Corn

Background for 1990 Farm Legislation

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Introduction

Corn is the leading U.S. crop, both in volume and in value. In 1987, farmers planted about 65 million acres in corn, accounting for about 22 percent of the 304 million acres planted to principal crops. About 90 percent of the acreage was harvested for grain and the balance for silage and forage, or abandoned. With an average yield of 119.4 bushels per acre, U.S. corn production for grain reached 7.1 billion bushels in 1987. The value at the farm gate totaled just over $13 billion, down about 36 percent from its record level of $21 billion in 1982.

Corn, soybeans, and cotton compete for the same land in various areas of the country. The primary demand for corn and soybeans is derived from the market for livestock products here and abroad. Corn is the most important grain used in feed rations. Soybean meal is the predominant oilseed meal used in concentrate feeds. In the 1987 crop year, corn accounted for 77 percent of all grains fed to livestock, while soybean meal accounted for around 90 percent of oilseed meals used. Corn programs have indirect but substantial effects on the soybean and livestock sectors.

Farm programs have been used for many decades to address periodic problems for corn producers, such as low prices and incomes. However, the environment is now complicated by the growing dependence of U.S. agriculture on export markets and mounting farm program costs.

As debate on the 1990 omnibus farm legislation begins, accurate information on the industries and current farm programs will be critical to formulating decisions regarding changes in agricultural programs and policies. This report provides detailed background on the corn industry, including trends in U.S. and world production and trade. It also describes the 50-year history of Federal programs for corn and discusses the effects of these programs on crop and livestock producers, consumers, and taxpayers. The report also highlights the issues likely to be discussed in the current policy debate.

Structure of the Corn Industry

Production

Total U.S. corn production has trended upward since the 1930's. Production has more than doubled since 1965, peaking at 8.9 billion bushels in 1985 (app. table 1). Year-to-year fluctuations in production occur, however, because of such

factors as the weather and Federal policies. Drought in 1988, for example, reduced production by more than 30 percent from the previous year. In 1983, drought and a payment-in-kind (PIK) program reduced corn production to 4.2 billion bushels, half the level in 1982 and the smallest corn harvest since 1970.

Harvested acreage has remained fairly constant (app. table 1), indicating that increased yields are responsible for most of the gains in corn production. Corn yields rose from 74.1 bushels per acre in 1965 to over 91 bushels in 1973. Yield gains slowed during the mid-1970's as more marginal, less productive land was brought into production. However, corn yields rose over 18 percent between 1978 and 1987 to 119.4 bushels per acre.

The general increase in yields over time is due mainly to changes in technology and production practices, including development of improved high yielding hybrid varieties, increased rates of fertilization, increased irrigation, higher seeding rates, improved control of weeds, insects, and disease, and diversion of less productive acreage. Total use of agricultural chemicals rose more than 150 percent between 1965 and 1981, then declined somewhat in recent years due to the increased amount of retired acreage. Barring weather fluctuations, such as occurred in 1983 and 1988, corn yields have been increasing about 2 bushels per acre per year.

In 1982, about 9.5 million acres of corn (nearly 12 percent of planted acres) were irrigated. Irrigation, not common in the Corn Belt, has increased in other areas, particularly in the Plains region. Leading States for irrigated corn are Nebraska, Kansas, Colorado, and Texas. Corn yields on irrigated land were 58 percent higher than on nonirrigated land in Nebraska, Kansas, and Texas, but at a higher cost of production.

Almost half the corn acreage is grown in rotation with soybeans. A corn-soybean rotation can result in a 15-percent corn yield increase and some increase in soybean yields because of better control of plant insects and diseases.

In 1980, approximately one-third of the total corn acreage was under some form of conservation tillage, up from 18 percent in 1972. Minimum tillage is gaining in popularity in corn production, although much of the growth in minimum tillage is in historically smaller corn growing areas such as the East and Southeast. Many farmers substitute the chisel plow for the moldboard plow as the primary tillage implement to help control erosion and to reduce production costs. Conservation tillage acreage is expected to continue increasing. This increase in conservation tillage would tend to depress yields slightly, but reduce production costs more.

Location and Size of Farms

The number of farms growing corn declined from 1.5 million in 1964 to 713,700 in 1982, while the average acreage harvested rose from 39 to 100 acres per farm. The 21 largest corn-producing

States accounted for nearly 84 percent of the farms growing corn in that year. Acreage planted to corn in the 21 States accounted for nearly 90 percent of the national total. A special tabulation of 1982 Census data in the 21 States showed total cropland in farms growing corn to be almost 200 million acres. The farms averaged more than 240 acres of cropland and had greater than $70,000 worth of sales per farm from all production. Farms with 500 acres of cropland or more accounted for 15.6 percent of farms growing corn but 45 percent of corn production (table 1). Farms with less than 100 acres of cropland accounted for around one-third of farms growing corn, but produced only 5 percent of the corn. Fifty-one percent of farms harvesting corn

Table 1--Number of farms harvesting corn in 21 largest corn-producing States, by acreage and sales classes, 1982

Cropland and sales class	Farms	Percentage of total
	Number	Percent
Cropland (acres):		
1-99	186,562	31.2
100-249	185,417	31.0
250-499	132,598	22.2
500-999	68,818	11.5
1,000 and over	24,225	4.1
Total	597,620	100.0
Sales class:		
Less than $2,500	55,784	7.8
$2,500-$9,999	112,081	15.7
$10,000-$39,999	198,413	27.8
$40,000-$99,999	183,485	25.7
$100,000-$249,999	124,486	17.5
$250,00-$499,999	29,465	4.1
$500,000-$999,999	7,532	1.1
Greater than $1,000,000	2,414	.3
Total	713,660	100.0

Note: The 21 States tabulated are: Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas, North Carolina, Georgia, Kentucky, Mississippi, Texas, Idaho, Colorado, Washington, and California. Sales class dates are based on farms that grew corn in 48 States in 1982.

Source: 1982 Census of Agriculture.

Table 2--Types of farms and crop mixes by size of farm growing corn for selected States, 1982[1]

Commodity	Size of farm (cropland acres)					
	1-99	100-249	250-499	500-999	Over 1,000	All farms
			Percent			
Type of farm:						
Cash grain	45.5	46.4	54.8	64.3	69.9	51.0
Other crops	15.9	7.5	5.0	4.8	6.7	9.2
Livestock	29.0	22.9	23.9	22.8	19.6	24.9
Dairy	6.9	21.0	13.7	6.0	2.1	12.5
Poultry	1.1	.5	.4	.3	.3	.6
Other livestock	1.7	1.7	2.2	1.9	1.4	1.8
			Acres per farm			
Harvested acres for principal crops:						
Corn	19.3	62.3	139.9	261.3	526.1	107.8
Sorghum	.2	1.1	4.2	13.5	56.8	5.2
Wheat	2.1	7.3	19.2	54.4	244.9	23.4
Oats	2.0	7.9	12.3	16.8	24.7	8.8
Barley	.1	.4	1.3	4.4	23.7	1.9
Soybeans	7.6	33.9	89.3	174.6	301.9	65.1
Hay	8.1	26.5	36.1	47.4	90.4	27.9

[1] States as shown in table 1 footnote.

in 1982 were classified as cash grain farms. The next most important type of farm was livestock, accounting for just under 25 percent. More of the large farms tended to be cash grain farms, while the proportion of livestock farms appeared to be fairly uniform across the various sizes (table 2).

Corn was the primary crop grown by all farms growing corn, accounting for about 44 percent of the total cropland allocated to specific crops. The next most important uses of cropland were for soybeans (27 percent) and hay crops (11.6 percent) for livestock feeding. The remaining cropland was used for growing wheat, oats, sorghum, and barley. The enterprise mix also varied by region. For example, farms growing corn in the eastern Corn Belt tended to be cash grain farms while those in the western Corn Belt were corn/livestock farms. Corn production is concentrated in the Corn Belt, Lake States, and Northern Plains.[1]

[1] Corn Belt States -- Iowa, Illinois, Ohio, Indiana, Missouri. Lake States -- Michigan, Wisconsin, Minnesota. Northern Plains -- North Dakota, South Dakota, Nebraska, Kansas. Southeast -- Alabama, Georgia, South Carolina, Florida. Delta States -- Arkansas, Mississippi, Louisiana.

The Corn Belt has accounted for around half of U.S. corn acreage since the 1950's. The Lake States' share has continued to increase and in 1987 was nearly double the 9-percent share of 1950. The Northern Plains has maintained a 15- to 18-percent share of corn acreage since 1960. The expansion in the Lake States came at the expense of the Southeast and Delta regions where the shares trended downward to 2.3 and 0.1 percent in 1987. This occurred because of competition from more profitable crops, such as soybeans and double-cropped wheat and soybeans.

Trends in Domestic Use and Stocks

In the 1980's, Federal policies and the weather meant large fluctuations in corn production and stocks. The combination of the PIK program and summer drought reduced U.S. corn production in 1983 to 4.2 billion bushels, half the level in 1982 and the smallest corn harvest since 1970. At the same time, however, beginning stocks were at record levels because of bumper 1981 and 1982 crops.

Total disappearance of corn, both domestic use and exports, has trended upward during the past 20 years, reaching a record 7.7 billion bushels in the 1987 crop year: 6.0 billion bushels for domestic use and 1.7 billion bushels for exports. During the

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Crop Acreage Base

The crop acreage base (CAB) was expanded in 1978 and 1979. Any corn grower, under the basic rule established first in the 1981 Act, could ask the Agricultural Stabilization and Conservation Service (ASCS) for certification of base acreage if there was a 2-year corn production record. Under the Food Security Act of 1985, the individual corn and sorghum bases were combined into one base for program participation purposes. The corn-sorghum acreage base is the average of acres planted and considered planted (primarily acres put into conserving uses under the acreage reduction program and the paid land diversion) to corn or sorghum in the last 5 years. During 1974-77, the base remained stable at nearly 61 million acres, but expanded to 76 million acres in response to rapidly growing export demand in 1978. By 1987, it reached 83 million acres (table 3).

With program participation at extremely high levels, the amount of base acreage tends to restrict additional acreage planted, and tends to control the corn crop size. The existence of base acreage also has the effect of limiting the growth of soybean acreage, because as a nonprogram crop, planting soybeans on base acreage causes the farmer to lose base acreage certification on that land.

Table 3--Corn base acreage, planted acreage, yield, and production, 1980-88

Item	Unit	1980	1981	1982	1983	1984	1985	1986	1987	1988
Base acres	Mil. ac.	84.1	80.5	81.2	81.2	80.8	84.2	82.4	83.3	83.4
Planted acres	Do.	84.0	84.1	81.9	60.2	80.5	83.4	76.7	65.7	67.5
Program yield	Bu./ac.	96.2	102.5	102.0	104.0	112.0	106.0	104.2	104.2	104.2
Yield	Do.	91.0	108.9	113.2	81.0	106.7	118.0	119.3	119.4	84.6
Production	Mil. bu.	6,639	8,119	8,235	4,166	7,674	8,876	8,249	7,072	4,921

1970's, corn exports grew faster (53 percent) than domestic use (5 percent). But, between 1980 and 1987, exports dropped from 2.4 billion bushels to 1.7 billion bushels (with a low of 1.2 billion bushels in 1985) as domestic use increased. Feed and residual use dropped in 1988 due to the drought. Corn exports, however, have been rising since 1985/86 and are projected to be 2.1 billion bushels in 1988/89.

Livestock and Poultry Feed

Livestock and poultry feeding accounted for 76 percent of the domestic use of corn in 1988/89. Corn accounted for 79 percent of all grains fed to livestock. Feed use ranged from a low of 3 billion bushels in 1964/65 to a record 4.7 billion bushels in 1987/88 as cattle on feed stood at 9.2 million head and grain-consuming animal units (GCAU's) totaled 77.3 million head (tables 4 and 5). Feed use of corn, being a derived demand, is positively related to cattle on feed or more generally to the number of animal units (includes pork and poultry as well). For example, feed use of corn dropped sharply in 1983/84 as cattle on feed fell from 10.3 million head to 9.9 million. A 10-percent rise in GCAU's has been associated with a 5-percent rise in corn feed use, and vice versa.

In addition to the change in number of animals fed, the variation in feed use reflects adjustments made by livestock and poultry producers in response to relative prices and availability of corn and competing feed grains or feed ingredients (see box). Factors such as variations in crop quality, the volume of feed required to achieve a particular protein content, can affect feed value and thus maintain a particular level of animal weight gain. For example, the increase of corn feed use between 1983-87 reflected the steady level of grain consuming animal units and also the decline in corn prices from $3.25 a bushel in 1983/84 to $1.94 in 1987/88. Higher corn prices because of drought and increased corn exports decreased corn feed use from 114.5 million tons in 1979 to 105 million the following year, because of drought and the PIK program in 1983, and the drought in the spring and summer of 1988. Estimates indicate feed use of corn increases (decreases) by 0.4 to 0.6 percent for a 1-percent decrease (increase) in the price of corn.

Table 4--U.S. corn supply and disappearance, 1978-88

Year beginning October 1	Supply			Disappearance				Ending stocks (Sept. 30)		
	Beginning stocks	Production	Total (including imports)	Food, seed, and industrial	Feed and residual	Exports	Total	Government owned	Privately owned[1]	Total
				Million bushels						
1978/79	1,111.4	7,267.8	8,380.5	620.7	4,322.8	2,133.1	7,076.6	99.7	1,204.2	1,303.9
1979/80	1,303.9	7,928.1	9,233.1	674.8	4,508.3	2,432.6	7,616.0	256.3	1,360.8	1,617.1
1980/81	1,617.1	6,639.4	8,257.7	735.3	4,132.9	2,355.2	7,223.4	237.8	796.5	1,034.3
1981/82	1,034.3	8,118.7	9,154.2	811.5	4,201.8	1,966.9	6,980.2	302.4	1,871.6	2,174.0
1982/83	2,174.0	8,235.1	10,410.0	897.8	4,522.3	1,870.0	7,290.1	1,166.3	1,953.6	3,119.9
1983/84	3,523.1	4,174.7	7,700.5	975.1	3,817.6	1,901.5	6,694.2	201.5	804.8	1,006.3
1984/85	1,006.3	7,674.0	8,683.8	1,091.0	4,079.0	1,865.0	7,035.6	224.9	1,423.3	1,648.2
1985/86	1,648.2	8,876.7	10,535.5	1,159.8	4,095.3	1,241.2	6,496.0	545.7	3,493.8	4,039.5
1986/87	4,039.5	8,249.9	12,291.5	1,190.6	4,717.3	1,504.4	7,412.3	1,443.2	3,438.5	4,881.7
1987/88	4,881.7	7,072.1	11,958.1	1,229.0	4,738.0	1,732.0	7,699.0	835.0	3,424.8	4,259.6
1988/89[2]	4,259.1	4,921.2	9,185.3	1,255.0	4,000.0	2,100.0	7,355.0	400.0	1,430.0	1,830.0

NA = Not available.

[1] Includes free stocks and farmer-owned reserve.
[2] Estimate as of Aug. 12, 1989.

Source: Feed Situation and Outlook. Econ. Res. Serv., U.S. Dept. Agr., 1984, 1988.

Table 5--Feed use and animal numbers, marketing years, 1979-88

Item	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
					Million metric tons					
Feed:										
Sorghum	12.3	7.7	10.9	12.9	9.9	13.6	16.8	13.8	13.9	14.0
Corn	114.5	105.0	106.7	114.9	98.4	103.5	103.9	119.6	124.4	114.3
Feed grains[1]	128.4	122.6	128.5	139.5	119.7	131.1	134.9	145.5	145.6	136.6
Wheat	2.5	5.3	3.1	7.8	12.3	11.0	7.3	10.5	7.5	7.5
All grains	130.9	127.9	131.6	147.3	132.0	142.1	142.2	156.0	153.1	144.1
Meals[2]	19.7	18.1	18.3	19.6	17.4	19.6	19.1	20.0	20.7	21.7
All grains and meals	150.6	146.0	149.9	166.9	149.4	161.7	161.3	176.0	173.8	165.8
					Million units					
Animals:										
GCAU[3]	82.3	80.6	77.5	78.5	78.3	76.5	75.4	75.0	77.3	76.4
					Million head					
Cattle[4]	10.4	9.8	9.0	10.3	9.9	10.3	10.6	9.7	9.2	9.7
					Dollars per bushel					
Prices:										
Corn	2.52	3.11	2.50	2.68	3.25	2.63	2.23	1.50	1.94	2.60
Sorghum	2.34	2.94	2.39	2.52	2.85	2.32	1.93	1.37	1.56	2.30
Wheat	3.78	3.91	3.65	3.55	3.50	3.39	3.08	2.42	2.59	3.70
					Metric tons per GCAU					
Feed rate[5]	1.83	1.81	1.93	2.13	1.93	2.11	2.15	2.36	2.30	2.17

[1] Also includes oats, barley, and rye.
[2] Include the following meals: soybean, cottonseed, peanut, linseed, and sunflowerseed.
[3] Grain-consuming animal units (GCAU's) (see glossary).
[4] 13 major States, January 1 of the second year indicated.
[5] Total grains and meals per grain-consuming animal unit.

Substitution in Feed Rations

The livestock feed ration (on a weight basis) contains two-thirds roughage and pasture and one-third concentrates (although poultry feeding relies primarily on concentrates). Feed concentrates include feed grains, wheat, rye, oilseed meals, animal protein feeds, grain protein, mill byproducts, and mineral supplements.

Competition among feed ingredients depends on relative prices and relative feed values. Average feed values on a bushel-for-bushel basis differ from a pound-for-pound basis because bushel weights generally are different, although corn and sorghum bushels each weigh 56 pounds. Feed values for major grains averaged across all livestock classes and shown as a percentage of corn's value are presented below:

	Pound for pound	Bushel for bushel
	Percent of corn's feed value	
Corn	100	100
Sorghum	95	95
Barley	90	77
Oats	90	51
Wheat	105	113

Prices of competing feed grains, feed wheat, and to a lesser extent feed ingredients such as soybean meal also are important determinants of feed use of corn. For example, the corn/sorghum feed use ratio increased in the feed ration from 6 to 1 in 1973/74 to 8.9 to 1 in 1986/87, partly because corn became cheaper relative to sorghum. Wheat feeding similarly increased from 7.8 million tons in 1982/83 to 10.5 million tons in 1986/87 because wheat became less expensive relative to corn. Substitution between corn and wheat has been moderated by wheat programs that set wheat loan rates relative to corn loan rates at a level exceeding feed value. A 1-percent drop in the wheat/corn price ratio generally boosts wheat feed use by 3.5 percent.

About a third of U.S. corn production is fed to livestock and poultry on the farms where it is raised; the rest enters the marketing system. Country elevators are the primary assemblers of corn sold from farms, accounting for about 80 percent of the volume, although some corn moves directly from farms to subterminal and terminal elevators.

The feed manufacturing industry is the most important user of corn in terms of sales volume, accounting for about a fourth of

the total feed use. In 1984, 6,411 feed manufacturers with potential annual capacity to produce 1,000 tons or more of feed produced 109.5 million tons of formula feed. The industry processes and mixes feed to specifications. Ingredients include corn and other feed grains, oilseed meals, grain byproducts, animal protein, minerals, and miscellaneous ingredients.

Food, Seed, and Industrial Use

Food, seed, and industrial uses of corn totaled over 1.2 billion bushels in 1987/88, about 20 percent of domestic use. The amount of corn used for food, seed, and industrial purposes doubled in the 1970's and again in the 1980's due to expanding markets for high-fructose corn syrup (HFCS) and other sweetener products produced by the wet-milling industry.

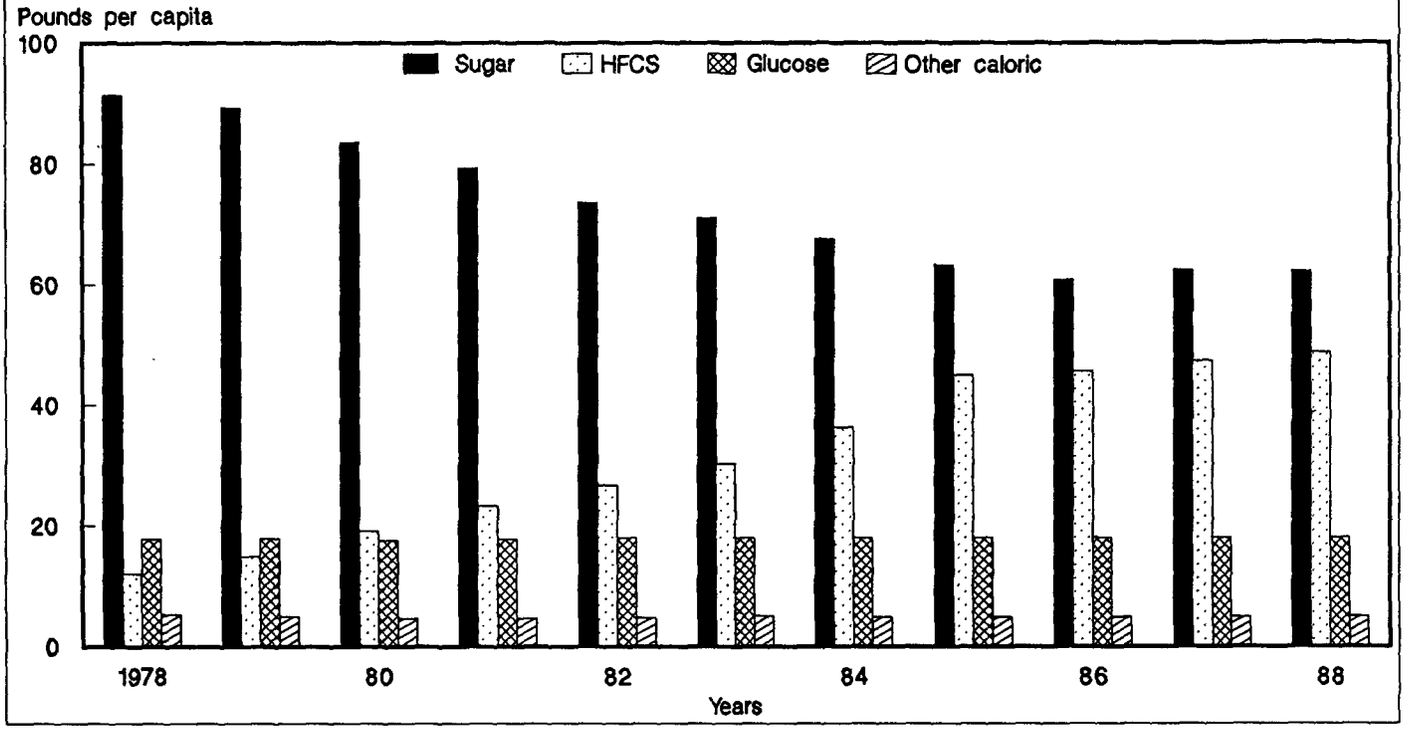
In 1987/88, about 713 million bushels of corn were used to produce HFCS, glucose, dextrose, and starch. Another 207 million bushels were used for ethanol production, up from 15 million bushels of corn in 1970. HFCS accounted for 12 percent of domestic corn use and ethanol, 3 percent.

The U.S. sugar programs and Federal and State tax incentives designed to expand capacity for ethanol production have stimulated the growth in corn wet-milling. Import fees, duties, and restrictive import quotas used to administer the current sugar program kept the domestic refined sugar price at an artificially high level, despite a declining world price. The U.S. sugar price has been about twice what it would have been without the program since 1982. On a per pound basis, wholesale HFCS prices have been able to undercut sugar prices by 20-30 percent in the 1980's. This helps to explain the growth of HFCS in the U.S. sweeteners market from 3 pounds per capita in 1974 to 48.7 pounds in 1988 (fig. 1). In contrast, per capita sugar consumption fell from 95.6 pounds in 1974 to 62 pounds in 1988 (table 6). Thus, the sugar program has stimulated additional substitution of HFCS for sugar in many food and beverage products, even though per capita consumption of HFCS probably would have grown anyway because of its low cost of production.

HFCS, glucose, and other caloric sweeteners now account for more than 53 percent of total domestic sweetener use, as opposed to 24 percent in 1975. Analysts expect the share to continue to grow if the current sugar program is maintained, thereby benefiting corn growers. Per capita consumption of HFCS, however, is projected to rise at a much slower rate than in earlier years as the HFCS industry has matured. Corn use for HFCS is projected to rise from 370 million bushels in 1988/89 to nearly 460 million bushels by 1995, an annual growth rate of about 3 percent. This compares to an annual growth rate of corn use for HFCS in the 1980's of 26 percent.

Fuel, industrial, and beverage alcohol sales grew from 75 million bushels in 1980/81 to an estimated 352 million bushels in 1987/88. Corn prices, government policy to deregulate natural gas, tax incentives, and petroleum prices all affect the

Figure 1
U.S. per capita sweetener consumption



competitive position of ethanol. The increase in the Federal excise tax break on ethanol blends from 5 cents to 6 cents a gallon, which took effect on January 1, 1985, substantially expanded ethanol sales. An additional factor is the Environmental Protection Agency's (EPA) determination to reduce automobile emissions by mandating sale of ethanol blend gasoline in certain high-pollution regions, such as Denver, Colorado.

Trends in the World Corn Market

World corn production trended upward from 1960 to the early 1980's, then fell to about 347 million tons in 1983/84. It climbed to near 480 million tons by 1986/87. The United States is the largest producer, accounting for more than 40 percent of world corn production in 1987/88 (table 7). China ranks second with 18 percent. East Europe and Brazil both produce 5-8 percent of world corn output.

The United States also is the largest corn consumer, typically accounting for around a third of world corn consumption. China ranks second with 16 percent. The EC-12, the Soviet Union, and Japan together account for about a sixth (table 7).

World Exports and Major Competing Exporters

World exports of coarse grains increased from about 25 million tons in 1960/61 to a record 90 million tons in 1982/83, dropping to about 83 million tons in 1987. Corn dominates the world trade in feed grains, accounting for about 70 percent (excluding intra-EC trade) in 1988/89.

Table 6--Per capita consumption of sweeteners, world sugar prices, refined sugar prices, and delivered prices for HFCS, 1979-88

Item	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
					Pounds					
Per capita consumption:										
Sugar	89.3	83.6	79.4	73.7	71.1	67.6	63.3	60.8	62.4	62.2
HFCS	14.9	19.2	23.3	26.7	30.3	36.3	45.0	45.6	47.3	48.7
Glucose	17.9	17.6	17.8	18.0	18.0	18.0	18.0	18.0	18.0	18.0
Other caloric	5.0	4.7	4.7	4.8	5.1	4.9	4.9	4.9	4.9	5.0
Total	127.1	125.1	125.4	123.2	124.5	126.5	131.2	129.3	132.6	133.1
					Cents per pound					
World raw price	9.74	29.02	16.93	8.42	8.49	5.18	4.04	6.05	6.71	10.07
Refined sugar price (f.o.b.)[1]	19.68	38.29	28.26	27.62	26.09	25.66	23.18	23.42	23.60	25.27
Delivered price for HFCS-42	13.54	24.27	21.94	16.82	18.47	20.41	19.38	19.30	17.72	16.46

[1] Wholesale prices of cane sugar, 100-lb. paper bags, Chicago market.

Table 7--World corn production, utilization, and trade for leading countries and the United States, 1984-88

Item	1984/85	1985/86	1986/87	1987/88	1988/89[1]
			Million metric tons		
Corn production:					
United States	194.9	225.5	209.6	179.6	125.0
China	73.4	63.8	70.9	79.8	75.0
East Europe	35.4	30.6	38.9	29.9	28.4
Brazil	22.0	21.0	26.5	24.5	23.0
World	458.8	479.8	477.7	447.0	397.8
Corn utilization:					
United States	131.3	133.5	150.0	151.6	140.3
China	65.7	73.2	74.4	77.0	74.0
USSR	32.9	24.8	19.6	22.1	33.3
West Europe	30.7	30.1	28.9	27.9	27.9
Japan	14.2	14.4	15.5	17.1	16.8
World	435.0	425.2	460.3	462.2	460.2
Corn exports:					
United States	46.7	31.5	39.4	44.5	53.4
Argentina	7.1	7.4	4.0	3.6	2.7
China	5.1	6.0	2.2	4.1	3.8
Thailand	3.2	3.8	2.6	.7	2.4
South Africa	.2	1.5	2.6	.6	2.0
World	66.6	54.5	56.4	56.8	66.8
Corn imports:					
USSR	20.3	10.3	7.6	8.1	17.3
Japan	14.0	14.6	16.1	16.7	16.7
EC-12[2]	9.0	4.8	2.8	3.3	3.0
Mexico	1.7	1.7	2.8	3.0	3.3

[1] Estimate as of Aug. 12, 1989.
[2] Excludes intra-European Community (EC) trade.

The United States, Argentina, South Africa, China, and Thailand are the leading corn exporters, accounting for more than 90 percent of total world corn exports (table 7). The United States ranks first, accounting for more than 70 percent of corn exports. In 1988/89, U.S. corn exports totaled an estimated 53.4 million metric tons.

Argentina has retained its distant second place share of world corn exports despite a decline since the 1985 peak of 13.6 percent. In 1988/89, Argentina accounted for slightly more than 4 percent of world corn exports. Exports declined over that period due to switching to other crops due to relative price

advantages, the chaotic state of the economy (particularly the massive inflation), and sporadic bad weather.

Thai exports of corn in general increased between 1965-85, although they have also been subject to variation due to poor quality and bad weather. Thailand now accounts for 3.6 percent of the world corn exports and its coarse grain (mostly corn) exports average about 3 million tons, with the exception of 1987/88, when the monsoon failed to produce adequate rain. In the past, export taxes were used by Thailand to generate customs revenue and control supplies to the domestic market. But these policies are being relaxed, making Thailand more price-competitive.

Thailand has an open market for corn with relatively few restrictions or incentives for corn production or exports. The government, however, has had a long-term bilateral supply accord with Taiwan and actively negotiates annual bilateral trade agreements for corn exports. The recent expansion in Thai corn production resulted from an increase in acreage planted. Expansion will depend on the allocation of foreign exchange to purchase fertilizer from abroad or produce it domestically, and on the availability of improved hybrids to boost yields. Prospects for further land expansion are limited. One factor which has limited Thai export capability, especially over the last few years, is the expansion in domestic use of corn, particularly in poultry feeding.

Exports from South Africa, while relatively small, have fluctuated greatly over the last decade. South African corn exports have ranged from almost 5 million metric tons in 1980 to a negligible amount in 1983 and 1984. These variations arise primarily from weather considerations. South Africa markets corn through its Maize Board which protects producers via a stabilization fund, and sets minimum selling prices below producer prices. Thus, world market price changes are not fully transmitted to producers and consumers.

China has been increasing its exports of corn since the beginning of agricultural reform in 1978, but has been a net exporter of corn only since 1985. Poor internal infrastructure, particularly transportation, has caused China to export corn from grain-surplus regions in northern China but import corn and other coarse grains into southern China. China's share of world corn exports since that time has ranged from 6-11 percent.

U.S. Exports of Corn

U.S. corn exports climbed steadily during the boom of the 1970's, peaking at 2.4 billion bushels in 1979. The U.S. market share declined in the early 1980's, but its share began to rebound in 1985 (table 8). High U.S. loan rates and a continued strong U.S. dollar contributed to the decline in U.S. corn and coarse grain exports in the early 1980's. U.S. corn loan rates above world market-clearing prices encouraged importers to buy less U.S. coarse grain. Such loan rate levels stimulated competing

Table 8--U.S. corn exports to selected countries, October-September year, 1983-87

Destination	1983/84	1984/85	1985/86	1986/87	1987/88
			1,000 metric tons		
Mexico	2,805	1,400	1,639	3,251	3,172
EC	7,982	5,954	3,046	1,948	2,663
USSR	6,282	14,399	6,376	3,884	5,119
Japan	13,775	11,165	9,313	12,450	14,879
South Korea	2,971	1,453	1,330	4,079	4,798
China	200	--	--	1,027	281
Taiwan	2,694	3,079	2,583	3,183	3,845
Egypt	1,302	1,398	1,496	2,036	873
Subtotal	38,011	38,848	25,783	29,910	35,630
Total	46,985	46,276	31,136	39,349	43,724

Note: Total U.S. exports may differ from table 7 due to different marketing year shown.
-- = Not Applicable.

exporters to expand their production and sell more in world markets at a price just under the loan rate, thereby reducing U.S. corn and coarse grain exports. U.S. corn exports change less than proportionally in the short run as U.S. corn prices change. However, in the longer run, a given percentage change in price leads to a larger percentage change in exports in the opposite direction. A higher price cuts exports and a lower price increases them.

The Food Security Act of 1985 lowered loan rates from their previous levels. This fact together with the issuance and exchange of generic certificates enhanced U.S. competitiveness on the world coarse grain market.

Increases in the value of the dollar also hurt the competitive position in the early 1980's. For example, as the U.S. dollar strengthened from 219 yen per dollar in 1979 to nearly 250 in 1985, U.S. corn exports declined from 61 million tons to 31.1 million tons. Similarly, as the yen/dollar rate declined to 135.8 by the end of 1986, U.S. corn exports increased to 39.3 million tons. During 1980-85, it is estimated that a 1-percent increase in the value of the U.S. dollar reduced U.S. corn exports by 3.1 percent. Subsequent to 1985, however, the value of the dollar decreased, enhancing the U.S. competitive position in the export market.

Table 9--Distribution of world corn exports and stocks, October-September years, 1984-88

Country	1984/85	1985/86	1986/87	1987/88	1988/89
			Percent		
Share of exports:					
United States	70.0	57.8	69.8	78.3	77.5
Argentina	10.7	13.6	7.1	6.3	4.1
South Africa	.3	2.7	4.6	1.0	3.0
Thailand	4.8	7.0	4.6	1.2	3.6
China	8.2	11.7	6.7	7.2	6.0
Other	6.0	7.2	7.2	6.0	5.8
			Million metric tons		
Total world corn exports	66.6	54.5	56.4	56.8	65.8
			Percent		
Share of ending stocks:					
United States	53.2	71.3	76.9	74.2	56.7
Total foreign	46.8	28.7	23.1	25.8	43.3
			Million metric tons		
Total world ending stocks	89.2	143.8	161.7	145.8	74.4

Note: Intra-EC trade is excluded.

Sales to the Soviet Union helped increase the U.S. share of world corn exports from 56 percent in 1972 to 78 percent in 1987/88 (table 9). During that period, however, the U.S. share fluctuated largely due to the January 1980 U.S. embargo on grain sales to the USSR. Following the embargo, the U.S. share of the world market for coarse grain declined by 6 percentage points from 1978/79 to 1982/83. Major countries that compete with the United States in the world grain market expanded their grain production and exports. For example, the Canadian share of the world wheat and coarse grains market rose from 11 to 15 percent, which it has maintained, while the Argentine share increased from 6 to 10 percent between 1982-85, but fell to around 4 percent in 1988/89. After the embargo, the USSR, the EC, Japan, Eastern Europe, and China increased their imports from major U.S. competing exporters. Meanwhile, the USSR cut its purchases of U.S. wheat, coarse grains, soybeans, and sorghum. In 1982/83, the USSR imported only 20 percent of its wheat and coarse grains from the United States, down from 72 percent in 1978/79. However, the U.S. share of Soviet imports now has risen to about a third due, in part, to a new long-term agreement and the export enhancement program (EEP).

The United States absorbs a disproportionate volume of coarse grain stocks when world supplies are large and releases coarse grain supplies when supplies are tight. The U.S. farmer-owned reserve and price support programs have helped the United States maintain its image as a reliable supplier of corn and coarse grain. The large stocks and competitive position of the dollar caused U.S. exports to rebound since 1985. Additional factors have been the unreliability of rival suppliers and various credit guarantee and food aid programs in use, although EEP has not been used for corn exports. The United States had 74 percent of world corn ending stocks in 1987/88 when corn supplies were large (see table 9). U.S. stocks served a cushioning role when the drought of 1988 depleted world corn stocks by 50 percent, yet world trade and consumption remained virtually unchanged.

Major Exporters and Competition from Other Feed Grains

Export competition for corn cannot be assessed in isolation from other feed grains because of the ease of substitution among alternative feed grains and carbohydrate sources in livestock and poultry feeding. Corn faces a large number of substitutes including other feed grains as well as feed wheat, grain byproducts, cassava, and citrus pulp. In this context, the United States faces competition not only from Argentina, South Africa, Thailand, and China for corn, but from Argentina and Thailand for other feed grains and nongrain feeds, as well as Canada and Australia for wheat and other feed grains (table 10).

Argentina world coarse grain export share (corn, sorghum, and barley) trended upward in the 1960's and 1970's but has fallen from a peak reached in the early 1980's. In some ways, soft wheat exports (that are feed quality) will be even greater competition to U.S. corn exports. There are several reasons why Argentine coarse grain exports grew during the 1970's. First, Argentina eliminated its export taxes for wheat, corn, and sorghum temporarily in 1977, restored them to 25 percent in 1982, eliminated them again in 1988, and reinstituted them in 1989. Floor prices for corn are based on the world price. Export taxes on those commodities were as high as 50 percent before 1977.

Second, Argentina sought to reduce the degree of overvaluation of its currency in the early 1980's by allowing the austral to depreciate against the U.S. dollar. This means that Argentina has the potential to undercut the U.S. export price as the value of the austral falls relative to the dollar. Finally, Argentina benefited from the sales suspension of sales to the Soviet Union, providing an opportunity for Argentina to negotiate a new long-term agreement, one of the few sources of corn and sorghum available to the Soviets. The Soviet Union purchased large quantities of corn and sorghum from Argentina at a premium price. In addition to the USSR agreement, Argentina has bilateral pacts with China, Iraq, Mexico, Algeria, Cuba, and a few other countries.

Canada and Australia, not major corn producers, are important exporters of other feed grains and feed wheat. Given the

Table 10--World coarse grain exports, crop years, 1984-88

Country or region	1984/85	1985/86	1986/87	1987/88	1988/89
			Million metric tons		
United States	55.4	36.4	47.5	53.5	59.0
Canada	3.3	5.8	6.6	4.2	3.9
Australia	6.4	5.0	3.1	2.5	2.6
Argentina	10.6	9.7	5.0	5.2	4.2
South Africa	.2	1.5	2.6	.6	2.0
Thailand	3.5	4.0	2.8	.7	2.6
China	5.6	6.3	2.0	3.6	3.8
World total	100.4	83.2	84.1	83.0	94.7

substitutability of feed grains in world markets, policies and trade practices in these countries can significantly affect U.S. corn exports.

Both Canada and Australia export feed grains through marketing boards and use price pooling to stabilize grower returns. These marketing boards also can influence domestic prices, although the degree of control varies by country, commodity, and use. Domestic wheat prices in Australia have been administered at levels above and below export prices. In the case of coarse grains (primarily barley and sorghum), however, sales are handled by state marketing boards, and no administrative price has been set for the domestic market. With U.S. dominance in world feed grain markets and the wide range of substitutability, the boards are not able to significantly affect world prices of feed grains.

Argentina and Australia primarily rely on the world market to absorb most of their production variability. These countries, along with Canada, have little economic incentive to expand their grain storage capacity, likely due to the U.S. willingness to carry the bulk of the world's stocks at no cost to taxpayers in competitors' countries. As a result, only pipeline supplies are usually held at the end of the marketing year in Argentina and Australia. In recent years, Canada has held coarse grain stocks (mostly barley) that are between 20-30 percent of annual production. This stocks size has not been the result of deliberate government policy but evidently the combination of bumper harvests and reduced exports due to export subsidization by major competitors. Until the EC began its voluntary set-aside program in 1988, the United States had been the only country spending money to cut back grain production.

Australia has long-term trade agreements with Egypt, China, Japan, and the USSR for wheat. Canada has long-term agreements with Brazil, China, the USSR, and East Germany for wheat and feed

grain sales. In addition, credit sales programs (subsidized interest rates) have been administered by the Australian Wheat Board to promote Australia's wheat exports.

France, a member of the EC which as a whole is a large net importer of corn, has expanded feed grain production more than enough to meet domestic needs. It now actively exports corn and barley. France is now the leading corn-producing country in the EC. Exports of corn and especially barley outside the EC are heavily subsidized. These exports have reduced U.S. corn exports and lowered world prices.

Major Importers

As can be seen from the discussion on corn exports, corn imports have greatly expanded over the last few decades. Since 1960, world trade in corn rose from 14 million metric tons to a high of 85.3 million metric tons in 1980, a more than 500-percent increase. Current trade levels are 10-25 percent below that peak. Japan is the leading importer, accounting for over 20 percent of world corn imports. A number of others, including the USSR, the EC, Mexico, and high-income East Asian countries, such as South Korea and Taiwan, are also substantial markets (see table 7). During the last two decades, especially during the 1970's, developing and centrally planned countries accounted for much of the increase in world corn imports in response to rapidly growing meat demand.

Corn imports by developing nations rose from an average of 7 percent of world corn trade in 1960-64 to about 30 percent in 1987-88. Corn imports by North Africa, the Middle East, Latin America (including Mexico), and high-income East Asian countries all increased rapidly in the early 1980's as income growth, such as in the OPEC countries and in East Asia, increased the demand for meat and for U.S. corn exports. Population growth contributed to the increase in the demand for corn as both feed and food. Finally, several countries, such as South Korea and Taiwan, adopted policies to protect domestic livestock industries. Their lack of ability to efficiently produce feed grains and protein meal encouraged imports of feedstuffs. The policies directly contributed to the increase in corn imports by South Korea and Taiwan from 5.6 million tons in 1983/84 to 8.6 million tons in 1987/88.

A worldwide recession in the early 1980's slowed the growth in corn imports by developing nations. After peaking at 18.5 million metric tons in 1986/87, imports by these countries declined to 15.5 million metric tons in 1988/89. This decline is largely due to the tremendous debt burden of many of these countries, limiting hard currency availability for food imports.

The import share of centrally planned countries increased from 7 percent in the early 1960's to more than 30 percent in the late 1980's. This growth was due largely to the decision by the Soviet Union to import supplies from the world market while

continuing to build livestock herds and to increase the ratio of feed concentrates in livestock feeds at the expense of feedstuffs of lower feed value.

The easy credit terms from the West which allowed Eastern Europe to purchase grain were ended as these countries began to experience debt-servicing difficulties in the mid-1980's. Consequently, its corn imports have fallen. As Chinese domestic corn production has expanded, corn imports by China (primarily from Thailand and the United States) have either drastically declined or disappeared since 1983/84 (with an exception in 1986/87 when Chinese imports totaled 1.0 million tons, because of a weather-related poor crop).

The EC has reduced corn imports over the last two decades. In 1960-64, the EC accounted for an average of 55.5 percent of world corn imports. That share fell to 4 percent by 1987-88. This share would have fallen still further except for the addition of Spain and Portugal to the EC in January 1986. Both of these countries still import substantial amounts of non-EC corn.

The drastic decline in EC corn imports reflects increased imports of cereal substitutes (nongrain feeds, excluding oilseed meal). At the same time, the EC's policy of high price support for cereals stimulated production of soft wheat, barley, and corn through expanded farm investments and productivity gains. The EC's Common Agricultural Policy (CAP) supports prices through purchases when the market price falls below a pre-set level. The CAP also establishes variable levies to support internal grain prices at levels well above world prices. Because the EC policy encourages use of domestically produced grains for livestock feeding, exports to the EC are now primarily used for industrial products, not for feed.

High grain prices have meant cassava, citrus pulp, and other substitute products not subject to restrictive import barriers have to some extent replaced corn as feed. Imports of the nongrain feeds by the EC surged from about 4.2 million tons in 1972 to a high of 16.2 million tons in 1982, and still greatly exceed EC grain imports.

Unlike the EC, the Japanese market share has risen, from 13 percent in the early 1960's to 34 percent in 1987/88, due to increased incomes and the demand for meat, and protection of domestic meat-livestock industries. U.S. corn exports to Japan rose from 11.2 million tons in 1979/80 to 14.9 million tons in 1987/88. The market share of non-EC Western European nations also has risen slightly as demand for meat has increased.

Implications of World Corn Market Trends for U.S. Exports

Recent trends in the world corn market suggest that imports by Japan, non-EC Western Europe, and developing and centrally planned nations have been increasingly important, while purchases by the EC have declined. The growth in world corn trade was largely due to expanded imports by developing and centrally