# ECONOMICS OF PRODUCING SUNFLOWERS FOR OIL IN THE UNITED STATES

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In considering whether or not to produce a new product one must be concerned basically with two questions:

1. What is the market for this product or similar product? and

2. Can we produce it at a price to compete in this market?

All other questions one might raise are essentially subordinate to these two. We may be able to modify the product in some way to give it wider acceptance or develop means for more efficient production; but these actions are still directed at our two basic questions.

In this paper we propose to examine these questions with respect to oilseed sunflowers as a new commercial crop for the United States, with special emphasis on the Cotton Belt States.

## The Market for Fats and Oils

In examining the oilseed market we shall emphasize some of longer-term trends. It is these trends which, in the final analysis, will largely govern the success or failure of a new oilseed product. Also, we shall confine our discussion to the domestic market both because of time limitations and because of its dominant importance to the domestic producer.

Figure 1 shows trends in our sources of supply for fats and oils over the past two decades. The available supply has shown a steady growth over this period of 3.2 percent compounded annually. All of the increase in supply has been from domestic production. Domestic production during the period grew at an annual rate of 3.6 percent.

Stocks of fats and oils at the beginning of each year, representing the carryover from the previous year's supply, for the most part, have fluctuated between 2 and 3 billion pounds. Imports have remained fairly steady at about 1 billion pounds annually. These figures include both

animal fats and vegetable oils used for both food and non-food purposes.

The disposition of total supply is depicted graphically in figure 2. During the past two decades substantial increases have occurred in both our domestic consumption of fats and oils and in our exports of these products. Domestic consumption increased at a steady rate of 2.2 percent a year. Exports have fluctuated quite a bit but overall show an average growth of 7.4 percent annually. Year-end carryover reached a peak of 3.5 billion pounds in 1963 and since has fluctuated between 2 and 3 billion pounds.

Per capita domestic consumption of fats and oils reached an all-time high in 1969 of 79 pounds (table 1). This represented a substantial increase over the 69.2 pounds per capita consumed in 1960. About two-thirds (49.9 pounds) of the 1969 total was consumed as food products and a little over one-third (26.6 pounds) as industrial products. Consumption of fats and oils in both food and industrial products has shown an upward trend since 1960.

The total domestic market for fats and oils in 1969 amounted to 17,860 million pounds (table 2). Food products accounted for 10,992 million pounds of this amount or 61.5 percent of the total and industrial products accounted for 6,868 million pounds or 38.5 percent of the total.

The overall growth rate of fat and oil markets averaged 2.9 percent per year for the period 1960 to 1969. Food product markets increased in size at a slightly higher annual rate than markets for industrial fats and oils.

A breakdown of the market for industrial fats and oils is given in table 3. Of special interest is the rather rapid growth of fats and oils used in the manufacture of fatty acids and animal feeds. These markets have grown at an annual rate of 6.2 and 7.8 percent, respectively. However, we do not consider industrial markets, in general, as prospective outlets for sunflower oil. For the most part these are outlets for low-grade fats and oils unsuited for human consumption. For example, half of the oil used in fatty acid manufacture is tall oil--a by-product of the manufacture of kraft paper. Fats and oils used in feeds, for the most part, are inedible grade animal and poultry fats.

Sunflower oil's greatest potential lies with its use in edible products. Its high ratio of polyunsaturated fatty acids to saturated fatty acids (P/S ratio), coupled with its excellent stability characteristics, make sunflower oil highly attractive for use in several food products.

The composition of the market for edible fats and oils is shown in figure 3. The top line of this graph represents the total volume of fats and oils used for food products for the period 1960 to 1969. The pattern formed by the different shaded areas illustrates the changes that have occurred in the edible oil market since 1960. You will note that the shaded areas representing butter and lard have become smaller with the passing of time. On the other hand, shaded areas representing margarine, shortening, (baking and frying fats), and salad and cooking oils have expanded.

Table 4 gives about the same product breakdown as figure 3 except that salad and cooking oils have been separated. Also, cooking oils used

in commercial frying of potato chips and frozen french fries are shown separately.

The most significant point shown in table 4 is the rapid expansion of cooking oils, demonstrated by a growth rate of 8.4 percent compounded annually. This market for vegetable oils has doubled in the past ten years and, if growth continues at the same rate, it will double again in the next ten years.

Production of potato chips and frozen french fries are examples of uses for which demand for cooking oils has expanded rapidly. Also, the rapid expansion in fast-food outlets, many of which specialize in fried foods such as chicken and catfish, has contributed to the growth in demand for cooking oils. Because in these types of operations the oil is used over several times, a highly stable oil is required. Without special processing soybean oil may develop off-flavors after repeated use because of its unstable linolenic acid component. The stable properties of sunflower oil should make it suitable for this purpose.

In addition to its potential use in cooking oils, there is also considerable interest in the use of sunflower oil in margarine. Margarine represents a 2.2 billion pound market for vegetable oils that, over the past ten years, has expanded at a rate of 3.2 percent annually. The sunflower name, as well as the desirable P/S ratio in the oil, should lend itself to successful promotion in this use.

Shortening also is an expanding outlet for vegetable oils. Production of shortening increased at an average annual rate of 4.9 percent over the past decade and amounted to 3.4 billion pounds in 1969. However, available fats and oils appear highly satisfactory for use in this product.

Fats and oils used in the manufacture of shortening over the period 1960-69 are shown in figure 4. Soybean oil and animal fats account for a major share of all oils used. Soybean oil has accounted for most of the increase in production of shortening since 1960. Use of cottonseed oil has declined while use of coconut and palm oil has increased. Use of animal fats in shortening also has shown some increase recently.

Figure 5 shows the dominant position of soybean oil in the manufacture of margarine. Use of corn oil, safflower oil and animal fats also have increased somewhat recently. Cottonseed oil use in margarine has trended downward.

The pattern of oil use in salad and cooking oils shows a sharp upward trend for soybean oil (figure 6). Soybean oil now accounts for over two-thirds of total oils used for these purposes. Cottonseed oil is second in importance but its use has declined in recent years, possibly because of declining production of cottonseed. Use of corn oil, peanut oil and safflower oil have expanded somewhat in this use recently.

Extensive use of soybean oil in liquid cooking oils is a relatively recent accomplishment. Improved techniques for stabilizing the oil in liquid form has made this possible. However, repeated use in commercial frying operations requires special processing. There would appear to be a place for a new domestic source of oil for this purpose.

The dominant position of soybean oil in our domestic edible oil markets is apparent from these market profiles. Its market position is increasing. In 1950 soybean oil amounted to 62 percent of our domestic production of edible vegetable oils. By 1960, its market position had increased to 73 percent and in 1969 to 83 percent. Sunflower oil could add needed diversity to our domestic edible oil supply.

Prices of our major edible oils, on a crude oil basis, over the past 5 years are shown in table 5. Average prices for this period ranged from 9.9 cents a pound for soybean oil to 15.3 cents for safflower oil. We believe sunflower oil should be at least equivalent in price to cottonseed oil, which averaged 12.3 cents a pound over the past 5 years.

What should a farmer expect to receive for his sunflower seed at the oil mill? Using a conservative figure of 11 cents a pound for oil, a rough estimate is as follows:

| Product from 100 lbs, of sunflower seed: | |
|---|---|
| 32 lbs. crude oil @ 11¢/lb | $3.52 |
| 42 lbs. 43% protein meal @ $70/ton | 1.47 |
| 16 lbs. seed hull @ $14/ton | .11 |
| 10 lbs. milling loss | -- |
| Total product value per 100 lbs. seed | $5.10 |
| Less processing cost and mill profit @ $20/ton | $1.00 |
| Net to pay for seed | $4.10 |

Thus, according to this rough estimate, the farmer should be able to expect around 4 cents for his seed. Keep in mind this is a crude estimate at this stage. We do not have firm information on processing costs or required profit levels. Also, the product yields used are based on limited experience with the 1968 and 1969 trial plantings. Oil yields should improve as processing techniques are improved and the new hybrids are commercialized.

The price paid producers for sunflower seed has ranged from 3 to 4.5 cents per pound. Three to 3.5 cents has been most common in the South whereas producers in the North have received 3.75 to 4.5 cents a pound.

## Economics of Producing Sunflower Seed

Sunflowers were first produced for oil on a commercial scale in the United States in 1967. Prior to this, the only sunflower production in this country had been in the Red River Valley of Minnesota and North Dakota. This production was for the bird seed and confectionery markets. In 1967, approximately 90,000 acres of high oil sunflowers were grown in the Red River Valley, and, in 1968, approximately 40,000 acres were produced on trial plantings on commercial farms in the Cotton Belt in the Southern United States. Acreage in both areas, however, has declined to

near one-half the acreage of the initial year planting.

Sunflower oil has many desirable physical characteristics. However, there will be little or no production of sunflowers for oil in the United States unless (1) the producers can realize a profit on the venture, and (2) this profit is equal to or greater than the net income realized from competing enterprises.

Trial plantings during the past 2 - 3 years have provided an increased recognition of the cultural problems and supplied data for enumeration of specific costs involved in the production of the crop. The estimated costs of producing an acre of sunflowers range from $35-$40 in the Cotton Belt to $25-$30 in the Red River Valley. These costs, based on records obtained from producers and oil mills, represent the costs of inputs, other than land, required to obtain yields of 1,000-1,250 pounds per acre. Producers in the Red River Valley appear to have a cost advantage due to the lack of need for extensive weed and insect control, and lower fertilizer requirements. However, the low rainfall may impose a limit to response to higher rates of fertilization to attain higher yields.

Some of the production problems have been solved, and there is reason to believe that others can be resolved through proper management or by the use of hybrid seed. With the current yields being obtained and a sale price of $0.03 per pound, which is the price most frequently paid, gross returns have ranged from $30-$37.50 per acre. This is just enough to cover total costs in some areas, and only enough to cover variable costs in other areas. Experience has indicated that the average maximum production of the open pollinated varieties is in the 1,500-2,000 pound per acre range, which will not place the crop in a competitive position with most crops, with present sunflower seed prices. Therefore, the future of commercial sunflower production may lie in hybrid varieties, which could obtain higher yields, perhaps up to 2,000-2,500 pounds per acre. To obtain these higher yields on a commercial scale, higher production costs will probably be experienced due to the more expensive hybrid seed, higher fertilization rates, and a need for more complete control of weeds and insects. Particularly this latter cost will likely increase, for an increase in sunflower acreage will likely be accompanied by an increase in sunflower insect species. The hybrids, in addition to having a higher projected yield, have a more uniform maturity date of the sunflower head which may solve one of the major harvesting problems. Presently in some areas of the South, the head of the open-pollinated varieties mature over a two-week period, causing a substantial loss at harvesting time due to the earlier maturing heads falling to the extent that they are not picked up by the combine during harvest.

In order to obtain yields to make the crop competitive with most other crops, the annual cost (exclusive of land) to produce an acre of sunflowers for oil is estimated to range from $40 in the Red River Valley to $47-$52 in the Cotton Belt (table 6). These costs include a value for operator labor used.

When considering the potential of a crop it is useful to consider the yield that permits gross returns to equal estimated costs. With non-land costs of sunflower production of $40 and $50 per acre, respectively, and a price of sunflower seed of $0.03 per pound, the break-even yield for these two costs is 1,334 and 1,667 pounds per acre. This does not

represent a profit. Only non-land expenses are paid (table 7).

In the following sections a comparison of sunflower with competing crops is made. Returns for competing crops are based on the average yields of each crop in a particular area. Costs are based upon the average yields and prices reported for each area in 1969. While it is realized that most individuals achieve production either above or below this average, this type analysis can indicate the average sunflower production needed in an area to compete with the average production of established crops. In comparing returns with other crops, a sale price for sunflower of $0.04 per pound will be used unless specified otherwise.

Southern United States

Historically, the crop of most economic significance in this area is cotton. Although cotton acreage has declined in recent years it is still considered a major cash crop in many areas of the South. The present government programs which include price supports and direct payments to farmers generally make cotton produced for the domestic market a more profitable alternative than sunflowers. However, sunflowers can possibly compete with cotton produced for the non-domestic market.

In the Southeastern states of South Carolina, Georgia, and Alabama sunflower yields of 1,200-1,500 pounds per acre will place the crop in a competitive position with non-domestic cotton. In the Delta Area adjacent to the Mississippi River very high cotton yields are commonplace. Here sunflower yields of 2,500-3,000 pounds would be needed to compare with returns from cotton produced for the non-domestic market. In recent years soybean acreage in these areas has expanded to the point that it is now considered a major cash crop. Yields of 25-35 bushels per acre have made the crop profitable in many localities, and sunflower yields of 1,600-2,000 pounds would be needed to compete with soybeans. Yields of this magnitude would be needed to compete with corn produced under the feed grain program; however, yields of 1,300-1,600 pounds should compete with corn not produced under the feed grain program.

In Texas and other areas of the South Central United States, estimated costs of successfully producing sunflowers are $3-$5 more than in the Southeastern states due to higher fertilizer and/or fixed machinery costs. This difference, although small, might be decisive in some cases. On the clay soils of the Rolling Plains and in the Central Prairie areas of Texas, sunflower yields of 2,000-2,200 pounds should compete with domestic cotton. Non-domestic cotton in these areas is often unprofitable. On the more productive loam soils of the Rolling Plains higher cotton yields would place domestic cotton out of competition, while 1,900 pound sunflower yields would compare with returns from non-domestic cotton. In this area, however, the carrot beetle presents a problem for sunflower production. Failure to control this insect or a higher cost for control can alter the net returns of the crop. Returns to corn and grain sorghum produced in the Central Prairie can be equaled with sunflower yields of 1,300-1,600 pounds per acre. This range in yield is dependent upon whether or not these crops are produced under the feed grain program.

Red River Valley of Minnesota and North Dakota

The established crop of major significance in this area is wheat.

With yields of spring wheat (other than Durum) of 25-30 bushels per acre, sunflower yields of 1,600-1,800 pounds would be required for the crop to compete with wheat. Where wheat certificates are issued to the producer, sunflower yields of 2,300-2,500 pounds would be required. These estimates apply to wheat that is continually cropped. Should sunflowers be produced on fallow, and compete with wheat on fallow, yields 100-200 pounds more than those previously mentioned would be required. However, yields of continuously cropped sunflowers competing with wheat on fallow would be less due to the returns from wheat being spread over a two-year period. No attempt is made to compare the crop with enterprises such as sugar beets or potatoes, as these are considered specialty crops.

The north central part of North Dakota, although it is not a part of the Red River Valley, has a suitable climate for raising sunflowers, and attempts have been made recently to introduce the crop in this area. Durum wheat and barley are the principle crops here. Sunflower yields of 1,500 pounds would compete with both wheat and barley grown without certificates. With certificates, a yield of 2,300 pounds would compete with wheat, and 1,600 pounds would compete with barley.

There are several problems to be resolved relating to sunflower production. It is felt that most of these can be solved within the range of cost estimates used in this analysis. However, these costs must be accompanied by an increase in yield of 50-100 percent in order for the crop to compete successfully with established crop enterprises.

## Conclusions

Substantial increases in use of salad and cooking oils, shortening, and margarine during the past decade strengthens the demand for a high quality oil to fill these needs. Sunflower oil appears to be well suited for these uses, especially for salad and cooking oils and margarine, due to its stable qualities and high ratio of polyunsaturated fatty acids to saturated fatty acids.

Since the introduction of high-oil sunflowers in the United States in 1967, sunflower acreage has remained limited due to production problems and the inability of the open-pollinated varieties to produce returns that can effectively compete for production resources with established crops. Hybrid varieties and improved cultural practices should boost yields sufficiently to make the crop competitive in many areas. Estimated non-land costs of producing these higher sunflower yields are $40-$50 per acre. Yields of 1,500-2,000 pounds per acre should permit sunflowers to compete economically with corn, soybeans, sorghum, and small grains in a number of farming areas. The crop will be less able to compete with cotton under present government programs.

* * *

Table 1 - - Per capita consumption of fat and oil products, 1960-69.

| Year | Food Products | Industrial Products | All Products |
|---|---|---|---|
| | pounds | | |
| 1960 | 45.3 | 24.0 | 69.2 |
| 1961 | 45.1 | 23.3 | 68.4 |
| 1962 | 45.7 | 25.7 | 71.4 |
| 1963 | 46.3 | 25.7 | 72.0 |
| 1964 | 47.5 | 26.3 | 73.8 |
| 1965 | 47.7 | 25.1 | 72.8 |
| 1966 | 49.6 | 27.5 | 77.3 |
| 1967 | 49.2 | 26.7 | 76.0 |
| 1968 | 51.0 | 26.5 | 77.6 |
| 1969 | 51.8 | 27.2 | 79.0 |

Table 2 - - Size and growth rate of food and industrial markets for fats and oils, 1969.

| Market | Quantity of fats and oil used in 1969 1/ | Percent of total | Average annual growth rate 2/ |
|---|---|---|---|
| | Million pounds | Percent | Percent |
| Food products | 10,992 | 61.5 | + 2.9 |
| Industrial products | 6,868 | 38.5 | + 2.7 |
| All fats and oil products | 17,860 | 100.0 | + 2.9 |

1/ Preliminary estimate.
2/ Growth rate compounded annually for the 10-year period 1960-69.

Table 3 - - Market volume and annual growth rates of fats and oils in industrial products.

| Product | Quantity of fats and oil used in 1969 1/ | Average annual growth rate 2/ 1960 to 1969 |
|---|---|---|
| | Million pounds | Percent |
| Soap | 678 | - 2.5 |
| Drying oil products | 765 | - 0.4 |
| Fatty acids | 1,945 | + 6.2 |
| Animal feeds | 1,078 | + 7.8 |
| Other industrial products | 2,402 | - 0.9 |
| All industrial products | 6,868 | + 2.7 |

1/ Preliminary estimate.
2/ Growth rate compounded annually for the 10-year period 1960-69.

Table 4 - - Market volume and annual growth rates of fats and oils in food products.

| Product | Quantity of fats and oil used in 1969 1/ | Average annual growth rate 2/ 1960 to 1969 |
|---|---|---|
| | Million pounds | Percent |
| Butter | 1,081 | - 2.8 |
| Margarine | 2,154 | + 3.2 |
| Lard | 1,017 | - 3.3 |
| Shortening | 3,404 | + 4.9 |
| Salad oils | 869 3/ | + 3.9 |
| Cooking oils | 1,796 3/ | + 8.4 |
| Potato chips | 384 3/ | + 6.6 |
| Frozen french fries | 121 3/ | +16.9 |
| Other edible uses | 473 | + 6.2 |
| All food products | 10,992 | + 2.9 |

1/ Preliminary estimate.
2/ Growth rate compounded annually for the 10-year period 1960-69
3/ 1968 data. A breakdown of the 2863 million pounds of salad and cooking oils for 1969 was not available.

Table 6 - - Estimated costs for one acre of sunflowers, Southeast United States*

| | Unit | Price (dollars) | Quantity | Amount (dollars) |
|---|---|---|---|---|
| Pre-harvest expenses: | | | | |
| Seed - hybrid | Lb. | 1.00 | 5.0 | 5.00 |
| Lime - prorated | Ton | 8.00 | .33 | 2.67 |
| Fertilizer - mixed, applied | Cwt. | 2.15 | 5.0 | 10.75 |
| Herbicide | Qt | 7.00 | 1/2 | 3.50 |
| Insecticide - custom, applied | Acre | 2.00 | 2.0 | 4.00 |
| Machinery costs: | | | | |
| Tractor | Hr. | 2.55 | 2.1 | 5.36 |
| Equipment | Hr. | | | 2.76 |
| Labor | Hr. | 1.50 | 2.1 | 3.15 |
| Sub-total | | | | 37.19 |
| Harvest expenses: | | | | |
| Machinery costs: | | | | |
| Equipment | Hr. | | | 7.27 |
| Labor | Hr. | 1.50 | 1.2 | 1.80 |
| Sub-total | | | | 9.07 |
| Total expenses | | | | 46.26 |
| Interest on operating capital | Dollar | .08 | 14.17 | 1.13 |
| Total production costs | | | | 47.39 |
| Total variable costs (excluding labor) | | | | 33.73 |
| Interest on operating capital | | | | 1.13 |
| Total | | | | 34.86 |
| Total variable costs including labor | | | | 39.81 |

* Due to wide variations in land values in different sections of the country, no attempt is made to include a charge for land. Total cost shown is exclusive of land cost.

Table 5 - - Wholesale prices of major vegetable oils, by years, 1965-69 1/ (cents per pound)

| Year | Corn | Cottonseed | Peanut | Soybean | Safflower |
|---|---|---|---|---|---|
| 1965 | 14.0 | 11.6 | 13.5 | 11.2 | 15.3 |
| 1966 | 16.1 | 14.1 | 13.7 | 11.6 | 16.2 |
| 1967 | 12.4 | 11.8 | 11.9 | 9.6 | 14.6 |
| 1968 | 15.2 | 13.0 | 13.2 | 8.2 | 14.7 |
| 1969 | 14.0 | 10.8 | 13.7 | 9.1 | 15.6 |
| Average | 14.3 | 12.3 | 13.2 | 9.9 | 15.3 |

1/ Price basis: corn-crude, tankcars, f.o.b. Midwest mills; Cottonseed-crude, tankcars f.o.b. Valley; Peanut-crude, tankcars, f.o.b., Southeastern mills; Soybean-crude, tankcars, f.o.b. Decatur, Safflower-tanks, New York.

Source: USDA, Fats and Oil Situation.

Table 7 - - Net returns to land and management for one acre of sunflowers, specified yields and prices, Southeastern United States

| Price per pound | Sunflower yield per acre (pounds) | | | | |
|---|---|---|---|---|---|
| | 1,000 | 1,500 | 2,000 | 2,500 | 3,000 |
| Dollars | Net returns (dollars) | | | | |
| .02 | - 27.39 | -17.39 | - 7.39 | 2.61 | 12.61 |
| .03 | - 17.39 | - 2.39 | 12.61 | 27.61 | 42.61 |
| .04 | - 7.39 | 12.61 | 32.61 | 52.61 | 72.61 |
| .05 | 2.61 | 27.61 | 52.61 | 77.61 | 102.61 |
| .06 | 12.61 | 42.61 | 72.61 | 102.61 | 132.61 |

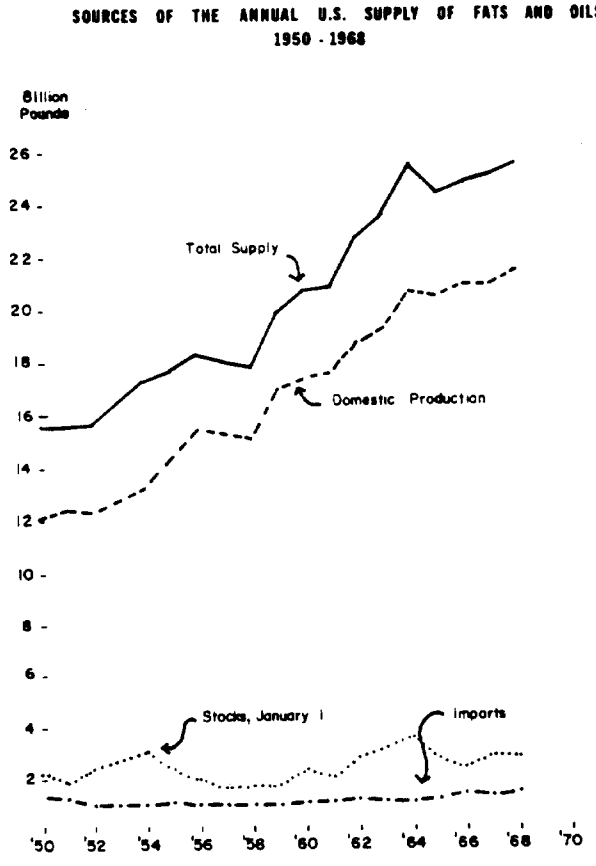


Figure 1

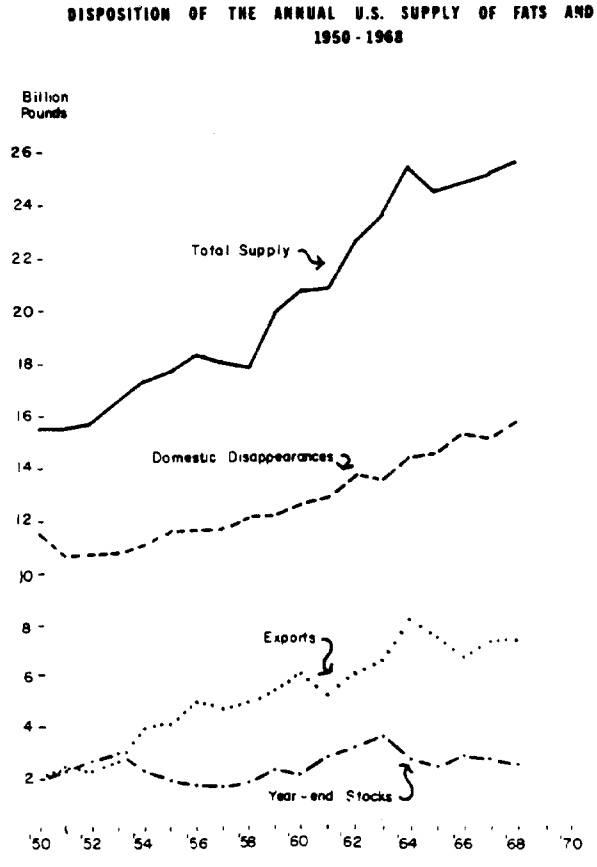


Figure 2

THE EDIBLE OIL MARKET: COMPOSITION AND TRENDS
1960 - 1969

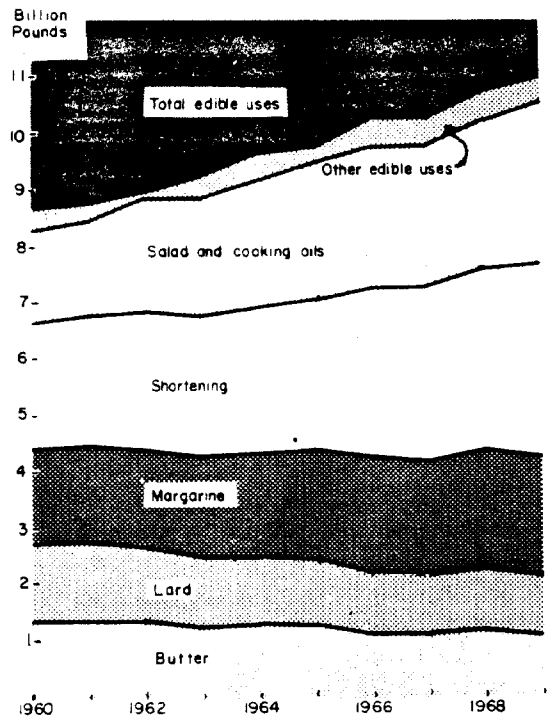


Figure 3

FATS AND OILS USED IN THE MANUFACTURE OF SHORTENING
1960 - 1969

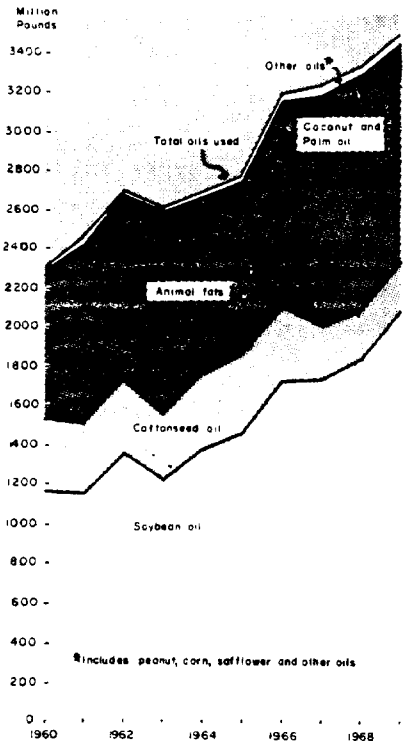


Figure 4

FATS AND OILS USED IN THE MANUFACTURE OF MARGARINE
1960 - 1969

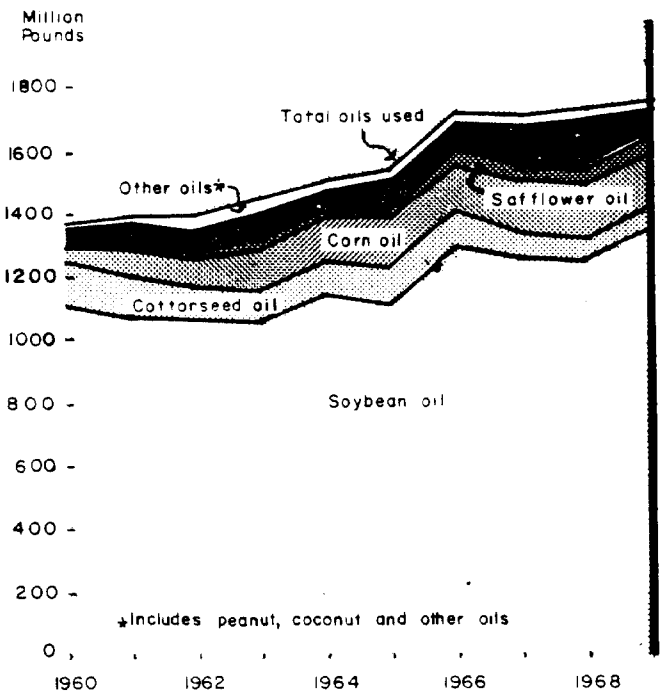


Figure 5

FATS AND OILS USED IN SALAD AND COOKING OILS
1960 - 1969

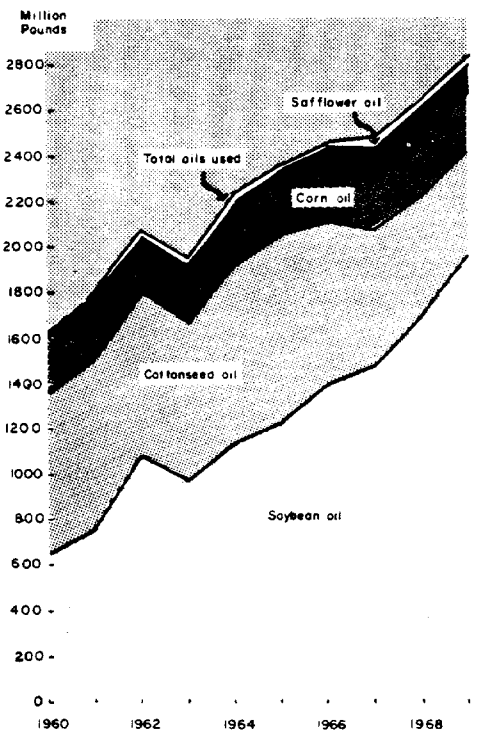


Figure 6