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Potentials for a Soybean Processing Plant

for Southeastern North Dakota

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This study was designed to provide useful information for those engaged in the production, processing and marketing of soybeans and its products.

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"BUY NORTH DAKOTA PRODUCTS"

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SUMMARY

Soybeans have become an important cash crop in southeastern North Dakota. The expansion of the acreage planted to soybeans in North Dakota has been hindered by small yields experienced by many growers.

The production of soybeans in southeastern North Dakota and in several counties in western Minnesota has been sufficient in the last five years to support a potential plant with a capacity of 200 tons of soybeans per day. This is assuming the soybeans would be available in about a 60 mile radius of the plant and the plant could obtain about 50 to 60 per cent of the production in this area.

Soybeans grown in North Dakota are marketed at Minneapolis, Canada, Duluth-Superior, the Red River Valley, and Iowa. In the 1960 crop year, 38 per cent were sold to markets in Minneapolis, 26 per cent to Canada, 21 per cent to Duluth-Superior, and 14 per cent in the Red River Valley.

The greatest resource requirement for a soybean processing plant is the capital to build and operate a plant. It is estimated that it would cost about 1.2 million dollars in fixed assets for a plant that will process 200 tons of soybeans per day and 775,000 dollars for a 100 ton per day plant. It is also estimated that another 1.5 million dollars will be required for working capital for a 200 ton per day plant and 1.0 million dollars for a 100 ton per day plant. A total of 2.7 million dollars would be required to build and operate a plant of 200 tons per day capacity and 1.8 million dollars for a 100 ton per day plant. The other resource requirements are generally available at most locations in southeastern North Dakota. Water might be the only other factor that would restrict a plant. A plant of 200 tons per day capacity would consume about 60,000 gallons of water per day, depending upon water temperature and other factors.

Plant location in regard to transportation facilities is very important. Transportation must be considered from the standpoint of assembling the raw material and marketing the oil and meal.

Soybean oil is processed to the crude state by most of the soybean oil processing plants. It must be further refined before the oil can be used for food or industrial purposes. The markets in which North Dakota could compete advantageously are those located to the west of North Dakota. California is the major soybean oil refining state located west of North Dakota.

The operations of the soybean processing industry are tied very closely to the consumption of meal. Soybean oil meal is a bulky product and expensive to store. Processors indicated that a small plant would have the greatest advantage by marketing its meal locally. A new plant in an area will have to provide an advantage in quality, price, and service to establish a market for the soybean oil meal. The processors indicated that the market is highly competitive and the processors presently supplying the market in the area of the new plant would not be willing to lose customers without putting up some resistance.

About 90 to 93 per cent of the soybean oil meal used for feeds is used in formula feeds. Poultry and hog feeds are the heavy users of soybean oil meal. If one took the state of North Dakota as the potential market for a plant, a plant of 100 tons of soybeans per day capacity could supply the present market for protein supplements. Marketing areas are not limited by state lines but it does illustrate the market area required for a small plant. A plant of larger capacity would have to look for markets in a much larger area which might include a number of states. The best market potential might be westward, where North Dakota's greatest competitive advantage as to transportation would apply.

A soybean processing plant has some risks associated with it. The risks would include the fluctuation of prices as they involve the inventories of the raw material and the finished products, financial risks, and selling the finished products in a competitive market with firms of all sizes.

The processing margins have not been as attractive the last few years as they were in the earlier years of the industry. One processor stated that the nation's soybean processing industry is overbuilt and almost all plants are operating at a rate less than the processors would like. Preliminary estimates of the soybeans crushed in the 1961-62 processing season indicate that about 439 million bushels were crushed, which was about 80 per cent of capacity. This is a new high for the industry. The industry has a crushing capacity of about 550 million bushels of soybeans. Processors stated that if a profitable market develops for meal or oil the present processors can increase their production because the nature of the business is such that most existing plants can increase their processing capacity at a smaller cost than it would take to build a new plant.

The processing margin is the combined value of the soybean oil and meal from a bushel of soybeans minus the cost of a bushel of soybeans. From this margin a processor must cover the processing costs and a profit. To estimate the processing margin for a plant located in southeastern North Dakota, the following assumptions were used:

1. Prices for soybeans, soybean oil, and soybean meal were the actual prices reported for each year from 1956 to 1961.

2. The oil price was the Decatur price minus a quarter of a cent per pound for transportation.

3. The meal price was the Decatur price plus $6.00 per ton.

4. The soybean price was the Decatur price for No. 2 yellow soybeans minus 13 cents a bushel for transportation.

5. A bushel of soybeans would yield 11.0 pounds of oil and 47.5 pounds of meal.

6. All meal would be sold in the local area of the plant.

This analysis showed that a plant located in North Dakota would be economical using the above assumptions. A new plant would need to look at future years which indications point out may find attractive processing margins harder to come by.

Mr. W. B. Bishop, Director of Facilities Planning of the A. E. Staley Manufacturing Company, in a talk entitled "Project Feasibility Analysis," published in the Industrial Development and Manufacturers Record in April 1962, summed up his talk by providing a check list to be used in a feasibility study of pitfalls to be avoided. The pitfalls to be avoided are:

1. Overly optimistic, or unduly pessimistic, estimate of market potential.

2. Optimistic or pessimistic sales price for products.

3. Failure to consider the position of a product or industry in its probable life cycle.

4. Poor design or conception of production facilities, resulting in lower production or higher costs than anticipated.

5. Inaccurate estimate of cost of facilities.

6. Failure to make best use of materials and techniques.

7. Failure to predict labor or material cost increases.

8. Lack of control of construction, causing expenditure greater than estimated.

9. Failure to locate plant strategically.

10. Failure to recognize capital required for development, inventory, advertising, and additional research.

11. Evaluation of returns over too short, or too long, a time period.

These factors and others, more or less obvious, can lead to over- or under-estimating return on investment. It becomes a management judgment as to how sound are the facts and assumptions on which the evaluation has been made. Where the element of risk seems greater, the required rate of return will no doubt be adjusted upward to provide a cushion against these pitfalls.

POTENTIALS FOR A SOYBEAN OIL PROCESSING PLANT IN SOUTHEASTERN NORTH DAKOTA

By LeRoy W. Schaffner, Fred R. Taylor, and Leonard Paulus[1]

INTRODUCTION

Soybeans have been grown commercially for about 37 years in the United States. In 1924, about five million bushels were grown compared to 693 million bushels in 1961. In 1961, 30 states were growing soybeans on a commercial basis. North Dakota ranked 22nd among the 30 states in the production of soybeans in 1961. Seventy-three per cent of the 693 million bushels were produced in the six states of Indiana, Illinois, Ohio, Iowa, Minnesota, and Missouri. Since 1950, the acreage harvested for beans in the United States has doubled and the production has increased two and one-third times.

Associated with the rapid development of soybean production was a corresponding development in the commercial demand for the oil and meal made from the raw commodity. Soybeans have become the leading oilseed produced in the United States.

In 1962, there were approximately 145 soybean processing plants located in 27 states (Table 1). Iowa had the largest number of plants with 22, Illinois had 17, Mississippi 13, and Arkansas 11. The processing plants have a total processing capacity of about 550 million bushels of soybeans. It is estimated that 439 million bushels of soybeans will be crushed in the October 1, 1961 to September 30, 1962 season.[2] If this estimate is correct, the plants will be operating at about 80 per cent of capacity.

The soybean processing industry has two major products--soybean oil and soybean meal. About 91 per cent of the oil is used in edible products such as shortenings, margarine, and salad oils. About 94 per cent of the soybean oil meal goes into livestock feeds. In the 1961 crop year, about 25 per cent of the oil production and about 9 per cent of the meal production was exported.

Soybeans have been grown commercially in North Dakota since 1942. Since 1956, North Dakota has produced over 2 million bushels of soybeans each year. In 1958, 3,710,000 bushels of soybeans were produced. Soybeans have become an important cash crop in southeastern North Dakota where about 90 per cent of the soybeans are produced.

Many farmers and businessmen in North Dakota believe that more industry in the state would be desirable and would also improve the economic well-being

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[1]Assistant Agricultural Economist, Agricultural Economist, and Graduate Assistant, North Dakota Agricultural Experiment Station.

[2]Fats and Oils Situation, May 1962, p. 5.

TABLE 1. NUMBER OF SOYBEAN PROCESSING PLANTS IN THE UNTTED STATES, BY STATES, 1962

State	Number of Plants
Alabama	4
Arizona	1
Arkansas	11
California	5
Delaware	1
Florida	2
Georgia	3
Illinois	17
Indiana	5
Iowa	22
Kansas	4
Kentucky	3
Louisiana	1
Minnesota	9
Mississippi	13
Missouri	4
Nebraska	3
New York	1
North Carolina	7
North Dakota	1
Ohio	7
Oklahoma	3
South Carolina	7
Tennessee	8
Texas	2
Virginia	1
Maryland	1
Total	145

Source: Soybean Blue Book, 1962, pp. 75-94.

of North Dakota agriculture.[3] Soybeans is one of the commodities which warrants further study to investigate the processing potential.

Objective of the Study

The objective of this study was to make an economic study of the soybean market and appraise the potentials for a soybean processing plant in southeastern North Dakota. Achievement of this objective required analysis of the

[3]Hertsgaard, Thor A., Taylor, Fred R., and Tetrault, Richard A., Research on Industrial Market Potentials for Selected North Dakota Agricultural Commodities, Mimeographed report, Department of Agricultural Economics, North Dakota Agricultural Experiment Station, Fargo, North Dakota, January 1, 1958.

present soybean situation, the future outlook for soybeans, and the resources required and the market outlook for the products of the processing phase of the soybean industry. The data used in this study were derived from secondary sources, interviews with soybean processors, and a mail questionnaire to country elevators.

SOYBEAN PRODUCTION IN SOUTHEASTERN NORTH DAKOTA

Soybean production in North Dakota is located primarily in the southeastern and Red River Valley counties (Figure 1). Soybean acreage was first reported in the agricultural statistics for North Dakota in 1942 when 7,000 planted acres were reported with a production of 40,000 bushels. Production and acreage reached a peak in 1958 with 277,000 acres planted and a production of 3,710,000 bushels. In the 12 counties reporting soybean production in 1961, Richland County was first in production with Cass County second and Traill County third.

A stable supply of raw material, soybeans in this case, is one of the requirements for a soybean processing plant. The supply must be large enough to keep a plant operating on a twelve month basis. The processing costs are increased if the plant has to buy beans some distance from the plant in order to have an adequate supply. The supply must also be adequate to maintain a plant in years of low production.

Table 2 shows the production of soybeans in the five southeastern counties plus Barnes and Cass counties in east central North Dakota for the six year period 1956 to 1961. In the last six years the production in these seven counties has varied from a low of 1,948,200 bushels to a high of 3,139,500 bushels. The average production in these seven counties in the six year period 1956-1961 was 2,483,291 bushels which is 90 per cent of the total state production for the same period. The other North Dakota counties which grow soybeans were not included because they are located closer to existing soybean processing plants.

Another area of potential soybean supplies is western Minnesota. The counties in Minnesota which might be a source of soybeans for a processing plant located in southeastern North Dakota include Becker, Clay, Otter Tail, and Wilkin counties. Production in these four counties in the six year period 1956-1961 ranged from a low of 2,013,300 bushels to a high of 2,379,900 bushels (Table 3). The average production for the six year period 1956-1961 was 2,091,333 bushels.

There are also three counties in South Dakota that might be a potential source for soybeans. These counties are Day, Marshall, and Roberts. The average production in these counties in the six year period 1956-1961 was 584,000 bushels (Table 4).

The production figures given in this section include total production. The total average production of soybeans for the 1956-1961 period in southeastern North Dakota, four counties in western Minnesota, and three counties in South Dakota was 5,158,641 bushels. Some of this production would be used for seed, feed, and other uses. A processor estimated that about 50 to 60

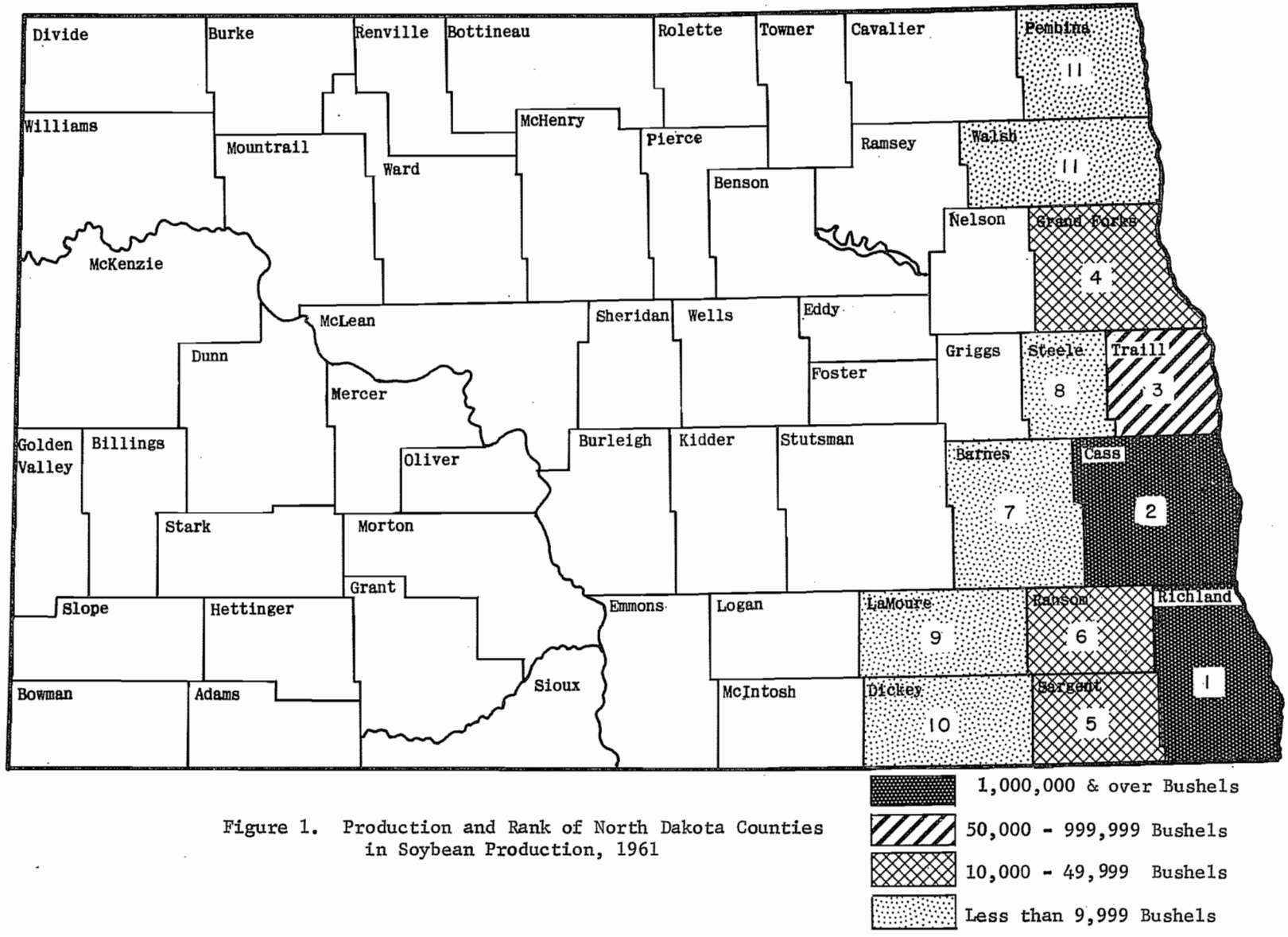

Figure 1. Production and Rank of North Dakota Counties in Soybean Production, 1961

TABLE 2. SOYBEAN PRODUCTION IN SEVEN COUNTIES IN SOUTHEASTERN NORTH DAKOTA, 1956-1961

County	1956	1957	1958	1959	1960	1961	Average 1956-1961
				(Bushels)			
Barnes	10,400	18,200	19,800	13,000	7,000	6,300	12,450
Cass	601,900	874,000	1,050,000	937,200	868,000	1,131,500	910,433
Dickey	9,600	15,000	6,300	2,400	2,700	2,600	6,433
LaMoure	1,500	3,000	9,600	5,600	1,700	2,700	4,017
Ransom	15,300	24,800	55,800	27,000	14,400	13,500	25,133
Richland	1,260,000	1,805,000	1,918,000	1,248,050	1,187,500	1,431,000	1,474,925
Sargent	49,500	68,000	80,000	42,700	36,000	23,200	49,900
Total	1,948,200	2,808,000	3,139,500	2,275,950	2,117,300	2,610,800	2,483,291

Source: U. S. Department of Agriculture, Statistical Reporting Service, Agricultural Estimates Division and North Dakota State University of Agriculture and Applied Science, Department of Agricultural Economics, North Dakota Crop and Livestock Statistics, Annual Summary for 1961, Ag. Statistics No. 8, May 1962, p. 45.

TABLE 3. SOYBEAN PRODUCTION IN FOUR WESTERN MINNESOTA COUNTIES, 1956-1961

County	1956	1957	1958	1959	1960	1961	Average 1956-1961
				(Bushels)			
Becker	116,000	124,800	135,600	84,500	79,500	114,800	109,200
Clay	800,800	841,500	883,500	1,072,700	875,200	1,132,200	934,317
Otter Tail	231,000	203,200	205,400	141,000	87,600	141,100	168,216
Wilkin	865,500	939,600	1,027,500	786,800	666,400	991,800	879,600
Total	2,013,300	2,109,100	2,252,000	2,085,000	1,708,700	2,379,900	2,091,333

Source: U. S. Department of Agriculture, Crop and Livestock Reporting Service and Minnesota Department of Agriculture, Minnesota Agricultural Statistics, 1958, 1959, 1960, 1961, and 1962.

TABLE 4. SOYBEAN PRODUCTION IN THREE SOUTH DAKOTA COUNTIES, 1956-1961

County	1956	1957	1958	1959	1960	1961	Average 1956-1961
				(Bushels)			
Day	34,000	43,200	16,900	2,400	5,400	6,100	18,000
Marshall	29,400	42,000	30,600	10,500	22,200	26,200	26,817
Roberts	556,400	660,200	557,200	256,900	623,800	580,700	539,200
Total	619,800	745,400	604,700	269,800	651,400	613,000	584,017

Source: U. S. Department of Agriculture, Statistical Reporting Service, Agricultural Estimates and South Dakota Department of Agriculture, Division of Agricultural Statistics, South Dakota Agriculture, 1961, pp. 34-36.

per cent of the production in the area of the processing plant could be obtained. This processor also estimated that the supply of soybeans for a plant should be available in about a 60 mile radius of the plant. If one takes these factors into account, using the 1956-1961 average production, the 5,158,641 bushel production would be reduced to about 2,200,000 bushels that a processing plant located in southeastern North Dakota would have as a potential supply.

Plant capacities are rated in terms of tons of soybeans processed in a twenty-four hour period. Plant sizes may vary from 25 tons to plants processing over 1,000 tons of soybeans per day. Table 5 shows the annual soybean requirements in bushels for plant sizes ranging from 25 to 1,000 tons per day and operating 330 days per year. Using the above estimate of 2,200,000 bushels of soybeans that might be available, this would be enough to support a plant that would process 200 tons of soybeans per day.

TABLE 5. ANNUAL SOYBEAN REQUIREMENTS FOR PROCESSING PLANTS OF VARIOUS SIZES OPERATING 330 DAYS PER YEAR

Daily Capacity in Tons Per 24 Hours	Annual Capacity in Bushels To Operate 330 Days Per Year
25	275,000
50	550,000
100	1,100,000
150	1,650,000
200	2,200,000
300	3,300,000
400	4,400,000
500	5,500,000
600	6,600,000
800	8,800,000
1,000	11,000,000

Source: U. S. Department of Agriculture, Agricultural Marketing Service, Marketing Research Division, Size of Soybean Oil Mills and Returns to Growers, Marketing Research Report No. 121, November 1956, p. 7.

MARKETING SOYBEANS

The present marketing pattern for soybeans in the area is of interest to any potential processing plant. In North Dakota, most farmers market their soybeans directly to the local country elevator.

To find out where the North Dakota soybeans go after they leave the country elevator, a questionnaire was sent out to all country elevators in the six counties of Grand Forks, Traill, Cass, Richland, Sargent, and Ransom. The information obtained from the elevator managers was the destination of the soybeans shipped from the elevator during the period October 1, 1960 to September 30, 1961, method of transportation used, and the elevator manager's estimate of whether soybean production in his area would increase, decrease, or remain the same in the next five years.

About 84 per cent of the soybeans were shipped by truck from the country elevator. The soybeans when sold from the local elevators went to markets in North Dakota, Minnesota, Iowa, and Canada. Table 6 shows the general destination of soybeans shipped from country elevators during the period October 1, 1960 to September 30, 1961. Thirty-eight per cent of the soybeans were marketed in the Minneapolis area, 26 per cent went to Canada, and 21 per cent went to Duluth-Superior. The sample accounted for about 52 per cent of the production in the six counties for the 1960 crop year.

The soybean processing plants at Grand Forks, North Dakota, and Halstad, Minnesota, were the main markets for the soybeans marketed with the Red River Valley as the destination.

TABLE 6. POINTS OF DESTINATION FOR SOYBEANS SHIPPED FROM COUNTRY ELEVATORS DURING THE PERIOD OCTOBER 1, 1960 TO SEPTEMBER 30, 1961

Destination	Per Cent of Total Bushels Shipped
Minneapolis	38
Canada	26
Duluth-Superior	21
Red River Valley	14
Iowa	1
Total	100

Thirty-one per cent of the elevator managers expected an increase in soybean production in the next five years, 11 per cent expected a decrease, and 58 per cent said it would remain the same. Of those reporting an increase in production, the average increase was expected to be about 20 per cent. Those that reported a decrease in production expected an average decrease of about 19 per cent. One of the main reasons mentioned by the elevator managers for the lack of interest in soybeans in their area was low yields.

RESOURCE REQUIREMENTS FOR A SOYBEAN OIL PROCESSING PLANT

One of the important material requirements--soybeans--has just been discussed. Resource requirements which are important for a processing plant include capital, fuel, electricity, water, and labor. The estimated requirements for these resources will be discussed in this section. Much of the data used was taken from secondary sources but will provide a very useful guide for analyzing an area as to its potential for a plant location.

Capital Requirements

The amount of capital required for a soybean processing plant will vary depending upon many factors. The soybean oil processing plant is a complex of raw material handling, finished material handling and storage facilities;

power and steam generation including the distribution systems; raw material preparation, solvent extraction, post extraction treatment facilities, control laboratory and office space. These facilities, with the exception of the solvent extraction, vary widely depending upon plant location, personal preference and the manner in which the raw material is purchased and stored and the finished products sold.

The capital requirements will be discussed in two parts--the capital requirements for fixed assets and the requirements for working capital.

Capital Requirements for Fixed Assets

The capital requirements for fixed assets are estimated for two sizes of plants--the 100 ton and the 200 ton per day capacity. Table 7 shows the estimated investment costs in fixed assets for these two sizes of plants. Processing equipment accounts for the highest investment costs. Soybean storage facilities account for the second highest investment cost. Processors interviewed pointed out the need for adequate storage facilities. Storage is essential to take advantage of low soybean prices during certain periods of the year and also to have soybeans available during periods when they are hard to obtain without paying premiums. The processors estimated a minimum storage facilities of about 600,000 bushels for a plant processing 200 tons of soybeans per day. This would provide enough beans to operate 90 days.

TABLE 7. ESTIMATED INVESTMENT REQUIREMENTS FOR A SOLVENT SOYBEAN OIL MILL PRODUCING CRUDE OIL AND 44 PER CENT PROTEIN MEAL

Investment Item	Size of Mill	
	100 Ton	200 Ton
Buildings for plant	$ 145,000	$ 145,000
Machinery and equipment	327,000	455,000
Soybean storage facilities[a]	210,000	420,000
Trucks and trailers	50,000	95,000
Land	3,000	5,000
Other	40,000	62,000
Total investment in fixed assets	$ 775,000	$1,182,000

[a]Storage capacity for 90 days operation.

The building costs were the same for both sizes of plants. Actually the 100 ton plant could get by with somewhat less building investment. If the plant was to be expanded the building space would also have to be expanded. The processors pointed out that it is well to start with building facilities which would allow for some expansion in plant size.

To erect a plant and have a minimum of soybean storage facilities would require about $1,182,000 for a 200 ton per day plant and about $775,000 for a 100 ton per day plant. As was mentioned, these costs could vary widely

depending upon the plant location, personal preference, and the manner in which the raw material is purchased and stored, and the finished products sold. Appendix Table 5 shows the total investment requirements for solvent soybean oil mills which vary in size from 25 to 1,000 tons per day. These costs are for the 1952-53 season but can be useful guides for estimating investment costs.

This study is concerned only with the processing of soybean oil to the crude stage since a small plant located in North Dakota would not have a processing advantage in refining edible oil. The processing of edible vegetable oil is largely carried on by a comparatively few large manufacturing concerns. The first stage, crushing soybeans, is usually carried on in the oilseed-producing area to minimize transportation costs. Refineries of edible oil frequently are located some distance from crude oil mills and near marketing or consuming areas because transportation of oil is less expensive than transportation of end products.[4] Manufacturers of margarine either produce their own refined oil or purchase it from a refinery. Edible oil obtained from refineries is tailored to produce a product having the characteristics specified by the margarine manufacturer.

Working Capital

A plant must have adequate working capital to operate efficiently. Plant managers pointed out that some new plants getting started have nearly failed because of trying to operate with insufficient capital.

The working capital is used for the purchase of beans for storage, to meet expenses during lags between product sales and receipt of payment, to meet expenses during shutdowns for repairs, and for acquiring working inventories such as meal bags, fuel, repair parts, and other supplies. The working capital must be adequate at any one time to meet the expenses during periods of shutdowns. Many plants use borrowed capital and use the beans in storage as collateral.

How much working capital is needed for a soybean processing plant? One processor estimated adequate working capital to be $130 working capital for each $100 invested in the plant and facilities. This would be about $1,536,000 for a 200 ton plant using the investment costs in Table 7. When one considers the cost of buying 600,000 bushels of soybeans for storage, this alone would amount to $1,416,000 at today's prices. This would leave $120,000 to meet the other expenses. Using this same formula, the 100 ton plant would require a working capital of about $1,000,000.

Combining the capital requirement for investment in fixed assets and the capital required for operating expenses gives a total of $2,718,000 for a 200 ton per day processing plant. The 100 ton per day processing plant would require a capital investment of $1,775,000.

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[4]Farnworth, Virginia M., Returns from Marketing Cottonseed and Soybean Oils in Margarine, Marketing Research Report No. 503, Economic Research Service, United States Department of Agriculture, October 1961, pp. 6-7.

Fuel Oil Requirements

If fuel oil is to be used for firing the boilers the estimated requirements are shwon in Table 8. It will take approximately 10.86 gallons of fuel oil to process a ton of soybeans. A 200 ton per day plant will consume 2,172 gallons per day or 716,760 gallons in 330 operating days.

TABLE 8. FUEL OIL REQUIREMENTS FOR SOLVENT OIL MILLS OF SELECTED CAPACITIES

Plant Capacity	Consumption[a]	
	Per Ton	Per Day
(Tons/Day)	(Gallons)	(Gallons)
50	10.86	543
100	10.86	1,086
150	10.86	1,629
200	10.86	2,172
300	10.86	3,258
400	10.86	4,344
500	10.86	5,430

[a]All mills used No. 6 fuel oil.

Source: United States Department of Agriculture, Agricultural Marketing Service, Marketing Research Division, Size of Soybean Oil Mills and Returns to Growers, Marketing Research Report No. 121, November 1956, p. 19.

Electricity Requirements

The electricity requirements presented in this section are based upon consumption in mills completely electrified. It is estimated that 40 kilowatt-hours per ton of soybeans would be required by solvent mills. Table 9 shows the electricity required by size of plant on the basis of daily and monthly operations.

TABLE 9. ELECTRICITY REQUIREMENTS FOR SOLVENT MILLS OF SELECTED CAPACITIES

Plant Capacity	Kilowatt-Hours Required	
	Per Day	Per Month
(Tons/Day)		
50	2,000	55,000
100	4,000	110,000
150	6,000	165,000
200	8,000	220,000
300	12,000	330,000
400	16,000	440,000
500	20,000	550,000

Source: United States Department of Agriculture, Agricultural Marketing Service, Marketing Research Division, Size of Soybean Oil Mills and Returns to Growers, Marketing Research Report No. 121, November 1956, p. 19.

Water Requirements

Water is an essential resource in processing soybeans. Water is used for sanitation, steam production, and condensing vaporized solvent. The estimated water requirements per ton of soybeans processed in solvent soybean oil mills was 300 gallons for all plant sizes. The water requirement will vary some depending upon the temperature of the water. Table 10 shows the per ton, per hour, and per day water requirements by size of plant. A plant of 200 ton per day capacity would require about 60,000 gallons of water per day. The water supply at any potential plant site must be adequate to take care of the needs for the size of plant desired. The supply must be adequate even during periods of low precipitation.

TABLE 10. WATER REQUIREMENTS FOR SOLVENT SOYBEAN OIL MILLS BY SELECTED PLANT CAPACITIES

Plant Capacity	Consumption[a]		
	Per Ton	Per Hour	Per Day
(Tons/Day)		(Gallons)	
50	300	625	15,000
100	300	1,250	30,000
150	300	1,875	45,000
200	300	2,500	60,000
300	300	3,750	90,000
400	300	5,000	120,000
500	300	6,250	150,000

[a]All mills had facilities for recirculating water which was used to condense solvent.

Source: United States Department of Agriculture, Agricultural Marketing Service, Marketing Research Division, Size of Soybean Oil Mills and Returns to Growers, Marketing Research Report No. 121, November 1956, p. 19.

Labor Requirements

Total labor requirements for a soybean processing plant will depend upon the plant layout, services performed, and the method of handling soybean oil meal. Table 11 shows the labor requirements for solvent extraction soybean oil mills of selected plant capacities studied in the 1952-53 processing season. One section of the table shows the labor requirements for plants producing bulk soybean oil meal only and the other section shows the labor requirements for producing various proportions of bulk and bagged soybean oil meal. Included in the make up of these labor requirements by plant capacity is the labor required for bean unloading, bean storage, bean preparation, oil extraction, meal processing, meal bagging, meal loading, maintenance, and miscellaneous.

TABLE 11. LABOR REQUIREMENTS FOR SOLVENT EXTRACTION SOYBEAN OIL MILLS BY SELECTED PLANT CAPACITIES

Plant Capacity	Producing Bulk Meal Only			Producing Bulk and Bagged Meal			
	Man Hours Per Ton of Soybeans	Bushels Per Man Hour	Number Employed	Man Hours Per Ton of Soybeans	Bushels Per Man Hour	Number Employed	Per Cent Bulk
(Tons/Day)							
50	1.64	20	11	1.98	17	13	34
100	1.13	29	15	1.42	24	18	56
150	.94	36	18	1.00	33	19	64
200	.88	38	22	.94	35	24	68
300	.71	47	27	.76	44	29	72
400	.66	50	33	.72	47	36	73
500	.58	57	37	.63	53	40	75

Source: United States Department of Agriculture, Agricultural Marketing Service, Marketing Research Division, Size of Soybean Oil Mills and Returns to Growers, Marketing Research Report No. 121, November 1956, pp. 10-13.

TRANSPORTATION

A soybean plant needs good transportation facilities. Transportation facilities are important for assembling the raw material and marketing the oil and meal.

During the crop season of October 1, 1960 to September 30, 1961, about 84 per cent of the soybeans were transported by truck when shipped from the country elevator. A soybean processing plant should consider the highway facilities for assembling the raw material and marketing soybean oil meal. The load limits which are put on highways during the spring season might also have a bearing on plant location. Costs are increased when lighter loads have to be hauled.

Soybean oil is shipped by railroad in nearly every case at the present time. Railroad transportation facilities to the potential market areas for the oil must be taken into consideration in plant location.

Southeastern North Dakota is well served by railroads. The main lines of the Great Northern, Northern Pacific, and the Minneapolis, St. Paul and Sault St. Marie railroads cross the area. Each of these has many branch lines serving the area.

Southeastern North Dakota is well located for hard surfaced highways which run north-south and east-west in the area. Federal highway 94 runs east and west across the northern part of the area. There are three state highways which cross the area in a north-south and east-west direction. Most of the major towns are served by hard surfaced highways.

UTILIZATION OF PRODUCTS

A soybean processing plant has two products to market--the oil and the meal. The amount of soybeans processed is partly determined by the demand for each of the products. These products have both a domestic and a foreign demand. The utilization and marketing of these products will be discussed in this section.

Soybean Oil

The production of soybean oil has increased from 1,937 million pounds in 1949 to 4,950 million pounds in 1962. This is an increase of 156 per cent. Table 12 shows the supply and disposition of soybean oil for the 14 year period 1949 to 1962. The proportion of soybean oil production that is used domestically is decreasing. During the period 1952 to 1954 when exports were down, about 92 per cent of the supply was used domestically. In 1961, only 63 per cent was used for domestic consumption. The trend in exports has been increasing in the last seven years.

Soybean crushings during the 1961-62 marketing year are estimated to reach a new high of around 439 million bushels. The highly favorable demand and price situation for soybean meal and low meal stocks provided the impetus for the heavy crush even though oil stocks remain at record levels. The build up in oil stocks was also reflected in the low oil price in the summer of 1962.

TABLE 12. SOYBEAN OIL: SUPPLY AND DISPOSITION, 1949-1963

Year	Supply			Disposition		
	Stocks	Production	Total	Domestic	Exports	Carryover
	(Million Pounds)					
1949	113	1,937	2,050	1,646	291	113
1950	113	2,454	2,567	1,906	490	171
1951	171	2,444	2,615	2,150	271	194
1952	194	2,536	2,730	2,462	93	174
1953	174	2,350	2,525	2,326	71	127
1954	127	2,711	2,838	2,609	50	179
1955	179	3,143	3,322	2,539	556	227
1956	227	3,431	3,658	2,565	807	286
1957	286	3,800	4,086	3,051	804	281
1958	281	4,251	4,532	3,304	930	298
1959	298	4,338	4,636	3,376	953	307
1960	307	4,420	4,727	3,329	721	677
1961[a]	677	4,790	5,467	3,478	1,335	650
1962[b]	650	4,950	5,600	3,600	1,575	425
1963[b]	425					

[a]Preliminary

[b]Forecast

Source: Fats and Oils Situation, January, May, August and November, 1962.

Domestic Markets for Oil

The food fats and oils produced and consumed in the United States, in order of importance, are soybean oil, lard, cottonseed oil, butter, edible beef fats, corn oil, and peanut oil. Soybean oil, lard, cottonseed oil, and butter account for about 90 per cent of the domestic consumption of separated fats and oils.

The major market for soybean oil in the United States is for food uses. In 1960, about 90 per cent of the domestic consumption of soybean oil went for food uses. Shortening utilized 32 per cent, margarine 31 per cent, and salad and cooking oils 27 per cent of the domestic consumption. Table 13 shows the consumption of soybean oil in the United States for the period 1949 to 1960.

The rapid increase in the use of soybean oil from pre World War II to the present was associated with an increasing population, relative stability in the per capita consumption of total fats and oils, and a relatively stable supply of competing fats and oils.[5] A prime detriment to a greater use of food fats and oils in industrial uses is the instability of their prices. Prices are the result of supply and demand conditions throughout the world and are subject to abrupt change. Where possible, industry prefers to utilize raw materials which are in relatively stable supply and which have a relatively stable price, and this in a large measure accounts for the relatively small proportion of soybean oil utilized in nonfood products.[6]

Figure 2 shows the trend in the price per pound for crude oil at Midwestern mills and the production of oil for the marketing year beginning October 1, 1949 and ending September 30, 1962. The figure shows the wide fluctuation in the price of soybean oil. Figure 2 shows that the production of soybean oil made a rapid growth from 1953 to 1958. During this 5-year period, production increased from 2,350 million pounds to 4,251 million pounds. Since 1958, production of soybean oil has been increasing but at a slower rate. Appendix Table 1 shows the price of oil by months for the crop year 1935 to 1962. The price of oil has continued to weaken during the 1962 summer season reaching as low as 7.5 cents on July 9 and 10.

Foreign Markets

Foreign markets are very important in the soybean oil industry. In the marketing year October 1, 1961 to September 30, 1962, about 25 per cent of the soybean oil supply was exported. The demand for food fats and oils in the United States is primarily for domestically produced butter, lard, edible beef fats, soybean oil, cottonseed oil, corn oil, peanut oil, and safflower oil. The total volume produced exceeds domestic consumption. Imports of fats and oils into the United States are negligible. Each year there is an adequate supply available to export to other countries.

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[5]Berg, Eric, Structure of the Soybean Oil Export Market, Research Report AERR-30, Department of Agricultural Economics, Agricultural Experiment Station, University of Illinois College of Agriculture, Urbana, Illinois, January 1960, p. 11.

[6]Ibid. p. 14.

TABLE 13. SOYBEAN OIL: UTILIZATION, YEAR BEGINNING OCTOBER 1949-1960

Utilization	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960[a]
						(Million Pounds)						
Food Uses:												
Shortening	776	795	800	879	905	979	803	764	993	1,136	1,182	1,097
Margarine	265	459	583	735	661	741	725	836	1,041	1,082	1,114	1,073
Cooking and Salad Oils	288	344	404	462	437	545	668	627	692	681	746	942
Other Edible										77	30	26
Total	1,329	1,599	1,786	2,077	2,002	2,264	2,196	2,227	2,726	2,976	3,072	3,137
Nonfood Uses:												
Paint and Varnish	112	91	109	155	138	138	115	117	103	102	103	96
Resins and Plastics		62	68	61	56	71	71	72	54	66	73	64
Other Drying Oil Products		11	11	9	7	11	9	9	9	6	4	4
Linoleum and Cloth	30	7	19	12	7	2	3	1				
Other Inedible	97	50	60	42	32	15	39	31	28	37	41	38
Foots and Loss	78	87	97	106	84	107	107	107	132	133	147	138
Total	317	308	364	386	324	344	344	337	325	343	368	340
Total Domestic Disappearance	1,646	1,906	2,150	2,463	2,326	2,609	2,539	2,565	3,051	3,320	3,440	3,476

[a]Preliminary

Source: Fats and Oils Situation, January 1962, p. 11.

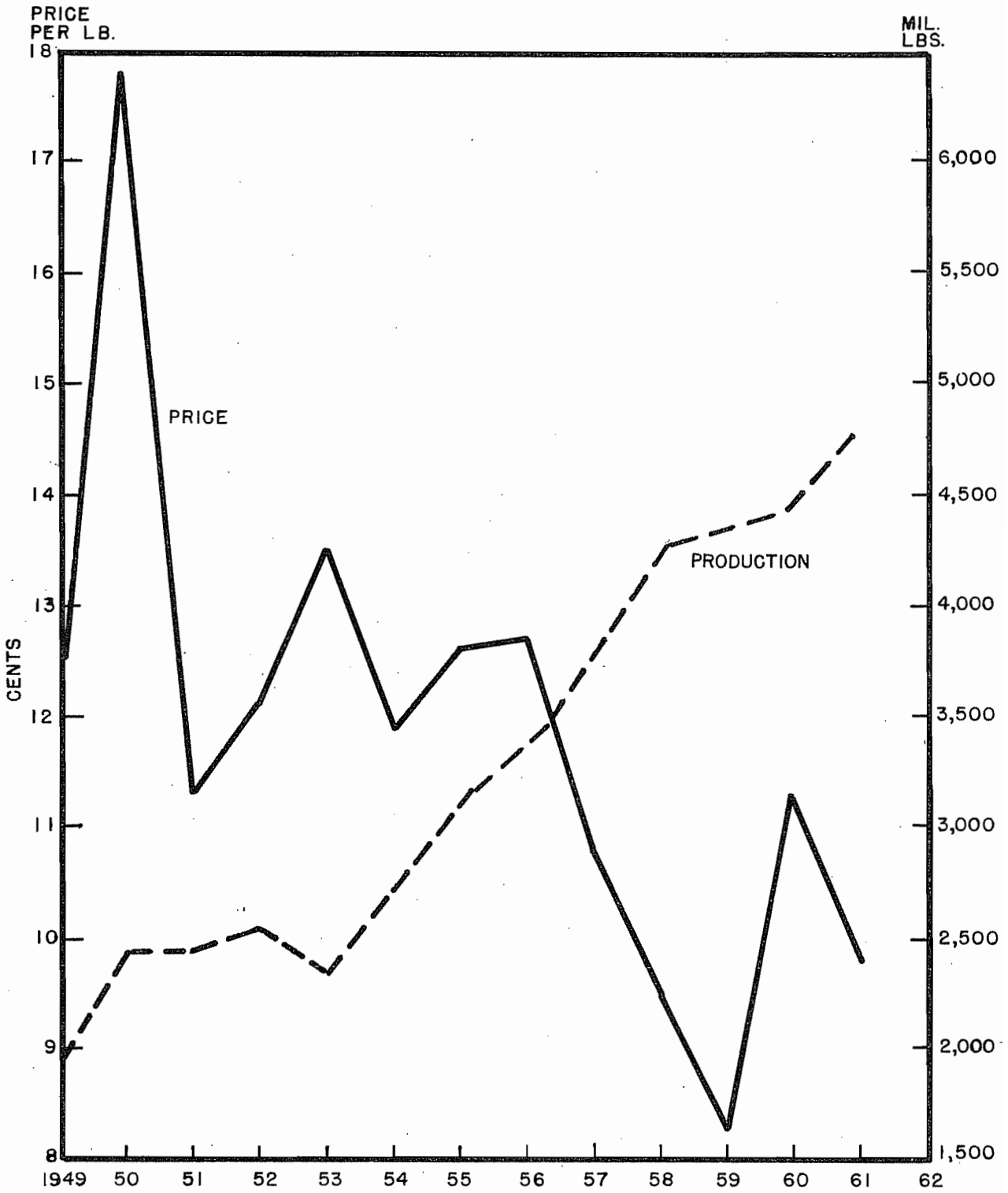

FIG. 2. UNITED STATES PRODUCTION AND PRICE PER POUND AT MIDWESTERN MILLS FOR SOYBEAN OIL, 1949-1961

The consumption of fats and oils in any given market is determined by:[7]

1. Consumer preferences
2. The ability of the marketing system to process raw materials into higher-quality products demanded by consumers and to make the finished products available to all potential consumers
3. Per capita income
4. Distribution of income
5. Price of fats and oils in relation to other goods
6. Total population of the market area.

Over a given period, each of the six factors affecting consumption is in turn affected by one or more of the remaining factors. Therefore, it is difficult to measure the effect of each factor on consumption independently of the remaining factors for a given period.

The major world export markets for fats and oils are western Europe, Japan, and Canada. Prior to 1949 the United States was a net importer of food and soap fats and oils. Because of the rapid increase in the production of soybean oil and tallow and grease, it has become the world's most important exporter of fats and oils. In becoming the largest exporter, the United States has largely replaced Asia, including China, in world markets. Table 14 shows the soybean oil exports from the United States to the countries of destination for the five year period 1957-58 to 1961-62. During this five year period, the proportion of the soybean oil that was exported to European countries ranged from 50 to 75 per cent of the total United States exports of soybean oil. The proportion dropped to 50 per cent in the 1961-62 season. Spain received from 57 to 71 per cent of the soybean oil that was exported to the European countries in the five year period 1957-58 to 1961-62.

If the present trend continues, the amount of soybean oil available for export will increase in the years to come. Finding export markets for the increased production of fats and oils in the United States will mainly involve getting a greater share of the large western European markets and expanding exports to the less developed countries as their demand increases.

The expansion of markets in western Europe will not be easy as the United States will be competing with many other countries for the same markets, and the western European countries are expanding their soybean processing facilities. Nigeria and French West Africa are the two most important suppliers for western Europe, excluding the United States. Also, increasing exports to the less developed countries will mean overcoming the difficulties of changing tastes and preferences, transportation in the countries, lack of manufacturing equipment, refrigeration facilities, and dollars to buy the oil.

The processors interviewed had mixed opinions on the outlook of the export market for soybean oil. Processors agreed that the countries that could use the soybean oil did not have the dollars to buy the oil. Also, there would need to be some educational work done in these countries to show how the oil could best be used in their diets and the benefits obtained by using soybean oil. The countries that have been importing large quantities of soybean oil are expanding their processing facilities.

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[7] Ibid. p. 58.

TABLE 14. EXPORTS OF UNITED STATES SOYBEAN OIL BY COUNTRY OF DESTINATION, YEAR BEGINNING OCTOBER, 1957-1961[a]

Continent and Country of Destination	1957-58	1958-59	1959-60	1960-61[b]	1961-62[b]
			(1,000 Pounds)		
North America:					
Canada	23,477	30,811	36,725	24,250	15,855
Mexico	39,424	8,603	1,795	4,972	2,681
Panama Canal Zone	9	35	9		8
Costa Rica	117	137	118	162	116
Guatemala		1	136	118	6
Honduras		21	5		420
Panama	1,168	774	306	217	454
Bahamas	30	44	20	22	13
Bermuda	41	55	48	85	84
Cuba	11,911	9,974	10,653	2,857	
Haiti	7,857	8,197	8,803	8,258	10,018
Netherlands Antilles	1,291	1,289	1,201	841	508
Other	3	569	2,065	22	33
Total	85,328	60,510	61,884	41,804	30,196
South America:					
Argentina		37	8,736		
Bolivia	948	723	2,137	1,355	594
Brazil					427
British Guiana			1,792		
Chile	457	1,981	11,874	21,351	35,045
Columbia	2,875	28,172	42,359	4,992	16,646
Ecuador	2,493	4,304	6,544	7,215	4,603
French Guiana			1,623		
Paraguay			110	42	
Peru	11	10,803	18,164	8,872	35,647
Surinam	32	39	62		
Uruguay			12,267		19
Venezuela	327	188	921	263	127
Total	7,143	46,247	106,589	44,090	93,108

(Continued)

TABLE 14. (Continued)

Continent and Country of Destination	1957-58	1958-59	1959-60	1960-61[b]	1961-62[b]
			(1,000 Pounds)		
Europe:					
Germany, East				13,240	1,343
Austria	1,764		1,102		23
Belgium-Luxembourg	9,505	22	1,356		18
France	60	24			36
Germany, West	5,337	5,723	52,006	2,295	9,220
Greece	3,043			45,257	
Iceland	671	836	950	897	1,084
Italy	67,093	64,341	11,789	39	47
Netherlands	3,786	22,142	66,364	16,785	7,504
Spain	382,481	445,897	357,924	288,532	399,742
Sweden	11	33	916	6	6
Switzerland			1,552		
Norway				3	57
United Kingdom	291	1,814	15,213	6,619	3,425
Czechoslovakia				4,406	
Poland	28,673	56,090	32,997	61,717	55,959
Rumania		3,365			
Yugoslavia	80,263	92,648	47,485	60,570	87,848
Finland				2,439	
Gibralter				112	
Other					9
Total	582,978	692,935	589,654	502,917	566,321
Asia:					
Iran	9	3	39	2,202	26,954
Israel	5,992	4,413	18,511	22,785	42,883
Turkey	86,571	71,938	45,748		78,589
China Taiwan	6,807	5,952	3,416	2,796	7,313
Hong Kong			6,174	4,428	52,226
India		14		6,725	249
Japan	127		98	2,488	51
Korea, South					164
Malaya-Singapore		7			
Pakistan	749	23,893	28,565	35,588	141,226
Philippines	135	10	66		766
Other	14	107	5	703	6,630
Total	100,404	106,337	102,622	77,715	357,051

(Continued)

TABLE 14. (Continued)

Continent and Country of Destination	1957-58	1958-59	1959-60	1960-61[b]	1961-62[b]
			(1,000 Pounds)		
Africa:					
Algeria					3,455
Egypt		8,776	46,674	5,108	40,573
Morocco	27,803	15,411	39,833	26,040	28,171
Union of South Africa			3,635	71	256
Other			203		1,410
Total	27,803	24,187	90,345	31,219	73,865
Oceania:					
Australia		11	1,466	2,629	3,464
French Pacific Islands	15	3		7	2
New Zealand	20				
Other				4	2
Total	35	14	1,466	2,640	3,468
Total United States Exports	803,986[c]	930,439[d]	952,754[e]	700,385	1,124,009

[a]Crude and refined oil combined as such.

[b]Preliminary

[c]Includes 295,000 pounds whose destination is not indicated.

[d]Includes 209,000 pounds whose destination is not indicated.

[e]Includes 194,000 pounds whose destination is not indicated.

Source: Soybean Blue Book, 1962, pp. 51-52.

U. S. Department of Agriculture, Foreign Agricultural Service, Foreign Agriculture Circular, December 11, 1963, pp. 4-5.

Destination of Crude Soybean Oil From Processing Plants in the Midwest

Information on the railroad shipments of soybean oil were obtained in an attempt to determine the general movement of crude soybean oil from specific processing areas. Data were considered for railroad shipments from the six leading soybean processing states of Illinois, Iowa, Ohio, Indiana, Minnesota, and Missouri.

Information was obtained from the waybill statistics for 1959 which are published by the Interstate Commerce Commission. The waybill statistics consist of a one per cent sample of all waybills obtained for the total carload traffic terminated by Class I railroads in the United States. It should be taken into consideration that only railroad shipments are included; however, the general direction of soybean oil shipments should be comparable for railroad and trucks.

Soybean oil from Ohio moved mainly to the Atlantic Coast states with New Jersey and New York the main states receiving oil (Table 15). Shipments from Indiana moved into neighboring states with Ohio, New Jersey, and New York being the leading states receiving the oil (Table 15).

Illinois, which is the leading soybean processing state, had the widest distribution of shipments. Shipments were concentrated in the North Atlantic and east North Central states (Table 15). However, some oil was also shipped to several southern states plus California. The five leading states receiving oil from Illinois were Illinois, New Jersey, Ohio, California, and New York.

Shipments from Missouri and Iowa follow the same general pattern. The three main states receiving oil from Missouri were Tennessee, Texas, and California. Illinois, California, Texas, and Tennessee were the four leading states receiving oil from Iowa.

Shipments of oil from Minnesota were widely dispersed, ranging from the east to the west coast. The three leading states receiving oil from Minnesota were California, Louisiana, and Illinois.

Soybean Oil Meal

Soybean acreage was increased during World War II as a quick source of edible oil, as the United States was then an importer. In recent years, because of the advances in knowledge of feeding high protein in animal and poultry nutrition, soybean meal has been in demand. Edible oil has been in surplus with much of the excess moved abroad under government surplus disposal programs.

Table 16 shows the supply and disposition of soybean oil meal from 1950 to 1961. Production has increased from 5,897,000 tons in 1950 to 10,342,000 tons in 1961. Domestic disappearance has increased from 5,748,000 tons in 1950 to 9,226,000 tons in 1961. Most of this is used in livestock feeds. In 1959, 42 per cent of the soybean oil meal used for livestock feed was used in poultry feeds, 30 per cent in hog feeds, 14 per cent for beef cattle, 10 per cent for dairy, and four per cent for other livestock. The poultry and hog enterprises consume about 72 per cent of the soybean meal used in livestock feeds.

TABLE 15. DESTINATION OF SOYBEAN OIL SHIPPED BY RAIL FROM SIX LEADING PROCESSING STATES, 1959[a]

Destination	State of Origin					
	Illinois	Iowa	Ohio	Indiana	Minnesota	Missouri
	(Tons)					
California	234	523			489	121
Colorado	15					
Florida	30				92	
Georgia	17		31			
Illinois	1,916	952			122	61
Indiana	99					
Iowa	30					
Kentucky	61			30		
Louisiana	31	60			250	
Maryland	91				31	
Massachusetts					31	
Michigan	90		31			
Minnesota		31				
Missouri	152	148			94	60
Nebraska	60					
New Jersey	789	152	652	397		
New York	213		428	62	31	
Ohio	351	62		185		31
Oregon					30	
Pennsylvania	31	31	62	18	31	31
South Carolina			30			
Tennessee	137	277				213
Texas	31	366			107	160
Virginia			30			
Wisconsin					93	

[a]Based on a one per cent sample of all waybills obtained for the total carload traffic terminated by Class I railroads in the United States

TABLE 16. SOYBEAN OIL MEAL: SUPPLY AND DISPOSITION, 1950-1961

Crop Year Oct.1	Supply				Disposition		
	Oct. 1 Stocks	Production	Imports	Total	Domestic	Exports	Carry-over
				(1,000 Tons)			
1950	35	5,897	33	5,965	5,748	181	36
1951	36	5,704	24	5,764	5,670	42	52
1952	52	5,551	41	5,644	5,540	47	57
1953	57	5,051	16	5,124	4,995	67	62
1954	62	5,705	a	5,767	5,458	272	37
1955	37	6,546		6,583	6,071	400	112
1956	111	7,510	a	7,621	7,123	443	55
1957	55	8,284	a	8,339	7,992	300	48
1958	48	9,490	a	9,538	8,968	512	58
1959	58	9,153		9,211	8,479	649	83
1960	83	9,452		9,535	8,867	590	78
1961	78	10,342		10,420	9,226	1,100	94

[a]Less than 500 tons.

Source: Agricultural Statistics, 1961, p. 141.

Fats and Oils Situation, November 1962, p. 18.

Destination of Soybean Oil Meal From Processing Plants in the Midwest

Information was obtained on shipments of soybean oil meal by railroads in an attempt to determine the approximate flow of soybean oil meal between states. Information was obtained from the carload waybill statistics for 1960 which are published by the Interstate Commerce Commission. The statistics are based on a one per cent sample of total carload traffic terminated on Class I linehaul railroads in the United States.

Information was not available on shipments of soybean oil meal which originated in North Dakota. Information is not made available from states which have less than three shippers to prevent disclosure under provisions of the Interstate Commerce Commission order dated September 6, 1946.

Only railroad shipments are included; therefore, the information is limited since no truck shipments are included. Much of the soybean oil meal moves by trucks in certain areas. However, the general direction of flow is shown which would probably be similar for both railroad or truck shipments.

Information was made available in units of tons, of a one per cent sample, from five states to their destination states. The five states considered as origins were Minnesota, Iowa, Missouri, Illinois, and Indiana. The shipments from Indiana generally moved to the Eastern and New England states (Table 17). The shipments from Illinois, however, moved mostly to the entire eastern half of the country. However, a relatively small amount moved to the Pacific Coast area.

The shipments of soybean oil meal from Minnesota, Iowa, and Missouri moved into the Central and Western states (Table 17). The movement from Missouri was primarily to the southern Great Plains and Southern states with a relatively small amount moving to the Pacific Coast states. Iowa's rail shipments were made primarily to the adjoining states of Kansas, Nebraska, South Dakota, Minnesota, Wisconsin, Illinois, and Missouri. Approximately 16 per cent of the soybean oil meal shipped outside of Iowa by railroad moved to three Pacific Coast states.

Minnesota, of the states considered, had the largest per cent of its shipments going to the Western states. Approximately 60 per cent of the shipments moving outside of Minnesota moved to California, Oregon, Washington, and Idaho.

POTENTIAL MARKETS FOR THE PRODUCTS

Data on the potential markets for the soybean oil and meal are very important to a new firm entering the industry. Obtaining a share of the market in a highly competitive industry like the soybean processing industry involves a risk. The market is presently being supplied by other firms in the industry and, because of the intense competition for the market, a new firm may have difficulty obtaining and keeping a market outlet for its production at a return it needs to meet operating expenses.

TABLE 17. DESTINATION OF SOYBEAN OIL MEAL SHIPPED FROM FIVE LEADING PROCESSING STATES, 1960[a]

Destination	State of Origin				
	Illinois	Iowa	Indiana	Minnesota	Missouri
	(Tons)				
Alabama	1,033				
Arkansas	414				195
California	172	730		509	92
Colorado		144			50
Delaware	100		189		
Georgia	758				
Idaho				80	50
Illinois	5,724	265	50		
Indiana	1,002		153		
Iowa	130	2,527		207	
Kansas	30	201			70
Kentucky	573				
Louisiana	101				59
Maine			50		
Maryland			1,713		
Massachusetts	50		20		
Michigan	160		50	20	
Minnesota		828		954	
Mississippi	236				59
Missouri	1,326	859			338
Nebraska		1,702			184
New Hampshire			40		
New Jersey	190		231		
New York	733		793	20	
North Carolina	939		103		
Ohio	1,542		1,247		
Oklahoma					100
Oregon	51	40		341	
Pennsylvania	438		439		
South Carolina	90				
South Dakota		40			40
Tennessee	1,502		40		
Texas	397	80			246
Utah		43			
Vermont			220		
Virginia	252		170		
Washington	41	101		498	50
Wisconsin	436	428		706	

[a]Based on a one per cent sample of all waybills obtained for the total carload traffic terminated by Class I railroads in the United States.

Soybean Oil

The soybean oil obtained from the initial processing is called crude oil. Before this oil can be used for edible and other uses it must be further refined. There are approximately 68 refiners of soybean oil located in 18 states (Table 18). The movement of soybean oil shown in Table 15 is very closely related to the location of the plants for refining soybean oil. The states receiving the largest amounts of oil according to the one per cent sample of waybill statistics were Illinois, New Jersey, California, Texas, Tennessee, and New York. The largest number of oil refining plants are also located in these same states.

The direction of flow of the soybean oil is influenced by the pricing system. The price of soybean oil is based on the price of oil at Decatur, Illinois, minus the cost of transportation from point of origin to Decatur. On this basis, a plant located in North Dakota would have the best advantage selling to markets in western United States or to the west of North Dakota.

TABLE 18. NUMBER AND LOCATION OF PLANTS REFINING SOYBEAN OIL, 1962

State in Which Plant is Located	Number of Plants
California	11
Georgia	3
Illinois	10
Indiana	1
Iowa	1
Kentucky	1
Louisiana	2
Minnesota	4
Missouri	1
New Jersey	6
New York	5
North Carolina	1
Ohio	5
Oklahoma	1
Pennsylvania	1
Tennessee	4
Texas	10
Wisconsin	1
Total	68

Source: Soybean Blue Book, 1962, pp. 104-105.

Soybean Oil Meal

A new firm in the soybean processing industry will want to have the market outlets for the meal developed before coming into the industry. Soybean oil meal is a bulky product to store as about 46 to 48 pounds of a bushel of soybeans is meal. Meal cannot be allowed to accumulate as it is subject to spoilage and costly to store. It is essential that the processing plant move the

meal to the markets very efficiently rather than having to store large quantities periodically.

The direction of flow of the meal from the plants as shown in Table 17 is guided by the pricing system. On the basis of the pricing system, the area in which a plant located in North Dakota would have the best advantage is locally and to markets to the west.

The pricing system for soybean oil meal is based on the Decatur price basis. Using the Decatur price, the most advantageous location of a processor is at an extreme distance from Decatur, where local soybean supplies are available and where meal is sold locally at the Decatur price plus freight, allowing the processor to retain the added freight revenue as profit.[8]

The processing-in-transit privilege is an important transportation factor that can affect location particularly from the standpoint of soybean supplies and the market for soybean meal. The processing-in-transit privilege does not apply to soybean oil. Therefore, the closer the processing plant to the supply of soybeans, the less the inbound-freight cost to the processor on that portion of the soybean that is used for oil and that portion that constitutes the 5 per cent processing waste.[9]

There are other aspects of transportation that qualify and modify the picture for soybean oil meal from the standpoint of plant location and price advantage. Soybean oil meal is sold on the basis of restricted and unrestricted Decatur prices. Restricted meal is that meal produced by a processor in a location far enough away from Decatur to permit advantageous sales in a local area. The meal is sold at an advantage only in this restricted local area.[10] The Decatur processed meal is unrestricted in that the nation can be considered as a market for the meal from the Decatur area. Usually Decatur processed meal sells at a premium over restricted meal. From the local processor's standpoint, this is a disadvantage because much of the freight advantage of a local area is lost. The advantage or disadvantage depends upon the local competitive situation. A processor may be willing to sell meal at a discount under the Decatur price to obtain a market as long as he can retain some of his local transportation advantage. The transportation advantage is narrowed when the competitors also lower their prices.

Another limitation of the transportation advantage is the fact that a processor usually cannot afford to sell most of his meal on the spot market because most processors have to be sure of a market outlet for the day-to-day production of soybean oil meal without having to worry about selling meal at distressed prices. As a result, the processor usually sells much of his meal for nearby delivery-month shipments. This deferred market tends to give unrestricted meal a slight price advantage.

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[8]Goldberg, Ray A., The Soybean Industry, The University of Minnesota Press, Minneapolis, Minnesota, 1952, p. 90.

[9]Ibid. p. 91.

[10]Ibid. p. 98.

It is very important that any new firm entering the soybean processing industry to understand thoroughly the relationships between bean prices in their local area and bean prices in other areas, the pricing system for beans, oil, and meal, the cost of transporting the products from the processing plant to the consumer. These all affect the competitive position with other firms in the industry and can contribute materially to the success or failure of a plant.

There are many plants competing for the North Dakota market and, as a result, a plant located some distance from North Dakota may be serving markets adjacent to a local processing plant. Many times trucks are looking for a back haul load and will bring meal back for a small cost.

Several people in the processing industry indicated that a small plant starting up would need to find a market for the meal locally. What is the market for soybean oil meal in North Dakota? There are no statistics available as to how much high protein feed is being fed at the present time or what proportion of the farmers feed some supplement. North Dakota farmers have been increasing their purchases of feed over the last 10-year period 1950 to 1960. In 1950, North Dakota farmers spent about 14.2 million dollars for feed purchased and in 1960 they spent 19.8 million dollars. This includes all feed purchases including grain, hay, concentrates, and other feeds. The annual sales of commercial feeds in North Dakota as reported to the State Laboratories Department increased from 118,990,500 pounds in 1950 to 200,266,000 pounds in 1960.

The largest use of soybean oil meal is in poultry and hog feeds. The numbers of these types of livestock in North Dakota make up a small proportion of the livestock population. On January 1, 1962, North Dakota had 1,445,000 beef animals, 436,000 dairy animals, 275,000 hogs, 591,000 stock sheep, 124,000 lambs on feed, 2,595,000 chickens, and 57,000 turkeys. If all farmers in North Dakota fed soybean meal as a protein supplement at about the recommended rate there would be a demand for about 165,000 tons of soybean oil meal.

In 1960, there were about 88,584 tons of commercial feed sold in North Dakota which would have a high protein feed as part of the feed mix.[11] There were only 761 tons of soybean meal sold independent of the other feed mixes. The principal demand for soybean oil meal would be the feed processors. Studies for the United States estimate that about 7 to 10 per cent of the soybean meal is used directly by farmers and 90 to 93 per cent in formula feeds.

Estimating from the amount of commercial feeds sold in North Dakota, farmers are using about 38,000 tons of protein supplements. This is about 20 to 25 per cent of the potential that might be used. On this basis, a plant of about 140 tons of beans per day would be able to supply the present demand of about 38,000 tons. About one-third of this demand could be supplied by the soybean processing plant located at Grand Forks. A plant of 100 tons per day capacity could supply the remaining two-thirds. This emphasizes the need for a new plant to develop a complete marketing system for its products, particularly the soybean oil meal.

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[11]North Dakota State Laboratories Department, Feeds, Fertilizer, Pesticides, 1960 Report, Bulletin No. 129, Bismarck, North Dakota, June 1961.

In future years, it is expected that livestock numbers will increase. It can be expected that the demand for soybean oil meal will not increase at the same rate as livestock numbers. Part of this will be the result of changes in the feeding rations. As more barley is used in place of corn, less protein supplements will be required. The same is true as better quality forages are used in the ration. New developments in the feeding rations in future years might also tend to reduce the amount of protein supplement required.

MARKETING RISKS

Some of the greatest risks of a soybean processing plant are associated with the marketing of the products. Some of the risk is associated with the fluctuation of prices as they involve the inventories of the raw and finished products. Other marketing risks involve selling the finished products in a competitive market with firms of all sizes. Some of the marketing risks are associated with the financial position of the processing plant.

Inventory stocks are owned by processors for an average of several months or more. The longer the period of ownership, the greater the possibility of a decline in price. The inventory is also exposed to other risks, including destruction or deterioration.

Risks commonly are highly concentrated in the accumulating agency. A soybean plant that has storage facilities will have a considerable investment in soybeans during a part of the processing season. Prices of the inventory must be estimated largely in advance and are arrived at on the basis of incomplete information. The processor takes the risk of being able to sell his products at the price he estimated he would get when he bought the soybeans.

Risks of agricultural marketing may be handled in the following ways under private enterprise:

1. Covered by insurance
2. Reduced through increased information
3. Reduced by combining marketing units
4. Reduced by transferring to others

Many risks incurred in marketing farm products are covered by insurance of various kinds. Such risks are principally those in which losses can be predicted at least with a moderate degree of accuracy, so that appropriate premiums can be determined.

Risks may be reduced by obtaining additional information concerning the conditions which give rise to the risk. These risks are greatly reduced today with the various reports that are issued on crop production, demand forecasts, and business outlook.

Risks may be reduced by combining small business units that perform the same type of services. A large unit can handle many risks to a better advantage than a small one. Greater advantages result from the combination of business units that render successive marketing services, such as wholesaling and retailing.

Price risks and some other risks may be transferred to others by means of forward contracts or by hedging in organized future markets. Such transfers are used most frequently to reduce burdensome inventory risks.

Most of the risks mentioned and others are present in the soybean processing industry. A new firm in the industry needs to analyze these risks very carefully before investing in a processing plant. The risks might be analyzed from three points of view which are as follows:

1. The firm could build a soybean plant, operate it and market the products itself

2. The firm could build a soybean plant and operate it but have someone else market the products

3. The firm could build a soybean plant and lease it out to someone else to do the processing and marketing.

The first alternative involves the most risk in that all the risks must be assumed by the firm. The firm must be able to assume all of the risks from assembling the raw material to the marketing of the final product to the consumer.

The second alternative would be considered an intermediate risk position. The firm would need to assume only the risks involved in building and operating a processing plant. The marketing risks would be assumed by the firm doing the marketing. This would involve contracting for a price in advance of the delivery of the products and would involve the risks associated with forward pricing.

The third alternative would involve leasing the plant out to another firm. The risk under this situation would be obtaining a lease that would give the desired return on the investment in the plant.

The soybean oil industry uses the first alternative almost exclusively. There was only one case, of the processors interviewed, where a company used the third alternative. Most of the processors did not feel that there was much opportunity in the industry for alternatives two and three. Two processors did indicate that alternatives two and three might have some advantages depending upon the particular situation. The viewpoint of the soybean industry might be explained by the fact that 58 per cent of the soybean oil mills in 1958 were operated by multiunit firms and 42 per cent by single unit firms. Of these establishments, 80 per cent were corporations and 20 per cent non-corporate firms.[12] In 1958, 86 per cent of the value of soybean oil shipments was accounted for by the 20 largest companies. The four largest companies accounted for 40 per cent of the value of the total soybean oil shipments and the eight largest companies accounted for 63 per cent.[13]

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[12]United States Department of Agriculture, Economic Research Service, Marketing and Transportation Situation, August 1962, p. 26.

[13]Ibid., p. 23.

PROCESSING MARGINS

Prior to buying or processing soybeans the crusher is vitally concerned with the combined value of the soybean oil meal and the soybean oil. The sum of these product values must exceed the cost of a bushel of soybeans by enough cents per bushel to cover the processing costs and a profit. This is commonly called the "processor margin" and on a United States average is said to be economically sound when the products bring from 15 to 25 cents higher per bushel than the soybeans cost.[14] This will depend upon the firm's cost of production. Some firms will have a production cost of over 30 cents per bushel. The industry, which has a crushing capacity in excess of the demand for the oil and meal, usually slows down or closes plants whenever prices for the combined products fail to return adequate margins. This situation developed in the summer of 1962 when the price of oil dropped because the demand for meal remained good but the demand for the oil lagged. The good demand for soybeans on the export market plus the high support price kept the prices processors had to pay for beans high.

Processing margins are based on the price of oil, the price of meal, the price of soybeans, and the processing costs. Factors affecting the prices include the size of the soybean crop, the size of the carry-over of beans, oil, and meal, the outlook for the future crop and its products, and the demand for the oil and meal.

The processing costs for soybean oil plants range from 11 cents per bushel to over 30 cents per bushel depending on the size, capitalization, depreciation, and other factors. One processor estimated that the average cost of processing beans to the crude state of the oil and 44 per cent meal is in the 20 cent range. This processor also stated that to achieve this average cost, it is necessary to have a processing plant with about 500 tons per day capacity.

Table 19 shows an estimation of the processing margin for the six-year period 1956 to 1961. The prices used in this analysis are based on Decatur prices for the oil and meal and Chicago prices for soybeans. The United States average was used for the yield of the products from a bushel of soybeans in each of the six years. If this analysis can be used as a guide, there was only one year in the six which a processor made a good return on the plant investment. In a plant operation, soybeans are bought and stored when the price is low. This way most plants that have storage facilities can lower the cost of the beans. Prices do fluctuate from month to month so there are generally times during the year when the returns are better than the average would indicate, and of course, there are periods when the returns are lower than the average. Processors usually slow down their operations or close the plant when prices for the oil and meal fail to return adequate margins.

Table 20 shows a similar analysis for North Dakota conditions as was shown in Table 19 for the United States. The oil price for North Dakota was the Decatur price minus a quarter of a cent per pound for transportation. The meal price was estimated to be the Decatur price plus $6.00 per ton. Since it was assumed the meal would be sold locally, part of the freight can be used to

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[14]Merrill Lynch, Pierce, Fenner and Smith, Inc., Soybean Meal - Facts - Figures - Futures, July 1960.

TABLE 19. PRICE SPREAD, SOYBEANS AND END PRODUCTS, BASED ON DECATUR AND CHICAGO PRICES, 1956-1961

Year	Crude Oil Price[a]	Yield	Value	Meal Price[b]	Yield	Value	Value of Products	Soybean Price[c]	Processing Margin
	(Per Lb.)	(Lbs)	(Dol.)	(Per Ton)	(Lbs)	(Dol.)	(Dol.)	(Dol./Bu)	(Dol.)
1956	12.7	10.9	1.38	47.45	48.5	1.15	2.53	2.34	.19
1957	10.8	10.7	1.16	53.40	47.8	1.28	2.44	2.24	.20
1958	9.5	10.6	1.01	55.80	48.3	1.35	2.36	2.14	.22
1959	8.3	11.0	.91	55.55	47.5	1.32	2.23	2.16	.07
1960	11.3	11.0	1.24	60.60	48.0	1.45	2.69	2.18	.51
1961[d]	9.5	10.9	1.04	65.30	47.9	1.56	2.60	2.46	.14

[a]Price of crude oil at Decatur, Illinois, for the crop year beginning October 1.

[b]Average wholesale price per ton, bulk, at Decatur, Illinois, for 44 per cent protein for the crop year beginning October 1.

[c]Price of No. 2 yellow soybeans at Chicago.

[d]Preliminary

TABLE 20. PRICE SPREAD, SOYBEANS AND END PRODUCTS, BASED ON NORTH DAKOTA PRICES, 1956-1961

Year	Crude Oil Price[a]	Yield	Value	Meal Price[b]	Yield	Value	Value of Products	Soybean Price[c]	Processing Margin
	(Per Lb.)	(Lbs)	(Dol.)	(Per Ton)	(Lbs)	(Dol.)	(Dol.)	(Dol./Bu)	(Dol.)
1956	12.45	11.0	1.37	53.45	47.5	1.27	2.64	2.21	.43
1957	10.55	11.0	1.16	59.40	47.5	1.41	2.57	2.11	.46
1958	9.25	11.0	1.02	61.80	47.5	1.47	2.49	2.01	.48
1959	8.05	11.0	.89	61.55	47.5	1.46	2.35	2.03	.32
1960	11.05	11.0	1.22	66.60	47.5	1.58	2.80	2.05	.75
1961[d]	9.25	11.0	1.02	71.30	47.5	1.69	2.71	2.33	.38

[a]The crude oil price is the price at Decatur, Illinois, minus .0025 cents.

[b]The soybean oil meal price is the price at Decatur, Illinois, plus $6.00.

[c]The price of soybeans is the Chicago price for No. 2 yellow soybeans minus 13 cents.

[d]Preliminary

meet the market competition. It actually costs about $13.00 per ton to transport meal from Decatur to North Dakota. The price used for soybeans is the Decatur price minus 13 cents. It was assumed that a bushel of soybeans would yield 11.0 pounds of oil and 47.5 pounds of meal. Using these assumptions the processor margin ranged from 32 to 75 cents per bushel for the six-year period 1956 to 1961. If a market could be developed locally for the soybean oil meal a plant located in North Dakota would be economical. One might expect the costs of production to be higher than the United States average since the plant would be smaller than the average plant in the United States. This analysis of costs and returns for North Dakota conditions was based on the assumption that all of the soybean oil meal could be sold locally and that part of the transportation cost of meal from Decatur to North Dakota could be absorbed as profit. Also, the actual prices for the six-year period 1956-1961 were used.

ESTIMATED INVESTMENT RETURN

Capital invested in a soybean processing plant should provide a return comparable to the return from alternative investments for the capital. In order to make an analysis of the return to the capital invested, certain assumptions have to be made on prices for the products produced, cost of plant operation, and investment requirements.

The following assumptions were used in estimating the return on investment:

1. The plant is capable of processing 200 tons of soybeans per day.
2. The plant would operate at 80 per cent of capacity.
3. A bushel of soybeans would yield 11.0 pounds of oil and 47.5 pounds of meal.
4. The fixed plant investment would be $1,181,600.
5. The fixed capital would be owned, but the working capital would be borrowed each year.
6. The average processing cost, which includes depreciation and interest on the working capital but excludes interest on the fixed investment, varied from 27.36 to 28.18 cents per bushel. This cost varied because of the changes in working capital required due to changes in the price paid for soybeans.

Twenty-seven combinations of oil, meal, and soybean prices were used. The prices used were 8.1, 9.5, and 10.9 cents per pound for oil; $52.60, $60.00, and $69.00 per ton for meal; and $1.90, $2.10, and $2.30 per bushel for soybeans.

The results of the 27 price combinations are shown in Table 21. Ten of the price combinations showed an operating loss, five of the combinations had a return to fixed investment of 10 per cent or less, and 12 had a return of better than 10 per cent.

When soybean prices were $1.90 a bushel, only one combination of oil and meal prices showed a loss, one case had a return of less than 10 per cent, and seven cases had a return of better than 10 per cent.

When soybean prices were $2.10 a bushel, three cases showed an operating loss, two had a return of less than 10 per cent, and four had a return of better than 10 per cent.

Of the nine price combinations when soybean prices were $2.30 a bushel, six showed an operating loss, two had returns of less than 10 per cent, and only one had a return of greater than 10 per cent.

The assumptions used in making this analysis must be kept clearly in mind when looking at the results in Table 21. Any change in the price relationships or assumptions used will give different results. The examples in Table 21 also show the effect of the variation in prices on returns. This type of analysis points up the need for the management of a potential processing plant to estimate the investment, operating costs, and the market potential for the products accurately.

TABLE 21. ESTIMATED RETURN ON FIXED INVESTMENT FOR A SOYBEAN PROCESSING PLANT OF 200 TONS PER DAY CAPACITY USING VARIOUS PRICE COMBINATIONS (1,760,000 Bushels Processed Annually)

Item	1	2	3	4	5	6	7	8	9
Soybean Price Paid	$1.90 per Bushel								
Prices Received									
Meal	$52.60 per Ton			$60.00 per Ton			$69.00 per Ton		
Oil (cents/lb.)	8.1	9.5	10.9	8.1	9.5	10.9	8.1	9.5	10.9
Investment									
Fixed	$1,181,600								
Working Capital	$1,250,400								
Income									
Oil	$1,568,160	$1,839,200	$2,110,240	$1,568,160	$1,839,200	$2,110,240	$1,568,160	$1,839,200	$2,110,240
Meal	2,200,000	2,200,000	2,200,000	2,508,000	2,508,000	2,508,000	2,886,400	2,886,400	2,886,400
Total Income	$3,768,160	$4,039,200	$4,310,240	$4,076,160	$4,347,200	$4,618,240	$4,454,560	$4,725,600	$4,996,640
Expenses									
Soybeans	$3,344,000	$3,344,000	$3,344,000	$3,344,000	$3,344,000	$3,344,000	$3,344,000	$3,344,000	$3,344,000
Processing	481,579	481,579	481,579	481,579	481,579	481,579	481,579	481,579	481,579
Income Taxes		111,735	260,482	132,019	280,765	429,513	339,685	488,431	637,178
Total Expenses	$3,825,579	$3,937,314	$4,086,061	$3,957,598	$4,106,344	$4,255,092	$4,165,264	$4,314,010	$4,462,757
Net Income	$ - 57,419	$ 101,886	$ 224,179	$ 118,562	$ 240,856	$ 363,148	$ 289,296	$ 411,590	$ 533,883
Per Cent Return on Fixed Investment		8.62	18.97	10.03	20.38	30.73	24.48	34.83	45.18

TABLE 21. (Continued)

Item	10	11	12	13	14	15	16	17	18
Soybean Price Paid	$2.10 per Bushel								
Prices Received									
Meal	$52.60 per Ton			$60.00 per Ton			$69.00 per Ton		
Oil (cents/lb.)	8.1	9.5	10.9	8.1	9.5	10.9	8.1	9.5	10.9
Investment									
Fixed	$1,181,600								
Working Capital	$1,370,400								
Income									
Oil	$1,568,160	$1,839,200	$2,110,240	$1,568,160	$1,839,200	$2,110,240	$1,568,160	$1,839,200	$2,110,240
Meal	2,200,000	2,200,000	2,200,000	2,508,000	2,508,000	2,508,000	2,886,400	2,886,400	2,886,400
Total Income	$3,768,160	$4,039,200	$4,310,240	$4,076,160	$4,347,200	$4,618,240	$4,454,560	$4,725,600	$4,996,640
Expenses									
Soybeans	$3,696,000	$3,696,000	$3,696,000	$3,696,000	$3,696,000	$3,696,000	$3,696,000	$3,696,000	$3,696,000
Processing	488,779	488,779	488,779	488,779	488,779	488,779	488,779	488,779	488,779
Income Taxes			63,353		83,637	232,384	142,556	291,302	440,049
Total Expenses	$4,184,779	$4,184,779	$4,248,132	$4,184,779	$4,268,416	$4,417,163	$4,327,335	$4,476,081	$4,624,828
Net Income	$ -416,619	$ -145,579	$ 62,108	$ -108,619	$ 78,784	$ 201,077	$ 127,225	$ 249,519	$ 371,812
Per Cent Return on Fixed Investment			5.26		6.67	17.02	10.77	21.12	31.47

TABLE 21. (Continued)

Item	19	20	21	22	23	24	25	26	27
Soybean Price Paid	$2.30 per Bushel								
Prices Received									
Meal	$52.60 per Ton			$60.00 per Ton			$69.00 per Ton		
Oil	8.1	9.5	10.9	8.1	9.5	10.9	8.1	9.5	10.9
Investment									
Fixed	$1,181,600								
Working Capital	$1,490,400								
Income									
Oil	$1,568,160	$1,839,200	$2,110,240	$1,568,160	$1,839,200	$2,110,240	$1,568,160	$1,839,200	$2,110,240
Meal	2,200,000	2,200,000	2,200,000	2,508,000	2,508,000	2,508,000	2,886,400	2,886,400	2,886,400
Total Income	$3,768,160	$4,039,200	$4,310,240	$4,076,160	$4,347,200	$4,618,240	$4,454,560	$4,725,600	$4,996,640
Expenses									
Soybeans	$4,048,000	$4,048,000	$4,048,000	$4,048,000	$4,048,000	$4,048,000	$4,048,000	$4,048,000	$4,048,000
Processing	495,979	495,979	495,979	495,979	495,979	495,979	495,979	495,979	495,979
Income Taxes						35,255		94,173	242,920
Total Expenses	$4,543,979	$4,543,979	$4,543,979	$4,543,979	$4,543,979	$4,579,234	$4,543,979	$4,638,152	$4,786,899
Net Income	$ -775,819	$ -504,779	$ -233,739	$ -467,819	$ -196,779	$ 39,006	$ - 89,419	$ 87,448	$ 209,741
Per Cent Return on Fixed Investment						3.30		7.40	17.75

A P P E N D I X

APPENDIX TABLE 1. AVERAGE PRICE PER POUND OF SOYBEAN OIL IN TANK CARS AT MIDWESTERN MILLS, BY MONTHS, OCTOBER 1935 TO SEPTEMBER 1962

Crop Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Average[a]
1935-36	8.1	8.1	8.1	7.6	7.2	6.8	6.8	6.3	6.0	7.9	8.0	8.2	7.4
1936-37	8.0	8.0	9.1	9.8	9.9	9.8	9.8	9.0	8.2				9.1
1937-38	5.8	5.6	5.2	5.8	6.1	6.4	5.9	5.7	5.2	5.9	5.7	5.2	5.7
1938-39	5.0	5.1	5.1	4.9	4.8	4.9	4.7	4.9	4.8	4.2	4.0	5.6	4.8
1939-40	5.0	4.7	5.3	5.2	5.4	5.6	5.5	5.0	4.7	4.6	4.2	3.9	4.9
1940-41	3.9	4.2	4.5	5.1	5.1	6.1	7.6	8.7	9.6	9.8	9.5	10.5	7.0
1941-42	10.4	9.8	10.1	11.4	11.7	11.8	11.8	11.8	11.6	11.2	11.4	11.7	11.2
1942-43	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8
1943-44	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8
1944-45	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8
1945-46	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.9
1946-47	18.8	24.2	24.6	26.0	28.4	33.6	27.4	21.4	18.2	17.2	15.9	18.8	22.9
1947-48	20.7	25.6	26.2	26.6	19.6	21.4	24.5	26.3	27.3	22.1	22.1	22.8	23.8
1948-49	18.6	19.1	17.3	14.3	12.3	10.8	10.5	10.8	9.4	9.7	12.9	11.4	13.1
1949-50	10.1	9.6	10.2	10.8	11.4	12.8	13.1	13.8	13.2	12.9	14.5	15.0	12.3
1950-51	14.6	17.1	19.6	20.6	21.1	20.5	20.5	19.5	16.4	14.5	15.4	14.0	17.8
1951-52	13.8	13.2	12.6	11.2	10.7	10.2	9.1	10.1	11.2	11.3	11.5	11.2	11.3
1952-53	10.9	11.8	12.9	12.7	12.6	13.5	13.7	12.3	11.5	10.3	10.8	11.7	12.1
1953-54	13.3	13.6	12.6	12.1	12.5	13.3	14.1	13.9	14.2	14.1	14.8	13.5	13.5
1954-55	12.1	12.2	12.5	12.2	12.2	11.8	11.6	12.2	12.6	11.6	11.3	10.6	11.9
1955-56	10.9	11.0	10.9	11.7	12.8	14.3	14.9	15.3	13.6	12.5	11.4	11.3	12.6
1956-57	12.5	13.6	14.1	14.4	14.0	13.0	12.4	11.7	11.7	11.9	11.4	11.3	12.7
1957-58	11.3	11.6	11.4	11.5	11.4	11.0	11.0	11.0	10.2	9.9	10.0	9.8	10.8
1958-59	10.2	10.4	9.5	9.5	9.3	9.3	9.3	9.4	9.5	9.2	9.3	9.1	9.5
1959-60	8.6	8.0	7.8	7.8	7.6	7.6	8.0	8.2	8.7	9.0	9.5	9.2	8.3
1960-61	9.4	10.2	10.0	10.9	12.2	13.0	13.3	12.7	11.6	10.9	10.9	10.5	11.3
1961-62	10.7	10.4	10.5	10.5	10.2	10.1	9.9	9.3	8.5	8.0	8.2	8.1	9.5

[a]Simple average

Source: Soybean Blue Book, 1962, p. 48.
Fats and Oils Situation, November 1962.

APPENDIX TABLE 2. AVERAGE WHOLESALE PRICE PER TON, BULK OF 44 PER CENT PROTEIN SOYBEAN MEAL AT DECATUR, OCTOBER 1950 TO SEPTEMBER 1962

Crop Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Ave.
1950-51	54.05	61.45	64.70	63.90	69.25	67.00	62.00	63.40	64.40	68.80	64.60	69.75	64.45
1951-52	74.00	74.00	74.00	74.00	74.00	74.00	83.90[a]	88.60[a]	93.25[a]	93.10[a]	103.60[a]	93.50[a]	83.35
1952-53	81.10	74.75	71.90	67.90	64.90	66.40	64.40	66.75	65.90	65.25	62.00	59.60	67.55
1953-54	57.25	59.40	71.60	73.75	77.10	84.50	95.95	89.40	87.40	92.40	87.60	67.25	78.65
1954-55	65.25	67.70	68.25	67.10	65.60	61.50	59.20	53.40	52.15	53.90	54.30	60.10	60.70
1955-56	56.00	49.00	50.25	51.00	49.40	47.40	53.00	60.05	60.75	54.80	52.10	46.90	52.55
1956-57	45.70	47.40	46.95	49.90	46.90	46.75	45.50	45.40	44.25	46.60	52.90	51.00	47.45
1957-58	46.60	45.00	43.90	43.75	46.90	54.25	59.50	55.60	56.75	68.60	60.25	59.70	53.40
1958-59	50.60	54.75	60.90	63.25	54.75	55.10	55.90	55.40	54.80	58.50	54.25	51.70	55.80
1959-60	56.60	58.50	58.70	61.50	57.50	55.85	56.50	54.20	52.50	50.75	50.30	53.75	55.55
1960-61	48.95	44.50	51.25	55.20	61.50	64.45	73.10	71.00	63.85	65.00	68.90	59.60	60.60
1961-62	55.80	59.30	60.20	59.90	57.60	60.60	62.50	64.10	66.70	68.50	71.10	76.70	63.60

[a]Soybean meal mix

Source: Soybean Blue Book, 1962, p. 46.

Fats and Oils Situation, November 1962.

APPENDIX TABLE 3. AVERAGE 15TH OF THE MONTH PRICES RECEIVED BY NORTH DAKOTA FARMERS FOR SOYBEANS, BY MONTHS JANUARY 1943 TO DECEMBER 1962

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Season Average
						(Dollars per bushel)							
1943	1.60	1.65	1.70	1.75	1.75	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90
1944	1.90	1.85	1.90	1.90	1.90	2.00	1.95	2.00	1.90	1.95	2.00	2.05	2.00
1945	2.05	2.05	2.10	2.10	2.10	2.20	2.20	2.20	2.15	2.10	2.10	2.10	2.10
1946	2.10	2.10	2.10	2.10	2.15	2.15	2.35	2.35	2.15	2.25	3.10	2.60	2.61
1947	2.80	3.00	3.60	3.50	2.95	2.80	3.00	3.10	2.95	2.95	3.25	3.60	3.32
1948	3.95	2.85	3.05	3.50	3.60	3.75	3.55	2.83	2.25	2.08	2.30	2.25	2.14
1949	2.10	1.85	1.90	1.90	2.00	1.95	2.10	2.80	2.20	2.05	1.91	2.02	2.11
1950	2.06	2.04	2.14	2.35	2.55	2.65	2.70	2.10	2.06	1.88	2.43	2.55	2.48
1951	2.70	2.95	3.05	3.00	3.05	2.75	2.70	2.60	2.60	2.50	2.60	2.65	2.59
1952	2.65	2.65	2.60	2.60	2.60	2.80	2.75	2.95	2.70	2.55	2.55	2.55	2.55
1953	2.50	2.40	2.60	2.60	2.50	2.45	2.30	2.25	2.15	2.25	2.45	2.55	2.64
1954	2.60	2.85	3.00	3.40	3.45	3.45	3.40	3.00	2.25	2.40	2.40	2.40	2.33
1955	2.40	2.45	2.35	2.25	2.25	2.20	2.05	2.05	1.85	1.92	1.95	1.99	2.11
1956	2.07	2.10	2.25	2.45	2.85	2.74	2.30	2.25	1.90	1.91	2.11	2.10	2.04
1957	2.11	2.06	2.08	2.06	2.05	2.00	2.08	2.06	1.99	1.88	1.89	1.87	1.91
1958	1.85	1.84	1.90	1.96	1.94	1.95	1.92	1.91	1.80	1.75	1.75	1.82	1.87
1959	1.84	1.87	1.88	1.90	1.93	1.90	1.90	1.86	1.74	1.79	1.84	1.80	1.82
1960	1.82	1.79	1.79	1.82	1.84	1.83	1.85	1.86	1.87	1.85	1.88	1.89	2.16
1961	2.05	2.30	2.45	2.87	2.78	2.46	2.35	2.36	2.17	2.05	2.15	2.16	2.20
1962	2.16	2.18	2.18	2.20	2.21	2.20	2.21	2.19	2.14	2.10	2.14	2.18	

Source: United States Department of Agriculture, Statistical Reporting Service, Agricultural Estimates Division

APPENDIX TABLE 4. SOYBEANS: UNITED STATES SUPPLY AND DISPOSITION, CROP YEARS, 1954-1963

Crop Year	Supply			Disposition				
	Oct. 1 Stocks	Production	Total	Crushed	Exports	Seed & Feed	Residual[c]	Carry-Over
	(Million Bushels)							
1954	1.3	341.1	342.4	249.0	60.6	23.4	-.6	9.9
1955	9.9	373.7	383.6	283.1	67.5	25.8	3.5	3.7
1956	3.7	449.3	453.0	315.9	85.4	26.4	15.4	9.9
1957	9.9	483.4	493.3	353.8	85.5	29.5	3.4	21.1
1958	21.1	580.2	601.3	401.2	110.1	27.4	.5	62.1
1959	62.1	532.9	595.0	393.4	141.4	29.3	7.7	23.2
1960	23.2	555.3	578.5	402.2	130.1	32.9	7.4	6.0
1961[a]	6.0	693.0	699.0	439.0	155.0	47.0	[d]	58.0
1962[b,e]	58.0	672.0	730.0	450.0	175.0	45.0		60.0
1963[e]	60.0							

[a]Preliminary and partly estimated.

[b]Except stocks October 1, 1962. Production indicated October 1.

[c]Includes fed to livestock on farms other than where produced, direct use for food and statistical discrepancies.

[d]Included in the seed and feed total.

[e]Forecast.

Source: Fats and Oils Situation, November 1962, p. 11.

APPENDIX TABLE 5. TOTAL INVESTMENT REQUIREMENTS FOR DIFFERENT DEPARTMENTS OF SOLVENT SOYBEAN OIL MILLS, BY SIZE OF MILL, 1952-53 SEASON

Department	Daily Capacity in Tons per Day					
	25	50	100	150	200	300
	(dollars)					
Elevator Department	155,810	219,620	349,780	522,330	683,240	840,660
Processing Department[a]	278,590	335,850	465,820	587,900	704,045	938,075
Product Storage and Shipping Department[b]	38,505	46,015	58,515	106,645	140,910	173,364
Service Department[c]	45,040	56,520	101,290	144,910	169,020	223,660
Fire Protection Department	63,509	63,845	65,489	68,972	69,692	74,480
Office and Analytical Laboratory	8,500	13,300	20,700	31,900	37,500	48,000
Railroad Tracks	15,000	16,000	18,000	30,000	40,000	55,000
Land	3,000	4,000	4,000	9,000	10,000	12,000
Total Investment	609,954	756,150	1,085,594	1,501,657	1,854,407	2,365,239

TABLE 5. (Continued)

Department	Daily Capacity in Tons per Day				
	400	500	600	800	1,000
			(dollars)		
Elevator Department	1,019,130	1,391,870	2,139,690	2,576,310	2,938,870
Processing Department[a]	1,127,635	1,300,640	1,560,870	1,863,765	2,149,625
Product Storage and Shipping Department[b]	204,331	267,121	281,161	337,921	366,129
Service Department[c]	266,220	315,070	351,970	421,450	475,680
Fire Protection Department	75,530	99,190	101,610	102,630	103,840
Office and Analytical Laboratory	57,700	66,700	75,000	89,000	102,000
Railroad Tracks	65,000	70,000	85,000	90,000	95,000
Land	15,000	16,000	17,000	19,000	20,000
Total Investment	2,830,546	3,526,591	4,612,301	5,500,076	6,251,144

[a]Includes the investment in flake preparation and meal processing and oil extraction equipment.

[b]Includes meal bagging, storage, and shipping and oil storage and shipping.

[c]Includes boiler room, machine shop, store-room, locker room, electric power substation, trucks, automobiles, miscellaneous equipment, and inventories of supplies.

Source: United States Department of Agriculture, Agricultural Marketing Service, Marketing Research Division, Size of Soybean Oil Mills and Returns to Growers, Marketing Research Report No. 121, November 1956, p. 95.

APPENDIX TABLE 6. ESTIMATED PROCESSING COSTS PER BUSHEL FOR SOLVENT EXTRACTION BY SIZE OF MILL, 1952-53 SEASON

Cost Items	Daily Capacity in Tons per Day										
	25	50	100	150	200	300	400	500	600	800	1,000
	(Cents per bushel of soybeans)										
Plant Costs											
Depreciation	8.06	4.88	3.40	3.06	2.80	2.39	2.13	2.08	2.26	1.99	1.80
Interest on Investment	8.87	5.50	3.95	3.64	3.37	2.87	2.57	2.57	2.80	2.50	2.27
Taxes	3.44	2.13	1.53	1.41	1.31	1.11	1.00	.99	1.08	.97	.88
Insurance	.40	.25	.18	.16	.15	.13	.12	.12	.13	.11	.10
Sub-total	20.77	12.76	9.06	8.27	7.63	6.50	5.82	5.76	6.27	5.57	5.05
Operating Costs											
Labor	14.32	6.85	5.32	4.81	4.53	3.97	3.75	3.76	3.45	3.06	2.66
Electricity	2.02	1.79	1.62	1.47	1.38	1.25	1.18	1.15	1.14	1.09	1.06
Fuel	3.76	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
Water	.27	.23	.19	.18	.17	.15	.14	.14	.14	.13	.12
Solvent	1.71	1.43	1.14	1.03	.91	.80	.74	.68	.68	.63	.57
Meal Bags	8.46	5.58	3.72	3.05	2.71	2.37	2.28	2.12	2.12	2.03	1.95
Maintenance and Repairs	1.83	1.65	1.50	1.41	1.35	1.26	1.20	1.17	1.14	1.08	1.05
Laboratory Services	.14	.14	.14	.38	.33	.38	.33	.30	.32	.29	.27
Insurance on Stocks	.09	.09	.09	.09	.09	.09	.09	.09	.09	.09	.09
Salaries	4.05	3.90	3.62	3.37	3.13	2.73	2.42	2.19	2.06	2.06	2.41
General Administration	.96	1.18	1.60	1.99	2.34	2.94	3.41	3.75	3.96	3.97	3.45
Welfare Risks	.95	.51	.42	.38	.36	.31	.29	.28	.26	.24	.23
Interest on Working Capital	1.64	1.47	1.49	1.50	1.50	1.50	1.50	1.51	1.51	1.51	1.50
Selling Expense	.65	1.00	1.23	1.35	1.41	1.47	1.47	1.53	1.53	1.59	1.64
Sub-total	40.85	27.78	24.04	22.97	22.17	21.18	20.76	20.63	20.36	19.73	18.96
Total Cost	61.62	40.54	33.10	31.24	29.80	27.68	26.58	26.39	26.63	25.30	24.01

Source: United States Department of Agriculture, Agricultural Marketing Service, Marketing Research Division, Size of Soybean Oil Mills and Returns to Growers, Marketing Research Report No. 121, November 1956, p. 24.

APPENDIX TABLE 7. ESTIMATED ACQUISITION COST PER BUSHEL OF SOYBEANS BY SIZE OF MILL, 1952-53 SEASON

Size of Mill	Proportion of Soybeans Acquired from			Average Handling Charges Per Bushel[b]	Transportation of Soybeans to Mill[c]	Total Acquisition Cost
	Farmers	Country Elevators	Other Intermediaries[a]			
(Tons per Day)	(Per Cent)	(Per Cent)	(Per Cent)	(Cents)	(Cents)	(Cents)
25	100	0	0	0.0	1.9	1.9
50	75	25	0	1.5	1.9	3.4
100	25	50	25	5.0	1.9	6.9
150	10	35	55	6.5	2.7	9.2
200	10	35	55	6.5	2.7	9.2
300	5	25	70	7.1	3.2	10.3
400	5	25	70	7.1	3.2	10.3
500	0	10	90	7.8	3.3	11.1
600	0	10	90	7.8	3.3	11.1
800	0	10	90	7.8	3.3	11.1
1,000	0	10	90	7.8	3.3	11.1

[a]Includes interior carlot dealers and commission firms.

[b]Proportion of soybeans acquired from farmers, country elevators, and intermediaries weighted by handling charges per bushel of 6 and 8 cents for country elevators and intermediaries respectively. No charges incurred on beans acquired directly from farmers. These handling charges are averages based on interviews in 1954 with 9 mill operators located in Illinois, Indiana, Iowa, and Ohio.

[c]Based on analysis of transportation cost data for the 1951 and 1952 seasons for mills operating in the 6 main soybean states.

Source: United States Department of Agriculture, Agricultural Marketing Service, Marketing Research Division, Size of Soybean Oil Mills and Returns to Growers, Marketing Research Report No. 121, November 1956, pp. 7 and 8.