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Sunflower Economics*

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Introduction

Sunflower is a crop with multiple uses, the most important of which are edible oil, high-protein meal, confectionary products, and wild birdfeed. Moreover, farmers to the north and west of the traditional corn-soybean production region, particularly in North Dakota, South Dakota, Minnesota (Tristate Region), and Manitoba, have long searched for a large-acreage, high-value crop to rotate with wheat and other small grains. To many, sunflower appeared to be that crop, and enthusiasm for sunflower production ran high in the late 1970s. But the answer has not proven to be that simple. This article traces briefly evolving production and demand for sunflower and discusses the future requirements for market demand and production expansion of this crop.

Historical Production

In 1959, 27,000 U.S. acres were planted to sunflower. Yields averaged 774 pounds per harvested acre, and total production was less than 20 million pounds. Comparable data for 1969 were 201,550 acres planted, a per-acre yield of 927 pounds, and total production of 177.5 million pounds. U.S. sunflower acreage exceeded one million acres for the first time in 1975. In the record production year of 1979, about 5.55 million acres of sunflower were planted, yields averaged 1,350 pounds per harvested acre, and reported production totalled 7,305.6 million pounds. (Concentration of sunflower acreage within the Tristate Region in 1979 is shown in Figure 1.) Then, with a severe drop in sunflower seed prices in the fall of 1979, planted acres slumped to below four million in 1980, and it became evident that sunflower was not yet, at least, the miracle crop that soybeans had been several decades earlier.

Factors Affecting Supply Response

Until the mid-1960s, sunflower was grown in the U.S. primarily for use in confectionary products and for wild birdfeed. But, despite rapid growth in these uses, production of "non-oil" type sunflower (mainly in North Dakota and Minnesota) has been only in the 220 to 320 thousand acre range in recent years. And, although this market is a premium one which needs to be preserved and strengthened, it uses only a small fraction of the millions of acres of cropland available for sunflower production. Since the mid-1960s however, several factors have spurred the potential for growing sunflower as an "oilseed" crop. It is to the production and utilization of oil-variety sunflower seed that the economic perspective of this report is directed.

In 1966 Cargill, Inc., a major U.S. grain firm, sent an oil-seed chemist to the Soviet Union to select seed from a hardy oil-seed variety to begin a breeding program for sunflower, and shortly thereafter Peredovik, a good Russian variety, was brought to the U.S. With these developments, and with the availability of cytoplasm male sterility and subsequent development of a fertility restorer line, the modern era of breeding high-oil-content, high-yielding sunflower hybrids was underway. As has been the case for corn, the modern method of hybrid seed production has achieved substantial control over some major diseases of sunflower, but some insect and disease problems still remain.

In 1972 wheat and corn set-aside acreage was at a peak and sunflower was grown as an alternative crop on about 435,000 acres (more than 300,000 acres in the Tristate Region alone). Sunflower seed prices peaked in 1974 (Table 1). Production increases in 1975-79 appear to have been mainly in response to favorable prices for sunflower seed relative to wheat and barley. Favorable relative prices for sunflower resulted in slightly expanded acreage again in 1981 and much expanded acreage in 1982 as the Tristate Region accounted for more than 4.8 million of the almost 5 million acres planted nationally, including non-oil varieties.

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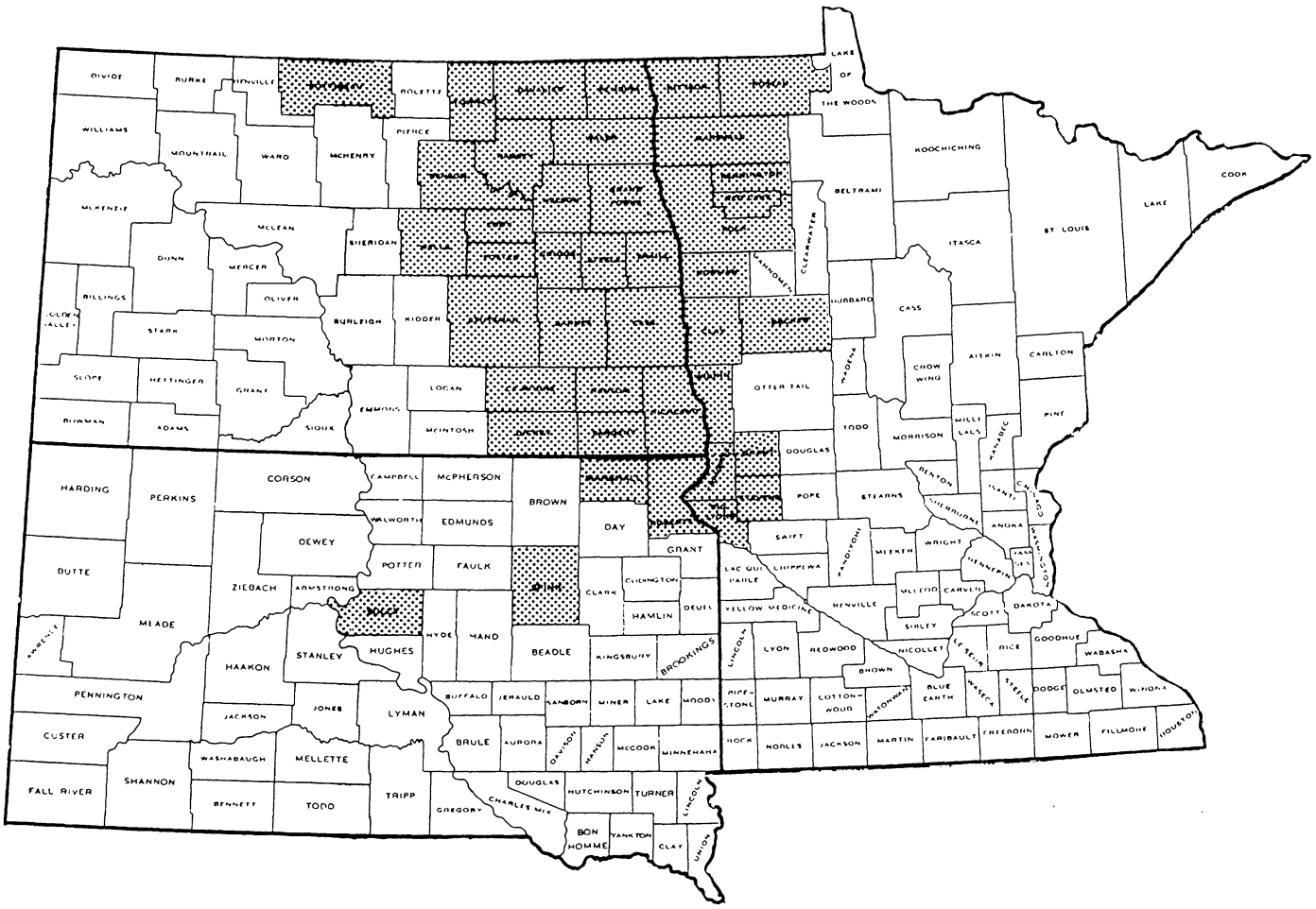
*Additional detail on the sunflower industry can be found in: W. Gineo and W.B. Sundquist, "Sunflower Supply Information," Staff Paper P81-30, December 1981, and W. Gineo, F. Paterson and W.B. Sundquist, "The Marketing-Demand Sector for Sunflower," Staff Paper P82-18, October 1982. Copies of both reports are available from the Department of Agricultural and Applied Economics, University of Minnesota, St. Paul, MN 55108.

Figure 1. Major Sunflower Producing Counties of the Tristate Region, 1979



Represents counties with sunflower acreage greater than 10 percent of the total county cropland acreage.

Table 1. Farm Level Prices for Oil Variety Sunflower Seeds ($/cwt.)

Year	MN	ND	SD	US
1970	4.00	4.25	N.A.	4.13
1971	4.40	4.40	N.A.	4.40
1972	4.65	4.55	N.A.	4.60
1973	9.00	9.00	N.A.	9.00
1974	17.50	13.60	17.50	15.30
1975	10.60	10.40	10.50	11.53
1976	10.50	10.80	10.75	11.18
1977	10.00	10.50	8.50	10.10
1978	11.60	10.40	10.30	10.70
1979	9.48	8.76	8.43	8.93
1980	11.00	10.80	11.10	10.90
1981	11.00	10.80	9.70	10.70

Sunflower as a Production Enterprise

Analysis of enterprise cost and return data for recent years suggests that, in those production areas where good corn and soybean yields can be obtained, sunflower cannot generally compete with these crops in generating per-acre income. Moreover, previous increases in sunflower acreage in the Tristate Region have been mainly at the expense of reduced acreages of barley, oats, hard red spring wheat, and durum. Sunflower has a relatively short growing season, tolerates drought quite well, and does not compete seriously with small grains for seasonal labor and machinery. Thus it has some desirable characteristics for growing in rotation with these crops.

Within the Tristate Region, sunflower has its strongest competitive advantage in areas where much of the land is currently devoted to wheat production. Due to low current wheat prices coupled with large amounts of wheat in storage, it is reasonable to expect that more acreage within this area would be devoted to sunflower production if this could be done on a profitable basis.

There are three likely avenues by which improved per-acre profits for sunflower can be achieved. Analysis of the enterprise cost and return data shows that chemical pesticide costs for sunflower are relatively large compared to alternative crops within the Tristate sunflower-wheat production area. Thus, if pesticide costs for sunflower could be reduced, sunflower production would become relatively more profitable.

The other two ways that sunflower production profitability could be increased are via increased per-acre yields and increased oil content of the seed. Since sunflower is a relatively new economic cash crop, there has been less genetic and biological research on the plant than for such crops as soybeans and corn. With additional research and development efforts, both yields and the oil content of seed may well be increased. If one or more of these alternatives for reduced per unit costs could be achieved, an additional several million acres of land in the Tristate Region would probably be planted to sunflower on a regular basis.

Market-Demand

The dramatic increase in consumption of edible vegetable oils has been one of the major developments in world-wide food consumption in the past two decades. Per capita consumption of all fats and oils in the U.S. increased from 45.3 pounds in 1960 to 55.5 in 1979 as the total domestic market grew by more than 20 percent. Per capita consumption of vegetable oils increased 81 percent during this period, while fats and oils from animal sources were down by 42 percent.

At the world level, total utilization of edible vegetable oils has increased by more than 50 percent to 40 million tons over the past 10 years. Although the rate of per capita increase in fat and oil consumption varies substantially by region, FAO data indicate that all major regions of the world have shown some increase over the past two decades.

As indicated above, part of the dramatic increase in vegetable oils consumption is the result of their substitution for animal fats and oils. Another part is attributable to rapid world population growth. A third major factor is the increased purchasing power of consumers due to higher per capita incomes. Higher per capita incomes on the world scene have also resulted in increased consumption of high-protein animal products. This, in turn, has increased the derived demand for high-protein oil seed meals, particularly soybean meal, but also the lesser oil seed meals including sunflower.

Domestic Use as Edible Oil

The total market for all edible vegetable oils in the U.S. from October 1979 to October 1980 was almost 10.7 billion pounds (Table 2), but the market for edible oils excluding soybean oil was less than 2.2 billion pounds. One extreme measure of the maximum edible oil market potential for sunflower in the U.S. is the total amount of fats and oils consumed. In 1979-80 this was 11.8 billion pounds, including animal and vegetable sources, of which sunflower oil was 84 million pounds or less than 0.5 percent. Thus, sunflower oil currently holds only a very minor share of the domestic edible oil market.

Sunflower oil has the advantage of being high in polyunsaturated fats. It is also lighter in color than other oils, especially corn oil. Though its stability is less than for most oils because of its low saturated fatty acid content, this can be increased by hydrogenation which, in turn, decreases the unsaturated fat content.

Among the edible oils, sunflower oil is considered a "premium" oil and used primarily as a salad or cooking oil and in margarine. Other premium oils that compete with sunflower oil for a similar market are corn, peanut, and safflower oils. Within the category of premium vegetable oils, the market share for sunflower oil is about 10 percent. Price competition in the domestic market, however, is keen, and price premiums for high-quality edible oils are virtually nonexistent. Thus, sunflower oil must be priced competitively with other vegetable oils if it is to expand its domestic market in any major amount.

The latter point highlights the important dual role that increased yields and/or oil content play in the potential growth of the sunflower industry. As previously mentioned, these accomplishments would bring about a more competitive crop for farmers, leading to increased sunflower acreage. This expanded production at lower per unit costs would, in turn, provide larger, more reliable domestic supplies of sunflower oil at more competitive prices.

Table 2. Domestic Consumption of Selected Fats and Oils, 1979

	Total	All Vegetable Oils	Vegetable Oils less Soybean Oil
		(million lbs.)	
Consumption in edible products	11,828.3	10,673.2	2,180.1
Baking or frying fats	4,200.8	3,149.9	491.7
Salad or cooking oil	5,271.0	5,271.0	1,118.3
Margarine	2,032.2	2,032.2	384.6
Other edible products	324.3	220.1	185.5

Sunflower Meal

Hulls from sunflower seed are high in fiber content. This has limited the utilization of sunflower meal for some livestock feeding uses. However, newer processing procedures which dehull the seed produce a high quality protein meal of about 44 percent protein compared to a protein content of about 28 percent in meal containing the hulls. The higher protein content meal can be used effectively in the rations for poultry, swine, and ruminants. Moreover, the hulls can be utilized as a fuel source in some of the newer sunflower processing plants, thus giving them some economic value in their own right. Finding domestic markets for increased volumes of sunflower meal does not appear to be a problem if it is priced competitively with other oilseed meals, particularly soybean and cottonseed meals.

Sunflower Oil as a Fuel

Limited amounts of sunflower oil have been used as a substitute for diesel fuel. Tests have been performed on diesel tractor engines to examine engine performance and to unveil any problems associated with the use of sunflower oil. In its utilization in diesel engines, sunflower oil has been used both in pure form and blended with diesel fuel in several different proportions.

The use of sunflower oil as a fuel on a regular basis can be examined in two ways, first from an economic standpoint and second from the technical feasibility side. The current economic outlook is not promising, because sunflower oil is currently more expensive than diesel fuel. A recent study suggests that the real (deflated) price of diesel fuel must increase by 6 percent annually from 1980-90 (for a compounded increase of 80 percent) to enable vegetable oils to replace approximately 25 percent of the diesel fuel use expected in 1990. The price ratio per BTU of sunflower oil to diesel fuel has declined in recent years. But, barring any major changes in U.S. oil prices, it is unlikely sunflower oil will become competitive with diesel fuel in the near future.

On the technical or engineering side, the use of sunflower oil as a fuel in diesel engines has shown some promise. There are several problems such as viscosity, filter clogging, poor cold weather starting, gumming, and carbon buildup on engine parts. But short-term use (less than 200 hours) of sunflower oil blended with diesel fuel, with proper engine maintenance, appears to minimize these problems and has led engineers to approve the short-term use of sunflower oil as a diesel fuel alternative. The long-term use of sunflower oil as a fuel, however, may adversely affect engine performance and durability. Such use is still under evaluation.

Processing Capacity

A past deterrent to expanding domestic markets for sunflower oil has been the shortage of processing capacity. Before 1979 there were no major plants designed specifically for sunflower processing. Processing of sunflower took place in plants designed for flaxseed, soybean, or cottonseed oil extraction. Due to decreased demand for linseed oil, several plants designed for flaxseed oil extraction were able to utilize their excess capacity by processing sunflower seed.

New plants now account for a major portion of the industry's increased sunflower processing capacity. Specifically, Cargill, Archer Daniels Midland, and Honeymead now have crushing capacity for one million metric tons per year. New plant facilities by Midwest Processing (at Velva, North Dakota) and National Sun Industries (at Enderlin, North Dakota) will soon add 50 percent more capacity to this total. Yet, in the 1981 marketing year, only about 600,000 metric tons of sunflower seeds were available for processing. As a result, some crushing facilities were necessarily idled because the active export market siphoned off available seed supplies for prices at which domestic crushers could not compete, and maintain a positive crushing margin.

Export Markets

On the international scene, sunflower seed, sunflower oil, and sunflower meal are all exchanged in world trade. However, the United States has only been involved in the trade of sunflower seed and oil. Table 3 reports a summary of the major importers of U.S. sunflower seed from 1973-81 and ranks the top importers in each year. The Netherlands, Portugal, and the Federal Republic of Germany have consistently imported relatively large quantities of U.S. sunflower seed. Since 1978 Mexico has also become an important importer.

Sunflower oil has been a preferred edible oil in several countries for a number of years but sunflower oil exports have only recently become a significant portion of the U.S. export picture. A major reason for sunflower oil exports being at low levels in previous years was the lack of U.S. processing facilities. Increased processing capacity has allowed sunflower oil exports to increase from approximately 86,000 metric tons in 1979 to more than 300,000 metric tons in 1980. Before 1978 Germany, the Netherlands, and Belgium consistently had high levels of U.S. imports, but in recent years (1979-80) Algeria, Venezuela, and Egypt have become larger importers of U.S. sunflower oil.

The potential for U.S. growth in the international sunflower market depends on several factors both in importing countries and in other exporting

Table 3. Top 5 Importers of U.S. Sunflower Seed, 1973-81

Country	81	80	79	78	77	76	75	74	73
Netherlands	2	1	1	1	1	2	3	3	1
Portugal	4	3	4	3	3	3	2	2	5
Germany (Fed)	5	4	2	2	2	1	1	1	2
Mexico	1	2	3	5					
Israel		5							
Italy			5		5				
France				4	4		5	4	4
Czechoslovakia						4			
Turkey						5	4		
Canada								5	3
Spain	3								

countries. U.S. sunflower seed exports compete primarily with exports from Canada and Bulgaria. If growing conditions in Canada and/or Bulgaria deteriorate, or if producers in these countries switch to other crops, U.S. exports of seed could increase. Decreased output by other seed exporters would allow the U.S. to increase its market share and absolute level of exports.

Seed-importing countries where the U.S. market share might increase are Germany, Italy, and Czechoslovakia. Over the past four years, the U.S. market share in Germany, a major importer, has averaged only 26 percent. While Italy and Czechoslovakia import less than Germany, the U.S. share of their imports is also quite low. Over the past three years, Mexico has imported sunflower seed exclusively from the U.S. However, these imports have been restricted by inadequate marketing facilities. If Mexican port and transport facilities are improved, Mexico can be expected to increase their imports of U.S. seed.

Another problem faced by U.S. exporters is that several of the western European countries importing U.S. seed view the U.S. as a residual supplier. They only purchase U.S. seed when their regular suppliers cannot meet their needs. This adds greatly to the volatility in the volume of U.S. exports, positioning U.S. producers at the whiplash end of major price swings associated with changes in export demand. If the U.S. can establish itself as a consistent and primary source of seed to these countries, the demand faced by U.S. exporters should stabilize somewhat and the potential for growth would be enhanced.

The potential for U.S. exports of sunflower oil is also significant. It was only in 1981 that the U.S. first exported more sunflower oil than any other country. Argentina has been the leading exporter of oil in other years. Romania has also been a consistent exporter of oil. The major importers are Belgium-Luxemborg, Germany, and Czechoslovakia. The U.S. could increase sunflower oil exports if it increased it negligible market share in these countries, possibly by producing a better quality oil than is marketed by other exporting countries.

General Factors in Trade

Several general factors could lead to increases in U.S. participation in the international trade of both sunflower oil and seed. First is the foreign exchange rate. If the value of an exporting country's currency rises vis-a-vis the importing countries' currencies, the goods in question become relatively more costly and therefore less attractive to the importer. Thus, recent increases in the strength of the U.S. dollar have hindered U.S. exporters of sunflower oil and seed. If the dollar were devalued relative to an importer's currency, the price of U.S. goods would become more attractive. Another consideration is the value of the U.S. dollar relative to the currencies of other sunflower seed and oil exporters. A devaluation in the dollar relative to the currencies of these other exporters would strengthen U.S. exports.

A second factor is internal policies of importing countries. If an importing country protects its domestic producers of competitive oils (olive, rapeseed, etc.) or domestic processors of oils, this puts the U.S. at a disadvantage. Such protection occurs in the form of quotas, tariffs, levies, or subsidies. This type of protection has not been uncommon. If restrictions were lifted U.S. sunflower exports would benefit.

Finally, U.S. exports could be increased if any of the usual demand shifters increased. Specifically, increases in population and/or incomes can be expected in a number of importing countries. Prime examples are Algeria and Egypt. Both countries import U.S. sunflower oil, and if incomes in these countries increase, U.S. oil imports will likely increase.

Sunflower Developments in Review

Despite a rather irregular pattern of prices and volumes of production, processing and export marketings, the U.S. sunflower industry has improved its technical capabilities tremendously over the past 15 years. It no longer represents the "residual claimant" for production and processing resources which it did several years ago. It now has many of the characteristics of an established industry. Very few industries become established without undergoing growing pains, and this has been true for the U.S. sunflower industry. With a much-improved technical base now in place for production and processing, future needs are to increase production efficiency and expand demand in both domestic and export markets.

A General Solution to Future Market (and Production) Expansion

Both sunflower oil and sunflower meal (particularly if the latter is produced from hulled seeds) are high-quality products which can be marketed in large volume if (1) supplies are dependable, and (2) product prices are competitive with substitute oil and meal products. The price competitiveness of sunflower oil, because of its high proportionate value (three-fourths to four-fifths of total seed value), is of critical importance for market expansion. In contrast, only about one-third of the value of soybeans is in the oil and two-thirds in the meal. As a result, increased demand for high-protein meal has strengthened the competitive position of soybeans vis-a-vis other oilseed crops.

To ensure price competitiveness of sunflower oil and meal, supplies of oil-type sunflower seed must be large enough and stable enough to service efficiently both the growing but somewhat volatile export market for sunflower seed and the requirements of domestic crushers. Moreover, this must be accomplished while returning sunflower producers a competitive return. In the long term, these objectives can only be accomplished by an effective research and development (R & D) program for sunflower which reduces per-unit production costs to a level competitive with other oilseed crops, particularly soybeans. Analysis directed at quantifying the potential future payoff for an effective R & D program for sunflower is now underway.

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