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Chapter 2

# **World Trends in Agricultural Production and Trade**

# World Trends in Agricultural Production and Trade

This chapter reviews changes that have occurred in the production and trade of key agricultural commodities since 1970, and summarizes projected world trends in production, consump-

tion, and trade of cereal grains and oilseeds. Developments that affect the U.S. market position for wheat, corn, and soybeans are emphasized.

## CROP PRODUCTION TRENDS

World crop production trends are affected by changes in both harvested area and yield. This section describes trends in harvested area, yield, and production for wheat, corn, and soybeans. Because substitutes exist for each crop in world markets, the section also reviews regional trends and forecasts for the general categories of cereal grains and oilseeds. In general, comparisons will be made between the United States on the one hand, and the principal producers and exporters of a particular crop on the other; the base period of 1969-71 is used to reflect levels of world production and trade prior to the export boom of the 1970s. Also, statistics relating to the European Economic Community (EEC) do not include figures from Spain and Portugal, the two most recent additions to the EEC.

### Harvested Area

Harvested area of wheat, corn, and soybeans increased throughout the world during the 1970s. For all three crops, the United States possessed the largest harvested area among major exporters

at the beginning of the period, and was able to expand that area significantly.

For wheat, U.S. harvested area increased substantially between 1969-71 and 1982-84, adding approximately 9.1 million hectares—an area close to that of Canada and Australia, the two leading producer-competitors (see table 2-1). Nevertheless, Canada and Australia did expand at impressive rates, and the U.S. figure has increased only slightly since 1974 to 1976, Argentina's harvested wheat area, a fraction of that of the United States, also rose substantially. Brazil and France enjoyed modest growth.

In harvested corn acreage, U.S. expansion dominated that of major competitors, especially Argentina (see table 2-2). Brazil was also able to expand its already large acreage. The enormous proportional growth in Thailand has allowed that country to compete actively with the United States in certain Third World markets.

The 10 million hectare increase in U.S. soybean acreage between 1969-71 and 1982-84 exceeded

Table 2.1.—Wheat: Harvested Area, Selected Countries, 1969.84

	1969-71	1974-76	1979-81	1982-84	Percent change 1969-71 to 1982-84
	(1,000 ha)				
Canada .. . . .	7,669	9,888	11,148	13,130	71
United States. . . . .	18,669	27,760	27,412	27,823	49
Argentina .. . . .	4,402	5,311	6,169	6,773	54
Brazil . . . . .	1,857	2,981	2,920	2,148	16
France ... ..	3,892	4,099	4,391	4,921	26
Australia . . . . .	7,695	8,606	11,144	12,214	59

SOURCE: FAO *Production Yearbook* Food and Agriculture Organization of the United Nations vols 36 and 38 1982 and 1984 Rome Italy

**Table 2-2.—Corn: Harvested Area, Selected Countries, 1969-84**

	1969-71	1974-76	1979-81	1982-84	Percent change 1969-71 to 1982-84
			(1,000 ha)		
United States. . . . .	23,749	27,591	29,548	26,441	11
Argentina . . . . .	3,880	3,107	2,828	3,055	-21
Brazil . . . . .	10,021	10,882	11,348	11,855	18
Thailand . . . . .	771	1,180	1,424	1,511	96

SOURCE: *FAO Production Yearbook*, Food and Agriculture Organization of the United Nations, vols 36 and 38, 1982 and 1984, Rome, Italy

the total harvested area of 1982-84 for Brazil, the next largest competitor (see table 2-3). The greatest proportional increase, however—74 percent—was achieved by Argentina, making it competitive with the United States. Much of this increase occurred between 1979-81 and 1982-84, during which time U.S. production actually declined. In contrast, Brazil's harvested soybean area fell by 20 percent over the 15-year period.

In the more inclusive category of cereal grains, harvested area grew at an average annual worldwide rate of 0.65 percent per year during the period

1969-71 to 1979-81 (see table 2-4). Annual expansion rates were well above average in Oceania, at 3.2 percent, and North America, at 1.75 percent. Area increases were also high in Sub-Saharan Africa and East Asia, while declines occurred in non-EEC Western Europe and Eastern Europe.

Projections of worldwide cereal grain trends in harvested areas, prepared by Resources For the Future and by Economic Perspectives, Inc. (RFF-EPI) indicate a 0.27 per year expansion for the period 1979-81 to 2000, only 42 percent of the 1970s rate (see table 2-4). Relatively rapid ex-

**Table 2-3.—Soybeans: Harvested Area, Selected Countries, 1969-84**

	1969-71	1974-76	1979-81	1982-84	Percent change 1969-71 to 1982-84
			(1,000 ha)		
United States. . . . .	17,036	20,822	27,160	26,717	57
Argentina . . . . .	1,314	375	1,665	2,281	74
Brazil . . . . .	10,976	5,795	8,347	8,525	-22
U.S.S.R. . . . .	860	801	843	830	-3

SOURCE: *FAO Production Yearbook*, Food and Agriculture Organization of the United Nations, vols 36 and 38, 1982 and 1984, Rome, Italy.

**Table 2-4.—Rates of Change in Harvested Area of Cereal Grains, Cereal Yields and Production, By Region, 1969-71 to 1979-81 and Projected, 2000**

Region	Area		Yield		Production	
	1969-71 to 1979-81	1979-81 to 2000	1969-71 to 1979-81	1979-81 to 2000	1969-71 to 1979-81	1979-81 to 2000
North Africa-Middle East. . . . .	0.06	0.18	2.04	2.17	2.10	2.35
Sub-Saharan . . . . .	1.17	0.70	0.93	1.00	2.10	1.70
EEC . . . . .	0.09	-0.14	2.39	1.26	2.30	1.12
Other Western Europe . . . . .	-0.17	-0.10	1.76	2.56	1.58	2.46
U.S.S.R. . . . .	0.53	0.05	-0.20	2.26	0.33	2.31
East Europe. . . . .	-0.43	0.08	2.75	1.08	2.31	1.16
South Asia. . . . .	0.42	0.14	1.94	1.97	2.37	2.11
East Asia . . . . .	1.12	1.28	1.47	1.21	2.60	2.51
Asia (planned) . . . . .	0.21	-0.22	3.44	1.85	3.65	1.63
Oceania . . . . .	3.20	2.10	0.78	1.16	4.00	3.29
Latin America . . . . .	0.73	0.49	2.18	1.98	2.92	2.48
North America . . . . .	1.75	0.24	1.71	1.11	3.50	1.35
World . . . . .	0.65	0.27	1.94	1.56	2.6	1.83

SOURCE: *Meeting Future Needs for United States Food, Fiber and Forest Products*, Resources For the Future, Washington, DC, 1984

pansion is forecast for East Asia and Oceania. The North American rate falls below the world average.

Average worldwide rates of harvested oilseed area grew by 2.21 percent between 1969-71 and 1979-81. However, this overall picture has resulted from substantial increases in particular areas—over 4 percent per year in Oceania, Latin America, North America, the EEC, and other Western European nations (see table 2-5).

The RFF-EPI projections through the year 2000 reveal a significantly different pattern. Expansion of oilseed area slows to approximately one-third of the 1970's rate, or 0.80 percent per year. Nevertheless, expansion should continue to be an important source of increased production in many

regions, since RFF-EPI predicts that rates of yield increase will decline as well.

## Yields

Expansion of harvested acreage often leads to a trade-off in yield, because marginal land is brought into production. Although actual yields may decline, a slowdown in the rate of yield increase is more common. The performance of U.S. competitors varied by both crop and country between the early 1970s and early 1980s.

The expansion of Canada's wheat area, though variable, was not accompanied by a significant change in Canadian yields, which remain below those of the United States (see table 2-6). Expansion of harvested acreage in Australia and Brazil

**Table 2-5.— Rates of Change in Harvested Area of Oilseeds, Oilseed Yields and Production, By Region, 1969-71 to 1979-81 and Projected, 2000**

Region	Area		Yield		Production	
	1969-71 to 1979-81	1979-81 to 2000	1969-71 to 1979-81	1979-81 to 2000	1969-71 to 1979-81	1979-81 to 2000
North Africa-Middle East. ....	-0.50	1.23	1.84	0.18	1.33	1.41
Sub-Saharan ... ..	-0.99	0.47	-0.05	0.70	-1.04	0.22
EEC ... ..	4.04	2.35	2.74	0.91	6.89	3.28
Other Western European ... ..	9.06	1.69	-1.91	2.56	6.98	4.30
U.S.S.R. ....	-0.25	0.30	0.74	2.66	0.49	2.97
East Europe ... ..	2.37	2.56	1.14	1.26	3.53	3.85
South Asia ... ..	0.63	0.43	0.39	1.19	1.02	1.63
East Asia .. .	1.07	0.69	1.46	2.47	2.54	3.18
Asia (planned) .. .	1.23	1.64	1.30	1.38	2.54	3.04
Oceania ... ..	7.53	1.08	2.34	1.37	10.04	2.47
Latin America ... ..	6.95	1.00	4.02	0.90	11.26	1.91
North America ... ..	4.18	0.69	1.33	1.08	5.57	1.79
World ... ..	2.21	0.80	2.02	1.33	4.27	2.13

SOURCE *Meeting Future Needs for United States Food, Fiber and Forest Products, Resources For the Future*, Washington, DC, 1984

**Table 2-6.—Wheat Yields, Selected Countries, 1969-84**

	1969-71	1974-76	1980	1981	1982	1983	1984
Kilograms per hectare							
Canada ... ..	1,813	1,819	1,738	1,996	2,143	1,941	1,611
United States ... ..	2,144	1,980	2,249	2,323	2,386	2,651	2,608
Argentina ... ..	1,334	1,603	1,549	1,297	2,049	1,788	2,124
Brazil .. .	939	879	865	1,151	646	1,190	1,054
France ... ..	3,626	4,078	5,169	4,809	5,236	5,127	6,454
Australia ... ..	1,171	1,362	962	1,377	770	1,709	1,521
Percent of U.S. yields							
Canada ... ..	85	92	77	86	90	73	62
United States ... ..	100	100	100	100	100	100	100
Argentina ... ..	62	81	69	56	86	67	81
Brazil .. .	44	44	38	50	27	45	40
France ... ..	169	206	230	207	219	193	247
Australia ... ..	55	69	43	59	32	64	58

SOURCE *FAO Production Yearbook Food and Agriculture Organization of the United Nations*, vols 38 and 38, 1982 and 1984 Rome, Italy

has led to yields that are more variable than those of the United States. Argentine wheat yields constitute more than three-quarters of the U.S. total. Interestingly, France has retained its yield advantage over the United States, even while expanding its harvested area by about one-quarter over the 1969-71 figure.

Changes in Argentine and Brazilian corn yields in relation to 1970's U.S. yields were not significant. Argentine yields hover at around one-half of the U.S. level, and Brazilian yields at around one-quarter (see table 2-7). Thailand's corn yields have declined slightly, relative to the United States.

The United States' two major competitors in world soybean trade, Argentina and Brazil, have closed much of the yield gap that existed in 1969 to 1971 (see table 2-8), a development largely attributable to the transfer of U.S. soybean varieties and pesticides to these countries (see ch. 4). In fact, 1984 Argentine soybean yields surpassed those of the United States by nearly 40 percent. The expected introduction of biotechnology to the United States in the late 1990s may increase yields.

However, whether technologies will first be applied in other countries, even though such innovations may come from the United States, remains to be seen (see ch. 4).

Projections of average U.S. wheat, corn, and soybean yields through the year 2000, taken from a recent OTA study, \* appear in table 2-9. These projections represent the "most likely environment" through 2000, and assume real growth in U.S. research and extension expenditures of 2 percent per year, as well as the continuation of past trends in the development and adoption of technology. Yields and production would increase with larger research and extension service expenditures.

The OTA projections indicate that average U.S. wheat yields in 2000 may be 25 percent higher than 1982 yields. Over the same period, corn yields may increase by 21 percent, and soybean

\*U.S. Congress, Office of Technology Assessment, *Technology, Public Policy, and the Changing Structure of American Agriculture*, OTA-F-285 (Washington, DC: U.S. Government printing Office, March 1986).

**Table 2-7.—Corn Yields, Selected Countries, 1969-84**

	1969-71	1974-76	1978	1979	1980	1981	1982	1983	1984
	Kilograms per hectare								
United States . . . . .	5,164	6,166	6,342	6,883	5,711	6,891	7,108	5,090	6,692
Argentina . . . . .	2,247	2,516	3,612	3,107	2,570	3,801	3,028	3,030	3,141
Brazil . . . . .	1,365	1,543	1,220	1,442	1,779	1,836	1,731	1,745	1,735
Thailand . . . . .	2,567	2,271	2,014	2,187	2,245	2,354	2,299	2,267	2,500
	Percent of U.S. yield								
Argentina . . . . .	44	41	57	45	45	55	43	60	47
Brazil . . . . .	26	25	19	21	31	27	24	34	26
Thailand . . . . .	50	37	32	32	39	34	32	45	37

SOURCE *FAO Production Yearbook*, Food and Agriculture Organization of the United Nations, vols 36 and 38, 1982 and 1984, Rome, Italy

**Table 2-8.—Soybean Yields, Selected Countries, 1969-84**

	1969-71	1974-76	1980	1981	1982	1983	1984
	Kilograms per hectare						
United States . . . . .	1,830	1,766	1,776	2,027	2,121	1,759	1,893
Argentina . . . . .	1,178	1,491	1,724	2,005	2,090	1,754	2,601
Brazil . . . . .	862	1,668	1,727	1,765	1,565	1,792	1,650
U.S.S.R. . . . .	606	674	615	568	715	665	699
	Percent of U.S. yields						
Argentina . . . . .	64	84	97	99	99	100	137
Brazil . . . . .	47	94	97	87	74	102	87
U.S.S.R. . . . .	33	38	35	28	34	38	37

SOURCE *FAO Production Yearbook*, Food and Agriculture Organization of the United Nations, vols. 36 and 38, 1982 and 1984, Rome, Italy

**Table 2-9—OTA Projections of Crop Yields, Crop Production, and Average Annual Growth Rates for Yields and Production**

Crop	Yield		Production	
	Actual 1982	Projected <sup>a</sup> 2000	Actual 1984	Projected <sup>a</sup> 2000
	bushels/acre		billion	bushels
Wheat . . . . .	36	45	2.6	3.5
Corn . . . . .	113	139	7.7	9.3
Soybeans . . . . .	30	37	1.9	3.2
	Projected average annual rate of growth through 2000		Percent of production growth due to yield growth	
	Yield	Production		
	percent		percent	
Wheat . . . . .	1.2	1.9	68	
Corn . . . . .	1.2	1.2	100	
Soybeans . . . . .	1.2	3.4	35	

<sup>a</sup>Projections for "most likely environment" assumes to year 2000 (a) a real rate of growth in research and extension expenditures of 2 percent per year and (b) the continuation of all other forces that have shaped past development and adoption of technology

SOURCE U S Congress, Office of Technology Assessment, *Technology, Public Policy, and the Changing Structure of American Agriculture* OTA-F-285 (Washington, DC: U S Government Printing Office March 1986)

yields by 23 percent. Combined production of the three crops in 2000 is expected to increase by nearly one-third over 1984 levels. Average annual rates of yield increase projected for wheat and corn —1.2 percent per year—fall below the RFF-EPI world rate for cereal grains over a comparable period. Recently, the United States has lagged behind many regions of the world in terms of annual growth in yields, since actual U.S. yields are relatively high.

For the broad category of cereal grains, substantial percentage yield increases occurred in most regions of the world in the 1970s, mainly because of improved varieties and management practices (see table 2-4). Worldwide yields grew at an annual rate of 1.9 percent. Substantial increases occurred in North Africa and the Middle East, the EEC, Eastern Europe, centrally planned economies in Asia—especially that of China—and Latin America. Cereal yields in those regions rose by over 2 percent per year between 1969-71 and 1979-81, compared to a 1.7 percent rate in North America. The slight average annual decline in yields experienced by the Soviet Union, —0.20 percent, represents the only average negative trend over the period.

RFF-EPI projections indicate a continued increase in world cereal yields, but at a slower rate than that of the 1970s (see table 2-4). Marked declines are projected for the EEC, Eastern Europe,

and Asian nations with centrally planned economies; North America may also experience a considerable drop. The Soviet Union, however, is expected to increase its average annual yield, from a decline of 0.20 percent to a 2.26 percent growth.

Yields of oilseed crops also grew rapidly during the 1970s (see table 2-5), at a worldwide rate of about 2 percent per year. Unlike wheat yields, substantial increases in certain regions set the pace: the EEC, Oceania, and Latin America all enjoyed annual growth in oilseed yields of over 2.3 percent, compared to a 1.3 percent average rise in North America. Annual yields fell in Western European countries not affiliated with the Community, and in Sub-Saharan Africa. A sharp decline in the average annual growth rate for world oilseed yields is foreseen by RFF-EPI, from 2.02 to 1.33 percent. Slower growth is forecast for North Africa and the Middle East, the EEC, Oceania, and especially for Latin America. In contrast, other Western European countries, the U. S. S. R., Sub-Saharan Africa, East Asia, and South Asia may enjoy significant increases.

## Production

World production of wheat, corn, and soybeans increased appreciably over the past 15 years. Between 1970-72 and 1980-82, world wheat production increased by 37 percent, corn produc-

tion grew 50 percent, and soybean output nearly doubled (see table 2-10). U.S. production of corn and wheat more than kept pace over this period, with wheat production rising by 75 percent and corn production by 50 percent. For soybeans, 75 percent U.S. production growth lagged somewhat behind world trends. As a result, U.S. farmers increased their share of expanding world wheat and corn production during this time.

Although U.S. production share for soybeans decreased, it remains comparatively large. In recent years, this country has accounted for 13 to 16 percent of world wheat production and over 45 percent of corn production—excluding 1983, when drought and government land idling pro-

grams cut the domestic corn crop in half. As for soybean production, the United States' share stands at approximately 60 percent (see table 2-11).

Traditional U.S. competitors in world grain and oilseed trade increased their crop production as well, and new competitors emerged for certain crops. For example, international corn production has increased by 40 percent since 1970 (see table 2-10). Corn exports by other countries have increased as well, but at a slower rate. Thailand, the fourth largest producer, is the only competitor to have achieved steady gains in production; its corn output has doubled since 1970, mainly due to increases in planted area. Thailand still

**Table 2-10.—World and U.S. Production of Corn, Wheat, and Soybeans, Selected Periods**

	Wheat		Corn		Soybeans	
	World	U.S.	World	U.S.	World	U.S.
			(million bushels)			
1970-72 .....	12,348	1,506	11,195	5,125	1,641	1,145
1980-82 .....	16,784	2,644	16,770	7,664	3,194	1,992
1983-85 <sup>a</sup> .....	18,483	2,480	16,821	6,905	3,283	1,799
			(percent increase)			
1970-72 to 1980-82 .....	36	76	50	50	95	74
1970-72 to 1983-85 .....	50	65	50	35	100	57

<sup>a</sup>1984 preliminary, 1985 projected

SOURCE: "Background for 1985 Farm Legislation," Economic Research Service, U S Department of Agriculture, Agricultural Information Bulletins No 467 (wheat), 471 (corn), and 472 (soybeans), 1985

**Table 2.11.—World Production and U.S. Share for Wheat, Corn, and Soybeans, 1970-85<sup>a</sup>**

Year	Wheat		Corn		Soybeans	
	World (million bushels)	U.S. share (percent)	World (million bushels)	U.S. share (percent)	World (million bushels)	U.S. share (percent)
1970 .....	11,530	12	10,291	40	1,627	69
1971 .....	12,893	13	11,736	48	1,734	68
1972 .....	12,621	12	11,558	48	1,807	70
1973 .....	12,705	12	12,574	45	2,292	68
1974 .....	13,235	13	11,362	41	2,007	61
1975 .....	13,099	16	12,818	46	2,409	64
1976 .....	15,484	14	13,917	45	2,183	59
1977 .....	14,113	15	14,295	46	2,651	67
1978 .....	16,417	11	15,326	47	2,843	66
1979 .....	15,597	14	16,613	48	3,443	66
1980 .....	16,274	15	15,893	42	2,969	60
1981 .....	16,476	17	17,204	47	3,164	63
1982 .....	17,604	16	17,216	48	3,438	64
1983 .....	18,037	13	13,624	31	3,042	54
1984 .....	18,912	14	18,003	43	3,391	55
1985 .....	18,513	13	18,930	47	3,457	61

<sup>a</sup>1984 preliminary, 1985, projected

SOURCE: "Background for 1985 Farm Legislation," Economic Research Service, U S Department of Agriculture, Agricultural Information Bulletins No 467 (wheat), 471 (corn), and 472 (soybeans), 1985

claims a small share of world production, about 10 percent, but this Asian nation has become an important factor in world corn trade.

Furthermore, worldwide soybean production and exports have changed dramatically since 1970 (see table 2-10). Production has tripled in Brazil, and has increased tenfold in Argentina. Brazil enjoyed a sharp rise in soybean exports during the mid-1970s, but has since fallen off. The Argentine export boom ensued in the late 1970s; it, too, suffered a severe downturn in the early 1980s.

Increases in harvested area and yields resulted in increased international production for both cereal grains and oilseeds during the 1970s (see tables 2-4 and 2-5). Cereal grain production rose at an average annual rate of 2.6 percent, led by Oceania at 4 percent, the planned economies of Asia at 3.65 percent, and North America at 3.5 percent. The U. S. S. R., at 0.33 percent, trailed all other regions.

Greater growth rates were achieved in oilseed production. World production rose by over 4 percent per year, with notably high growth rates in Latin America, Oceania, all of Western Europe, and North America. The U.S.S.R. increased oilseed production at a slower rate than all regions except Sub-Saharan Africa, which experienced a decline.

## Extensive v. Intensive Agricultural Production

The relative importance of area expansion as opposed to yields varies by both region and crop (see tables 2-12 and 2-13). While technology can play an important role in land expansion, especially with respect to land clearing and preparation for irrigation, it is more directly associated with trends in yields. The more a country relies on high yields, or "intensive" cultural practices, to increase production, the greater its dependence on agricultural technology.

World cereal grain production rose at an average rate of 2.6 percent per year between 1969-71 and 1979-81 (see table 2-4). One-quarter of this increase resulted from expansion of harvested area, and the remaining three-quarters from yield improvements. Production increases in Oceania, North America, and Sub-Saharan Africa were more dependent on increasing land area, accounting for 80, 50, and 56 percent of average annual production expansion, respectively. The U.S.S.R. also depended on expansion of harvested area to increase production, but the Soviets experienced a trade-off in yields during the 1970s. Had the U.S.S.R. matched the world average annual growth rate in cereal yields of 1.94 percent, its total production would have increased by 2.47 percent per

**Table 2.12.—Sources of Change in Cereal Grain Production, by Region, 1969-71 to 1979-81 and Projected to 2000: Average Annual Changes in Area and Yield as a Percent of Change in Production**

Region	Area		Yield	
	1969-71 to 1979-81	1979-81 to 2000	1969-71 to 1979-81	1979-81 to 2000
North Africa-Middle East . . . . .	3	8	97	92
Sub-Saharan . . . . .	56	41	44	59
EEC . . . . .	-4	-13	104	113
Other Western European . . . . .	-11	-4	111	104
U.S.S.R. . . . .	161	2	-61	98
Eastern Europe . . . . .	-19	7	119	93
South Asia . . . . .	18	7	82	93
East Asia . . . . .	43	51	57	48
Asia (planned) . . . . .	6	-13	94	113
Oceania . . . . .	80	64	20	35
Latin America . . . . .	25	20	75	80
North America . . . . .	50	18	49	82
World . . . . .	25	15	75	85

SOURCE *Meet/rig Future Needs for United States Food, Fiber and Forest Products, Resources For the Future*, Washington, DC 1984

**Table 2.13.—Sources of Change in Oilseed Production, by Region, 1969-71 to 1979-81 and Projected to 2000: Average Annual Changes in Area and Yield as a Percent of Change in Production**

Region	Area		Yield	
	1969-71 to 1979-81	1979-81 to 2000	1969-71 to 1979-81	1979-81 to 2000
North Africa-Middle East . . . . .	-38	87	138	13
Sub-Saharan . . . . .	95	-214	5	318
EEC . . . . .	59	72	40	28
Other Western European . . . . .	130	39	-27	60
U.S.S.R. . . . .	-51	10	151	90
East Europe . . . . .	67	66	32	33
South Asia . . . . .	62	26	38	73
East Asia . . . . .	42	22	57	78
Asia (planned) . . . . .	48	54	51	45
Oceania . . . . .	75	44	23	55
Latin America . . . . .	62	52	36	47
North America . . . . .	75	39	24	60
World . . . . .	52	38	47	62

SOURCE: "Meeting Future Needs for United States Food, Fiber and Forest Products, Resources For the Future, Washington, DC, 1984

year instead of 0.33 percent; this might have had a profound impact on world cereal trade. The opposite pattern is noted in the EEC, other Western European countries, and Eastern Europe. In these regions, agricultural production became more intensive: yield increases more than compensated for a decline in land area, raising average production as a whole.

The effects of extensive and intensive agricultural production as a source of growth will shift dramatically for cereal crops over the next 15 years, according to the RFF-EPI projections. Approximately 15 percent of the anticipated annual growth in world cereal production will result from increased area, as opposed to 25 percent in the 1970s; 85 percent is expected to come from higher yields, a reflection of high marginal returns to nonland inputs and advances in technology. Area expansion is forecast to play a lesser role in average annual production growth than during the 1970s in every region except East Asia and North Africa and the Middle East. In two important cereal regions, the EEC and the Asian centrally planned nations, projected declines in harvested area could reduce overall production growth rates by 13 percent unless yields increase. Growth in cereal production rates will also depend on more intensive agricultural practices in the crucial regions of North America and Oceania.

The United States' unique ability to increase crop production rapidly aids its international competitiveness in agriculture. Several factors contribute to this responsiveness: a considerable stock of arable land that suits world standards for intensive cropping, even though a sizable portion is marginal from a domestic perspective; maintenance of large carryover stocks of wheat and feed grains; and the technical capacity of U.S. farmers to expand plantings while increasing yields. U.S. farmers served the growing export markets of the 1970s and early 1980s, and can do so in the future.

Expansion of U.S. production capacity in the 1970s actually fostered trade, helping to keep world grain and oilseed prices in check after depletion of stocks triggered abrupt price increases from 1972 to 1975. Increased production also allowed U.S. farmers to increase their share in some markets, at least temporarily. In addition, the responsiveness of U.S. agriculture was an important factor in controlling inflation of domestic food prices, which had reached a rate of 14 percent in 1973-74 and which accounted for over one-half of the overall 1973 increase in the consumer price index.<sup>2</sup> Despite reductions in U.S. stocks of wheat and corn—as well as increases in domestic exports of

<sup>2</sup>Andrew Schmitz, "United States Competitiveness in Agricultural Trade," contractor report prepared for the Office of Technology Assessment, 1985.

these crops—between 1971 and 1975, stock levels were still ample by 1975. In the case of wheat, they were excessive.

To the extent that agricultural production can insulate the U.S. economy from abrupt increases in food prices and overall inflation, it has a positive effect on disposable income and thus can indirectly aid other sectors of the economy. Agriculture also enhances competitiveness in other sectors by its moderating influence on cost-of-living adjustments (COLAS) in wages. However, a trade-off exists, which has been dramatically evident since 1981: overproduction may result in lower farm incomes and increased costs for domestic farm programs.

As the export market contracted and became more competitive after 1981, the robust expansion of the preceding decade exposed U.S. agriculture to serious adjustment problems. In the price regime of the 1970s, grain and oilseed pro-

duction were profitable enterprises for more U.S. farmers, in a wider range of production areas, than has been the case since 1981. The increased importance of feed grain—primarily corn—and soybean exports, which are more sensitive to income changes than wheat, has added to the instability. By the early 1980s, area planted for wheat, corn, and soybeans in the United States had reached record levels. Yields were also exceptional in 1981 and 1982, and international production remained high as well. As a result, enormous stocks of wheat and corn accumulated in this country (see table 2-14). Wheat stocks at the end of 1982 constituted 63 percent of total consumption—exports plus domestic consumption—and corn stocks had reached the highest level in 20 years. Corn stocks did drop substantially between 1982 and 1983, the result of a national production control program, as well as a severe drought; however, stocks doubled between 1983 and 1984.

**Table 2-14.—U.S. Ending Stocks and Stock-to-Use Ratios for Wheat, Corn, and Soybeans, 1970-84**

Year	Wheat		Corn		Soybeans	
	Ending stocks (million bushels)	Stocks-to-use (percent)	Ending stocks (million bushels)	Stocks-to-use (percent)	Ending stocks (million bushels)	Stocks-to-use (percent)
1970 . . . . .	823	55	666	15	99	8
1971 . . . . .	983	66	1,127	22	72	6
1972 . . . . .	597	30	708	12	60	5
1973 . . . . .	340	17	484	8	171	12
1974 . . . . .	435	26	361	8	188	16
1975 . . . . .	666	35	400	7	245	16
1976 . . . . .	1,113	65	886	15	103	7
1977 . . . . .	1,178	59	1,111	18	161	9
1978 . . . . .	924	46	1,304	18	176	9
1979 . . . . .	902	42	1,617	21	358	17
1980 . . . . .	989	43	1,034	14	313	17
1981 . . . . .	1,159	44	2,174	31	254	13
1982 . . . . .	1,515	63	3,119	43	345	18
1983 . . . . .	1,399	55	723	11	176	10
1984 . . . . .	1,425	55	1,379	20	316	18

SOURCE "Background for 1985 Farm Legislation," Economic Research Service, U. S. Department of Agriculture, Agricultural Information Bulletins No 467 (wheat), 471 (corn), and 472 (soybeans), 1985

## U.S. MARKET SHARES

Although the United States continues to dominate world trade in wheat, corn, and soybeans, the U.S. share of world markets for these crops has fluctuated over the past 15 years (see table 2-15). For example, the U.S. share of world wheat

exports increased sharply between 1971 and 1973, from 33 to a record 53 percent. Since then, the export share has ranged from **30** to **48** percent of the world total. A declining market share since 1981 has presented serious problems for U.S.

**Table 2-15.—World Exports and U.S. Market Share for Wheat, Corn, and Soybeans, 1970-85<sup>a</sup>**

Year	Wheat <sup>b</sup>		Corn <sup>c</sup>		Soybeans	
	World (million bushels)	U.S. share (percent)	World (million bushels)	U.S. share (percent)	World (million bushels)	U.S. share (percent)
1970 .....	2,021	37	1,236	41	462	94
1971 .....	1,911	33	1,374	57	474	88
1972 .....	2,462	48	1,752	71	567	85
1973 .....	2,315	53	2,106	58	664	81
1974 .....	2,363	43	1,823	63	572	74
1975 .....	2,451	48	2,386	72	706	79
1976 .....	2,326	41	2,386	71	703	80
1977 .....	2,675	42	2,602	75	820	85
1978 .....	2,646	45	2,799	76	906	82
1979 .....	3,160	44	3,086	79	1,071	82
1980 .....	3,458	44	3,295	72	903	80
1981 .....	3,722	48	2,831	70	1,085	86
1982 .....	3,625	42	2,634	71	1,045	87
1983 .....	3,747	38	2,617	71	960	77
1984 .....	3,899	36	2,837	65	918	65
1985 .....	3,238	30	2,620	55	974	80

<sup>a</sup>1985 preliminary.<sup>b</sup>Wheat includes intra-EEC trade<sup>c</sup>Corn includes intra-EEC trade

SOURCE: "Background for 1965 Farm Legislation," Economic Research Service, U.S. Department of Agriculture, Agricultural Information Bulletins No. 467 (wheat), 471 (corn), and 472 (soybeans), 1965

wheat producers, but it is important to note that pronounced declines were experienced in 1974 and 1976, when conditions were generally favorable for U.S. exports. In other words, the U.S. market share for wheat has been unstable, to some extent. Still, the effects of a decline in both market share and prices have been painful for U.S. producers over the last several years.

The United States has also dominated world corn exports, and has increased its share since the mid-1970s; again, however, this trend has varied, ranging from 41 to 79 percent since 1970. Markedly large annual changes occurred between 1970 and 1973, and relatively large decreases have occurred since 1983. The fact that corn is one of numerous livestock feed sources traded in international markets complicates matters; other coarse grains, such as sorghum, feed wheat, grain by-products, manioc, and citrus pulp, compete with corn. In this larger context, the United States has suffered considerably in recent years. Argentina's exports of corn and sorghum have made that country a major competitor in the world coarse grain market. The U.S. share of coarse grain exports declined from 72 percent in 1979-80 to just under 60 percent in 1981-82, where it remained through 1984-85, while Argentina's share doubled over the same period (see table 2-16). An overall

decline in world markets for both corn and coarse grains has made the U.S. farmer's loss in market share all the more difficult.

In soybeans, the United States has dominated an international market that increased enormously during the 1970s, but has since leveled off (see table 2-15). The U.S. share typically exceeds 80 percent of world exports. Still, there have been a number of interludes during which U.S. market share shifted up or down, notably 1970-71, 1973-74, 1976-77, 1980-81, and each year since 1982.

Although the United States ships wheat, corn, and soybeans to dozens of countries, the import levels of several key countries or groups of countries present major sources of instability for U.S. exports. Soybean purchases by centrally planned and developing countries, and by the EEC, have been a major source of variability. Corn purchases by the EEC, the U. S. S. R., and China have a profound effect on U.S. corn exports. The U.S.S.R. and China are also the most important sources of variability in world wheat trade. In recent years, China has increased wheat production and has reduced imports from the United States.<sup>3</sup>

<sup>3</sup>FAO Trade Yearbook, Food and Agriculture Organization of the United Nations, vols. 32-38, 1970 to 1984, Rome, Italy.

**Table 2-16.—World Coarse Grain Exports, 1979.86 Crop Years**

Country or region	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86a
Million metric tons							
United States . . . . .	71.4	69.6	58.4	54.0	55.8	55.5	45.9
Canada . . . . .	3.8	5.5	7.2	7.1	5.5	3.3	5.8
Australia . . . . .	4.1	2.3	3.1	1	5.5	7.1	6.0
Argentina . . . . .	5.3	14.2	10.3	11.6	10.9	10.6	11.9
South Africa . . . . .	3.5	4.1	4.7	2.3	0.1	0.5	1.0
Thailand . . . . .	2.2	2.4	3.5	2.3	3.4	3.5	3.8
Other . . . . .	9.1	10.7	9.4	11.6	10.8	21.0	17.9
World total . . . . .	99.4	108.8	96.6	89.9	92	101.5	92.3
Percent of world total							
United States . . . . .	72	64	60	60	61	55	50
Canada . . . . .	4	5	7	8	6	3	6
Australia . . . . .	4	2	3	1	6	7	7
Argentina . . . . .	5	13	11	13	12	10	13
South Africa . . . . .	4	4	5	3	0	0	1
Thailand . . . . .	2	2	4	3	4	3	4
Other . . . . .	9	10	10	13	12	21	19
World total . . . . .	100	100	100	100	100	100	100

SOURCE *Agricultural Statistics*, US Department of Agriculture Washington, DC 1986

Although the United States has experienced a pronounced decline from peak export years, U.S. shares of world wheat, corn, and soybean exports have not fallen so precipitously from long-term levels as to indicate a major shift in this country's international position. Significant annual changes in the U.S. market share—including some major losses—did occur before 1981. But these fluctua-

tions in market share did not attract as much attention in the 1970s, due to expanding world markets and more favorable prices. U.S. exports of cereal and oilseed crops will probably increase over the long term, but world trends in production and consumption, and in imports and exports, suggest that U.S. market shares will continue to fluctuate from year to year.

## THE LONG-TERM OUTLOOK FOR INTERNATIONAL TRADE

Based on anticipated trends in the food consumption and production of other regions, exports of cereals and oilseeds from North America are likely to increase over the long term, but at a slower average rate than experienced in the 1970s. Also, North American exports will play a more important role in the world food system. However, U.S. farmers will have to rely on world markets for their economic well-being to a greater degree than they do today, and will be exposed to greater risks as a result.

Table 2-17 shows regional production and consumption of cereal grains in 1978-80, and as projected for the year 2000 by RFF-EPI. Production is envisioned as increasing in all regions over the next 15 years, but consumption—a function of

population, income trends, and evolving diets—is projected to outstrip production in every region but the EEC, Oceania, and North America. In 2000, Sub-Saharan Africa's cereal consumption exceeds production to a much greater extent than in the late 1970s; North Africa and the Middle East and South Asia will also be less able to meet consumption needs from domestic production. The entire Western European region should enjoy a considerably improved production-consumption balance,

Of the three surplus producing regions, Oceania is the most dependent on exports, with a production/consumption ratio of **2.67** in the late 1970s; a somewhat lower ratio is forecast for 2000. The EEC is projected to increase its exportable surplus

**Table 2-17.—Production and Consumption of Cereal Grains, 1978-80 and Projected to 2000, by Region**

	1978-80			2000		
	Production	Consumption (1,000 mt)	Ratio	Production	Consumption (1,000 mt)	Ratio
North Africa-Middle East . . . . .	59,899	84,032	0.71	95,317	141,827	0.67
Sub-Saharan . . . . .	53,939	58,324	0.92	78,897	108,187	0.73
EEC . . . . .	121,940	123,115	0.99	153,330	133,337	1.15
Other Western European . . . . .	32,708	42,358	0.77	49,446	57,747	0.86
U.S.S.R. . . . .	195,698	220,312	0.89	276,488	306,290	0.90
Eastern Europe . . . . .	95,256	109,489	0.87	119,153	138,879	0.86
South Asia . . . . .	180,675	182,754	0.99	277,446	291,288	0.95
East Asia . . . . .	100,245	130,082	0.77	170,709	223,804	0.76
Asia (planned) . . . . .	302,715	317,712	0.95	425,333	456,912	0.93
Oceania . . . . .	22,444	8,398	2.67	41,749	16,413	2.54
Latin America . . . . .	85,513	91,315	0.94	151,310	161,123	0.94
North America . . . . .	322,625	199,753	1.62	450,546	253,917	1.77
World . . . . .	1,573,647	1,567,644	1.00	2,289,724	2,289,724	1.00

SOURCE *Meeting Future Needs for United States Food, Fiber and Forest Products, Resources For the Future* Washington, DC, 1984.

**Table 2.18.—Production and Consumption of Oilseeds, 1978-80 and Projected to 2000, by Region**

	1978-80			2000		
	Production	Consumption (1,000mt)	Ratio	Production	Consumption (1,000mt)	Ratio
North Africa-Middle East . . . . .	3,417	4,811	0.71	4,679	10,065	0.46
Sub-Saharan . . . . .	7,508	5,324	1.41	7,539	8,734	0.86
EEL . . . . .	2,002	32,362	0.06	4,527	43,796	0.10
Other Western European . . . . .	1,059	6,127	0.17	2,403	9,783	0.25
U.S.S.R . . . . .	12,008	11,963	1.00	21,405	20,306	1.05
Eastern Europe . . . . .	3,900	10,805	0.36	8,468	16,633	0.51
South Asia . . . . .	13,997	11,256	1.24	19,172	17,046	1.12
East Asia . . . . .	3,145	9,032	0.35	5,998	22,565	0.27
Asia (planned) . . . . .	19,213	20,251	0.95	38,455	36,659	1.05
Oceania . . . . .	460	408	1.13	793	1,989	0.40
Latin America . . . . .	24,058	8,840	2.72	38,083	18,359	2.07
North America . . . . .	67,119	32,870	2.04	97,695	43,282	2.26
World . . . . .	157,796	154,049	1.02	249,217	249,217	1.00

SOURCE *Meeting Future Needs for United States Food, Fiber and Forest Products, Resources For the Future*, Washington, DC, 1984

by approximately 15 percent, suggesting that U.S. imports to the EEC will decrease while competition with the EEC in other cereal markets will grow more intense. The exportable surplus will also increase in North America, where production is expected to exceed consumption by 77 percent in 2000, compared to 62 percent in the late 1970s.

Oilseed production is projected to increase in every region (see table 2-18) by 2000, although only 5 of the 12 regions should have an export surplus. Sub-Saharan Africa is likely to become a deficit region for oilseeds, with consumption topping production. Production/consumption ratios will also grow more precarious in North Africa and the Middle East, and in Oceania. The major surplus regions will continue to be North

America and Latin America, both of which may produce more than twice the oilseed volumes that they consume. Latin America should lose its considerable dependency on exports to absorb production—nearly three times regional consumption in 1978 to 1980—because its level of consumption will increase sharply. However, North America, and the United States in particular, is forecast to grow more dependent on foreign markets.

### **World Trade in Wheat, Corn, and Soybeans**

In absolute terms, world trade in these crops has increased dramatically since 1970. World wheat exports grew by 60 percent, corn exports

by 111 percent, and soybean exports by 110 percent between 1970 and 1985 (see table 2-15). In terms of relative changes, however, world exports of the three crops rose as a proportion of world production throughout the 1970s, but have decreased since that time. The corn market held the most pronounced change. World corn exports constituted about 12 percent of total production in the early 1970s; this figure climbed to a peak of 21 percent in 1980 and remained high, at 19 percent, in 1983. Since that time, corn exports have fallen to 14 percent of world production (see table 2-19). The corn market, which had approached wheat in terms of the proportion traded, has again fallen behind both wheat and soybeans in this category. In addition, the shift of interna-

tional wheat trade toward commercial sales represents an important development of the past two decades,

Table 2-20 summarizes the flow of world trade in cereals and oilseeds, as implied by the regional production/consumption balances discussed in the preceding section. Cereals trade could double between 1980 and 2000, and oilseed trade may rise by about half. The RFF-EPI projections indicate that the volume of U.S. cereal grain exports could increase by about 58 percent, and oilseed exports by about 64 percent, compared to 1979-80.

Future patterns of trade implied by the RFF-EPI projections show a shift in world imports of cereal grains, away from Europe and the U.S.S.R. and toward regions where demand has been more variable, like Asia (see table 2-21). Increased cereal imports to Sub-Saharan Africa will largely be in the form of food aid and concessional sales. A similar shift in the flow of trade is anticipated for oilseeds. European regions, especially the EEC and Eastern Europe, will account for a smaller share of imports; North Africa and the Middle East, Sub-Saharan Africa, and in particular East Asia, are expected to grow as import markets. A change in import share toward developing countries may increase the variability of world trade in cereals, grains, and oilseeds. On the whole, production/consumption trends imply that U.S. producers will become more dependent on export markets, while exports will become less predictable in other regions. The burden of the increased risks associated with these developments will, in large measure, fall on the United States.

**Table 2-19.—World Exports as a Share of World Production, 1970-83 (percent)**

	Wheat	Corn	Soybeans
1970 . . . . .	18	12	28
1971 . . . . .	15	12	27
1972 . . . . .	20	15	31
1973 . . . . .	18	17	29
1974 . . . . .	18	16	29
1975 . . . . .	19	19	29
1976 . . . . .	15	17	32
1977 . . . . .	19	18	31
1978 . . . . .	16	18	32
1979 . . . . .	20	19	31
1980 . . . . .	21	21	30
1981 . . . . .	23	16	34
1982 . . . . .	20	15	31
1983 . . . . .	21	19	32
1984 . . . . .	21	16	27
1985 . . . . .	18	14	28

SOURCE *Meeting Future Needs for United States Food, Fiber and Forest Products Resources For the Future*, Washington DC, 1984

**Table 2-20.—Trade Patterns Implied By Projected Balance of Production and Consumption of Cereal Grains and Oilseeds, 1978.80 and Projected for 2000, by Region<sup>a</sup>(l,000 MT)**

Region	Cereal grains		Oilseeds	
	1978-80	2000	1978-80	2000
North Africa-Middle East . .	(24,133)	(46,510)	(1,394)	(5,386)
Sub-Saharan . . . . .	(4,385)	(29,290)	2,184	(1,195)
EEC . . . . .	(1,175)	19,993	(30,360)	(39,269)
Other Western European . .	(9,650)	(8,301)	(5,068)	(7,380)
U.S.S.R . . . . .	(24,614)	(29,802)		1,099
Eastern Europe . . . . .	(14,233)	(19,726)	(6,905)	(8,165)
South Asia . . . . .	(2,079)	(13,842)	2,741	2,126
East Asia . . . . .	(29,837)	(53,095)	(5,887)	(16,567)
Asia (planned) . . . . .	(14,997)	(31,579)	(1,038)	1,796
Oceania . . . . .	14,046	25,336	52	(1,196)
Latin America . . . . .	(5,802)	(9,813)	15,218	19,724
North America . . . . .	122,872	196,629	34,249	54,413
World . . . . .	-130,905	-241,958	-50.652	-79,158

<sup>a</sup>Parenthesized values indicate amount by which consumption exceeds supply (implying imports).

SOURCE *Meeting Future Needs for United States Food, Fiber and Forest Products*, Resources For the Future, Washington, DC, 1984.

**Table 2-21.—Projected Shifts In Shares of World Trade in Cereal Grains and Oilseeds, 1978.80 to 2000, Percent of Imports (exports parenthesized)**

Region	Cereal grains		Oilseeds	
	1978-80	2000	1978-80	2000
North Africa-Middle East . .	18	19		7
Sub-Saharan . . . . .	3	12	(4)	2
EEC . . . . .	1	(8)	60	50
Other Western European . .	7	3	10	
U.S.S.R . . . . .	19	12	(0)	(1)
Eastern Europe . . . . .	11	8	14	10
South Asia . . . . .	2	6	(5)	(3)
East Asia . . . . .	23	22	12	21
Asia (planned) . . . . .				(2)
Oceania . . . . .	(11)	(10)	(:)	
Latin America . . . . .			(30)	(25)
North America . . . . .	(94)	(81)	(68)	(69)

SOURCE *Meeting Future Needs for United States Food, Fiber and Forest Products*, Resources For the Future, Washington, DC, 1984.