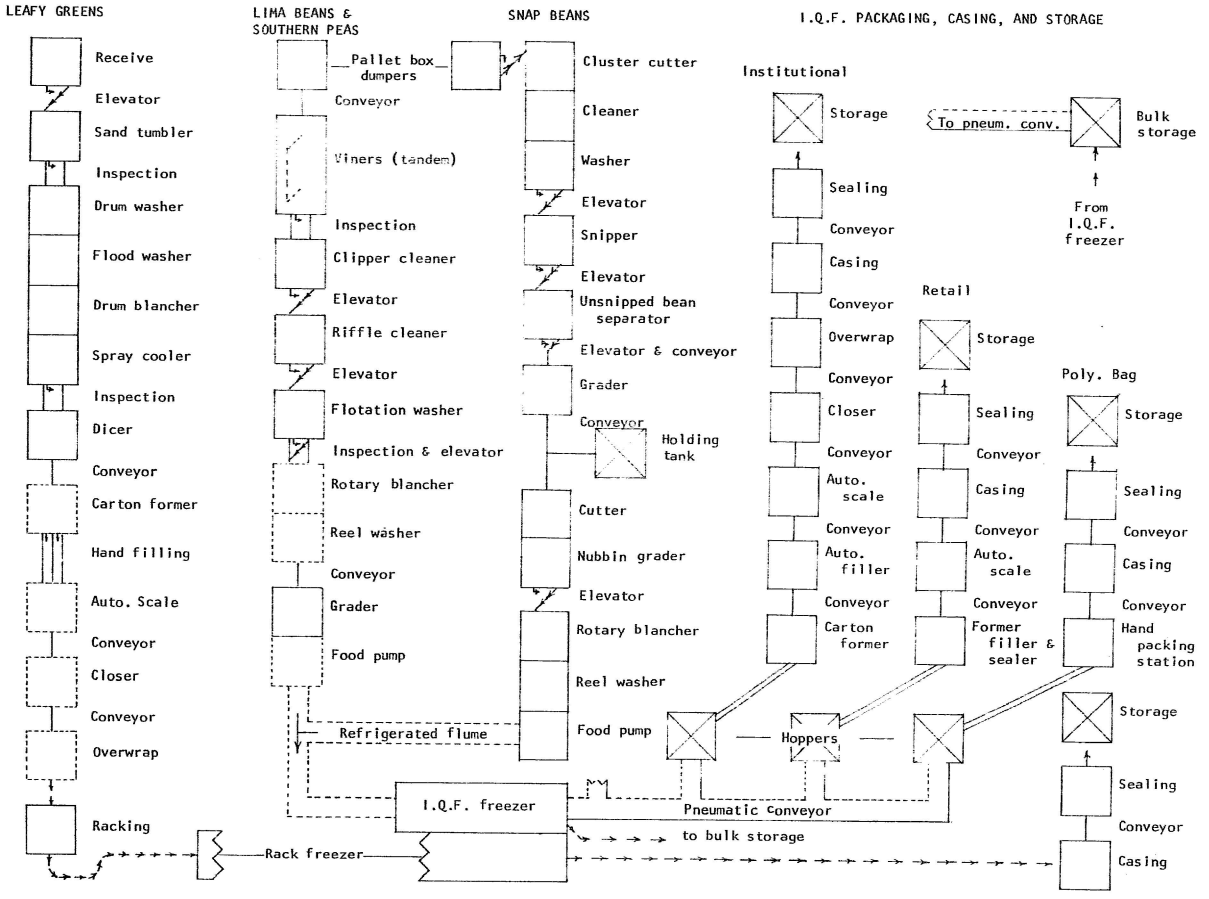

Figure 3. Stages of Preparation, Freezing, Packaging, Casing, and Storage of Lima Beans, Southern Peas, Snap Beans, and Leafy Greens.

Expected annual output of the freezing plant operating 2,630 hours is 14,475,000 pounds. This is composed of 4,320,000 pounds of lima beans, 960,000 pounds of southern peas, 5,280,000 pounds of green beans, and 3,915,000 pounds of leafy greens. This amount of product would require 8,685 tons of raw product based on the assumed finished product yields for each of the vegetables (see Table 8).

Investment in Buildings and Equipment 1/.--All building and equipment requirements were itemized. This permitted a detailed compilation of the replacement costs of all components. The total investment required for the freezing plant would be approximately $1,530,872. About 40 percent of this is needed for buildings with the balance going for machinery and equipment (Table 9).

All buildings and equipment are assumed to be new with the exception of four stationary viners. Replacement costs for these are based on rebuilt viners adapted for shelling lima beans and southern peas after the pods have been removed from the vine. Except for the freezer storage and office buildings, reinforced concrete floors, concrete block walls, and insulated metal roofs with structural steel supports were specified. The office building is of masonry construction with finished interior walls and air conditioning. Building costs include plumbing, electrical wiring, lighting, heating, and ventilation. Replacement costs for machinery and equipment include charges for transportation and installation.

Fixed and Variable Costs.--Annual fixed costs for the freezing plant are $247,680 (Table 10). These overhead costs are depreciation on buildings and equipment, interest on average annual investment in buildings and equipment, taxes, and insurance.

Variable costs, or the direct expenses of raw product, processing, transportation, and sales for the expected annual pack, total $2,344,551. This category includes all variable costs. After raw product, the largest expenditure among these items of variable costs is for packaging material. Boxes for the retail and institutional pack, overwrap, polyethelene bags, I.Q.F. bulk container liners, and shipping cartons are included in packaging. These costs are followed by labor costs, transportation costs for distribution of finished product, and sales expenses, in that order. (See Table 10 for breakdown of fixed and variable costs by individual products).

1/ No attempt has been made to include land costs. Sites were available in the area for a processing plant at varying costs when this study was made. Architectural, engineering, and legal fees, if any, connected with the initial investment were not included in the investment cost estimates.

TABLE 8.--FREEZING PLANT - ANNUAL OPERATING TIME, RAW PRODUCT REQUIREMENTS, FINISHED PRODUCT YIELD AND OUTPUT FOR PROCESSING SELECTED VEGETABLES, MISSOURI DELTA, 1965.

Product	Expected Operating Days 1/	Hours Per Day	Hours Operated Annually	Expected Raw Product Requirements 2/		Finished Product Yield	Expected Output Rates of Finished Product	
				Hourly	Annually		Hourly	Annually
				tons	tons	percent	pounds	pounds
Lima beans	36	20	720	3.15 3/	2,268	96	6,000	4,320,000
Southern peas	8	20	160	3.15 3/	504	96	6,000	960,000
Green beans	44	20	880	4.05	3,564	74	6,000	5,280,000
Leafy greens	87	10	870	2.70	2,349	83	4,500	3,915,000
Total	175	--	2,630	--	8,685	--	--	14,475,000

1/ Assumes an average operating week of five days.

2/ Ninety percent of rated capacity. Loss of 10 percent assumed due to unavoidable delays and abnormal product quality.

3/ Shelled basis.

TABLE 9.--FREEZING PLANT - INVESTMENT IN BUILDINGS AND EQUIPMENT FOR PROCESSING SELECTED VEGETABLES, MISSOURI DELTA, 1965.

Item	Size, Capacity, or Number	Replacement Cost	Allocation of Replacement Cost by Product 1/			
			Lima beans	Sou. peas	Green beans	Leafy greens
		dollars				
Buildings:						
Processing 2/	100' x 228' x 14'	122,046	36,370	8,055	44,547	33,074
Freezer storage	200' x 150' x 20'	360,000	107,280	23,760	131,400	97,560
Dry storage	60' x 100' x 20'	22,140	6,598	1,461	8,081	6,000
Packaging I.Q.F.	40' x 100' x 14'	16,000	4,768	1,056	5,840	4,336
Boiler & mech.	50' x 75' x 14'	13,838	4,124	913	5,051	3,750
Refrigerated dock	1800 sq. ft.	13,000	3,874	858	4,745	3,523
Office	60' x 60'	30,000	8,940	1,980	10,950	8,130
Well, building, pump, and tank	400 gpm	21,000	6,258	1,386	7,665	5,691
Truck scale	50 ft.	14,000	4,172	924	5,110	3,794
Other	--	5,000	1,490	330	1,825	1,355
Subtotal		617,024	183,874	40,723	225,214	167,213
Equipment:						
Preparation	--	210,132	39,744	8,843	129,234	32,311
Freezing	--	239,000	71,575	15,925	87,500	64,000
Refrigeration	--	221,000	65,858	14,586	80,665	59,891
Packaging & casing 3/	--	117,307	28,375	6,319	34,673	47,940
Boiler	90 bhp	13,620	4,059	899	4,971	3,691
Fork trucks	2	18,317	6,484	1,429	7,913	2,491
Trucks	2	5,500	1,639	363	2,008	1,490
Pallets	5,500	19,250	5,737	1,270	7,026	5,217
Pallet boxes	360	4,446	1,818	405	2,223	--
Bulk I.Q.F. cont.	4,892	32,776	13,405	2,983	16,388	--
Pallet racks	--	15,000	4,470	990	5,475	4,065
Other 4/	--	17,500	5,215	1,155	6,388	4,742
Subtotal		913,848	248,379	55,167	384,464	225,838
Total		1,530,872	432,253	95,890	609,678	393,051

1/ Allocation based on proportion of pack involved.

2/ Includes preparation, freezing, and leafy greens packaging and casing.

3/ Some equipment leased.

4/ Includes office, shop, laboratory, and sewage equipment.

TABLE 10.--FREEZING PLANT - FIXED AND VARIABLE COSTS FOR PROCESSING SELECTED VEGETABLES, MISSOURI DELTA, 1965.

Cost Category	Lima Beans	Southern Peas	Green Beans	Leafy Greens	Total
	dollars				
Fixed costs:					
Buildings 1/	12,264	2,716	15,022	11,153	41,155
Equipment 1/	31,359	6,980	48,451	29,414	116,204
Interest 2/	12,918	2,867	18,189	11,952	45,926
Taxes & Insurance 3/	12,488	2,771	17,582	11,554	44,395
Total fixed costs	69,029	15,334	99,244	64,073	247,680
Variable costs:					
Processing:					
Management 4/	12,380	2,742	15,163	11,258	41,543
Labor 4/ - seasonal	25,342	5,584	32,214	44,241	107,381
- other	31,589	7,044	38,633	32,800	110,066
Packaging material	151,596	33,688	185,284	126,341	496,909
Utilities, fuel, & gasoline	10,739	2,386	15,626	12,452	41,203
Insurance & inventory taxes 5/	11,764	2,724	12,061	2,856	29,405
Maintenance & repairs 6/	15,142	3,363	22,506	14,024	55,035
Product damage 7/	9,677	2,093	11,035	5,481	28,286
Interest on operating capital 8/	25,910	5,819	29,521	8,567	69,817
Miscellaneous 9/	23,053	4,948	26,704	14,636	69,341
Subtotal	317,192	70,391	388,747	272,656	1,048,986
Raw product 10/	362,880	85,680	392,040	68,125	908,725
Transportation 11/	64,800	14,400	79,200	58,725	217,125
Sales 12/	58,061	12,557	66,211	32,886	169,715
Total variable costs	802,933	183,028	926,198	432,392	2,344,551
Total	871,962	198,362	1,025,442	496,465	2,592,231

Footnotes on following page.

Footnotes, TABLE 10.

1/ Depreciation computed at 6.67 percent of replacement costs for buildings and 12.5 percent for equipment.

2/ Interest on investment computed at three percent of replacement cost.

3/ Taxes computed at 1.4 percent of replacement costs for buildings and equipment. Insurance computed at 1.5 percent of building and equipment replacement costs.

4/ Includes fringe labor costs at 9.5 percent of payroll where applicable.

5/ Inventory taxes computed at 1.4 percent of December 31 inventory. Insurance computed at 1.5 percent of average monthly inventory value.

6/ Maintenance costs estimated at 1.5 percent of replacement cost of buildings and equipment. Repair costs estimated at 0.4 percent of equipment replacement cost per 100 hours of annual operation.

7/ Estimated at one percent of annual pack.

8/ Assumes inventory turnover once annually. Interest estimated at six percent of gross value of average month's inventory.

9/ Office supplies, telephone, janitorial supplies, and contingencies estimated at two percent of annual gross revenue. Also includes inspection fees and glycol.

10/ Prices per ton of raw product delivered to the plant were $160 for lima beans (shelled basis), $170 for southern peas (shelled basis), $110 for green beans, $45 for spinach, and $25 for other leafy greens.

11/ Estimated at 1.5 cents per pound of annual pack.

12/ Estimated at six percent of annual gross revenue.

Operating Capital.--An item that is extremely important to any business venture but frequently overlooked in planning is operating capital. Assuming that sales are evenly spread over a 12-month period, the amount of operating capital required is largely equal to the cost of producing the average monthly inventory of finished product. However, since it must also cover any advances to raw product producers, inventories of supplies, accounts receivable, and contingencies, gross value of the average monthly finished product inventory appears to be a better measure of operating capital requirements than is cost. Average monthly operating capital needs would be around $1,165,000. In the course of a year, the range would be from a low of $373,000 for the month of May to a high of $1,685,000 for the month of October.

Gross Revenue.--Expected gross revenue for the proposed freezing plant totals $2,828,580 and is based on delivered product prices. The prices used are those generally prevailing in the south for nonadvertised brands (Table 11).

Net Revenue.--Net revenue was derived by subtracting from the gross revenue the costs of raw product, processing, selling, and transportation. Based upon the cost and revenue estimates made in this study, net revenue for the freezing plant is $236,349 (Table 12). Expressed as a percent of investment and operating capital, this is a net profit rate of nine percent per annum prior to the deduction of any state or federal income tax.

Canning Plant Costs and Returns

Operations.--Raw product is received in the same fashion as indicated for the freezing plant. The preparation line for green beans was changed slightly to handle whole green beans in addition to the cuts (Figure 4). After each product has gone through the preparation line, it is conveyed to a common can filling area. Product is placed in 303 cans, number 10 cans, or both by means of hand pack fillers. These are the most important can sizes for this product mix.

Filled cans are cooked in vertical retorts and then cooled in a water cooling canal. Next they are labeled and cased or placed bright (unlabeled) in unsealed cases, palletized, and then stored. Cans placed in cases bright are removed from storage and labeled as sales are made.

Expected annual output of the canning plant operating 2,630 hours is 966,287 case equivalents of 24 number 303 cans (Table 13). A major share of this is green beans with 415,978 cases, followed in order by lima beans with a pack of 262,773 cases, leafy greens with 229,142 cases, and southern peas with 58,394 cases. This size pack would require 8,685 tons of raw product based on the assumed number of cases packed per ton of farm weight.

TABLE 11.--FREEZING PLANT - PRICES AND GROSS REVENUE FROM PROCESSING SELECTED VEGETABLES, MISSOURI DELTA, 1965 1/

Product	Total Pack	Retail				Institutional		Total Revenue
		Box		Bag				
		Percent of pack	Price per lb.	Percent of pack	Price per lb.	Percent of pack	Price per lb.	
	1000 lb.		dollars		dollars		dollars	dollars
Lima beans	4,320	65	.23	10	.22	25	.21	967,680
Southern peas	960	65	.23	10	.21	25	.19	209,280
Green beans	5,280	65	.22	10	.21	25	.18	1,103,520
Spinach	783	75	.15	0	--	25	.11	109,620
Leafy greens	3,132	75	.15	0	--	25	.11	438,480
Total	14,475	--	--	--	--	--	--	2,828,580

1/ Prices include transportation charges. Price data were obtained from Quick Frozen Foods, Vols. 25-28, E. W. Williams Publications, Inc., New York, New York, 1962-1965; brokers; processors; and retail chains.

TABLE 12.--FREEZING PLANT - TOTAL COSTS, GROSS REVENUE, AND NET REVENUE FOR PROCESSING SELECTED VEGETABLES, MISSOURI DELTA, 1965.

Product	Cost Item					Total Cost	Gross Revenue	Net Revenue
		Variable						
	Fixed 1/	Processing	Raw Product	Sales	Trans.			
	dollars							
Lima beans	69,029	317,192	362,880	58,061	64,800	871,962	967,680	95,718
Southern peas	15,334	70,391	85,680	12,557	14,400	198,362	209,280	10,918
Green beans	99,244	388,747	392,040	66,211	79,200	1,025,442	1,103,520	78,078
Spinach	12,815	54,531	21,150	6,577	11,745	99,293	109,620	10,327
Leafy greens	51,259	218,125	46,975	26,309	46,980	397,172	438,480	41,308
Total	247,681	1,048,986	908,725	169,715	217,125	2,592,231	2,828,580	236,349

1/ Excludes annual land charges.

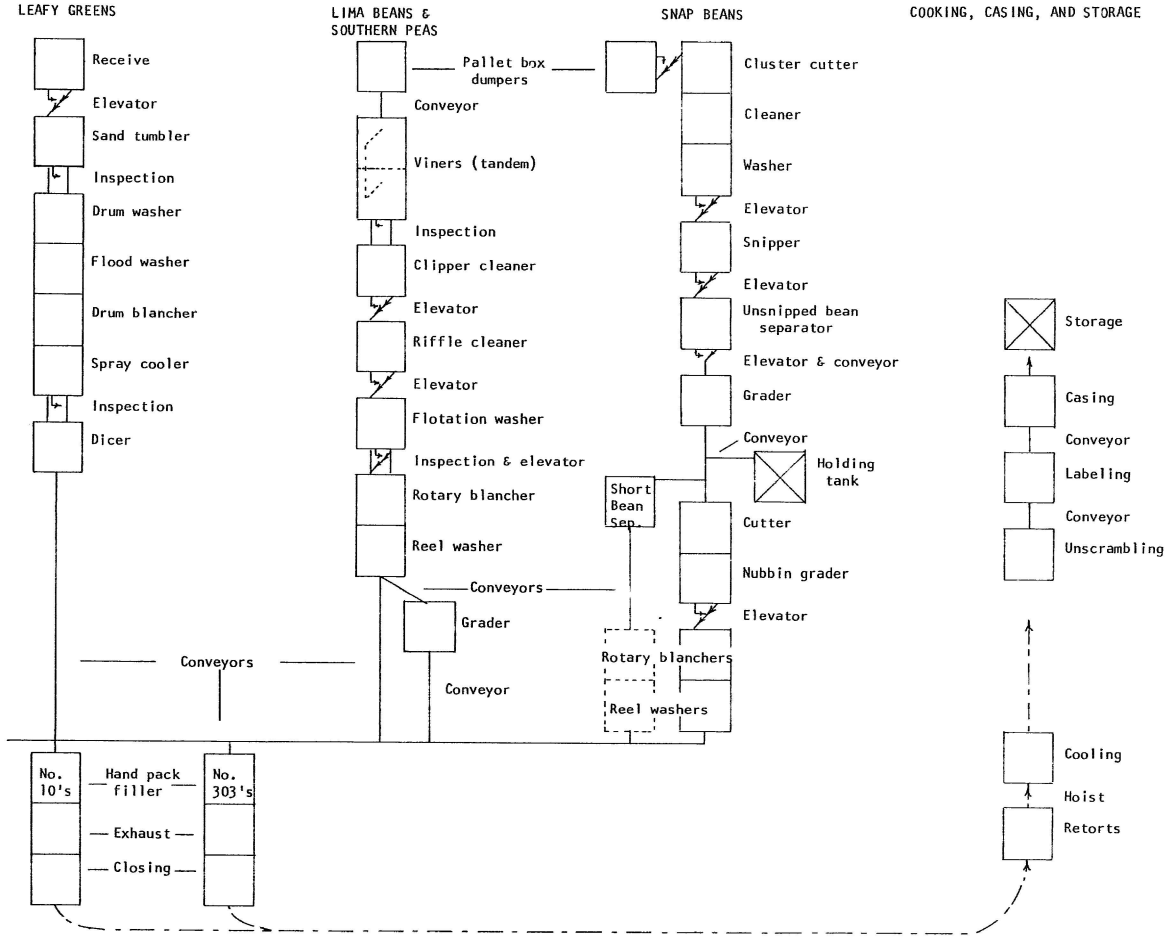

Figure 4. Stages of Preparation, Processing, Casing, and Storage of Lima Beans, Southern Peas, Snap Beans, and Leafy Greens.

TABLE 13.--CANNING PLANT - ANNUAL OPERATING TIME, RAW PRODUCT REQUIREMENTS, FINISHED PRODUCT YIELD AND OUTPUT FOR PROCESSING SELECTED VEGETABLES, MISSOURI DELTA, 1965.

Product	Expected Operating Days 1/	Hours Per Day	Hours Operated Annually	Expected Raw Product Requirements 2/		Cases of 24/303's Per Ton	Expected Output Rates 24/303 case equivalents	
				Hourly	Annually		Hourly	Annually
				tons	tons		cases	cases
Lima beans	36	20	720	3.15 3/	2,268	115.9	365.0	262,773
Southern peas	8	20	160	3.15 3/	504	115.9	365.0	58,394
Green beans	44	20	880	4.05	3,564	116.8	472.7	415,978
Leafy greens	87	10	870	2.70	2,349	97.6	263.4	229,142
Total	175	--	2,630	--	8,685	--	--	966,287

1/ Assumes an average operating week of five days.

2/ Ninety percent of rated capacity. Loss of 10 percent assumed due to unavoidable delays and abnormal product quality.

3/ Shelled basis.

Investment in Buildings and Equipment 1/.--All building and equipment requirements were itemized so that a detailed compilation of the replacement costs could be made. Total initial investment required for the canning plant would be approximately $693,148 (Table 14). Almost 60 percent of this amount is for the equipment.

Replacement costs of all buildings and equipment are for new items with the exception of four stationary viners. Their replacement costs are for rebuilt viners adapted for shelling lima beans and southern peas after the pods have been removed from the vine. Transportation and installation costs are included in replacement costs for machinery and equipment.

The building specifications call for reinforced concrete floors, concrete block walls, and insulated metal roofs with structural steel supports. One exception to the above is the office building which is of masonry construction with finished interior walls and air conditioning. All building costs include plumbing, electrical wiring, lighting, heating, and ventilation.

Fixed and Variable Costs.--Annual fixed costs for the canning plant total $105,327 (Table 15). Included in this category of costs are depreciation on buildings and equipment, interest on average annual investment in buildings and equipment, taxes, and insurance.

Variable costs, or the direct expenses of raw product, processing, and sales for the expected annual pack, total $2,363,862 (Table 15). This includes all variable costs. Largest among these items is the cost of raw product at $908,725, but containers (cans and shipping cartons) and labels are a close second at $856,102. These are followed in order by labor costs and sales expenses to round out the largest expense items.

Operating Capital.--Based on the assumption that sales are evenly distributed throughout the year, operating capital requirements for the canning plant total approximately $855,000. This is the gross value of the average monthly inventory. Considerable variation exists in the amount of operating capital needed each month. The range is from a low of $292,111 in May to a high of $1,433,465 in October.

Gross Revenue.--The gross revenue from the annual pack of the proposed canning plant is estimated at $2,567,984 (Table 16). Prices used were f.o.b. plant and were indicative of those generally prevailing in the south for nonadvertised brands.

1/ Excludes land costs and any architectural, engineering, and legal fees connected with the initial investment.

TABLE 14.--CANNING PLANT - INVESTMENT IN BUILDINGS AND EQUIPMENT FOR PROCESSING SELECTED VEGETABLES, MISSOURI DELTA, 1965.

Item	Size, Capacity, or Number	Replacement Cost	Allocation of Replacement Cost by Product 1/			
			Lima beans	Sou. peas	Green beans	Leafy greens
		dollars				
Buildings:						
Processing	100' x 228' x 14'	124,352	33,824	7,461	53,596	29,471
Warehouse	100' x 276' x 20'	101,796	27,688	6,108	43,874	24,126
Office	60' x 60'	30,000	8,160	1,800	12,930	7,110
Well, building, pump, & tank	400 gpm	21,000	5,712	1,260	9,051	4,977
Truck scale	50 ft.	14,000	3,808	840	6,034	3,318
Other	--	5,000	1,360	300	2,155	1,185
Subtotal		296,148	80,552	17,769	127,640	70,187
Equipment:						
Preparation	--	217,805	42,365	9,426	133,957	32,057
Cooking & can handling	--	99,765	27,136	5,986	42,999	23,644
Boiler	300 bhp	22,500	6,120	1,350	9,697	5,333
Fork trucks	2	12,780	4,013	895	6,364	1,508
Trucks	2	5,500	1,496	330	2,371	1,303
Pallets	5,000	17,000	4,624	1,020	7,327	4,029
Bulk pallet boxes	360	4,150	1,477	328	2,345	--
Other 2/	--	17,500	4,760	1,050	7,542	4,148
Subtotal		397,000	91,991	20,385	212,602	72,022
Total		693,148	172,543	38,154	340,242	142,209

1/ Allocation based on proportion of pack involved.

2/ Includes office, shop, laboratory, and sewage equipment.

TABLE 15.--CANNING PLANT - FIXED AND VARIABLE COSTS FOR PROCESSING SELECTED VEGETABLES, MISSOURI DELTA, 1965

Cost Category	Lima Beans	Southern Peas	Green Beans	Leafy Greens	Total
	dollars				
Fixed costs:					
Buildings 1/	4,028	888	6,382	3,509	14,807
Equipment 1/	11,499	2,548	26,575	9,003	49,625
Interest 2/	5,180	1,140	10,213	4,261	20,794
Taxes & Insurance 3/	5,007	1,102	9,873	4,119	20,101
Total fixed costs	25,714	5,678	53,043	20,892	105,327
Variable costs:					
Processing:					
Management 4/	11,800	1,992	17,905	9,846	41,543
Labor 4/ - seasonal	41,410	7,946	54,755	50,127	154,238
- other	13,724	2,417	20,954	11,522	48,617
Containers & labels	230,047	51,122	375,338	199,595	856,102
Utilities, fuel, & gasoline	8,404	1,866	10,790	10,580	31,640
Insurance & inventory taxes 5/	10,293	2,363	9,584	2,453	24,693
Maintenance & repairs 6/	5,823	1,289	12,595	4,627	24,334
Product damage 7/	8,484	1,810	10,654	4,732	25,680
Interest on operating capital 8/	21,376	4,817	18,450	6,542	51,185
Salt	3,305	734	5,210	2,897	12,146
Miscellaneous 9/	18,383	3,933	23,548	10,696	56,560
Subtotal	373,049	80,289	559,783	313,617	1,326,738
Raw product 10/	362,880	85,680	392,040	68,125	908,725
Sales 11/	42,421	9,052	53,268	23,658	128,399
Total variable costs	778,350	175,021	1,005,091	405,400	2,363,862
Total	804,064	180,699	1,058,134	426,292	2,469,189

Footnotes on following page.

Footnotes, TABLE 15.

1/ Depreciation computed at 5.0 percent of replacement costs for buildings and 12.5 percent for equipment.

2/ Interest on investment computed at three percent of replacement cost.

3/ Taxes computed at 1.4 percent of replacement for buildings and equipment. Insurance computed at 1.5 percent of building and equipment replacement costs.

4/ Includes fringe labor costs at 9.5 percent of payroll where applicable.

5/ Inventory taxes computed at 1.4 percent of December 31 inventory. Insurance computed at 1.5 percent of average monthly inventory value.

6/ Maintenance cost estimated at 1.5 percent of replacement cost of buildings and equipment. Repair costs estimated at 0.4 percent of equipment replacement cost per 100 hours of annual operation.

7/ Estimated at one percent of annual pack.

8/ Assumes inventory turnover once annually. Interest estimated at six percent of gross value of average month's inventory.

9/ Office supplies, telephone, janitorial supplies, and contingencies estimated at two percent of annual gross revenue. Also includes inspection fees and rental for salt tablet dispensers.

10/ Prices per ton of raw product delivered to the plant were $160 for lima beans (shelled basis), $170 for southern peas (shelled basis), $110 for green beans, $45 for spinach, and $25 for other leafy greens.

11/ Estimated at five percent of annual gross revenue.

TABLE 16.--CANNING PLANT - PRICES AND GROSS REVENUE FROM PROCESSING SELECTED VEGETABLES, MISSOURI DELTA, 1965.

Product	Total Pack		Price Per Case		Total Revenue
	24/303's	6/10's	24/303's	6/10's	
	cases		dollars		
Lima beans	197,136	40,464	3.22	5.28	848.428
Southern peas	43,808	8,992	3.26	4.25	181,030
Green beans	312,488	63,800	2.66	3.67	1,065,364
Spinach	34,313	7,099	2.42	2.82	103,057
Leafy greens	137,251	28,397	2.20	2.40	370,105
Total	724,996	148,752	--	--	2,567,984

1/ Price data were obtained from Canner-Packer, Vols. 131-133, Triad Publishing Company, Chicago, Illinois, 1962-1964; brokers; processors; and retail chains.

Net Revenue.--Net revenue was derived by subtracting from the gross revenue the costs of processing, raw product, and selling. Based upon the cost and revenue estimates made in this study, net revenue for the canning plant would be $98,795 (Table 17). This amount of net profit expressed as a percent of investment and operating capital gives a six percent rate of net profit before any state or federal income tax is deducted.

Marketing the Finished Product

Costs and revenues for the freezing and canning plants proposed in this study are descriptive of plants that have been in operation long enough to overcome the problems frequently associated with a new plant. Therefore, costs associated with entry into the highly competitive processed vegetables market are not included in any of the above cost analysis because of their special nature.

Selling Costs.--Few firms of the size of this facility can market their products more economically by means of their own sales force than they can through brokers. Brokers usually charge three percent of the invoice value of products they sell. The processor may have arrangements with his brokers to allow certain direct sales; however, the cost of such sales is assumed to be approximately equal to the brokerage fee. This being the case, the three percent brokerage fee was applied to the total packs.

A practice that has become quite commonplace among processors is that of giving a discount for cash payment within 10 days of delivery. Freezers usually give a two percent cash discount while canners more commonly give a 1.5 percent discount. These discounts were included as a part of selling costs. An additional selling cost allowance was made to provide for other selling costs normally incurred by processors. These include such things as additional broker services, promotional allowances, and special discounts. One percent and 0.5 percent of gross sales were charged to the freezing and canning plants, respectively. This makes an over-all charge of six percent of gross sales for the freezing plant and five percent of gross sales for the canning plant to cover selling costs incurred under normal marketing conditions.

Market Entry.--Costs of market entry for a new plant are affected in magnitude largely by the nature and type of firm operating the plant and the method of sales chosen. These costs range in size from those of a national processor producing product for sale under already established brand names with strong demand to those of a new firm with a single plant entering the market in direct competition with nationally and regionally advertised processor brands and private brands. The following discussion is largely couched in terms of a new firm with a single plant.

A firm entering the processed vegetable market for the first time has the following sales alternatives: (1) processing

TABLE 17.--CANNING PLANT - TOTAL COSTS, GROSS REVENUE, AND NET REVENUE FOR PROCESSING SELECTED VEGETABLES, MISSOURI DELTA, 1965.

Product	Cost Item				Total Cost	Gross Revenue	Net Revenue
	Fixed 1/	Variable					
		Processing	Raw product	Sales			
	dollars						
Lima beans	25,714	373,049	362,880	42,421	804,064	848,428	44,364
Southern peas	5,678	80,289	85,680	9,052	180,699	181,030	331
Green beans	53,043	559,783	392,040	53,268	1,058,134	1,065,364	7,230
Spinach	4,178	62,723	21,150	4,732	85,258	103,057	17,799
Leafy greens	16,714	250,894	46,975	18,926	341,034	370,105	29,071
Total	105,327	1,326,738	908,725	128,399	2,469,189	2,567,984	98,795

1/ Excludes annual land charges.

under contract for an established food processor, (2) packing under the private labels of food distributors, (3) selling under its own label, and (4) some combination of these. In this study, the assumption has been made that the latter approach will be used, i.e., product will be sold under the firm's own nonadvertised label and to some extent under private labels and other processors' labels. Such an approach opens several sales avenues and, thus, provides the processor with greater flexibility in dealing with each of these markets. A processor relying solely on sales under another processor's label or a distributor's label can have a very favorable arrangement. Nevertheless, he may be at the same time in a very vulnerable bargaining position. Certain price concessions can become almost mandatory when contracts are renegotiated and alternative outlets are not readily available.

The problem of market entry with respect to selling the finished product under labels of other firms is largely a matter of price, assuming that other normal conditions are met. These conditions include specifications for quality, container types and sizes, quantity, and delivery schedule. Furthermore, a new firm must convey an image of dependability concerning its competence in meeting contractual obligations.

Entry of a firm into the market with its own branded products, even though they are nonadvertised, is likely to be more costly as well as challenging than would be the other sales alternatives. The first expense is that of developing brand names and designing labels. Package appearance has considerable influence on the buying decision of the customer. Therefore, highly competent assistance should be obtained to assure maximum benefits with respect to package designs and brand names.

Market entry costs will increase operating costs materially during the first one or two years of operation. Very few marketing firms are interested in stocking new brands because of display and storage space restrictions. Adding a new brand of a particular product usually means dropping one or more other brands. Consequently, in order to induce marketing firms to change, there must be an economic incentive. Problems associated with dropping nonadvertised brands exist but are not nearly so great as is the case for a heavily advertised brand.

Market entry success with the type of brands proposed in this study revolves around the question of the form and extent of the economic incentive necessary for obtaining satisfactory market entry. It goes almost without saying that product quality must be as good or better than comparable brands to start with. Several techniques of market entry may be employed. One that is fairly common is an introductory offer of one case of merchandise free with each 10 cases purchased. This may be coupled with a cooperative advertising allowance. The advertising allowance would continue after the introductory free case offer was withdrawn. Such an allowance would apply to retail items and probably range from five to 10 cents per dozen packages for all items. Special

advertising allowances of 15 to 20 cents per dozen for selected items may be offered on a carefully planned basis during the first few weeks. Some charge for this type of activity was included in the regular selling costs. This would permit a gradual phasing of the market entry activities into the regular selling program after the first few months in the market. Exact amount of time required cannot be specified since it will vary by type of marketing firm and location.

Another approach to market entry is lower prices than other processors charge for their nonadvertised brands. Some aspects of the previously described approach are likely to be included too but to a lesser extent. The lowering of price one cent per pound for frozen items or 10 cents per case for canned items should facilitate selling a considerable amount of product. Such a price reduction might need to be applied to certain key items or varied among products. This program would need to be closed out very discretely.

Price retaliation by established processors should be considered when lower prices are used as an introductory measure. Brands distributed by larger firms and over a larger geographic area than that contemplated for this plant are not as likely to be lowered in price. Federal statutes prevent retaliation by these larger firms by lowering prices in the affected markets only. Therefore, to meet the competition, losses in revenue would accrue to the larger firm over its entire distribution area.

These are some techniques that may be employed to gain satisfactory entry into the market. Emphasis should be placed on the fact that obtaining such a position will likely be quite costly. For example, if the entire first year output of the freezing plant was sold for one cent less per pound this would amount to almost $145,000 in terms of lost revenues. The 10 cents per case for the canning plant would amount to a loss of approximately $90,000. One very clear implication of the market entry discussion is the need for a good management team.

Raw Product Procurement

Success in operating a processing plant is often associated with the raw product. The potential for an adequate supply at a reasonable cost is necessary, but there are other factors of equal importance. The raw vegetable products must move to the plant in a manner that permits the most efficient harvesting and processing conditions possible.

Production of the bulk of the raw product needs of the proposed plant would be expected to take place under contract with individual growers. Contracts are in the best interest of both parties. They enable the processor to more closely regulate supply and the grower is guaranteed a market before new resources are committed to the production of any vegetable crops. It is important

that varieties and cultural practices be specified so as to provide the processor with raw product from varieties best suited to the area for processing and uniformly high in quality and yield. Planting dates must be specified after careful planning to provide for a steady flow of raw product in keeping with the processing plant production schedule. These matters, just as is true for marketing, require capable management that possesses the experience and know-how for accomplishing the above objectives.

It is not unlikely that for the first year or two some portion of the raw product supplies will need to be grown by the processor on leased land. An arrangement of this type would help guarantee supplies in amount and quality while at the same time being used for demonstrational purposes for other potential growers in the area.

COORDINATION OF PRODUCTION AND PROCESSING ANALYSES

The production analysis indicated that it would be profitable to produce three of the selected vegetables in the area. Two of these, green beans and leafy greens, could be produced in large quantities. Lima beans would be grown on a much smaller scale. The question that must be answered is whether an adequate quantity of the raw product mix will be available to either a freezing plant or a canning plant. A minimum of 8,685 tons of raw product would be needed (Table 18). One can quickly see that it would take only a small portion of the most profitable quantity of green beans and leafy greens, while for lima beans it would require a large portion of the amount in the optimal plans. Southern peas were not included among the vegetables the program analysis showed would be most profitable to produce.

With this information would it be reasonable to expect sufficient raw product to support one of the proposed processing plants? Certainly for the two largest tonnage crops, green beans and leafy greens, it would. They account for two-thirds of the total quantity of raw product needed for the processing plant. If 3,904 acres of lima beans were all that could be grown profitably, it would be doubtful, at least for a few years, whether the processing plant would get the needed amount. However, lima beans were limited in the optimal plans by the quantity of seasonal labor available. The addition of 100 seasonal laborers during May to August would enable lima bean acreage to expand by 2,400 acres. Therefore, in the light of current labor developments in the area, e.g., reduced chopping in cotton etc., adequate quantities of lima beans could be grown.

The processing plants would need only about 33 percent more than the present production of southern peas in the area. Farmers in the Delta have found it profitable to expand the acreage of southern peas during recent years, so it would seem reasonable to expect them to produce the additional small quantity

TABLE 18.--RAW PRODUCT REQUIREMENTS, YIELDS PER ACRE, AND GROWERS' GROSS REVENUE FOR SELECTED VEGETABLES, MISSOURI DELTA, 1965.

Product	Annual Tonnage	Yield Per Acre	Acres 1/	Price Per Ton	Gross Revenue
	---------tons---------			--------dollars---------	
Lima beans 2/	2,268	1.0	2,268	160	362,880
Southern peas 2/	504	0.3	1,680	170	85,680
Green beans	3,564	1.0	3,564	110	392,040
Spinach	470	2.8	168	45	21,150
Leafy greens	1,879	5.0	376	25	46,975
Total	8,685	--	8,056	--	908,725

1/ Annual land requirements would be about 50 percent less due to double-cropping.

2/ Shelled basis.

needed. In the event adequate production of southern peas fails to materialize, there are reasonable alternatives. Since the lima bean, southern pea, and leafy greens harvest seasons overlap, lima beans and leafy greens could replace any shortages that may develop due to inadequate production of southern peas. Another alternative, but less attractive because of transportation costs, is to obtain southern peas from adjacent supply areas such as Western Tennessee.

It may be helpful in evaluating whether the needed raw product would be forthcoming to see how many farms would be needed to grow the raw products. Thirty-seven medium-size farms growing 100 acres of green beans per farm, eight medium-size farms growing 68 acres of greens per farm, and 206 large farms growing 11 acres of lima beans per farm would provide the processing plant proposed in this study with adequate quantities of raw product for these vegetables.

OTHER CONSIDERATIONS

This study was directed toward a seven county area in southeast Missouri, but the production analysis was based on a study of 11 townships within the area. Even in this small sub-area there would appear to be little doubt about procuring the needed raw product.

The area has a full week's difference in the length of the growing season between its north and south borders. This enables a wide range of harvesting dates. A further spreading of the harvesting period for some vegetable crops could be obtained by procuring vegetables from states to the south.

U. S. Highways 60 and 61 and Interstate 55 cross the area and there is adequate rail service. Consequently, modern rapid transportation is available to market outlets. With the completion of the bridge across the Mississippi River at Caruthersville, the important southern vegetable producing area of West Tennessee will be within 50 miles.

The good highway system and availability of an abundant water supply any place in the area make it practical to locate a processing plant at any of several possible locations. A plant located near the center of the area would be able to minimize transportation cost from the farm to the plant. Several suitable plant locations are available which would not require raw product to be transported more than 25 to 30 miles.

For the most efficient operation of a processing plant, it is highly desirable to run the plant near capacity for as long a period as possible. The plants designed for this study would operate approximately eight months in processing the combination of vegetables grown in this area. A longer operating season would be possible if vegetables could be transported from other areas

farther south or if products other than these vegetables could be processed in the off season. A canning plant might find it economical to process dry beans and peas during the winter months.

The production analysis of this study indicated that vegetable production under present technology would be profitable on many farms. An expanded research program for the area, which develops new varieties and cultural practices as well as evaluates current varieties of vegetables and uses of insecticides and herbicides, would be of considerable value to prospective processors and growers.

At present, almost the entire area included in the study is under quarantine for the cyst nematode. This has at least two important considerations. First, the movement of raw products from the area to processing plants outside the area is seriously restricted; and secondly, the presence of nematodes in the area must be considered in the selection of vegetable crops and varieties.

This vast area of productive soils with an abundant supply of irrigation water is well suited for growing vegetables but has just begun to grow them on a commercial basis. Fresh market production of sweet corn and Irish potatoes has increased rapidly during the past two or three years. Farmers in the area are demonstrating their interest in growing new crops that offer increased profits. The farm units are large, well equipped, and adequately financed so that cropping changes can be made very rapidly.

FEASIBILITY

The production analysis clearly indicates that with the conditions which existed in 1964 it would be practical to grow adequate quantities of vegetables for a processing plant in the study area. The estimated production of green beans and leafy greens would be sufficient for needs of more than one plant at the assumed prices. An adequate quantity of lima beans would depend on the availability of seasonal labor for chopping and irrigating. At present, there would appear to be sufficient seasonal labor to easily supply the needs of one plant.

To obtain the needed amount of southern peas, it would be necessary to get growers with the light sandy soils to grow them or increase the yields per acre on the more productive soils. Considering the rapidly expanding acreage of southern peas on the light sandy soils, it would not appear too difficult to get the quantity needed for a plant.

This analysis shows that either a freezing or canning plant might be considered a feasible investment. The freezing plant is the preferred choice if adequate capital is available.

Estimates of net income after corporate income taxes provide the best indication of economic feasibility for the processing plants. The costs and returns developed in this analysis are indicative of conditions that existed in the industry at the time the study was made. The profitability of each of the plants is as follows:

Item	Freezing	Canning
Net income before income taxes 1/	$236,349	$98,795
Corporate income taxes 2/	109,406	41,949
Net income (profit)	126,943	56,846
Profit rate based on initial investment	8.3%	8.2%
Profit rate based on total assets employed 3/	4.7%	3.7%
Profit rate based on gross sales	4.5%	2.2%

In determining the feasibility of growing fruits and vegetables for processing, and of building and operating a processing plant, many factors must be considered. We should be cognizant of the area's disadvantages as well as its advantages because the projected net returns reflect more or less average conditions. Fruit and vegetable processing plants are unusual in that extremes in weather conditions may restrict supplies or harvesting operations to the extent that they may be closed for prolonged periods of time. Prices of finished products may drop to unprofitable levels in some years because of larger than usual supplies. Hence, net returns can be fairly variable from year to year and additional capital may be needed to continue operations following unprofitable periods of operation. Prospective investors should carefully reevaluate the assumptions made with regard to such items as operating time, labor efficiency, raw product procurement, market entry, and input and finished product prices as well as all other factors considered before making a decision to invest.

1/ See footnotes 2 and 8 of Tables 10 and 15 for explanation of handling of interest charges.

2/ Includes federal and Missouri corporate income taxes but no allowance made for the seven percent investment credit allowed for qualified new and used equipment.

3/ Total assets are composed of initial investment capital and operating capital.

AREA BENEFITS

This study was designed to measure net returns to a vegetable processing operation, the effect on net farm income, and the direct effects on the labor resource. No attempt has been made to measure the secondary effects of the proposed processing facility on the area's over-all economy.

A vegetable processing plant would provide employment for both full-time and seasonal workers. Employment figures for the freezing plant vary somewhat from those for the canning plant. Numbers of seasonal workers required in the freezing plant would be 28 for lima beans and southern peas, 29 for green beans and institutional leafy greens, and 36 for leafy greens in retail packages. During the four months that two shifts are in operation, a total of 58 to 60 seasonal workers would be required (Table 19). The other four months the proposed plant would work from 29 to 36 seasonal workers. Most of the seasonal workers are unskilled and the rest are largely semi-skilled.

The I.Q.F. packaging operation is planned to operate on a single shift basis with the workers transferring to leafy greens packaging when that line is in operation. These workers would total 14 and be employed on an annual basis. The freezing plant also would use the services of 19 additional full-time and two part-time employees. This latter group includes management, office personnel, laborers, and other personnel. Total employment on an annual basis is 72 man-year equivalents. Annual payroll, including fringe benefits for the freezing plant, would total about $258,990. Of this amount $41,543 would be paid to management, $107,381 is for seasonal workers, and $110,066 is for other workers employed on an annual basis. (See Table 19 for wage and salary rates).

Seasonal employees for the canning plant include 38 for lima beans and southern peas, 43 for green beans, and 39 for leafy greens per shift. Two shifts would be used for four months and work 76 to 86 people (Table 19). Eighteen additional employees would be employed on an annual basis and two on a part-time basis; these would include management, office personnel, laborers, and other personnel. In man-year equivalents, total employment in the canning plant would be 70. Annual payroll of the canning plant, including fringe benefits, would total $244,398. This is broken down as follows: management, $41,543; seasonal labor, $154,238; and other employees, $48,617.

Raw product requirements for either of the plants in this study would be the same. A total of 8,685 tons of raw product would be needed. With the yields expected in the area, it would take 8,056 acres to produce this amount of vegetables. Since most of the vegetables will be produced as double-crops, only about half of this acreage would be planted in vegetables at one time (Table 18). The approximately 4,028 acres of cropland used to

TABLE 19.--FREEZING AND CANNING PLANTS -- ESTIMATED LABOR AND MANAGEMENT REQUIREMENTS AND COSTS, MISSOURI DELTA, 1965.

Type of Employee	Labor Requirements by Hourly Wage Rate						Total Salaries Per Year	
	$1.25	$1.35	$1.40	$1.50	$1.60	$3.00		
	number of workers							dollars
Freezing plant:								
Seasonal labor	38	8	6	6	2			
Full-time labor	15	5	2			3		
Other							2 1/	7,800
Full-time office	1						1	4,200
Part-time office	2							
Management							4 2/	40,000
Canning plant:								
Seasonal labor	58	4	14	8	2			
Full-time labor	5	5						
Other							2 1/	7,800
Full-time office	1						1	4,200
Part-time office	2							
Management							4 2/	40,000

1/ Includes mechanic at $4,200 and shipping clerk at $3,600.

2/ Includes manager at $20,000, production manager at $10,000, plant superintendent at $5,000, and field superintendent at $5,000.

grow the vegetables would produce $908,725 gross income. This would be approximately $225.60 gross income per acre of cropland. A 30 bushel per acre soybean crop would gross approximately $78 per acre or $314,184 for the 4,028 acres.

A comparison of the gross income, of course, does not give a good indication of net income. A look at the return above direct cost may give a clearer picture. Thirty bushels of soybeans per acre will give $60.33 above direct cost. On the same basis, an acre double-cropped to green beans and greens will net $81.08 above direct cost. Therefore, the shift of cropland from soybean production to vegetable production would increase net farm income approximately $74,700.

The production of the 8,056 acres of vegetables would provide added work for seasonal laborers in the area. The labor would be used in chopping, irrigating, hauling, etc. Most of the labor would be needed before or after cotton chopping, the major employment for this labor now. Therefore, the present seasonal workers would be able to find employment over a much longer season. The 8,056 acres of vegetables would require approximately 102,000 hours of seasonal labor. At the 1964 wage rate of 60 cents per hour, this would add $61,200 of annual income for the seasonal day laborers.

BIBLIOGRAPHY

Agriculture Handbook No. 251, U. S. Department of Agriculture, Statistical Reporting Service, Crop Reporting Board, Washington, D. C. Usual Planting and Harvesting Dates, June 1963.

The Almanac of the Canning, Freezing, Preserving Industries. 49th edition, Edward E. Judge, Westminister, Maryland, 1964.

Brooke, Donald L. Costs and Returns from Vegetable Crops in Florida - Seasons 1962 - 1963. Agricultural Economics Mimeo Report EC 64-11, Department of Agricultural Economics, Florida Agricultural Experiment Stations, Gainesville, Florida, April 1964.

Canner-Packer. Vols. 131-133, Triad Publishing Company, Chicago, Illinois, 1962-1964.

Chapman, W. F. Jr., Brooks, T. L., and Ford, K. E. Vegetable Production Density - Tennessee. Mimeo Series N. S. 214, Georgia Agricultural Experiment Station, Experiment, Georgia, October 1964.

College of Business Administration, University of Arkansas, Potentials for Vegetable Processing: Eastern Arkansas. Fayetteville, Arkansas, November 1961.

Davis, G. B., and Hutchings, H. M. Costs and Efficiencies in Pea Freezing Operations, Part 2. - Packaging and Freezing. Agricultural Experiment Station, Oregon State College, Corvallis, in cooperation with Agricultural Marketing Service, U. S. Department of Agriculture, Miscellaneous Paper 87, March 1960.

Department of Agricultural Economics, Mississippi State University, University of Arkansas, and Louisiana State University. Budgets for Major Farm Enterprises in the Mississippi River Delta of Arkansas, Louisiana, and Mississippi. Agricultural Economics M. R. No. 30, June 1961.

Ford, K. E., Chapman, W. F. Jr., and Brooks, T. L. Vegetable Production Density - Arkansas. Mimeo Series N. S. 215, Georgia Agricultural Experiment Station, Experiment, Georgia, October 1964.

Gaus, A. E. Missouri Vegetable Planning and Planting Calendar. Extension Folder 5, University of Missouri, Extension Division, January 1963.

Gavett, Earle E. Labor Used to Produce Vegetables Estimates by States, 1959. Farm Production Economics Division, Economic Research Service, U. S. Department of Agriculture, Statistical Bulletin No. 341, March 1964.

Hammond, Leigh H., and King, R. A. Planning Data for the Sweet Potato Industry, 2. Costs and Returns for a Model Canning Plant. A. E. Information Series No. 93, Department of Agricultural Economics, N. C. State College, Raleigh, N. C., in cooperation with Economic Research Service, U. S. Department of Agriculture, June 1962.

Jones, T. L., and Miller, Frank. Irrigation Practices and Costs in Southeastern Missouri - 1960. Research Bulletin 795, University of Missouri, College of Agriculture, Agricultural Experiment Station, Columbia, Missouri, March 1962.

Kearl, C. D., Foster, J. Q., and Hayes, S. Enterprise Costs and Returns on A Market Garden Farm. A. E. Res. 117, Cornell University, Ithaca, New York, June 1963.

McQuigg, J. D., and Decker, W. L. Climate of the Southeast Lowlands of Missouri. Bulletin 794, University of Missouri, Agricultural Experiment Station, Columbia, Missouri, August 1963.

Missouri Annual Farm Labor Report, 1963, 1964. E. S. 225, Missouri State Employment Service.

Quick Frozen Foods. Vols. 25-28, E. W. Williams Publications, Inc., New York, New York, 1962-1965.

Reed, Robert H. Economic Efficiency in Assembly and Processing Lima Beans for Freezing. Mimeographed Report No. 219, University of California, Division of Agricultural Sciences, June 1959.

Reed, Robert H., and Sammet, L. L. Multiple-Product Processing of California Frozen Vegetables. Giannini Foundation Research Report No. 264, University of California, Division of Agricultural Sciences, July 1963.

Smith, R. C. Marketing Northeastern Canned Fruits and Vegetables Through Food Brokers. University of Delaware, Agricultural Experiment Station, Newark, Delaware, Bulletin No. 345, June 1963.

Suter, Robert C. What Are My Costs of Rasing Strawberries? Memo EC-266 Cooperative Extension Service, Purdue University, Lafayette, Indiana, January 1963.

United States Department of Agriculture. Conversion Factors and Weights and Measures for Agricultural Commodities and Their Products. Production and Marketing Administration, Washington, D. C., May 1952

United States Department of Commerce, Bureau of the Census. U. S. Census of Agriculture: 1930-1959. Washington, D. C., 1952-1961.

Williams, F. W. "The Economic Feasibility of Establishing a Vegetable Processing Plant in Jackson County, Florida." ARA Case Book No. 2. United States Department of Commerce, Area Redevelopment Administration, Washington, D. C., November 1963.

APPENDIX

TABLE I.--TYPICAL COTTON BUDGET, MISSOURI DELTA 1/.

Item	Costs and Returns for Selected Yields of Lint (pounds per acre)			
	500	600 2/	700	800
	dollars			
Price per pound:				
Lint	0.303	0.303	0.303	0.303
Seed	0.0225	0.0225	0.0225	0.0225
Gross income per acre	171.75	206.10	240.45	274.80
Total expenses per acre	92.18	96.23	100.28	104.33
Net return to labor 3/, land, and capital	79.57	109.87	140.17	170.47

TABLE II.--TYPICAL CORN BUDGET, MISSOURI DELTA 1/

Item	Costs and Returns for Selected Yields (bushels per acre)			
	70	80	90 2/	100
	dollars			
Price per bushel	1.19	1.19	1.19	1.19
Gross income per acre	83.30	95.20	107.10	119.00
Total expenses per acre	34.33	34.33	38.51	42.00
Net return to labor 3/, land and capital	48.97	60.87	68.59	77.00

See footnotes at end of Appendix.

TABLE III.--TYPICAL SINGLE-CROP SOYBEAN BUDGET, MISSOURI DELTA. 1/

Item	Costs and Returns for Selected Yields (bushels per acre)			
	20	25 2/	30	35
	dollars			
Price per bushel	2.60	2.60	2.60	2.60
Gross income per acre	52.00	65.00	78.00	91.00
Total expenses per acre	17.67	17.67	17.67	17.67
Net returns to labor 3/, land, and capital	34.33	47.33	60.33	73.33

TABLE IV.--TYPICAL DOUBLE-CROP SOYBEAN BUDGET, MISSOURI DELTA. 1/

Item	Costs and Returns for Selected Yields (bushels per acre)			
	10	15	20 2/	25
	dollars			
Price per bushel	2.60	2.60	2.60	2.60
Gross income per acre	26.00	39.00	52.00	65.00
Total expenses per acre	14.62	14.62	14.62	14.62
Net returns to labor 3/, land, and capital	11.38	24.38	37.38	50.38

TABLE V.--TYPICAL WHEAT BUDGET, MISSOURI DELTA. 1/

Item	Costs and Returns for Selected Yields (bushels per acre)			
	25	30	35 2/	40
	dollars			
Price per bushel	1.32	1.32	1.32	1.32
Gross income per acre	33.00	39.60	46.20	52.80
Total expenses per acre	23.46	23.46	23.46	23.46
Net returns to labor 3/, land, and capital	9.54	16.14	22.74	29.34

See footnotes at end of Appendix.

TABLE VI.--FRUIT AND VEGETABLE SINGLE-CROP ENTERPRISE BUDGETS AND DOUBLE-CROP ENTERPRISE BUDGETS, MISSOURI DELTA. 1/

Enterprise	Yield per acre	Price per unit	Costs and Returns Per Acre: Gross income	Total expense	Net returns to land, labor 3/, and capital: Single crop	Double crop
	(tons)	----------	dollars	----------		
1. Lima beans	1.0 4/	140.00	140.00	67.71	72.29	--
2. Southern peas	0.6	85.00	51.00	28.70	22.30	--
3. Spring greens	4.554 5/	27.45	125.00	79.37	45.63	117.92
& lima beans	1.0 4/	140.00	140.00	67.71	72.29	
4. Spring greens	4.554 5/	27.45	125.00	79.37	45.63	67.93
& southern peas	0.6	85.00	51.00	28.70	22.30	
5. Spring greens	4.554 5/	27.45	125.00	79.37	45.63	89.82
& fall greens	4.554 5/	27.45	125.00	80.81	44.19	
6. Spring greens	4.554 5/	27.45	125.00	79.37	45.63	81.08
& fall green beans	1.0	110.00	110.00	74.55	35.45	
7. Spring green beans and	1.0	110.00	110.00	73.11	36.89	109.18
lima beans	1.0 4/	140.00	140.00	67.71	72.29	
8. Spring green beans and	1.0	110.00	110.00	73.11	36.89	59.19
southern peas	0.6	85.00	51.00	28.70	22.30	
9. Spring green beans and	1.0	110.00	110.00	73.11	36.89	81.08
fall greens	4.554 5/	27.45	125.00	80.81	44.19	
10. Spring green beans and	1.0	110.00	110.00	73.11	36.89	73.78
fall green beans	1.0	110.00	110.00	73.11	36.89	
11. Spring green beans and	1.0	110.00	110.00	73.11	36.89	60.79
double-crop soybeans	15.0 bu.	2.60	39.00	15.10	23.90	
12. Strawberries	6,830 lbs.	0.148	1,010.84	786.50	224.32	--

1/ A wide range of detailed cost and return budgets representing different yields, machinery size, and chemical practices have been prepared by the Agricultural Economics Department, University of Missouri.

2/ Modal yields used in the linear programming analysis of the representative farmers.

3/ The residual labor includes all labor except seasonal labor. It includes operator, family, and regular hired labor.

4/ Shelled basis.

5/ Yield composed of 20 percent of spinach yield of 2.77 tons per acre and 80 percent of 5.0 tons yield per acre for greens (kale, turnip, collard, and mustard).