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SUNFLOWER SUPPLY INFORMATION

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This report is concerned with a discussion of the sunflower production sector.* It summarizes and discusses the North American sunflower production sector in terms of area, acreage, total production, yields and prices. In addition, a preliminary evaluation of the potential level of sunflower production is made.

The major portion of Canadian and United States sunflower production takes place in a limited geographical region. Canadian production occcurs primarily in the Province of Manitoba with limited production taking place in Saskatchewan. Canadian production figures are shown in Table 1. Since 1977 total Canadian production has exceeded 100 million pounds and in 1979 reached a record of 484 million pounds. During this period, Manitoba accounted for over 95 percent of the total Canadian production. Most of the United States sunflower production stretches southward from the Canadian border through parts of Minnesota, North Dakota and South Dakota (tristate region).

Numerous other states including California, Texas, Montana, Mississippi, Kansas, and Florida also produce sunflower but at a relatively low level compared to the tristate region. Approximately ninety percent of U.S. production occurs in the latter region. In recent years, total production in the tristate region has been at least 10 times greater than Canadian production. Since the tristate production region is such an important one, the following discussion will focus mainly on it.

Within the tristate region, sunflower production is quite concentrated in the Red River Valley. Figure 1 delineates those counties, within the tristate region, in which 1979 sunflower acreage exceeded

*This report is part of a broader research study to evaluate the expected returns to alternative levels of R & D investment for sunflower.

Table 1

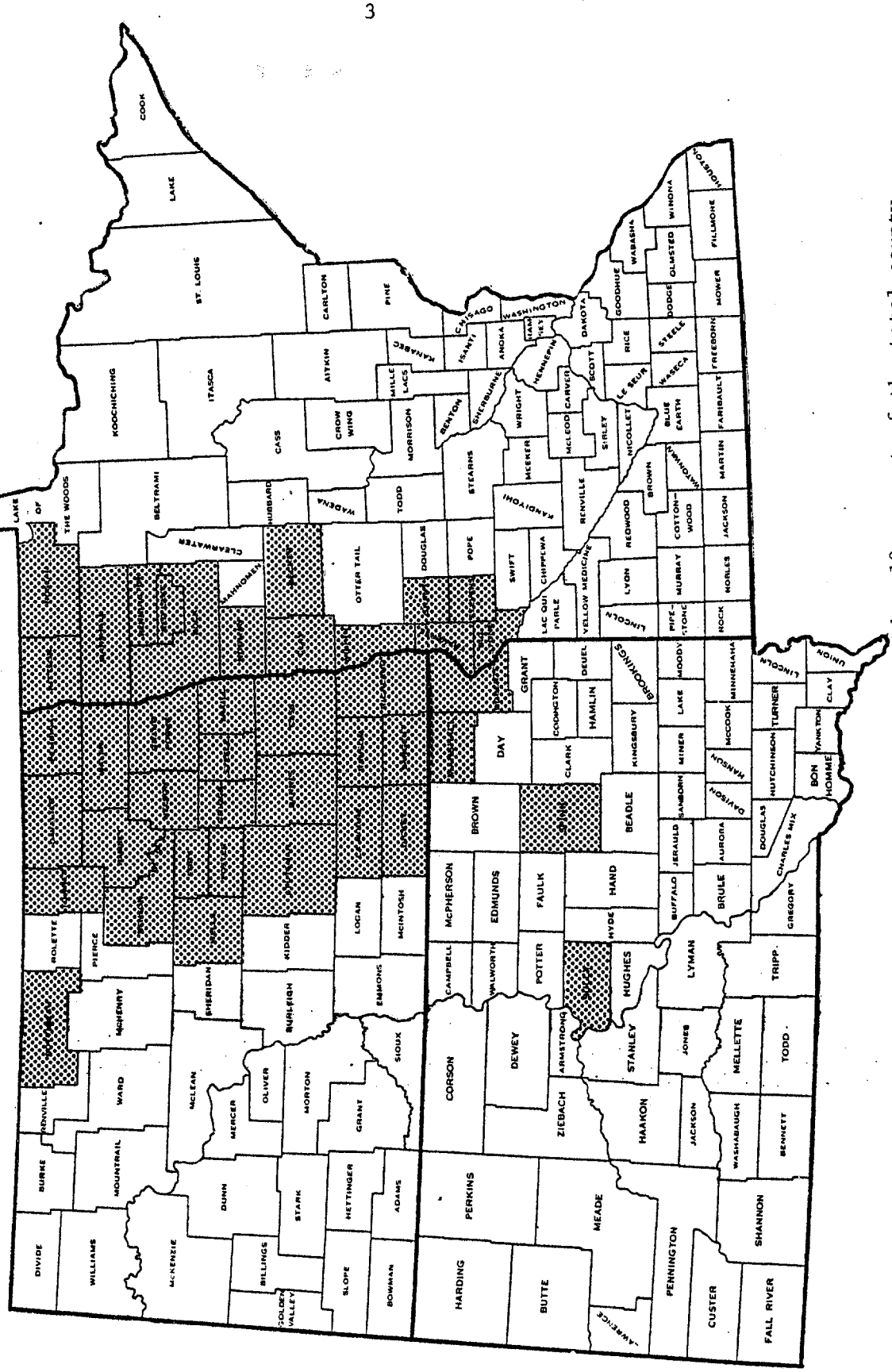
Canadian Sunflower Production and Prices

	YEAR														
	1959	1964	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Manitoba															
Acreage	32,000	48,000	48,000	65,000	155,000	190,000	125,000	21,000	62,000	50,000	165,000	215,000	380,000	320,000	289,000
Yield/Acre (lbs.)	480	525	708	800	750	800	700	867	1,065	1,060	1,061	1,182	1,211	1,092	
Prod (1,000 lbs.)	15,360	25,200	34,000	52,000	116,250	152,000	87,500	18,200	66,000	53,000	175,000	254,000	460,000	349,000	
Price/cwt ($)	4.00	5.00	6.00	6.85	6.10	7.00	10.02	20.50	10.31	10.00	11.50	11.00	9.00		
Saskatchewan															
Prod (1,000 lbs.)	N/A	N/A	------	1,800	41,800	13,600	1,800	1,800	------	------	3,200	10,000	24,000	19,500*	
Alberta															
Prod (1,000 lbs.)	N/A	N/A	------	1,200	6,200	1,200	1,200	------	------	------	-------	-------	-------		
Canada															
Prod (1,000 lbs.)	15,360	25,200	34,000	55,000	164,250	166,800	90,500	20,000	66,000	53,000	178,200	264,000	484,400	368,500	

Sources: Manitoba data - 1979 Year Book, Manitoba Agriculture.
Saskatchewan and Alberta data - 1969-1976 Canadian Grains Industry - Statistical Handbook 1978; Grains Council, Winnipeg, Manitoba.
Saskatchewan and Alberta data - 1977-1979 Canadian Grains Industry - Statistical Handbook 1980; Grains Council, Winnipeg, Manitoba.

* estimate based on reported acreage (Saskatchewan) and yield for Manitoba production.

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

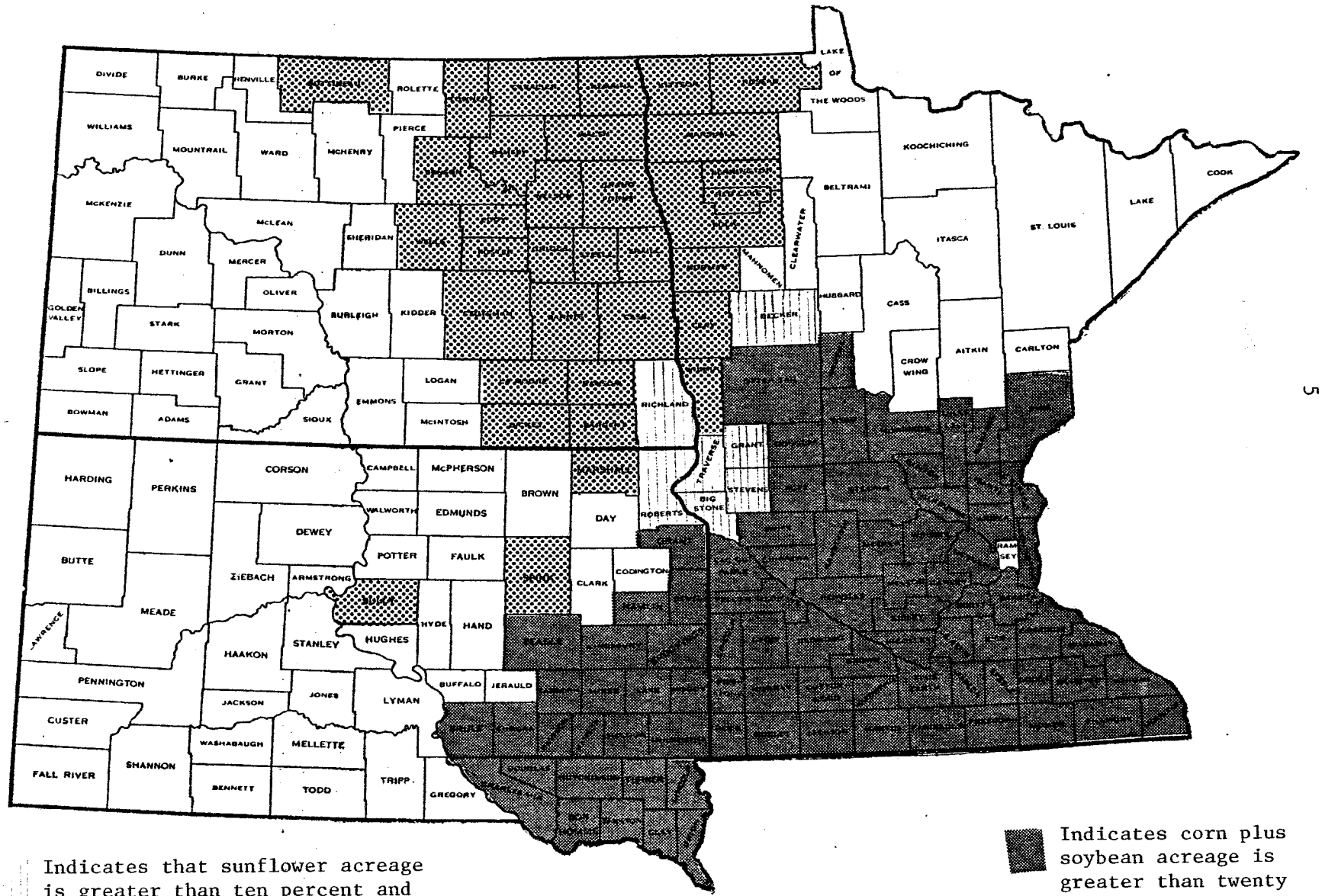


ten percent of total county cropland acreage (as reported in the 1978 Census of Agriculture). This area covers Bottineau county and the counties in the eastern third of North Dakota, the western counties north of Big Stone and Stevens counties in Minnesota and the following counties in South Dakota: Sully, Spink, Roberts, and Marshall.

The southern boundary of the major production area in the tri-state region (with the exception of Sully and Spink counties in South Dakota) is quite distinct. If the boundary of this sunflower production region is contrasted with the corn and soybean producing areas of the tristate region, as in Figure 2, one can see that the southern boundary of the sunflower producing area is approximately the northern boundary of the corn and soybean production area.[1] The two production areas overlap at the intersection of the three state boundaries. And, if a northeast to southwest diagonal were drawn through the intersection of the tristate boundaries, it would roughly divide the two production areas.

An explanation for the historic production pattern presented in Figure 2, can be based on certain characteristics of the sunflower, soybean and corn plants. Sunflower is more drought resistant at the early stages of development than are corn and soybeans and the sunflower producing area typically has drier soil conditions than the corn and soybean production area. Sunflower plants also have a relatively short growing season and sunflower seedlings are relatively more frost resistant than corn and soybeans. These two facts also give sunflower an edge over corn and soybeans because the sunflower producing area typically has a shorter growing season and greater probability of early season frost than the corn and soybean production region of Figure 2. Thus, on a biological basis it would be difficult for corn and soybean to be a major crop in the sunflower production area (especially in the northern

Figure 2
Percentage of Total Cropland Acreage
Sunflower, Corn, Soybean, 1979.



Indicates that sunflower acreage is greater than ten percent and corn plus soybean acreage is greater than twenty percent of total cropland acreage.

Indicates sunflower acreage planted is greater than ten percent of total cropland acreage.

Indicates corn plus soybean acreage is greater than twenty percent of total cropland acreage.

portions of this area). On the other hand, because corn and soybeans are economically viable crops in the area in which they are grown it would be difficult for sunflower to replace them.

The history of sunflower as an important crop, in the tristate region, is not a long one. In fact, until the mid-sixties sunflower was grown primarily as an ornamental and confectionary (bird feed and nuts) crop. However, since 1966 several factors have led to an increase in interest and the acceptability of sunflowers as an economically viable oilseed crop. Among these factors are the following biological developments of the sunflower plant: 1) the oil content of the seed almost doubled to approximately forty percent of the seed weight, 2) major increases in yields per acre of sunflower seed, and 3) improved resistance of the sunflower plant to disease. Coupled with these biological developments are several facts which have given rise to sporadic increases in sunflower acreage.

In 1959, total sunflower acreage in the United States was 27,000 acres. Yields averaged 774 pounds per harvested acreage and total production was less than 20 million pounds (see Table 2). Between 1959 and 1969, oil content and yields for sunflower had been increased. These changes resulted in sunflower acreage increases. In 1969, acreage was 201,550 acres; average yield was up to 927 pounds per harvested acre and total production exceeded 177 million pounds.[2]

In the early seventies, non-U.S. output had declined providing the setting for U.S. entry into the international market. In response to this, U.S. production was increased over 200 percent from 189.1 million pounds in 1970 to 431.7 in 1971 (Table 2) and world consumers increased

Table 2

Total Sunflower Seed Production*

	1972	1973	1974	1975	1976	1977	1978	1979	1980
Acreage Planted									
MN	301,000	260,000	193,000	245,000	214,000	525,000	710,000	1,400,000	875,000
ND	418,000	418,000	379,000	542,000	620,000	1,360,000	1,920,000	3,460,000	2,500,000
SD	42,000	81,000	88,300	178,000	100,000	136,000	165,000	620,000	475,000
CA	4,000	2,000							
TX	500	1,000	7,500	310,000	184,000	300,000	45,000	75,000	140,000
Other States	95,700	4,000	9,210	18,250	28,040				
Total U.S.	861,200	766,000	677,010	1,293,350	1,146,040	2,321,000	2,840,000	5,555,000	3,990,000
Acreage Harvested									
MN	285,000	255,000	181,000	211,000	210,060	518,000	698,000	1,347,000	825,000
ND	407,000	411,000	367,000	498,000	600,000	1,320,000	1,910,000	3,378,000	2,425,000
SD	39,000	79,000	86,300	175,000	76,000	132,000	160,000	615,000	474,000
CA	3,800	1,800							
TX	400	900	6,500	287,080	137,060	235,00	30,000	70,000	120,000
Other States	3,800	3,800	8,710	17,520	26,060				
Total U.S.	812,200	751,500	649,510	1,188,600	1,049,120	2,205,000	2,798,000	5,410,000	3,844,000
Yields (lb./ac.)									
MN	929	1,130	950	1,129	1,224	1,558	1,536	1,389	1,184
ND	906	996	961	1,100	1,000	1,255	1,351	1,360	980
SD	1,025	950	744	676	500	959	1,119	1,230	920
CA	1,000	1,000							
TX	900	1,000	592	962	798	717	727	1,208	
Other States	750	912	1,337	1,181	1,043				
Total U.S.	905	1,036	930	1,011	983	1,252	1,377	1,350	1,033
Total Production (1,000 lbs.)									
MN	265,850	288,060	172,025	238,210	257,000	807,060	1,072,020	1,870,620	1,036,000
ND	368,710	409,350	352,680	547,800	600,000	1,658,250	2,579,700	4,594,080	2,450,000
SD	40,000	75,050	64,220	118,325	38,000	126,560	179,020	756,300	437,000
CA	3,800	1,800							
TX	360	855	3,850	276,220	109,380	168,600	21,800	84,590	
Other States	57,750	3,465	11,649	20,685	27,189				
Total U.S.	735,470	778,580	604,423	1,201,240	1,031,669	2,760,470	3,852,540	7,305,590	3,923,000

Data Sources: 1959-1973 Fat and Oil Situation, November 1974, page 31; 1974-1976 Fat and Oil Situation, July 1978, page 29; 1977-78 Crop Production, June 1979, page B-11; 1979 Annual Crop Summary, January 1980, page B-27; 1980 Acreage Crop Summary, June 1980, page B-13. All sources are USDA publications.

Table 2

(continued)

Total Sunflower Seed Production*

	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
Acreage Planted													
MN	3,2001			NA	29,000	23,000	24,000	27,000	94,0001	68,000	85,000	92,000	162,000
ND	14,580			13,000	31,000	18,500	25,000	49,000	127,000	88,000	110,000	127,000	243,000
SD	20			NA	NA	IOS**	NA	NA	NA	IOS	100	400	15,000
CA	5,100			NA	NA	4,700	NA	NA	NA	IOS	3,500	1,100	2,000
TX	900			NA	NA	IOS	NA	NA	NA	IOS	750[2]	IOS	IOS
Other States	3,200			NA	NA	2,500	NA	NA	NA	36,500[1]	2,200[2]	1,500[2]	6,100
Total U.S.	27,000			38,000	65,000	48,700	56,000	82,500	227,000	192,500	201,550	222,000	428,100
Acreage Harvested													
MN	2,978			NA	28,000	22,000	21,000	25,000	91,000	64,000	77,000	86,000	155,000
ND	13,640			12,5000	30,000	18,000	25,000	48,000	125,000	87,000	108,000	121,000	237,000
SD	16			NA	NA	IOS	NA	NA	NA	IOS	100	300	12,000
CA	5,070			NA	NA	4,562	NA	NA	NA	IOS	3,449	1,000	1,900
TX	861			NA	NA	IOS	NA	NA	NA	IOS	713[2]	IOS	IOS
Other States	3,167			NA	NA	2,338	NA	NA	NA	31,000[1]	2,173[2]	1,300[2]	5,700
Total U.S.	25,732			38,000	65,000	49,900	53,000	79,000	221,500	182,000	191,435	209,600	411,600
Yields (lb./ac.)													
MN	942			NA	1,100	680	800	920	1,005	1,032	964	863	1,086
ND	731			980	970	600	850	880	1,060	1,030	900	929	1,027
SD	---			NA	NA	IOS	NA	NA	NA	NA	800	950	1,100
CA	935			NA	NA	1,633	NA	NA	NA	NA	1,000	1,000	1,100
TX	826			NA	NA	IOS	NA	NA	NA	NA	800	NA	NA
Other States	538			NA	NA	543	NA	NA	NA	922	900	935	842
Total U.S.	774			950***	990***	735	850	900	1,036	1,012	927	902	1,049
Total Production (1,000 lbs.)													
MN	2,806			NA	30,800	14,960	16,800	23,000	91,460	66,060	74,230	74,210	168,260
ND	9,966			12,250	10,800	21,250	42,240	42,240	132,500	89,610	97,200	112,460	243,420
SD	4			NA	NA	IOS	NA	NA	NA	IOS	80	285	13,200
CA	4,742			NA	NA	7,448	NA	NA	NA	IOS	3,450	1,000	2,090
TX	711			NA	NA	IOS	NA	NA	NA	IOS	570[2]	IOS	IOS
Other States	1,703			NA	NA	1,270	NA	NA	NA	28,575[1]	1,955[2]	1,270	4,800
Total U.S.	19,932			36,100	34,478	45,050	71,100	71,100	229,460	184,245	177,485	189,125	431,770

*Does not distinguish between oil and confectioner usage.

**In other states.

***Estimated.

[1]Includes test plots in southern states.

[2]Excludes test plots in southern states.

Data Sources: 1959-1973 Fat and Oil Situation, November 1974, page 31; 1974-1976 Fat and Oil Situation, July 1978, page 29; 1977-78 Crop Production, June 1979, page B-11; 1979 Annual Crop Summary, January 1980, page B-27; 1980 Acreage Crop Summary, June 1980, page B-13. All sources are USDA publications.

U.S. imports from approximately 7 million pounds to over 88 million pounds (Table 3). In 1972, wheat and corn set aside acreage was at a peak level. Peak set aside acreage allowed producers to grow sunflower as an alternative crop on approximately 435,000 set aside acres (307,000 acres in the tristate region alone).[3] Thus, from 1971 to 1972 acreage almost doubled again and total production increased from 431.7 to 735.4 million pounds (Tables 2 and 3). In 1974, there was a decrease in acreage planted and total production. The reason for this decrease was primarily due to the termination of the set aside program, permitting producers to shift acreage from sunflower back to wheat and other set aside crops. The data of Table 2 also show increases in sunflower acreage and production in 1975 and 1977. Rationale, for these increases, may be due to the depressed prices for wheat in these years. Since wheat is the primary crop with which sunflower competes for acreage, (See Figure 3) decreases in the price of wheat would lead producers to shift acreage into sunflower production. This rationale appears to be reasonable when one also considers that prices received for sunflower in 1974-1976 were at a relatively high level. Prices received by producers for sunflower oilseed are reported in Table 4.

Further increases in acreage and production occurred in 1978. Production expansion continued into 1979 when both acreage and production levels were at an all time high. Acreage exceeded 5.5 million acres and production was greater than 7.6 billion pounds. The rapid expansion in sunflower production from 1976 to 1979 was influenced by the following facts: 1) favorable sunflower prices relative to wheat and barley (competing crops in production) 2) declines in Soviet Union production which resulted in increased quantities of U.S. sunflower entering the

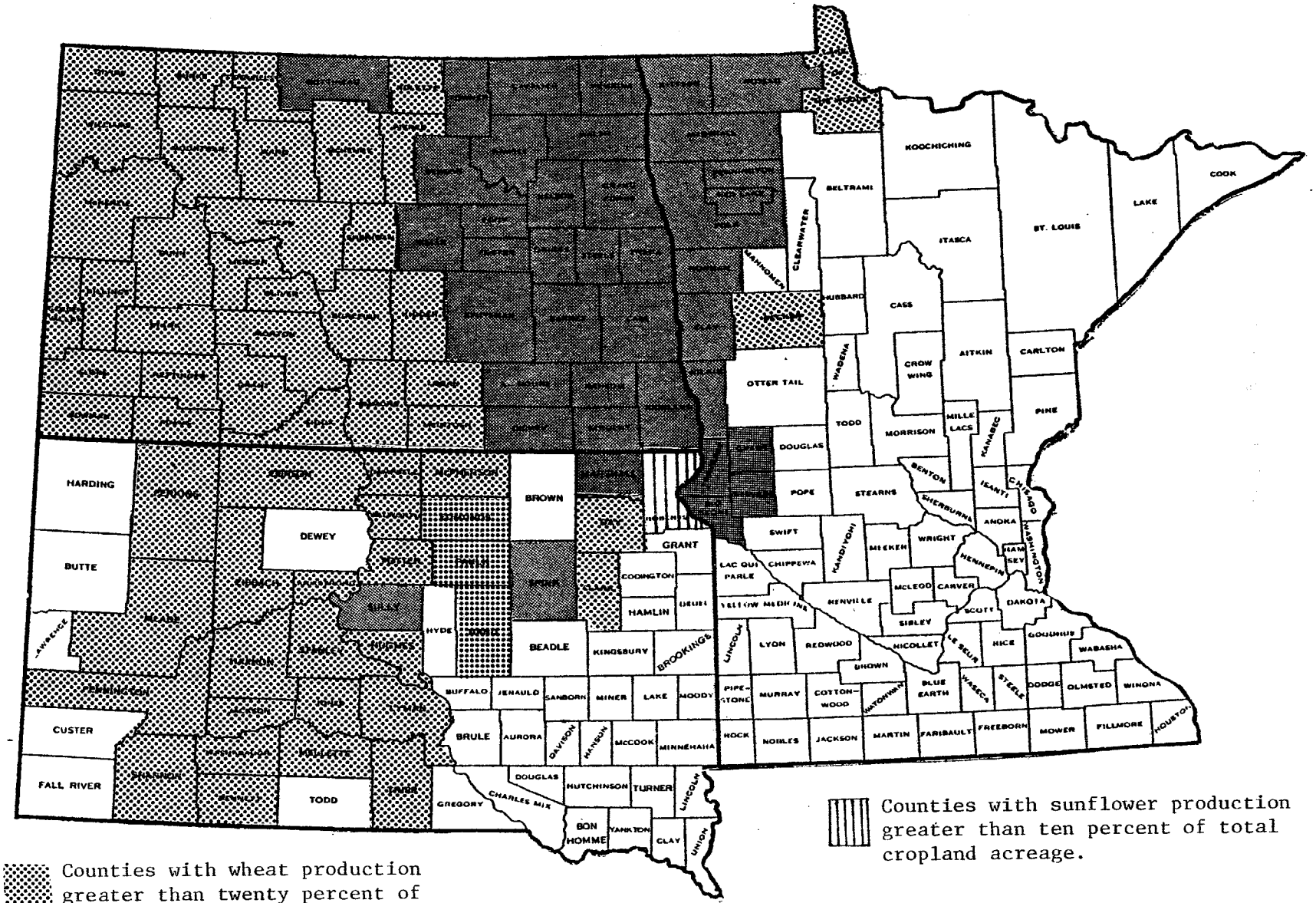
Table 3
Supply and Disposition of Sunflower 1969-1980
(1,000 lbs)

	1969	1970	1971	1972	1973	1974	1975	1976**	1977**	1978**	1979**	1980**
U.S. Production	177,485	189,125	431,770	735,470	778,580	604,423	1,201,240	1,097,800	2,926,000	4,010,600	7,664,800	3,995,200
Imports	5,253	9,109	5,278	5,209	4,995	2,741	4,825	4,400	6,600	15,400	22,000	24,200
Beginning Stock (Sept. 1)								-0-	50,600	169,400	286,000	2,360,600
Total Supply	182,738	198,234	437,048	740,679	783,575	607,174	1,206,065	1,102,200	2,983,200	4,195,400	7,884,800	6,380,000
Non Oil Use	122,865	119,634	234,637	173,257	198,079	204,431	200,760	226,600	248,600	330,000	301,400	275,000
Exports	2,130	6,954	88,836	394,000	457,340	333,740	674,151	741,400	2,072,400	3,005,200	4,004,000	3,850,000
Crush	43,480	61,520	114,770	162,845	164,522	65,770	395,930	77,000	481,800	642,400	1,203,400	1,430,000
Year end Stock (Aug. 31)								50,600	169,400	286,000	2,360,600	803,000
							% OF TOTAL	SUPPLY				
% of Total Supply entering												
Non Oil Use	67	60	54	23	25*	34	17*	21	8	8	4	4
Exports	1	4	20	53	58	55	56	67	70	72	51	60
Crush	24	31	26	22	21	11	33	7	16	15	15	22
Year end Stock								5	6	7	30	13

*To balance total supply with total distribution, the data source (F.O.S. 292, July 1978) included an adjustment category in the distribution total. When distribution in the non oil, exports and crush categories exceeded total available supply, the adjustment is a negative number. It follows that when the adjustment factor is negative, the sum of the percentages of total supply entering non oil use, exports and crush may be greater than 100%.

**The figures in these columns originate from data reported in The Fat and Oil Situation, 302 January 1981. The data is reported on an annual balance sheet basis (Oct. 1-Sept. 30) with stock carry overs rather than on an annual basis (as the years 1969-1975 were).

Figure 3
Percentage of Total Cropland Acreage in Sunflower and Wheat, 1979



Counties with wheat production greater than twenty percent of the total cropland acreage.

Counties with sunflower production greater than ten percent of total cropland acreage.

Counties with wheat production greater than twenty percent and sunflower production greater than ten percent of the total cropland acreage.

Table 4

Prices Received by Farmers for Oil Variety Sunflower Seed
(Dol/Cwt)

Year	MN	ND	SD[2]	TX[2]	U.S.
1964[1]	4.10	4.15	-----	-----	4.13
1965	4.70	5.00	-----	-----	4.85
1966	5.50	5.70	-----	-----	4.60
1967	4.85	4.50	-----	-----	4.68
1968	3.90	3.85	-----	-----	3.87
1969	3.85	4.05	-----	-----	3.95
1970	4.00	4.25	-----	-----	4.13
1971	4.40	4.40	-----	-----	4.40
1972	4.65	4.55	-----	-----	4.60
1973	9.00	9.00	-----	-----	9.00
1974	17.50	13.60	17.50	12.00	15.30
1975	10.60	10.40	10.50	15.00	11.53
1976	10.50	10.80	10.75	15.00	11.18
1977	10.00	10.50	8.50	8.00	10.10
1978	11.60	10.40	10.30	10.20	10.70
1979	9.48	8.76	8.43	10.60	8.93
1980	11.60	11.50	11.50	13.00	11.50

[1]The data reported in the years 1964-66 represent prices of both oil and non-oil seed variety.

[2]Production in these states was at a relatively low level for the years 1964-73.

Sources: Fat and Oil Situation 275, November 1974, page 32; Fat and Oil Situation 292, July 1978, page 30: Crop Production, C.R.B., E.S.C.S., USDA, June 1979, pages 8-11.

export market and 3) tight supplies of peanut oil (a competing product on the demand side).[4]

In both 1980 and 1981 acreage was well below the 1979 level of 5.5 million acres. In 1980 acreage was approximately 3.7 million acres and for 1981 acreage is approximately 3.6 million acres.

The previous discussion has dealt with the changes in producer planning in the sunflower industry. Attempts have been made to explain these changes in producer plans by citing different structural changes which would provide the stimulus for the noted change in production. The stimuli discussed have been changes in technology of the sunflower plant, responses to the price of substitute crops in production and policy changes or stipulations for substitute crops. Economic theory ties changes such as these with shifts in the supply curve. Based on the changes in production levels, it appears that there have been numerous shifts of the primary (farm level) sunflower supply curve since the crop's emergence.

A discussion of production responses in the sunflower industry would not be complete without the acknowledgement of producers' responses to own price (price received for sunflower by producers). For the purpose of this discussion we can assume that producers' production plans for the year are based on the price received for sunflower seed in the previous period. Thus, the quantity supplied (total production) to the market in time period, t, is a function of the price received for sunflower in the t-1 period. Table 5 gives the information needed to evaluate price response for production years 1969-1980. In Table 5 note the asterisks associated with certain years. These asterisks denote years in which changes in the determinants of supply (supply shifters) have occurred. An attempt to sort out shifts or changes in the supply curve from changes in the quantity supplied (due to a price change) would be difficult.

Table 5

Sunflower Production and Priee Information 1969-1980

Year	Total Production (million lbs.)	Price ($/cwt.)
1968		3.87
1969	177.5	3.95
1970*	189.1	4.13
1971	431.8	4.40
1972*	735.5	4.60
1973	778.6	9.00
1974*	604.4	15.30
1975*	1201.2	11.53
1976	1097.8	11.18
1977*	2926.0	10.10
1978	4010.6	10.70
1979*	7664.8	8.93
1980	3995.2	11.50

* Denotes years where changes in the determinants of supply (supply shifts) have occurred. The discussion of these determinants is in the text.

This difficulty arises because of the frequent shifts in the sunflower supply curve. However, there may be three instances where it might be possible to isolate a change in quantity supplied resulting from a change in price. In the following cases 1969-70, 1972-73, and 1979-80 it appears that there may be no change in the supply curve. If we assume that the data reported in each of these two year periods are on a single supply curve and that this supply curve is approximately linear it would be possible to calculate arc price elasticities of supply.[5] The elasticities are as follows: 1969-70, 3.1; 1972-73, 1.3; 1979-80, 0.30. The earlier values (1969-70 and 1972-73) of 3.1 and 1.3 appear to be high. At the time, the price level was relatively low and price response could be expected to be large. A number of other explanations might also be appropriate in explaining the high price elasticities reported here. Circumstances unique to a particular year and production area such as a late arrival of spring could have influenced a number of producers to plant sunflower. There is also the possibility that a supply shift which has not been accounted for actually occurred. Further, the industry was just developing and several other factors not accounted for in this analysis (such as gains in knowledge and certainity) could have had a greater impact on producer decisions than sunflower price did.

Much of the previous discussion has dealt with the sunflower supply sector from a historical prospective that attempted to give insights or rationale for previous production levels. This previous discussion and a more detailed look at the 1979 production year can provide a basis for projections of future sunflower acreage.[6] The objective of the subsequent portion of this report is to identify the conditions which would facilitate growth in the acreage devoted to sunflower production.

As noted above, tristate sunflower production occurs in a limited area (figure 1). However, within this production region, conditions vary considerably, giving rise to varying crop output mixes and production costs. In order to obtain an accurate picture of how growth in sunflower acreage might occur, it would be appropriate to account for these differences. Thus, partitioning of the tristate production area would be desirable. The partitioning of production areas based on varying production conditions has been accomplished by the USDA, ESCS, FEDS Budget Reports (FEDS). For convenience this report will utilize the FEDS partitioning scheme. Figure 4 illustrates and labels this scheme for the tristate region. The areas of interest for discussion purposes are those which encompass the tristate sunflower producing area. These regions are: areas 200 and 300 in North Dakota, areas 100 and 300 in Minnesota and area 200 in South Dakota.[7] These areas will be referred to as FED budget areas.

In 1979 sunflower acreage increased substantially over the 1978 level (Table 2). The increase in sunflower acreage must have been accompanied by the decline in acreage devoted to alternative crops in production. Table 6 gives the percentage of change in acreage devoted to the major crops in each of the FED budget areas of interest for 1978 to 1979. Table 6 illustrates increases in sunflower acreage in each of the FED budget areas and decreases in acreage devoted to barley, oats, durum wheat and hard red spring wheat. The point to be made here is that between 1978 and 1979, a portion of cropland acreage was shifted from the production of barley, oats and wheat to sunflower production, implying that barley, oats and wheat are substitutes in production for sunflower.[8] The overlap of sunflower and wheat production was illustrated in figure 3.

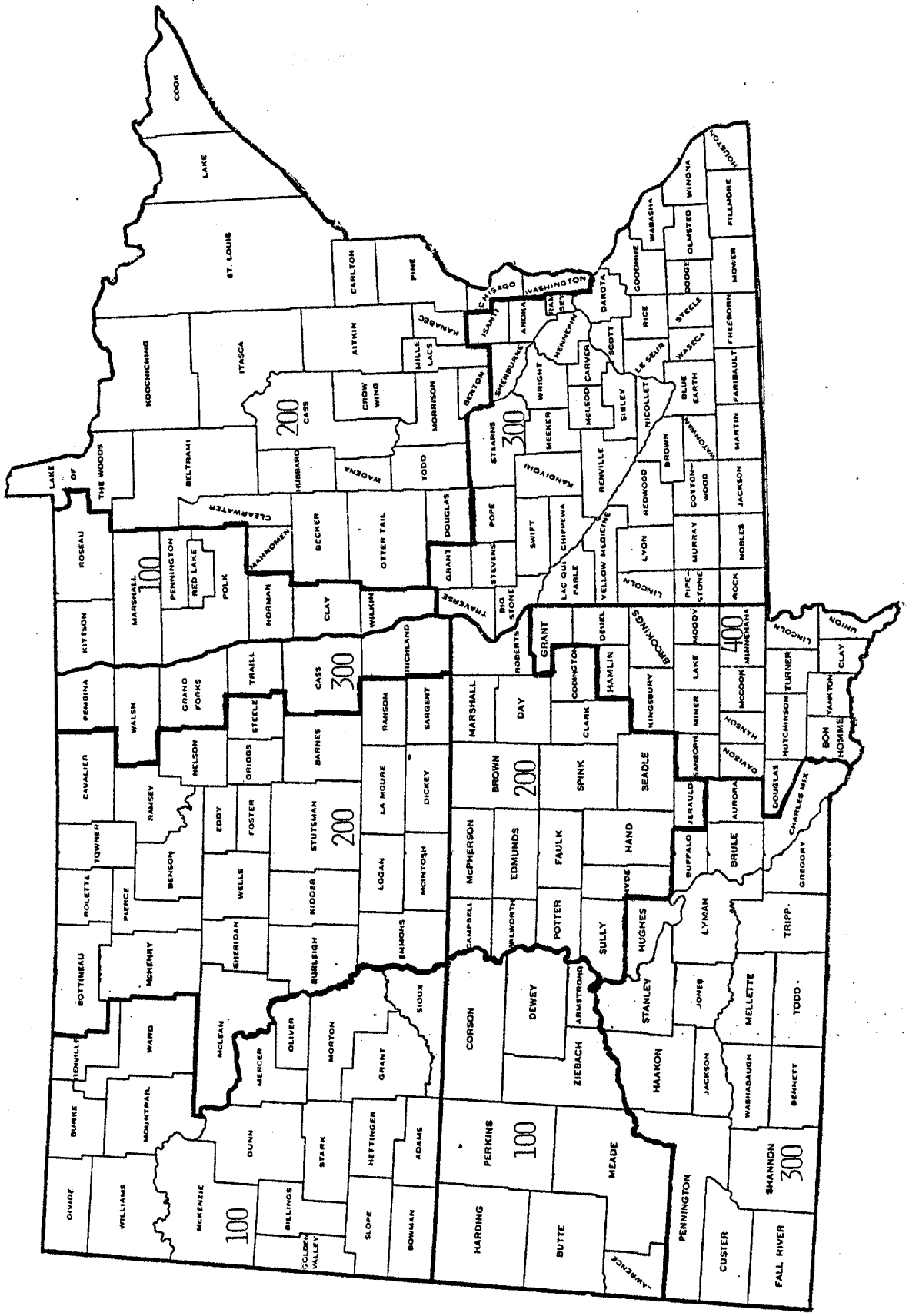


Figure 4
Delineation of Tristate Production Regions

TABLE 6

PERCENT CHANGE IN ACREAGE FOR SELECTED CROPS AND REGIONS
(1978 to 1979)

REGION [1]

CROP	200-ND	300-ND	100-MN	300-MN	200-SD
Sunflower	93	52	95	76	250
Hard Red Spring Wheat (F)[2]	4	7	6[3]	-27[3]	47
Hard Red Spring Wheat (C)	-3	-2			-24
Durum	-38		-16[4]		
Barley	-32	-31	-27	-41	-28
Corn for Grain		17		-2	22
Soybeans				29	
Oats				-25	-24

* Source of data to calculate percent changes: FEDS Budget

1) For region delineation, see figure 4

2) F refers to acreage following fallow and C refers to hard red spring wheat acreage on a continuous rotation scheme.

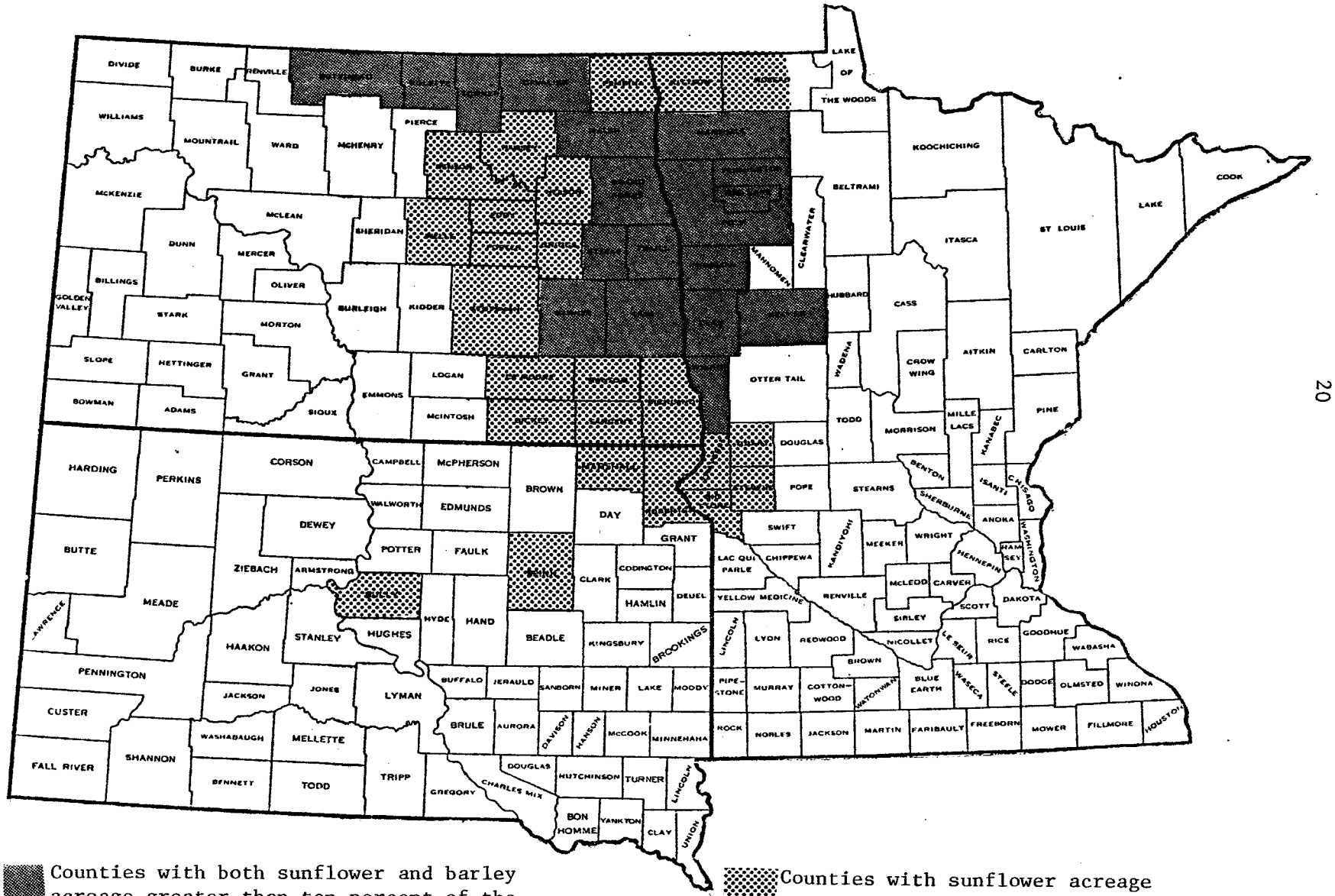
3) No breakdown was reported between hard red spring wheat on a fallow or continuous basis.

4) Total acreage less than 100,000 acres in the area

Figure 5 shows the areas where both barley and sunflower are produced. The region in which barley acreage is greater than ten percent of total cropland acreage is contained within the sunflower producing area, identified in figure 1. Also note that this barley producing area does not contain FED budget areas of 200 in South Dakota and 300 in Minnesota but the declines in acreage for these two areas from 1978 to 1979 were 41% or 90,000 total acres and 20% or 60,000 acres respectively. Thus, shifts in acreage from barley production in these areas could also affect sunflower acreage levels.

Changes in the production levels of alternative crops can arise from actual income levels received and/or by producer expectations of future income levels or changes in the cost of production. Actual and expected income levels are determined by prices and yield levels. Relative prices of of substitute crops in production also play an important role in determining the output mix. If the price of sunflower is high relative to wheat and barley (as it was in 1978) a shift to sunflower production will occur (as it did in 1979). Further shifts in the production of alternative crops will occur if the cost of production of one crop declines relative to another. A relative comparison of returns and costs of production for 1979 is made between sunflower and barley in Table 7 and between sunflower and wheat in Table 8. These two tables indicate the relative competitiveness of sunflower with barley and wheat. In certain geographical areas sunflower is more competitive (300 ND) than in others (100 MN). The competitiveness of sunflower could be increased by decreasing the variable cost of producing sunflower, especially in a cost area where sunflower was consistently at a relative disadvantage. Tables 7 and 8 show that in all areas the total variable cost of producing sunflower is greater than the variable

Figure 5
Percentage of Total Cropland Acreage in Sunflower and Barley, 1979.



Counties with both sunflower and barley acreage greater than ten percent of the total cropland acreage.

Counties with sunflower acreage greater than ten percent of the the total cropland acreage.

TABLE 7

SUNFLOWER AND BARLEY

RELATIVE COMPARISON OF RETURNS AND COSTS FOR 1979
(PER ACRE BASIS)

FED BUDGET AREA

CATEGORY	100 MN	300 MN	200 ND	300 ND	200 SD
Avg. Gross Income [1]	+	+	+	+	+
Avg. Income minus Total Cost (TC)	-	+	+	+	-
Avg. Income minus Variable Cost (VC)	-	+	+	+	+
Total Cost (TC)	-	-	-	+	-
Variable Costs	-	-	-	-	-
Insecticide, Fungicide & Herbicide Costs	-	-	-	-	-
Fertilizer Costs	-	-	+	+	-
Harvest Costs	-	+	-	+	+
Ownership Costs [2]	-	+	+	+	-
Other Costs [3]	-	+	-	+	-
Capital Costs [4]	-	-	+	+	+
Labor Costs	-	+	+	+	+

\+ Indicates sunflower has a relative advantage in this area and category; (+) in a cost category implies sunflower has lower cost, (+) in a return category implies sunflower has a higher return.

\- Indicates sunflower has a relative disadvantage in the area and category.

1) Gross income here is computed using an average yield of the 3 year period 1978-1980 and the 1979 price; thus the reference to average gross income. This average income was also used in computing the following two categories, average income minus TC and average income minus VC.

2) Ownership costs include tractor and machinery costs.

3) Other costs include land and overhead cost plus a return to management.

4) Capital and labor costs refer to the sum of both harvest and preharvest costs incurred for the respective factors of production.

TABLE 8

SUNFLOWER AND WHEAT*

COMPARISON OF RETURNS AND COSTS
(per acre basis)

FED BUDGET AREA

Category	100 MN	300 MN	200 ND	300 ND	200 ND
Avg. Gross Income[1]	-	-	-	+	+
Avg. Income minus Total Cost (TC)	-	+	+	+	+
Avg. Income minus Variable Cost (VC)	-	-	-	+	+
Total Cost (TC)	-	+	+	+	-
Variable Cost (VC)	-	-	-	-	-
Insecticide, Fungicide and Herbicide Costs	-	-	-	+	-
Fertilizer Cost	-	+	-	+	-
Harvest Cost	NA	-	-	+	+
Ownership Costs[2]	NA	+	-	+	-
Other Costs[3]	-	+	+	+	-
Capital Costs[4]	-	+	+	+	-
Labor Costs	-	+	+	-	-

* Sunflower is compared to different categories of wheat. The category is based on the percent changes in acreage reported in Table 6 and the absolute amount of acreage of wheat planted. For areas of Minnesota the comparison is between hard red spring wheat (no breakdown between continuous cropping or fallow) and sunflower. In areas 300 ND and 200 SD the category used is hard red spring wheat following crops, and in area 200 ND durum wheat is used for comparison purposes.

\+ Indicates sunflower has a relative advantage in this area and category; (+) in a cost category implies sunflower has lower cost, (+) in a return category implies sunflower has a higher return.

\- Indicates sunflower has a relative disadvantage in the area and category.

1) Gross income here is computed using an average yield of the 3 year period 1978-1980 and the 1979 price; thus the reference to average gross income. This average was also used in computing the following two categories, average income minus total cost (TC) and average income minus variable cost (VC).

2) Ownership costs include tractor and machinery costs.

3) Other costs include land and overhead cost plus a return to management.

4) Capital and labor costs refer to the sum of both harvest and preharvest cost incurred for the respective factors of production.

cost of producing either wheat or barley. In addition, sunflower cost for herbicides, fungicides and insecticides are greater in almost all FED budget areas.[9] Ceteris paribus, advances which reduced overall variable costs or advances which reduced sunflower producers need for fungicides, herbicides, or insecticides would be beneficial in aiding the growth of sunflower acreage. Increases in sunflower relative crop yields would also lead to increases in sunflower acreage. Johnson, Doty and Kramer (5) have reported that yield potential of sunflowers is great, in fact, future yields of 3000 lbs. an acre may not be unrealistic. The impact of yield increases of this magnitude could be substantial, possibly allowing sunflower to gain a price advantage in the cooking oil market (assuming product acceptance by consumers) over soybean oil. In sum, favorable relative price conditions, decreased production costs and increased yields might lead to increases in sunflower acreage.

The magnitude of these increases would depend on several factors. In a 1977 study by Helgeson and Cobia et al (4), estimates of the potential supply of sunflower were made. These estimates were made with a supply response model for two regions in North Dakota (East Central and Northwest Central). The model was based on relative price responses by producers and imposed appropriate agronomic constraints on sunflower acreage. Results indicated that sunflower could be grown profitably on approximately 22% of the total cropland acreage in the East Central area and 16% of the total cropland acreage in the Northwest Central area. For the tristate region their study suggested that a maximum of 3.334 million acres of sunflower could be grown in the tristate region . Helgeson and Cobia reported maximum potential acreage for North Dakota at 3 million acres, South Dakota at 158,000 acres and Minnesota 176,000 acres. In light of acreage levels in recent years

(reported in Table 2 of this study) it appears that the Helgeson and Cobia estimates are conservative. It appears that an updated estimate of potential sunflower supply would require further research focusing on the entire tristate sunflower production area (Figure 1), rather than North Dakota alone.

SUMMARY

This report focused on the major sunflower production area of the United States - the tristate region of Minnesota, North Dakota and South Dakota. A description of this sunflower production sector was given in terms of historical acreage, yields and prices. Significant changes in acreage were rationalized by identifying the factors which stimulated producers to alter their production patterns. Sunflower production conditions were also compared to alternative crop (wheat and barley) conditions. And, the conditions which would lead to sunflower acreage increases were discussed.

FOOTNOTES

1. The corn and soybean production area is defined by 1979 corn plus 1979 soybean acreage being twenty percent or more of the total cropland acreage (as reported in the 1978 Census of Agriculture) of the county.

2. The discussion that follows focuses on changes in production levels since 1969, much of the rationale that will be provided originates in the two articles: Thomason, Francis, the U.S. Sunflower Seed Situation in Fat and Oil Situation, FOS 292, July 1978, ERS USDA pp. 24-39 and Thomason, Francis F.O.S. - 275, November 1974, ERS USDA pp.27-36.

3. See Thomason, Francis; 1974, op. cit. page 29.

4. See: The Sunflower, Report by USDA FAS on the world sunflower scene, p. 19 August/September 1979.

5. The purpose in calculating these arc price elasticities of supply is to get some crude estimates of producer response to price. Strictly speaking, a more sophisticated analysis might be appropriate to get an accurate analysis of producer price response. Thus, the elasticities to be reported should be interpreted as "crude" estimates. The definition of arc price elasticity of supply used here is:

$$\frac{\Delta Q}{\bar{Q}} \div \frac{\Delta P}{\bar{P}}$$

where: Q = quantity supplied
P = own price
Δ = indicates the change in the variable over the arc, and a bar over a variable refers to the average value of the variable over the relevant time period.

6. Production year 1979 was chosen because of the high level of production occurring in this year. Insights for potential sunflower acreage can be gained by examining production costs and the shifts of acreage planted between crops for this year.

7. The consideration of these areas eliminates Becker County of Minnesota from the discussion. Becker County is included in area 200 of Minnesota.

8. While recognizing the fact that wheat, barley and oats are the main substitutes for sunflower in production, this study will treat wheat and barley as the primary substitutes for sunflower. This is done because of the relatively small amount of oat acreage sunflower replaced compared to the amount of wheat and barley acreage replaced in 1979.

9. This disadvantage ranges from 0 to 8.50 dollars per acre over the regions.

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