United States
Department of
Agriculture

Economic
Research
Service

IOS-3

February 1984

Inputs

OUTLOOK & SITUATION

Highlighted in this Issue: FERTILIZER

Contents

Situation Coordinator
Theodore Eichers

Principal Contributors
Paul Andrilenas, Bill Serletis (Fertilizer) (202) 475-4787
Herman Delvo, Michael Hanthorn (Pesticides) (202) 475-3850
Daniel Piper, Carlos Sisco (Farm Machinery) (202) 475-4793
Theodore Eichers (Energy) (202) 475-4792

Natural Resource Economics Division
Economic Research Service
U.S. Department of Agriculture
Washington, D.C. 20250

Approved by the World Agricultural Outlook Board. Summary released January 25, 1984. The next summary of the Inputs Outlook and Situation highlighting farm machinery is scheduled for release April 25. It will appear on several computer networks by 3:30 ET on the day of release. Full text and tables are also released electronically, often several days before the report itself is published.

For information on providers of electronic access to Outlook and Situation reports, write EMS/USDA, Rm. 440 GHI, Washington, D.C. 20250. Telephone (202) 382-9754.

The *Inputs Oulook and Situation* is published 4 times a year. Annual subscription: $8.50 U.S., $10.65 foreign. Order from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Make checks payable to the Superintendent of Documents.

Current subscribers will receive renewal notices from the Government Printing Office approximately 90 days before their subscriptions expire. Notices will be sent ONLY ONCE and should be returned promptly to ensure uninterrupted service.

Summary

Farm demand for fertilizers, pesticides, machinery, and energy is expected to rise significantly this year, primarily because of increases in planted acreage resulting from a scaled-down PIK and other acreage reduction programs and relatively favorable crop prices. Purchased input prices are likely to rise modestly: 6 to 8 percent for fertilizers; 1 percent for pesticides; machinery 5 to 8 percent; and energy 1 to 2 percent. Supplies of most items are expected to be adequate.

Fertilizer use in 1984 will be up substantially after the large drop last year. Total plant nutrient consumption is likely to be 20 percent greater than last year's level and may slightly exceed total 1982 use. Nitrogen consumption for the current crop year is expected to be about 11 million tons, up 20 percent over 1983. Potash use should be up about 22 percent to 5.9 million tons and phosphate use should rise 18 percent to 4.9 million tons.

Phosphate fertilizer exports for 1983/84 are expected to increase about 5 percent, following a 4-percent rise in 1982/83. Nitrogen exports are likely to continue their decline because of rising U.S. production costs compared with those in other producing countries. Potash imports could be up 12 to 14 percent to 5.1 million tons.

Supplies of all fertilizer materials should be adequate, with prices likely to be up 6 to 8 percent. Although excess capacity exists, U.S. phosphate producers have increased output and Canadian potash production has risen. Some U.S. nitrogen plants which had been shut down are also coming back into production.

Worldwide depressed economic activity has dampened fertilizer demand in recent years and only a modest recovery is expected this year. Growth in fertilizer consumption has stagnated in the developed economies and dropped substantially in many developing countries. Growth rates are expected to pick up in the next 4 to 5 years, with the developing countries showing much greater gains, 5 to 7 percent a year, than the developed nations, 2 to 3 percent.

Many of the developing countries that have been relying largely on imports to supply their fertilizer needs are planning to construct their own production facilities for certain types of materials. However, at least for the next 1 to 2 years, some developing countries will lack the resources either to import sufficient fertilizer materials or to construct their own production and mixing facilities.

Farm pesticide use is expected to rise in 1984 in response to increases in field crop acreage. Aggregate use is projected to climb 15 percent or more and reach or slightly exceed 1982 levels. Pesticide prices are expected to remain essentially unchanged and supplies should be ample with large inventory carryovers from last year and excess production capacity in the industry.

Farm machinery sales are likely to increase this year, possibly 10 percent or more, following a steady 4-year decline. Unit sales of many machinery items in 1983 were half the 1979 levels. Improved farm income prospects and pent-up demand are the major reasons for the anticipated sales gains. Machinery price increases are expected to be modest, in the 5 to 8 percent range, compared to increases of 10 percent or more in the late-1970's and early-1980's. Industry sales promotion and discount programs to encourage machinery purchases and reduce burdensome inventories will continue. Financially, 1983 was a difficult year for machinery manufacturers; however, fourth-quarter profits were reportedly improved for some firms.

Petroleum supplies are expected to be adequate for the 1984 crop season, with only modest price changes anticipated. Gasoline prices may drop about 5 cents a gallon, while diesel fuel prices are likely to rise about 3 cents. Prices for natural gas, the raw material used for ammonia nitrogen fertilizer production, have been rising rapidly in recent years. Prices to industrial users are expected to climb about 13 percent in 1984.

FERTILIZER

Demand

Acreage planted to major field crops is likely to increase this year because of less extensive acreage reduction programs following the smallest grain harvest in a decade, thus substantially increasing U.S. fertilizer use in 1983/84.

Field crop acreage is projected to expand 10 to 20 percent from last year's PIK-reduced area, back to levels planted in 1982 (table 1). Corn and cotton acreage is expected to increase 35 to 40 percent. Wheat acreage may increase 5 to 15 percent from 1983 levels, while soybean acres could gain 10 to 15 percent. Rice acreage should rise to 1982 levels. Barley and oats acreages are projected to decrease 20 to 30 percent in 1984.

Table 1.—Actual and projected U.S. planted field crop acreages

Crop	Planted acres 1982	Planted acres 1983	Percentage change 1982-83	Percentage change Projected 1983-84
	Million		*Percent*	
Row crops:				
Corn	81.8	60.2	−26	37 to 43
Soybeans	71.5	63.5	−11	11 to 17
Cotton	11.3	8.0	−29	33 to 43
Grain sorghum	16.1	11.8	−27	36 to 44
Peanuts	1.3	1.4	8	−1 to 1
Tobacco (harvested)	0.9	0.8	−11	2 to 6
Total	182.9	145.7	−20	25 to 31
Small grain crops:				
Rice	3.3	2.2	−33	36 to 50
Wheat	87.4	76.8	−12	5 to 15
Barley and oats	23.9	30.9	29	−30 to −20
Total	114.6	109.9	−4	−4 to 6
Total	297.5	255.6	−14	12 to 20

Sources: (4, 7).

Use

An expected sharp rise in corn acreage will help reverse a 2-year decline in fertilizer use on corn and boost total use. Plant nutrient consumption could be up about 20 percent from the 18.2 million tons used in 1982/83. Anticipated use in 1983/84, at about 22 million tons, could modestly exceed 1981/82 levels.

Projected 1983/84 U.S. nitrogen consumption, at 10.9 to 11.1 million tons, will be up about 20 percent from the 9.2 million tons used in 1982/83 (table 2). Compared with last year, domestic consumption of phosphate fertilizer in 1983/84 is expected to increase around 18 percent to about 4.9 million tons, while potash use will total about 5.9 million tons.

Exports

After a 19-percent decline in 1982/83, nitrogen exports could decrease by more than 20 percent in 1983/84 (table 2). An increase in ammonium phosphate exports would bolster nitrogen exports, but other factors that contributed to reduced nitrogen exports in 1982/83 will continue in 1983/84. The strong U.S. dollar, weakened world economic activity, and higher cost domestic production will reduce U.S. nitrogen exports below the 1982/83 level of 2 million tons.

A slower-than-expected improvement in worldwide economic conditions has hampered phosphate fertilizer exports. Phosphate exports, after a 4-percent increase in 1982/83, could increase another 5 percent in 1983/84, but still remain below the 1980/81 record.

U.S. potash exports, although generally minimal, will probably decline in 1983/84 in the face of growing competition from other world sources.

Table 2.—U.S. supply-use balance for fertilizer, years ending June 30, 1982 to 1984

Item	Nitrogen 1982	Nitrogen 1983	Nitrogen 1984[1]	Phosphate 1982	Phosphate 1983	Phosphate 1984[1]	Potash 1982	Potash 1983	Potash 1984[1]
				Million nutrient tons					
Producers' beginning inventory	1.85	2.07	2.00	.91	.68	.67	.35	.57	.46
Production	14.53	11.32	12.00	8.77	9.45	10.15	2.16	1.81	1.80
Imports	2.57	2.77	3.55	[2].20	[2].13	[2].10	4.91	4.51	5.10
Total available supply	18.95	16.16	17.55	9.88	10.26	10.92	7.42	6.89	7.36
Agricultural consumption	11.00	9.20	11.00	4.81	4.16	4.90	5.63	4.85	5.90
Exports	2.50	2.00	1.55	[2]3.75	[2]3.92	[2]4.15	.61	.62	.40
Total agricultural and export demand	13.50	11.20	12.55	8.56	8.08	9.05	6.24	5.47	6.30
Producers' ending inventory	2.07	2.00	1.60	.68	.67	.70	.57	.46	.45
Available for non-agricultural use	3.38	2.96	3.40	.64	1.51	1.22	.61	.96	.61

[1]Forecast. [2]Does not include phosphate rock.

Sources: (10, 11, 12).

Supplies

Supplies of all fertilizers are expected to be adequate. Reactivation of idle U.S. phosphate and other North American potash production capacity is expected to keep supplies adequate. Supplies to handle increased consumption of nitrogen will come from more domestic production and imports.

Domestic fertilizer production capacity is currently underutilized. Current production rates indicate that about 80 percent of anhydrous ammonia capacity, estimated at over 17 million tons, is being used. Additional idle anhydrous ammonia production capacity could be returned to operation with appropriate economic incentives. Wet-process phosphoric acid facilities capable of producing close to 11 million tons are operating at about 80-to-85 percent of capacity. U.S. potash capacity of about 2.5 million tons and Canadian capacity near 9.8 million tons are being used at an 80 to 85 percent rate.

Production

U.S. nitrogen production could increase about 6 percent, but the picture is not clear because of uncertainties concerning natural gas feedstock prices and longer-term fertilizer prices and production costs (table 2). U.S. nitrogen production for 1983/84 will depend on fertilizer prices, imports, and when and how much idle production capacity is reopened.

The competitive position of the U.S. nitrogen fertilizer industry has eroded as the relative natural gas feedstock costs of domestic producers continue to exceed those of foreign producers. Consequently, nitrogen fertilizer imports have increased, forcing high-cost U.S. producers to close their plants. However, the escalation in domestic natural gas prices has slowed. In addition, certain firms in the nitrogen fertilizer industry have been able to negotiate gas price concessions, thus improving their competitive position.

Industry average natural gas costs to produce a ton of anhydrous ammonia have decreased about 6 percent from mid-1982 highs (1). The declining price of residual fuel oil, the economic downturn, and aggressive energy conservation efforts have changed conditions in the natural gas markets. Higher reserves at the gas field and lower wellhead prices have created opportunities for some firms to obtain less expensive gas on the spot market or directly from producers.

Production facilities are adequate to meet expected phosphate fertilizer needs for both domestic and export demand. With producer inventories and retail and distributor stocks near normal working levels, some idled production capacity could be reactivated.

Potash supplies should be adequate in 1983/84. Idle North American production capacity will be reactivated as demand rebounds. In addition, potash producers, as in previous years, have moved fertilizer materials to regional warehouses, assuring prompt delivery to dealers in the 1984 spring season.

Nitrogen fertilizer production dropped sharply in 1982/83 in response to reduced domestic and export demand (table 3). Demand prospects early in the year indicated that nitrogen fertilizer consumption would drop below year-earlier levels. High participation in acreage reduction programs, including the PIK program, exacerbated the situation and further reduced demand. Production was lowered to match depressed demand. Anhydrous ammonia production decreased about 22 percent, to 13.8 million tons. Urea and solid ammonium nitrate production levels also were down about 20 percent, while nitrogen solution production dropped 17 percent.

Table 3.—Production of fertilizer nutrients, years ending June 30, 1982 and 1983

Material	1982	1983[1]	Change
	1,000 tons		*Percent*
Nitrogenous fertilizers:[2]			
Anhydrous ammonia	17,685	13,811	−22
Ammonium nitrate, solid	3,193	2,616	−18
Urea[3]	7,166	5,600	−22
Nitrogen solutions	925	2,434	−17
Phosphate fertilizers:[4]			
Normal and enriched superphosphate	185	56	−70
Triple superphosphate	1,263	1,164	−8
Diammonium phosphate	3,462	4,151	+20
Other ammonium phosphates	841	971	+15
Total selected phosphatic fertilizers	5,751	6,342	+10
Wet-process phosphoric acid[5]	7,841	8,615	+10
Muriate of potash:[6]			
United States	2,164	1,807	−16
Canada	6,661	5,929	−11

[1]Preliminary. [2]Nitrogen solutions in 1,000 tons of N. Other nitrogen products in 1,000 tons of material. [3]Includes material for nonfertilizer use. [4]Reported in 1,000 tons P_2O_5. [5]Includes merchant acid. [6]Reported in 1,000 tons of K_2O

Source: (2, 12).

In response to a buildup in depleted stocks in the distribution system and increased exports, total output of selected processed phosphate fertilizers in 1982/83 was up 10 percent, after a 30-percent year-earlier decline. Diammonium phosphate production increased about 20 percent and output of other ammonium phosphates rose 15 percent. Wet-process phosphoric acid production, at 8.6 million nutrient tons, was up 10 percent after a 24-percent decline in 1981/82.

U.S. potash production, 1.8 million nutrient tons in 1982/83, was down more than 16 percent from a year earlier and Canadian production declined 11 percent. High producer inventories and reduced ~~use required~~ the sharp drop in output.

Imports

Potential shortfalls in nitrogen supplies, caused by delays in reopening U.S. production facilities, will be avoided by increased imports. Nitrogen imports in 1983/84 could be up over 25 percent from the 2.8 million tons imported in 1982/83 (table 2). Potash imports could increase to over 5 million tons of K_2O, as domestic consumption increases. Because imports are a very small share of the market, a decline in phosphate imports will have little impact on fertilizer supplies.

Inventories

Although U.S. fertilizer use dropped substantially in 1982/83, fertilizer producers kept phosphate and nitrogen inventories at desirable levels. Production of nitrogen materials was reduced in line with lower demand and increased imports to achieve inventory management goals. Producers increased phosphate output to satisfy increased export demand and to replenish depleted stocks in the distribution system. Also, U.S. potash producers reduced inventories from high year-earlier levels by cutting output.

Farm Prices

After holding steady or declining for 2 years, spring 1984 fertilizer prices are expected to exceed spring 1983 levels, with nitrogen prices advancing the most. Spring 1984 average farm prices for fertilizer could be up 6 to 8 percent from a year earlier. Nitrogen prices could be up 9 to 11 percent, phosphate up about 6 to 8 percent, and potash drawing even with spring 1983 prices.

In recent years, low nitrogen fertilizer prices and increasing production costs have eliminated industry profits for many producers. In 1983/84, nitrogen producers were not expected to increase output without the incentive of higher prices. Phosphate and potash price increases will be dampened by the availability of idle production capacity to meet the expected surge in demand. Potash price increases could be affected by recent selective reductions in potash shipping charges, if they are passed through to farmers.

Lower demand in 1982/83 reduced fertilizer prices. The sharp drop in fertilizer use prevented spring 1983 price recovery from the usual autumn decline. Spring 1983 prices for triple superphosphate, diammonium phosphate, and muriate of potash were actually below October 1982 prices (table 4). Compared with a year earlier, May 1983 anhydrous ammonia prices were down 7 percent. Muriate of potash prices were down the most, 8 percent.

December 1983 prices for many fertilizer materials were up from October. Anhydrous ammonia, diammonium phosphate, and triple superphosphate prices were up about 3 percent. Ammonium nitrate and potash prices were up over 1 percent, while urea prices were unchanged.

December farm prices followed earlier increases at wholesale. Gulf f.o.b. anhydrous ammonia prices began to increase in September 1983 and wholesale urea prices began to rise a month later. Anhydrous ammonia prices increased from about $120 per ton in September 1983 to about $180 in December, while urea prices increased from $125 to $140. Also, Florida wholesale prices of triple superphosphate and diammonium phosphate turned up in September 1983.

Fertilizer Trade

The volume of fertilizer imported in 1982/83 was down less than 2 percent, with value down 8 percent (table 5). About 11.4 million metric tons of material were imported, with a value of $1.3 billion. The volume of fertilizer materials exported was almost the same as a year earlier, while the value declined about 10 percent (table 6). About 21.6 million metric tons of fertilizer materials valued at $2.2 billion were exported by U.S. producers in 1983.

Nitrogen

According to U.S. Department of Commerce trade statistics, imports of all nitrogen products in 1982/83 were up primarily because of a 72-percent increase in urea imports (table 5). Although anhydrous ammonia imports were down more than 4 percent, urea and anhydrous ammonia, together, accounted for 95 percent of the 1982/83 nitrogen plant nutrients imported, up from 90 percent in 1981/82. Ammonia comprised 66 percent of nitrogen nutrients imported and urea 29 percent. Canada provided about 30 percent of U.S. anhydrous ammonia imports, Mexico 25 percent, and the Soviet Union and Trinidad added 22 and 18 percent, respectively.

Canada remained the largest urea supplier, providing 654,000 metric tons, or 44 percent of these imports. The Netherlands was the second-ranking urea supplier with 20 percent, while the Soviet Union provided 15 percent.

Diammonium phosphate, urea, and anhydrous ammonia accounted for 87 percent of the nitrogen exports, with shares of 40, 30, and 17 percent, respectively. The largest urea exports went to Asian countries: People's Republic of China, Phillipines, Indonesia, and Singapore. Canada and Brazil also purchased large tonnages of urea from the United States.

Table 4.—Average U.S. farm prices paid for selected fertilizer materials

Year		Anhydrous ammonia (82%)	Superphosphate (44-46%)	Diammonium phosphate (18-46-0%)	Potash (60%)	Mixed fertilizer (6-24-24%)
				Dollars per ton		
1980	May	234	251	298	135	213
1981	May	247	249	283	155	226
1982	May	255	228	262	155	219
	October	236	216	251	146	211
	December	230	212	248	143	207
1983	May	237	214	249	143	206
	October	226	205	238	128	196
	December	232	210	245	131	198

Source (5)

Substantial changes in nitrogen exports and imports early in the 1983/84 fertilizer year reflected economic conditions in the world. In terms of plant nutrients, nitrogen exports in the July-November 1983 period were down 19 percent from a year earlier. Anhydrous ammonia exports, at 134,000 metric tons, were down 43 percent, while urea exports, at 342,000 metric tons, were down about 36 percent (table 6). In contrast, nitrogen imports were up about 36 percent. Anhydrous ammonia imports were up about 38 percent to about 1.2 million metric tons. Urea imports were up 37 percent to 521,000 metric tons.

Phosphate

Exports of normal and triple superphosphates, ammonium phosphates, and phosphate rock in 1982/83 were all up from a year earlier. At 4.1 million metric tons, diammonium phosphates accounted for 55 percent of U.S. exports of upgraded phosphate materials. Although phosphoric acid exports decreased, they still accounted for about 25 percent of all P_2O_5 exports.

Japan, Pakistan, and Belgium-Luxemburg were the largest purchasers of U.S. diammonium phosphate. Belgium-Luxemburg and Italy were the major European customers, while the People's Republic of China was the largest Asian customer. The Soviet Union remains the largest purchaser of U.S. phosphoric acid.

The turnaround in phosphate exports stalled as shipments of P_2O_5 in the July-November 1983 period declined about 1 percent from the year-earlier 5-month period. Total phosphoric acid exports were down 11 percent, while exports of concentrated superphosphate declined about 18 percent. Diammonium phosphate exports were up 4 percent.

Potash

Imports of potash (K_2O) declined 8 percent in 1982/83 (table 5). Although down from 7.2 million metric tons in 1981/82 to 6.6 million tons of material in 1982/83, potassium chloride remained the largest potash import item. Canada provided about 89 percent of potassium chloride imports. Israel was the only other significant supplier, providing 7 percent of imports.

U.S. exports of potash in 1982/83 were close to year-earlier levels (table 6). About 1 million tons of potassium chloride and other potassic fertilizers were shipped in 1982/83. In the July-November 1983 period, potassium chloride imports were up about 14 percent, reflecting the expected rebound in domestic fertilizer use. Exports of potash continued to decline.

Table 5.—U.S. imports of selected fertilizer materials, years ending June 30, 1981 to 1984

Material	1981	1982	1983[1]	1984[2]
		Thousand metric tons		
Nitrogen:				
Anhydrous ammonia	1,960	2,035	1,945	1,196
Urea	845	864	1,484	521
Ammonium nitrate	224	256	242	138
Ammonium sulfate	257	294	278	68
Sodium nitrate	129	128	106	22
Calcium nitrate	113	126	127	47
Nitrogen solutions	127	143	113	75
Other	113	60	73	37
Total	3,768	3,906	4,368	2,104
Phosphate:				
Ammonium phosphates	337	261	194	60
Crude phosphates	247	17	34	3
Phosphoric acid	38	36	5	*
Normal and triple superphosphate	47	24	13	4
Other	28	10	7	2
Total	697	348	253	69
Potash:				
Potassium chloride	8,285	7,240	6,643	2,985
Potassium sulfate	31	28	28	*
Potassium nitrate[3]	66	48	48	16
Total	8,382	7,316	6,719	3,001
Mixed fertilizers	136	132	110	26
Total	12,983	11,702	11,450	5,200
		Billion dollars		
Total value[4]	1.3	1.4	1.3	.54

* = Less than 1,000 metric tons.

[1]Preliminary. [2]Data for July-November 1983. [3]Includes potassium sodium nitrate. [4]Value by fertilizer material in appendix table 1.

Source: (11).

Fertilizer Use Estimates

In the year ending June 30, 1983, about 42.3 million tons of fertilizer materials were used in the United States and Puerto Rico (table 7). This represented a 13-percent decrease from the 48.7 million tons consumed in 1981/82. In terms of primary nutrients, total use was down 15 percent to 18.2 million tons. Nitrogen fell 16 percent to 9.2 million tons, while phosphate and potash each dropped 14 percent to 4.2 and 4.9 million tons, respectively.

Fertilizer use declined in all regions of the country in 1982/83. It fell the most in the Lake States and Corn Belt—the result of the sharp drop in corn acres (table 8). Consumption of each plant nutrient—nitrogen, phosphate, and potash—followed total use patterns (table 9). Nitrogen and phosphate use declined most in the corn growing regions. Proportionately, potash use was down the most in the Northern Plains, but the quantity used fell more in the Corn Belt and Lake State regions.

The proportion of fertilizers applied as mixtures increased slightly to 44 percent of total use in 1982/83, while the proportion applied as direct applications decreased to 56 percent (table 10). These proportions were close to those attained in earlier years.

Table 6.—U.S. exports of selected fertilizer materials, years ending June 30, 1981 to 1984

Material	1981	1982	1983[1]	1984[2]
		Thousand metric tons		
Nitrogen:				
Anhydrous ammonia	740	688	386	134
Urea	1,817	1,591	1,195	342
Ammonium nitrate	70	66	28	25
Ammonium sulfate	725	527	599	310
Sodium nitrate	13	22	17	7
Nitrogen solutions	568	214	110	12
Other[3]	134	143	113	11
Total	4,067	3,251	2,448	841
Phosphate:				
Phosphate rock	12,851	10,007	10,807	5,081
Normal superphosphate	27	17	56	24
Triple superphosphate	1,609	1,216	1,293	479
Diammonium phosphate	4,815	3,783	4,134	1,804
Other ammonium phosphate	526	265	283	166
Phosphoric acid	1,347	1,462	1,381	520
Other	17	16	8	2
Total	21,192	16,766	17,962	8,076
Potash:				
Potassium chloride	950	640	656	148
Other potassic fertilizer	384	349	362	157
Total	1,334	989	1,018	305
Mixed fertilizers	341	287	170	70
Total	26,934	21,293	21,598	9,292
		Billion dollars		
Total value[4]	3.2	2.5	2.2	.86

[1]Preliminary. [2]Data for July-November 1983. [3]Includes acqua ammonia. [4]Value by fertilizer material in appendix table 2.

Source: (10).

Table 7.—U.S. fertilizer consumption, 1974 to 1983[1]

Year ending June 30	Total fertilizer materials	Primary nutrient use: N	P_2O_5	K_2O	Total[2]	Change from 1977
		Million tons				*Percent*
1974	47.1	9.2	5.1	5.1	19.3	87
1975	42.5	8.6	4.5	4.5	17.6	80
1976	49.2	10.4	5.3	5.2	20.9	95
1977	51.6	10.7	5.6	5.8	22.1	100
1978	47.5	10.0	5.1	5.5	20.6	93
1979	51.5	10.7	5.6	6.3	22.6	102
1980	52.8	11.4	5.4	6.3	23.1	105
1981	54.0	11.9	5.5	6.3	23.7	107
1982	48.7	11.0	4.8	5.6	21.4	97
1983	42.3	9.2	4.2	4.9	18.2	82

[1]Includes Puerto Rico. Detailed State data shown in appendix table 3. [3]Totals may not add due to rounding.

Source: (6).

The five leading States in order of total consumption and decrease in volume consumed from a year earlier were: Illinois, down 23 percent; California, 8 percent; Iowa, 26 percent; Texas, 2 percent; and Indiana, 15 percent.

Fertilizer application rates have leveled off in recent years. Although somewhat higher use rates were expected in 1982/83 because of the PIK program, application rates generally remained flat and in some cases even declined. Changes in fertilizer application rates were mixed in 1983. Substantial reductions in acres planted allowed farmers to concentrate available funds for purchased inputs on fewer acres. However, soil moisture conditions in certain areas may have affected fertilizer application rates. Also, 1982/83 fertilizer application rates do not accurately reflect total use on abandoned acres, especially wheat areas. Since application rates reflect harvested acres, these estimates will not show fertilizer use on abandoned acres. Fertilizer application rates on soybeans and wheat increased modestly in 1983 after year-earlier declines (table 11). Use per acre on these crops increased for all three plant nutrients—nitrogen, phosphate, and potash. Nitrogen application rates on corn increased, but phosphate and potash rates declined slightly. All cotton fertilizer application rates declined.

Table 8.—Regional fertilizer consumption, years ending June 30, 1982 and 1983

Region	1982[1]	1983[1]	Change
	Thousand tons		*Percent*
Northeast	844	776	−8
Lake States	2,686	2,114	−21
Corn Belt	7,402	5,933	−20
Northern Plains	2,305	1,932	−16
Appalachia	1,719	1,507	−12
Southeast	1,699	1,546	−9
Delta States	936	864	−8
Southern Plains	1,419	1,359	−4
Mountain	985	888	−10
Pacific[2]	1,410	1,265	−10
U.S. total[3]	21,403	18,185	−15

[1]Totals may not add due to rounding. [2]Includes Alaska and Hawaii. [3]Excludes Puerto Rico. Detailed State data shown in appendix table 3.

Source: (6).

Table 9.—Regional plant nutrient use, years ending June 30, 1982 and 1983

Region	1982[1]	1983[1]	Change
	Thousand tons N		*Percent*
Nitrogen:			
Northeast	321	289	−10
Lake States	1,074	803	−25
Corn Belt	3,358	2,614	−22
Northern Plains	1,669	1,398	−16
Appalachia	679	573	−16
Southeast	724	644	−11
Delta States	530	464	−12
Southern Plains	960	902	−6
Mountain	683	626	−8
Pacific[2]	976	872	−11
U.S. total[3]	10,974	9,185	−16
	Thousand tons P_2O_5		*Percent*
Phosphate:			
Northeast	240	226	−6
Lake States	625	491	−21
Corn Belt	1,605	1,330	−17
Northern Plains	503	428	−15
Appalachia	437	391	−11
Southeast	342	311	−9
Delta States	177	171	−3
Southern Plains	329	320	−3
Mountain	266	231	−13
Pacific[2]	286	261	−9
U.S. total[3]	4,810	4,160	−14
	Thousand tons K_2O		*Percent*
Potash:			
Northeast	283	262	−7
Lake States	987	821	−17
Corn Belt	2,439	1,989	−18
Northern Plains	134	107	−20
Appalachia	603	544	−10
Southeast	633	591	−7
Delta States	229	228	0
Southern Plains	130	138	+6
Mountain	37	30	−19
Pacific[2]	148	132	−11
U.S. total[3]	5,623	4,842	−14

[1]Totals may not add due to rounding. [2]Includes Alaska and Hawaii. [3]Excludes Puerto Rico. Detailed State data shown in appendix table 3.

Source: (6).

Table 10.—Average annual U.S. fertilizer use by application, 1974 to 1983[1]

Year ending June 30	All fertilizer	Mixtures[2] Quantity	Mixtures[2] Share of total	Materials[3] Quantity	Materials[3] Share of total
		Million tons	*Percent*	*Million tons*	*Percent*
1974	47.1	24.1	51	23.0	49
1975	42.5	20.7	49	21.8	51
1976	49.2	23.0	47	26.2	53
1977	51.6	24.1	47	27.5	53
1978	47.5	22.1	47	25.4	53
1979	51.5	23.7	46	27.7	54
1980	52.8	23.3	44	29.5	56
1981	54.0	23.5	44	30.5	56
1982	48.7	20.9	43	27.8	57
1983	42.3	18.8	44	23.5	56

[1]Includes Puerto Rico. [2]Materials that contain more than one primary nutrient. [3]Fertilizer materials that contain one primary nutrient.

Source: (6).

Corn For Grain

Of the corn fields surveyed in 1983, 96 percent of the harvested acreage received some fertilizer, a 1-percent drop from a year earlier. The proportion of corn acres receiving nitrogen and potash declined slightly, while acres fertilized with phosphate remained at year-earlier levels. In 1983, the nitrogen application rate was 137 pounds an acre, up about 2 percent and equal to 1981's record. Phosphate and potash application rates were down over 1 percent, at 64 and 85 pounds per acre, respectively.

Cotton

About 68 percent of the harvested cotton acreage received some fertilizer, down from 71 percent in 1982. Compared with 1982, the proportion of cotton acreage fertilized with nitrogen decreased from 71 to 68 percent. The proportion fertilized with phosphate increased from 41 to 44 percent, while the proportion fertilized with potash remained the same. The pounds of each of the three plant nutrients applied per acre averaged below year-earlier quantities. Nitrogen rates averaged 81 pounds per acre and phosphate 45 pounds. Potash use declined the most, to 52 pounds an acre.

Soybeans For Beans

The proportion of harvested soybean acreage receiving fertilizer increased to 33 percent—after a 3-year decline. The proportion of acreage receiving nitrogen increased to 20 percent, phosphate to 30 percent, and potash to 32 percent. Nitrogen use increased to 18 pounds an acre, while phosphate and potash each increased 2 pounds, to 45 pounds and 70 pounds, respectively.

All Wheat

Wheat fertilizer application rates rose to record levels in 1983. Seventy-three percent of the 1983 harvested wheat acreage was fertilized. Nitrogen was applied on 72 percent of the acres, phosphate on 48 percent, and potash 20 percent. Nitrogen applications were up 1 pound to 60 pounds an acre. Phosphate use was up 2 pounds to 39 pounds an acre, while the average potash rate increased the most, to 48 pounds.

World Fertilizer Review and Prospects

Production

A drop in fertilizer use in 1981/82 and 1982/83 resulted in excess production capacity for all three nutrients. A 1-percent drop in nitrogen production was not enough to offset the stagnation in consumption of nitrogen fertilizers (table 12). World phosphate production dropped over 7 percent, yet this was not sufficient to offset reduced demand, especially in North America and Latin America. World potash production was down over 6 percent and, like nitrogen and phosphate, failed to match the drop in use.

Table 11.—Fertilizer use on U.S. harvested acres of corn for grain, cotton, soybeans, and all wheat, 1979 to 1983[1]

Crop and year	Total harvested acreage	Harvested acres receiving				Application rates		
		Any fertilizer	N	P_2O_5	K_2O	N	P_2O_5	K_2O
	Million acres	*Percent*				*Pounds*		
Corn:								
1979	72.4	96	96	89	82	135	69	84
1980	73.0	96	96	87	81	130	66	86
1981	74.6	97	97	90	84	137	67	86
1982	73.2	97	97	88	84	135	65	86
1983	51.2	96	96	88	83	137	64	85
Cotton:								
1979	12.8	71	71	48	27	71	50	44
1980	13.2	71	71	48	30	72	46	46
1981	13.8	75	75	52	30	72	46	46
1982	9.7	71	71	41	30	82	46	55
1983	7.1	68	68	44	30	81	45	52
Soybeans:								
1979	70.6	40	26	38	39	16	46	67
1980	67.9	37	23	35	36	17	46	70
1981	66.4	36	21	33	35	18	46	76
1982	69.8	30	17	27	29	17	43	68
1983	61.4	33	20	30	32	18	45	70
All wheat:								
1979	62.5	66	65	44	18	54	38	43
1980	71.0	67	67	43	18	58	39	40
1981	81.0	70	70	47	20	58	39	47
1982	78.8	70	70	45	18	59	37	41
1983	61.0	73	72	48	20	60	39	48

[1]Detail for States by crop are found in appendix tables 4 to 7.

Sources: (8, 9).

Table 12.—World fertilizer production and consumption, years ending June 30, 1981 and 1982

Plant nutrient	1981	1982	Change
	Million metric tons		*Percent*
Production			
Nitrogen	62.6	62.0	−1.0
Phosphate	34.5	31.9	−7.5
Potash	27.5	25.7	−6.5
Total	124.6	119.6	−4.0
Consumption			
Nitrogen	60.6	60.4	−.3
Phosphate	31.5	30.9	−1.9
Potash	24.3	23.9	−1.6
Total	116.4	115.2	−1.0

Source (3)

Increased nitrogen production in countries with access to abundant supplies of natural gas offset production declines in North America and Western Europe which exceeded 8 percent. Latin American nitrogen production increased about 9 percent in 1981/82 due mainly to increased Mexican output, while Eastern European production increased less than 4 percent.

Many countries are currently expanding nitrogen production capacity to develop self-sufficiency. Additions to production capacity in India and Indonesia in 1981/82 added about 25 percent to nitrogen output in the Far East. Despite production bottlenecks, Eastern Europe increased over 3 percent. Meanwhile, Chinese production remained at year-earlier levels.

In 1981/82, worldwide production of phosphate fertilizers declined more sharply than output of the other two nutrients. The North American countries, which accounted for 9 percent of the drop, reduced production by 24 percent. Compared to North America, the decline in phosphate production in Western Europe was much less because of the smaller drop in consumption within its own market.

Production in Eastern Europe and the Soviet Union, which accounts for about 23 percent of world production, increased over 4 percent in 1981/82. During 1981/82, increased production in Eastern Europe, a net importing region, permitted a reduced level of imports. This decline contributed to surplus supplies in other parts of the world.

World potash production also declined in 1981/82. A 6-percent decline in the developed countries more than offset a 7-percent increase in Eastern Europe.

Between 1982/83 and 1987/88, world nitrogen production is projected to increase over 21 percent (table 13). Although no additional urea and ammonia capacity is expected for Western Europe and the United States because of their high gas costs, nitrogen production capacity should increase in many underdeveloped countries with large gas supplies. These countries include those desiring to export, such as Mexico and Trinidad-Tobago, as well as those desiring self-sufficiency, such as India and Indonesia. In addition, Eastern Europe, mainly the Soviet Union with abundant supplies of natural gas, is planning to increase production by 18 percent. After recovering from disruptions in world nitrogen fertilizer

Table 13.—Projected world fertilizer supply and demand changes, 1983 to 1988[1]

World regions	Nitrogen	Phosphate	Potash
	Percent increase		
Supply			
Developed market economies	15.2	2.3	21.9
Developing market economies	50.6	51.3	38.6
Eastern Europe and Soviet Union	18.4	17.9	21.6
Centrally planned countries of Asia	9.4	20.7	48.6
Total	21.4	15.1	24.8
Demand			
Developed market economies	3.6	22.5	21.9
Developing market economies	35.3	43.2	38.6
Eastern Europe and Soviet Union	21.3	13.2	21.6
Centrally planned countries of Asia	11.5	19.5	48.6
Total	20.9	23.6	24.8

[1]Additional detail in appendix tables 8, 9, and 10.

Source (3)

markets and despite increased production, a smaller surplus of nitrogen to supply world needs, nevertheless, is projected in 1987/88 than in 1983/84 (appendix table 8). Low levels of plant capacity utilization—India averages 70 percent, while Eastern Europe averages 65 percent—in countries expanding production should curtail the expansion of world nitrogen surpluses.

Both the non-Communist developing countries and Eastern Europe will increase their shares of world nitrogen production at the expense of the developed countries (table 14). The shift of nitrogen production from the United States, Western Europe, and Japan to Mexico, the Soviet Union, and other energy-rich countries will decrease the share produced in the developed countries. The share held by the centrally planned countries of Asia, namely China, are also expected to decline.

Between 1982/83 and 1987/88, phosphate production should increase about 15 percent, well below the increase in the nitrogen sector (appendix table 9). The developed market economies are projected to increase phosphate production by about 2 percent, but the developing market economies are expected to increase production over 50 percent. Largest gains are expected in Africa and the Far East.

The developing countries are projected to produce a greater proportion of world phosphate fertilizer (table 14). The increases in North Africa and Middle East nations will come at the expense of the Eastern European region. In the developed countries, the shares of North America and Oceania will increase, but Western Europe's share of phosphate supplies will decline.

Unlike nitrogen, the developing countries lack the raw materials for becoming self-sufficient in potash production. Between 1982/83 and 1987/88, potash production should increase gradually (appendix table 10). Production from 1982/83 to 1987/88 is projected to increase by only 15 percent, well below the increase expected for nitrogen. Increases in production will take place in the Soviet Union, Canada, Israel, and Jordan. In Canada, new potash mines are slated to open in Saskatchewan and New Brunswick. Eastern Europe, including the Soviet Union, is attempting to increase the utilization rates of its production capacity. Israel and Jordan are producing potash in the Dead Sea area.

North America, primarily because of increased Canadian production, is expected to supply a greater proportion of world potash. Although the Soviet Union is the world's largest producer, its share of potash supplies is expected to decline as production increases faster in other areas.

Consumption

Worldwide consumption of fertilizers declined 1 percent between 1981 and 1982 (table 12). Phosphate consumption declined about 2 percent, while potash dropped less than 2 percent. Cutbacks in fertilizer use affected nitrogen the least, leaving 1981/82 consumption close to year-earlier levels.

In North America, the decline in nitrogen fertilizer use reflects a decrease in the U.S. because of depressed economic conditions in agriculture. Nitrogen fertilizer use in China and Brazil declined as these countries restricted nitrogen imports to conserve foreign exchange. Asia, with the exception of China, continued to increase nitrogen fertilizer use to increase crop yields. Also, the centrally planned countries of Eastern Europe, with abundant supplies of nitrogen fertilizer from their production facilities, increased consumption.

In 1981/82, the developed market economies, which consume a large part of world phosphate, experienced the largest decrease in use. Phosphate use dropped over 11 percent as farmers reduced planted acres or fertilizer application rates. In the developing countries, Latin American use dropped when Brazil placed stiff tarriffs on phosphate imports. Asian farmers, who apply low levels of phosphate fertilizers per hectare, continued to increase total consumption, as did farmers in centrally planned countries of Eastern Europe.

Unfortunately, the decline in world phosphate consumption coincided with a major expansion in capacity in North America and North Africa, resulting in an excess supply and idle production capacity.

In 1981/82, world potash consumption declined but by less than phosphate use. The drop was largely attributed to the decline in North American use which accounted for a large proportion of world consumption (table 14).

World fertilizer demand is showing signs of recovering, particularly in the United States where planted acres are expected to increase following the poor harvest in 1983. However, in the near-term worldwide recovery is expect-

Table 14.—Projected regional shares of world fertilizer supply capabilities and demand, 1983 and 1988[1]

World regions	Nitrogen		Phosphates		Potash	
	1983	1988	1983	1988	1983	1988
	Percent change					
Supply:						
Developed market economies-	39.7	32.3	46.5	47.6	53.4	55.6
North America	19.8	16.6	24.8	26.5	30.0	34.9
Western Europe	17.1	13.9	16.8	13.4	19.9	17.0
Oceania	0.3	0.4	1.3	3.4	0.0	0.0
Other countries	2.5	1.4	3.6	4.3	3.5	3.6
Developing market economies-	15.8	21.9	15.4	20.8	0.1	2.3
Africa	0.4	0.6	2.6	7.8	0.0	0.0
Latin America	3.0	5.6	4.9	4.8	0.1	0.0
Asia	12.4	15.8	7.9	8.2	0.0	1.8
Eastern Europe and Soviet Union	27.2	29.5	29.3	23.3	46.4	42.0
Centrally planned countries of Asia	17.3	16.3	8.8	8.4	0.0	0.0
Demand:						
Developed market economies-	36.8	33.0	41.2	38.6	48.6	45.5
North America	18.2	16.3	16.2	15.6	22.7	22.2
Western Europe	16.1	14.6	17.2	16.1	21.9	19.4
Oceania	0.4	0.4	3.7	3.4	1.1	1.0
Other countries	2.0	1.8	4.1	3.6	3.0	3.0
Developing market economies-	21.1	24.8	19.8	23.5	12.7	14.9
Africa	1.1	1.3	1.8	1.9	1.1	1.3
Latin America	4.7	5.4	7.1	8.1	5.5	7.1
Asia	15.3	18.1	10.9	13.6	6.0	6.5
Eastern Europe and Soviet Union	21.7	22.7	29.0	27.6	35.4	36.1
Centrally planned countries of Asia	20.4	19.5	10.0	10.3	3.3	3.5

[1]Additional detail in appendix tables 8, 9, and 10.

Source: (3).

ed to be slow as developing countries continue to have problems with their balance of payments. Debt problems will limit their ability to purchase needed fertilizers, at least, in the next 1 or 2 years.

Between 1982/83 and 1987/88, world nitrogen consumption is projected to increase about 21 percent (table 13). This growth, however, could fall short of the high growth rates in the 1970's. Asian countries, especially India and China, will be pressured to increase agricultural production through more fertilizer use and increased crop yields. Nitrogen fertilizer consumption growth rates in Asia should be greater than those in Latin America. The increase in application rates per hectare in Asian countries will add more to world fertilizer use than an expansion in crop acres in Latin America, where extensive land resources are available for increasing production. Nitrogen fertilizer consumption in Eastern Europe should continue its past pace.

By the period ending with 1987/83, phosphate consumption is projected to increase about 24 percent (table 13); however, excess production capacity will keep the world market oversupplied.

In the 1982/83 to 1987/88 period, potash consumption is expected to increase about 25 percent (table 13). The return of U.S. acreage to production should greatly stimulate potash use in the early years of the forecast period. Potash use in Latin America, especially in Brazil, is expected to increase to overcome severe soil deficiencies of the nutrient. In Asia, where very little potash is applied, use is expected to increase. Eastern Europe, with tremendous supply capability, will probably use more potash.

Because fertilizer consumption growth rates are expected to be larger in the developing countries, they will increase their share of total world fertilizer use (table 14). Asia will increase its share of total world nitrogen consumption. The share of world nitrogen consumption held by centrally planned Asian countries is expected to remain virtually unchanged. Eastern Europe's share, including that of the Soviet Union, will increase slightly.

Eastern Europe should consume a slightly smaller share of the world's phosphate fertilizer. Increased use by non-Communist Asian countries will increase their share, while the centrally planned countries of Asia will maintain the same share.

The share of world potash consumed by developing countries will increase because of the substantial increase in use expected in Latin America. The slow growth in potash use in Western Europe will contribute to the declining share by developed countries. The share held by Eastern Europe is forecast to increase slightly, while the share held by centrally planned Asian countries will remain about the same.

World Fertilizer Trade

The Soviet Union, which exports almost three times as much anhydrous ammonia as Mexico, the next largest exporter, will continue to be a major seller. The Middle East and Mexico are increasing production capacity and anhydrous ammonia exports. Canada, another major exporter because of its freight advantage, will supply the northern farm areas of the United States with anhydrous ammonia. Western Europe and the United States, with their large output of diammonium phosphate, ammonium nitrates, and urea-ammonium nitrate solutions and with their relatively high gas costs, will continue to be major anhydrous ammonia importers.

Urea is expected to be the most widely traded fertilizer product. Western Europe, Japan, and North America, because of relatively higher production costs, will lose a part of their export market. Eastern Europe is expected to be the major supplier filling this void. For example, Brazil is currently importing much of its urea from Eastern Europe instead of the United States. Meanwhile, urea exports from Eastern Europe and the Middle East are penetrating the Chinese market, once dominated by Japan. High raw material costs are forcing Japan to be a net importer of nitrogen fertilizers.

On a per nutrient basis, phosphoric acid is cheaper to transport than phosphate rock. As a result, Morrocco and Tunisia, the second and third leading rock exporters, are planning additional phosphoric acid production capacity near their mines. This vertical integration has enabled trade in processed phosphates to increase more rapidly than that of rock. For example, in 1965 only 15 percent of phosphate trade was in processed phosphates, by 1980 it had doubled to 30 percent and could reach 50 percent by the early 1990's.

In the world potash market, Canada and Eastern Europe are the leading exporters. However, reduced exports to Asia and Brazil have forced Canada to look for alternative markets. Eastern Europe has traditionally dominated the Western European potash market, but because of lower freight rates, Canada is beginning to make sales in Western Europe.

World Fertilizer Prices

The world fertilizer market reflects depressed economic conditions. Prices declined dramatically in the last half of 1982 and early 1983. In the United States, anhydrous ammonia and urea prices began to recover in the third quarter of 1983 in anticipation of expected improvements in the U.S. fertilizer market. But prices for these products continued to decline in Western Europe. Increased urea production from Eastern Europe, which has a strong need for hard currency, and the Middle East generally dampened world prices.

Phosphoric acid prices have declined because of restrictive tariffs imposed by Brazil on phosphate fertilizer and reduced demand for ammonium phosphates and triple superphosphate in other world markets. The slack demand for phosphoric acid and upgraded phosphate fertilizers has also depressed phosphate rock prices. A rebound in phosphoric acid production and prices from recent lows will depend upon a turnaround in the demand for phosphate products.

In September 1983, the average world price of triple superphosphate was at its lowest level because reduced imports by Brazil and Indonesia created a surplus. Diammonium phosphate, because of its high nitrogen content, has recently been traded more heavily than triple superphosphate. After a temporary price rebound during the first quarter of 1983, the strong U.S. dollar dampened U.S. diammonium phosphate export sales and prices slipped.

World potash prices declined dramatically during the second and third quarters of 1982. Since then they have remained level, as reduced production kept the market balanced despite less consumption in the developed countries and Brazil. There are encouraging signs that increased potash use will raise prices. China, striving for more optimal nutrient use to increase yields, is shifting imports from nitrogen to phosphate and potash. India, while reducing its imports of nitrogen and phosphate because of its greater self-sufficiency in those nutrients, is increasing potash imports.

Trends In Fertilizer Use

In addition to a general increase in the amount of fertilizer applied per unit of cropland, several other trends are developing that could impact on future fertilizer use. Developing countries, trying to improve crop yields, are using more phosphate and potash nutrients relative to nitrogen. The Indian government is encouraging the use of more irrigation and high yielding wheat and rice varieties, consequently, the crop needs for all three plant nutrients will be greater. China has supplied much of its phosphate and potash needs by applying organic fertilizers. However, the rapidly growing demand for food and steady depletion of phosphate and potash in the soil has compelled China to utilize more inorganic phosphate and potash fertilizers.

Use of solid bulk blends is expected to increase because they can be manufactured locally, reducing distribution costs and minimizing some of the bottlenecks of moving fertilizer to farmers. In addition, specialized mutiple nutrient blends can cater to specific crop needs, soil, and climatic conditions.

Bulk blending will probably shift use away from triple superphosphate to other sources of phosphate. Because urea is incompatible with normal and triple superphosphate when bulk blended with them, other compatible phosphate sources, such as, diammonium phosphate will be used. As the use of bulk blends increases, the demand for diammonium phosphate should also increase.

Large phosphate importers, such as China and Brazil, are reducing their dependence on foreign sources by developing their indigenous reserves of low-grade phosphate rock. By degrading more slowly than the more soluble triple superphosphate, finely ground phosphate rock directly applied, supplies reserve phosphate nutrients years after application. However, the development of these reserves may be limited by the availability and expense of sulfur used in acidifying low-grade phosphate rock.

Government Policy

Governments of many developing countries are encouraging more fertilizer use per hectare by subsidizing production and farmer purchases. India, the Philippines, Indonesia, and Mexico are among the most active. For example, the Indian government compensates producers amounting to the difference between the market selling price and the lower price paid by farmers. The Philippines provide a cash subsidy to producers and importers for selling fertilizers to growers of food crops at less than the market price. In Indonesia, guaranteed crop price supports and subsidized fertilizer prices heavily favor fertilizer use. In addition to direct subsidies, other countries have granted their domestic producers access to natural gas at prices below the export price.

Many developing countries are now restricting fertilizer subsidies because of severe shortages of foreign exchange. The International Monetary Fund is pressuring many of its debtor countries to make these restrictions. For example, Indonesia raised the regulated price of fertilizer to better reflect its market price. In 1982, India raised the farm price of fertilizer. Brazil raised interest rates on credit and tightened eligibility requirements for credit. Mexico is considering raising domestic fertilizer prices.

In lieu of subsidies, governments are seeking more fertilizer use by promoting greater efficiency in production and distribution. For example, the Indian government is now basing the price subsidy offered domestic producers on an 80-percent capacity utilization rate. India is reducing transportation bottlenecks by standardizing railway equipment, improving roadways, and more optimally locating storage facilities. In many countries, local distribution centers are adding bulk blending operations.

The financial structure of many countries makes credit scarce and nonuniform. India and other countries are encouraging cooperatives to provide credit for fertilizer purchases. This will help promote uniformity in interest rates paid by farmers and add to credit availability.

Indonesia, the Philippines, Tunisia, South Korea, India, and Saudi Arabia are encouraging equity participation by foreign investors in domestic fertilizer projects. Equity participation reduces the interest payment liability on projects for central governments with limited supplies of foreign exchange. It also enables technology transfers and supervision by foreign managers to increase the rate of plant capacity utilization. Incentives for equity participation include profit remittances, tax holidays on reinvested income, and tax exemptions.

Corn and Soybean Fertilizer Use for Alternative Tillage Practices

Michael Hanthorn and Michael Duffy[1]

Abstract: Average per-acre nitrogen, phosphorus, and potassium application rates do not vary significantly for most U.S. corn and soybean farmers using different tillage practices. Future adoption of conservation tillage practices should not have much impact on the total volume of fertilizers sold in U.S. corn and soybean markets.

Keywords: Fertilizer use, tillage practices, corn, soybeans, major producing Regions.

This report compares fertilizer use for corn and soybeans by farmers using different tillage practices in the major producing States during 1980. Included are the results of a statistical analysis of average per-acre nitrogen, phosphorus, and potassium application rates by farmers using no-till, reduced-till, and conventional-till methods. Corn and soybean production data for 1980 also were analyzed to determine whether average per-acre returns and other affected input use and costs differed among alternative tillage practices. The other inputs include labor, fuel and repairs, machinery, pesticides, and seed. See "Returns to Corn and Soybean Tillage Practices" (2), for a complete description of the analysis.

Tillage Practices

Most U.S. corn and soybean farmers historically have used tillage practices that involve extensive field preparation prior to planting. The practices include the use of a moldboard or disk plow to turn the soil and secondary field operations to prepare a seedbed. Conventional tillage techniques incorporate all or most plant residue into the soil, leaving fields vulnerable to wind and water erosion.

In recent years, many U.S. corn and soybean farmers have adopted conservation tillage practices which leave more plant residue on field surfaces and disturb less soil than do conventional tillage practices. Conservation tillage includes no-till and reduced-till strategies. With no-till, plant residue is left undisturbed on the field surface until the soil is broken at planting. Reduced-till strategies usually include the use of a chisel plow or other secondary tillage implements instead of a moldboard plow and result in some soil breakage and partial plant residue disturbance.

Increases in plant residue and decreases in soil disturbance cause average soil temperatures to fall and soil moisture levels to rise. Farmers adjust their input mix in response to changes in soil conditions to obtain optimal plant stands. By adopting conservation tillage, they also reduce the number of field operations which lowers labor, fuel and repair, and machinery use and costs.

The proportion of nonirrigated corn acreage planted to no-till strategies increased from 1 percent in 1980 to 4 percent in 1982 (table 15). No-till soybean acreage remained relatively stable at 3 to 4 percent. However, reduced-till soybean acreage rose substantially from 21 percent in 1980 to 33 percent in 1982. The largest proportional increase occurred in the Southeast, although other producing regions realized significant gains as well.

[1]Micheal Hanthorn is an agricultural economist with the Natural Resource Economics Division, Economic Research Service. Michael Duffy is an Area Farm Management Specialist with the Iowa State Extension Service and was formerly employed by the Economic Research Service.

Table 15.—Proportion of planted corn and soybean acreage by tillage practices, 1980 and 1982

Crop, region	No-till		Reduced-till		Conventional-till	
	1980	1982	1980	1982	1980	1982
			Percent			
Corn:						
10 major producing States[1]	1	4	40	42	59	54
Soybeans:						
Midwest[2]	2	3	27	39	71	58
Midsouth[3]	6	6	8	18	86	76
Southeast[4]	5	4	16	40	79	56
Total	3	4	21	33	76	63

[1]Includes Illinois, Indiana, Iowa, Michigan, Missouri, Minnesota, Nebraska, Ohio, South Dakota, and Wisconsin. [2]Includes Illinois, Indiana, Iowa, Kansas, Kentucky (excluding the extreme western counties), Minnesota, Missouri (excluding the bootheel), Nebraska, and Ohio. [3]Includes Alabama, Arkansas, extreme western Kentucky, Louisiana, Mississippi, the bootheel of Missouri, and Tennessee. [4]Includes Georgia, North Carolina, and South Carolina.

Fertilizer Use

Opinions vary within the agricultural research community as to whether soil characteristic changes in conservation tillage fields cause corn and soybean farmers to adjust their fertilizer use. In a recent study, Crosson found some agricultural research supported the contention that conservation tillage farmers apply more nitrogen than do conventional tillage farmers because lower nitrogen mineralization rates and higher denitrification rates in conservation-till fields reduce nutrient assimilation (1). Also, most fertilizers are applied on or just below the field surface. Increased plant residue on conservation-till fields may tie up some of the applied nitrogen, reducing the amount available for crop development. Other research, however, suggested that per-acre nitrogen application rates were the same for all tillage practices.

Table 16.—Average per-acre corn and soybean fertilizer application rates for different tillage practices, 1980[1]

Crop, region, tillage practices	Nitrogen	Phosphorus	Potassium
	Pounds per acre		
Corn:			
10 major producing States			
No-till	144	76	105
Reduced-till	136	66	86
Conventional-till	117	60	77
Soybeans:			
Midwest			
No-till	6	24	29
Reduced-till	3	12	20
Conventional-till	3	13	19
Midsouth			
No-till	6	17	20
Reduced-till	4	22	26
Conventional-till	5	24	32
Southeast			
No-till	13	25	47
Reduced-till	12	37	66
Conventional-till	8	27	58

[1]The Tukey-Kramer method was used to test for differences in nitrogen, phosphorus, and potassium application rates for each group of farmers using different tillage practices. We found no statistically significant differences in rates at the 5-percent confidence level.

Crosson's report also stated that the availability of phosphorus and potassium to crops is not reduced by the accumulation of nutrients just below the surface—a result of less soil disturbance or increased plant residue. In summary, Crosson indicated that researchers had not conclusively determined whether fertilizer requirements varied significantly among alternative tillage strategies.

Analysis of the 1980 data shows that although corn fertilizer application rates are inversely related to the extent to which farmers tilled their fields, the differences are not statistically significant (table 16). There are also no statistically significant differences in the amounts of fertilizer applied per acre on soybeans in any region. But, all three groups (no-till, reduced-till, and conventional-till) of Southeast soybean farmers applied more fertilizers per acre than each of their respective counterparts in the other regions. Southeast soils are characteristically not as productive as soils in the other regions, which may in part account for the regional differences in fertilizer rates.

Based on the statistical findings of the analysis, future adoption of conservation tillage practices by U.S. corn and soybean farmers should not have a major impact on per-acre fertilizer use barring dramatic changes in either relative input costs or crop prices. As a consequence, conservation tillage should not significantly affect quantities of fertilizers purchased by U.S. corn and soybean growers.

PESTICIDES

Demand and Supply

Aggregate pesticide demand in 1984 should return to 1982 levels in response to a 10-to-20-percent increase in planted field crop acreage (table 17). Herbicides applied

Table 17.—Projected U.S. field crop acreage and pesticide demand, 1984

Crop	Projected planted acres in 1984[1]	Herbicide use 1982	Herbicide use Projected 1984	Insecticide use 1982	Insecticide use Projected 1984
	Million	*Million pounds (a.i.)*			
Row crops:					
Corn	82.5- 86.1	243.4	245.8-255.6	30.1	30.4-31.6
Cotton	10.6- 11.4	17.3	16.3- 17.5	16.9	15.9-17.1
Grain sorghum	16.0- 17.0	15.3	15.1- 16.2	2.5	2.5- 2.7
Peanuts	1.4	4.9	5.3	1.0	1.1
Soybeans	70.5- 74.3	125.2	123.9-130.2	10.9	10.8-11.3
Tobacco (harv.)	0.8	1.5	1.4	3.5	3.3
Total	181.8-191.1	407.6	407.8-426.2	64.9	64.0-67.1
Small grain crops:					
Rice	3.0- 3.3	13.9	12.6- 13.9	0.6	0.5- 0.6
Wheat	80.6- 88.3	18.0	16.6- 18.2	2.4	2.2- 2.4
Barley and oats	21.6- 24.7	5.9	5.3- 6.1	0.2	0.2
Total	105.2-116.3	37.8	34.5- 38.2	3.2	2.9- 3.2
Total	287.0-307.4	445.4	442.3-464.4	68.1	66.8-70.3

[1]Based on projected percentage changes in 1984 planted field crop acreages from 1983 levels presented in table 1 of this report.

Sources: (1, 2, 4).

to field crops totaled 445 million pounds of active ingredients (a.i.) in 1982 and should fall between 442 and 464 million pounds (a.i.) in 1984. Insecticide use on the major field crops should total 67 to 70 million pounds (a.i.) this coming season, compared to 68 million pounds in 1982.

These demand projections are well below the anticipated U.S. net domestic supply of herbicides (608 million pounds) and insecticides (215 million pounds) for the upcoming crop season. Anticipated net domestic supplies of fungicides and other pesticide classes also are expected to meet U.S. field crop producer demand in 1984. Most U.S. pesticide producers are operating well below capacity and have large inventory carryovers from the 1983 growing season. Increased demand for pesticides should reduce domestic inventories somewhat this year.

Average wholesale insecticide prices are projected to rise only 1 percent in 1984 from last year's levels, while wholesale prices for herbicides and fungicides are not expected to increase.

Pesticide Use and Tillage Practices

There was no substantial change in the major herbicides or insecticides applied by either corn or soybean farmers using different tillage practices in 1980 and 1982. The proportions of acres treated with most pesticides were similar among tillage practices. Also, neither per-acre corn nor soybean pesticide application rates varied significantly among different tillage practices. Farmers apply pesticides according to label recommendations, which are generally the same for all tillage practices.

Herbicides

The proportion of no-till corn acreage treated with cyanazine and simazine increased from 9 to 29 percent and from 0 to 12 percent, respectively, between 1980 and 1982 (table 18). These herbicides are selective broad spectrum materials and are generally applied prior to crop emergence. They also can be mixed and applied with fertilizers, which may account for their increased use on no-till acreage. No-till farmers make fewer trips

Table 18.—Proportion of planted corn and soybean acreage treated with major herbicides by tillage practices, 1980 and 1982[1]

Crop, herbicides	No-till		Reduced-till		Conventional-till	
	1980	1982	1980	1982	1980	1982
				Percent		
Corn:						
Alachlor	43	27	34	40	40	39
Atrazine	73	77	55	66	58	65
Butylate +	7	3	31	35	18	15
Cyanazine	9	29	22	22	18	20
Dicamba	—	7	15	18	10	12
EPTC +	—	*	1	3	3	4
Metolachlor	27	28	9	12	9	16
Paraquat	40	33	*	1	—	1
Pendimethalin	—	2	*	*	1	*
Propachlor	—	—	2	2	3	2
Simazine	—	12	1	1	1	1
2,4-D	12	12	22	23	22	15
Soybeans:						
Alachlor	28	38	29	22	27	29
Acifluorfen	2	12	1	6	2	8
Bentazon	28	15	21	16	23	18
Bifenox	3	—	2	1	1	—
Chloramben	—	4	7	10	6	7
Dinoseb	6	3	2	3	6	8
Fluchloralin	—	—	2	3	4	6
Glyphosate	20	9	7	2	4	*
Linuron	23	24	8	8	11	14
Metolachlor	11	13	3	9	3	9
Metribuzin	26	55	34	39	28	29
Naptalam	6	3	2	3	5	5
Oryzalin	10	3	1	2	1	3
Profluralin	—	—	2	1	2	1
Paraquat	33	26	1	3	1	1
Pendimethalin	2	15	2	2	3	3
2,4-DB	7	7	2	3	3	4
Trifluralin	34	32	53	61	47	48

— = None reported.

* = Less than 1 percent.

[1]Results from States that accounted for 77 and 92 percent of the respective U.S. corn and soybean planted acreage in 1980 and 97 and 99 percent, respectively, in 1982.

Sources: (3, 4).

across their fields and usually apply seed, fertilizer, and pesticides in one operation.

No-till farmers generally do not break the soil surface in their fields except at planting. As a result, they tend not to use herbicides that require incorporation. A lower proportion of the no-till corn acreage was treated with butylate + and very little with EPTC + compared to proportions of either reduced- or conventional-till corn acreage because these materials require incorporation.

On the other hand, a higher proportion of the no-till corn acreage was treated with metolachlor and paraquat than were proportions of more intensively tilled corn acreage. Metolachlor label recommendations include instructions for application with fertilizers, or in tank-mixes with atrazine or simazine plus either glyphosate or paraquat for use on no-till or reduced-till corn. Nearly all of the paraquat used on corn was applied to no-till acreage. Paraquat is a contact herbicide that effectively controls most emerged annual weeds and grasses. It can be used alone, but is usually applied in combination with other herbicides, such as atrazine, cyanazine, or simazine, which provide residual weed control during the season. Paraquat tank-mixed with atrazine also is recommended for postemergence applications when corn is at least 10 inches tall.

A higher proportion of the no-till soybean acreage was treated with linuron, metolachlor, metribuzin (1982), and oryzalin (1980) than were proportions of either reduced- or conventional-till soybeans. Different combinations of these selective broad spectrum herbicides are specifically recommended for use on no-till soybeans when tank-mixed with either glyphosate or paraquat for effective weed control throughout the season. Alachlor is commonly applied to no-till soybeans in combination with the aforementioned herbicides for increased broad spectrum weed control. Glyphosate and paraquat also are individually applied to no-till soybeans in directed sprays after the crop reaches eight inches in height.

No-till soybean acreage is not treated with fluchloralin or profluralin because these herbicides require incorporation following application. Chloramben is generally not used on no-till soybeans because it requires incorporation when adequate soil moisture is not present to activate the material within two weeks following application.

The proportion of no-till soybean acreage treated with pendimethalin increased from 2 percent in 1980 to 15 percent in 1982. Although pendimethalin is usually incorporated alone or in tank-mixes with metribuzin before planting on conventionally tilled soybeans, it is also tank-mixed with either linuron or metribuzin in preemergence broadcast applications on no-till soybeans.

Insecticides

Insecticide use patterns were more variable than herbicide use patterns for corn farmers using different tillage practices in 1980 and 1982 (table 19). A higher proportion of the no-till corn acreage was treated with carbofuran and chlorpyrifos than were proportions of either reduced- or conventional-till corn acreage. Carbofuran and chlorpyrifos product labels include recommendations for use on no-till corn, which may account for differences in use patterns among tillage practices for these materials relative to other insecticides. Also, a lower proportion of the no-till corn acreage was treated with fonofos and

Table 19.—Proportion of planted corn and soybean acreage treated with major insecticides by tillage practices, 1980 and 1982[1]

Crop, Insecticides	No-till		Reduced-till		Conventional-till	
	1980	1982	1980	1982	1980	1982
	Percent					
Corn:						
Carbaryl	4	2	*	*	1	*
Carbofuran	15	18	7	8	12	7
Chlorpyrifos	17	10	5	6	3	3
Ethoprop	—	3	*	1	1	1
Fonofos	4	2	9	9	9	8
Methyl parathion	4	—	—	*	—	*
Parathion	12	—	—	1	—	*
Phorate	—	3	6	10	5	3
Terbufos	4	10	15	15	11	8
Toxaphene	4	5	*	*	*	*
Soybeans:						
Carbaryl	2	2	1	5	3	2
Chlorpyrifos	2	—	—	2	—	1
EPN	2	—	—	—	*	*
Methyl parathion	—	*	1	6	3	5
Methomyl	10	2	2	1	5	3
Permethrin	—	*	—	3	1	4
Toxaphene	2	*	1	3	2	3

* = Less than 1 percent.

— = None reported.

[1]Results from States that accounted for 77 and 92 percent of the respective U.S. corn and soybean planted acreage in 1980 and 97 and 99 percent, respectively, in 1982.

Sources: (3, 4).

terbufos (1980) than were proportions of other corn acreage. Three-fourths of all corn insecticide acre-treatments were made with these four soil insecticides in 1980 and 1982, primarily to control corn rootworm infestations and other insects, such as cutworms, wireworms, and corn borers.

Insecticide use on corn fluctuates more than herbicide use because insect infestations are more variable than weed infestations from year to year and among tillage practices. Use of foliar insecticides such as carbaryl, methyl parathion, parathion, and toxaphene on corn varies more than the use of such soil insecticides as carbofuran and terbufos. A higher proportion of no-till corn acreage was treated with these materials in postemergence applications for armyworm and cutworm control than were proportions of corn acreage tilled more intensively. This suggests that no-till corn farmers had greater insect problems after crop emergence, requiring insecticide control, than did either reduced- or conventional-till corn farmers.

There was little variation in soybean insecticide use patterns between 1980 and 1982. Soybean farmers generally apply less insecticides than do corn farmers, and most soybean insecticide use occurs in the southern growing regions where insect infestations are more severe. Also, most soybean insecticide applications are made when insect infestations approach or reach levels that cause significant economic loss, while most corn insecticide applications are made to prevent damage from soil insect infestations. More no-till soybean acreage was treated with methomyl in 1980 than was soybean acreage tilled more intensively. Methomyl is an effective foliar insecticide that controls most soybean insect pests. Otherwise, soybean insecticide use patterns were similar for the different tillage practices in 1980 and 1982.

Pesticide Use Projections

Corn and soybean herbicide use patterns in 1984 should be similar to those in 1982, assuming that 1984 corn and soybean plantings rise back to 1982 levels and the proportion of acres planted to different tillage practices remains relatively constant. Future adoption of no-till practices should increase the aggregate use of selective broad spectrum herbicides such as atrazine, linuron, metolachlor, metribuzin, oryzalin, and simazine. Application of nonselective postemergence herbicides such as glyphosate and paraquat could increase as well. Use of herbicides requiring incorporation, such as butylate +, chloramben, and EPTC +, may decline slightly if no-till corn acreage continues to increase.

The trend towards conservation tillage is influenced by many factors, such as a desire to decrease operating costs (labor, fuel, and machinery) and soil loss. As farmers shift to conservation tillage, especially no-till, they substitute different mixes or increased amounts of herbicides for mechanical cultivation, resulting in decreased use of other inputs for weed control. There are currently several postemergence herbicides commonly used by no-till farmers. These include paraquat on corn and diclofop-methyl, glyphosate, mefluidide, and paraquat on soybeans.

Two new herbicides were registered and marketed for use on soybeans in 1983. Fluazifop-butyl and sethoxydim are postemergence compounds that control selected annual and perennial grasses. Another herbicide recently marketed specifically for use on no-till corn and soybeans is a premix formulation of alachlor and glyphosate. It is recommended for application before crop emergence and provides season-long broad spectrum weed control. This herbicide can be applied alone or in tank-mixes with other effective corn and soybean herbicides.

Several other postemergence herbicides are currently being developed and may be marketed within the next few years. One material is tridiphane which may be registered in some crop regions during 1984. Tridiphane is a postemergence herbicide that effectively controls most grasses. It will be recommended for use on corn in tank-mixes with triazine herbicides to provide broad spectrum weed control. Another compound being developed, DPX-Y6202, is a postemergence herbicide that effectively controls annual and perennial grasses. It is being developed for the soybean and cotton herbicide markets. The producer has submitted a request to the Environmental Protection Agency for an Experimental Use Permit. Availability of these and other effective postemergence herbicides should increase corn and soybean farmers' weed control options, therefore, encourage more conventional-till farmers to adopt conservation tillage practices.

Insecticide use patterns for specific materials are more difficult to project given the variability of corn and soybean insect infestations from one year to the next. Analysis of the 1980 pesticide use data, however, suggests that a higher proportion of no-till corn acreage is treated with soil insecticides than are proportions of more intensively tilled corn acreage. Also, more foliar insecticide applications are made on no-till corn acreage, which suggests that no-till corn farmers are experiencing greater insect pest problems after crop emergence than are other corn farmers. Further increases in no-till corn acreage may result in increased use of such soil insecticides as carbofuran and chlorpyrifos as well as carbaryl, methyl parathion, and parathion.

Soybean insecticide use patterns in 1980 and 1982 displayed little variation among tillage practices. If insect pest problems in 1984 are similar to those from 1980 to 1982, soybean insecticide use this coming season should be comparable to 1982 use patterns.

Regulatory Actions

The following is an update of two recent Environmental Protection Agency (EPA) regulatory actions. The EPA has appointed an Administrative Law Judge to preside over the hearings to determine whether ethylene dibromide (EDB) use will be cancelled. A prehearing conference was held on December 5, 1983. Use sites were discussed, but no decision was made on which would be included in the cancellation hearings. The only definitive outcome of the meeting was that another prehearing conference would be held in March 1984.

On October 18, 1983, EPA published in the Federal Register a notice of intent to cancel all registrations of 2,4,5-T and silvex products under FIFRA section 6(b)1. Several pesticide producers that hold technical and product registrations have requested hearings on the cancellation decision. To date, EPA has not initiated hearings.

FARM MACHINERY

Outlook for 1984

Farm machinery sales should rebound this year after a steady decline the last four years. Unit sales may be up more than 10 percent, with price increases likely to be in the 5-8 percent range. Cash farm income, adjusted for inflation, which declined in 1980, 1981, and 1982, increased last year but not to the 1980 level. Prices received by farmers for many key cash crops in recent months have been higher than a year earlier. Farm production costs have nearly stabilized, with prices paid by farmers rising less than 5 percent since December 1982. Major field crop acreage in 1984 is expected to rise about 15 percent over 1983 levels. These factors should enhance farmers' income expectations and lead to increased demand for new equipment.

However, several factors could dampen prospects. First, although farm commodity prices are likely to be favorable during the first half of 1984, increased crop production could lead to lower prices during the second half of the year (4). Secondly, although loanable funds are available and interest rates are not expected to increase appreciably, if at all, lenders are expected to be more selective than in the past (3).

Review of 1979-1983

During the 1979-1981 period, value of manufacturers' shipments for major U.S. farm machinery items or categories ranged between $9.0 and $9.5 billion (table 20). Value of shipments for tractors and combines increased while all other categories either remained constant or declined. Between 1981 and 1982, value of shipments for farm machinery dropped over $2 billion. The value of tractor shipments fell by $0.9 billion, or 29 percent, from 1981 to 1982 and accounted for 43 percent of the decrease in the total value of all machinery shipments. Harvesting machinery shipments, including combines, combine heads, and related equipment declined by $0.4 billion, or 15 percent, and accounted for 19 percent of the decreased shipments. The remaining machinery categories decreased $0.8 billion, or 21 percent, and accounted for 38 percent of the 1981 to 1982 decline.

Manufacturers' unit shipments of major equipment items declined without exception during the 1979-1982 period (table 21). Five of the 10 categories declined by over 50 percent, including tractors, 59 percent; haying equipment, 51 percent; primary tillage equipment, 75 percent; secondary tillage equipment, 58 percent; and mechanical pest control equipment, 52 percent.

Retail sales of most major farm machinery items declined from 1979 into 1983. When comparing the first 11 months of 1983 and 1982, sales of tractors, combines, forage harvesters, and balers declined, while sales of mower conditioners were constant (table 22).

The industry has undertaken extensive efforts to bolster sales. By using heavy discounting, rebates, and deferred interest payments in 1983, there was success in reducing inventories of some farm machinery items.

Prices paid by farmers for machinery have increased over the past five years, especially for tractors and combines (table 23). However, since 1981 price increases have moderated; and for plows, disk harrows, and grain drills, they have been stable. Farm machinery prices rose more than prices of all production items as a group during the

Table 20.—Value of farm machinery shipments by U.S. manufacturers, 1979 to 1982

Equipment category	Value of shipments 1979	1980	1981	1982
	Billion dollars			
Tractors (wheel, PTO)[1]	2.9	2.8	3.1	2.2
Combines, basic unit	1.0	1.1	1.4	1.3
Combine heads[2]	.3	.3	.4	.2
Other harvesting[3]	.8	.8	.8	.7
Planting, fertilizing	.7	.7	.8	.7
Hay equipment	.7	.8	.7	.5
Crop handling[4]	.8	.7	.6	.5
Tillage, land preparation[5]	.9	.7	.6	.4
Livestock[6]	.8	.6	.6	.5
Pest control[7]	.5	.5	.5	.4
Total	9.4	9.0	9.5	7.4

[1]Wheel tractors with power take off. [2]Includes small grain and corn heads. [3]Does not include hay harvesting equipment. [4]Includes farm elevators and blowers, farm wagons and other farm transportation equipment (excluding motor trucks), and machines for preparing crops for market or for on-farm use. [5]Includes primary tillage (plows, disc plows, chisel, subsoilers), secondary tillage (harrows, field cultivators, rollers, packers, pulverizers), combination tillage implements, land leveling, and stalk shredding equipment. [6]Equipment for handling or feeding livestock. [7]Includes sprayers, dusters, cultivators, and weeders.

Sources: (6, 7).

Table 21.—Selected farm machinery shipments by U.S. manufacturers, 1979 to 1982

Equipment category	Complete units shipped 1979	1980	1981	1982	Change from 1979 to 1982
	Thousand				*Percent*
Tractors (wheel, PTO)[1]	160	118	118	65	−59
Combines, basic unit	32	29	32	23	−30
Combine heads[2]	70	61	66	36	−49
Other harvesting[3]	35	30	21	13	−48
Planting, fertilizing	—	271	276	193	—
Hay equipment	136	133	103	67	−51
Crop handling[4]	728	525	471	419	−42
Primary tillage[5]	49	35	28	12	−75
Secondary tillage[6]	285	233	169	121	−58
Pest control:					
Mechanical[7]	113	102	76	54	−52
Chemical[8]	218	184	204	148	−32

— = Not available.

[1]Wheel tractors with power take off. [2]Includes small grain and corn heads. [3]Does not include hay harvesting equipment. [4]Includes farm elevators and blowers, farm wagons and other farm transportation equipment (excluding motor trucks), and machines for preparing crops for market or for on-farm use. [5]Includes plows, disc plows, chisel, subsoilers. [6]Includes harrows, field cultivators, rollers, packers, pulverizers, combination tillage implements, land leveling, and stalk shredding equipment. [7]Includes cultivators and weeders. [8]Includes sprayers and dusters.

Sources: (6, 7).

Table 22.—Unit sales of selected farm machinery items, 1979 to 1983[1]

Year	Tractors: 2-wheel drive[2]	Tractors: 4-wheel drive	Self-propelled combines	Forage harvesters	Balers[3]	Mower conditioners
			Thousand units			
Full Year:						
1979	132.5	12.5	34.1	13.9	19.7	27.2
1980	115.2	12.6	28.4	10.9	15.8	21.4
1981	99.0	11.3	29.3	8.6	15.2	19.7
1982	73.5	8.2	18.3	5.7	9.9	14.6
January-November:						
1982	68.7	7.5	16.0	5.5	9.7	14.2
1983	62.7	5.2	12.5	4.7	9.3	14.2
			Percent			
Average annual change						
1979-82	−15	−11	−15	−20	−17	−15
1982-83 4/	− 9	−31	−22	−15	−4	0

[1]Includes U.S. retail sales plus farm machinery manufactured in the United States or Canada and exported to any other country. Does not include farm machinery manufactured in Canada and sold there. [2]Includes two-wheel drive tractors with 40 PTO horsepower and over. [3]Includes balers producing bales weighing under 200 pounds. [4]January-November sales comparison.

Source: (1, 2).

Table 23.—Average per-unit farm machinery prices paid by U.S. farmers, 1979 to 1983, September each year

Item	1979	1980	1981	1982	1983
			Dollars		
Wheel tractor, 110-129 PTO	29,000	32,500	36,200	37,500	40,600
Plow, 5-bottom	4,890	5,400	6,120	6,650	6,630
Disk harrow, tandem, 16 feet wide	5,600	6,320	7,100	7,560	7,810
Grain drill, press, 24 tubes	6,460	6,800	7,870	8,470	9,010
Self-propelled combine, grain head, large capacity	60,700	69,000	77,800	83,300	85,100

Source: (5).

Table 24.—Indexes of prices paid for farm machinery, 1979 to 1983

Year	Tractors and self-propelled machinery	Other machinery and implements	All items used for production
		Index 1977=100	
1979	122	119	125
1980	136	132	138
1981	152	146	148
1982	165	160	149
1983[1]	174	171	153
		Percent	
Average annual price increase 1979-1983	9.3	9.8	5.3

[1]Through November 30, 1983.

Source: (5).

1979-83 period (table 24). The average annual increase in the price index was 9 to 10 percent for farm machinery, compared to 5 percent for all production items.

The overall financial performance of the farm machinery industry remained unprofitable in 1983, continuing a 4-year decline (1979-1982) in net income for the leading manufacturers. High inventory levels and declining unit sales kept the industry in financial difficulty. Many firms are limiting output, thereby reducing production costs and stabilizing dealer inventories.

ENERGY

Petroleum Situation

The availability and prices of gasoline, diesel fuel, fuel oil, and propane should be favorable for farmers during 1984. Users of petroleum products will continue to benefit from worldwide excess oil production capacity. Gasoline prices are expected to remain relatively constant during the first half of the year, but may decline about 5 cents-per-gallon by the fourth-quarter. The average price for the year will be about the same as in 1983. Fuel oil and diesel fuel prices are expected to rise about 3 percent in 1984, less than the rate of inflation. Propane prices also are expected to change little during the year. Electricity prices are projected to rise by 7 percent. The average price of natural gas to industrial users is expected to rise by 13 percent. Residential natural gas users can expect price increases of about 9 percent (4).

U.S. energy prices are strongly influenced by world oil prices. The Organization of Petroleum Exporting Countries (OPEC) in March 1983 lowered its official crude oil price from $34 per barrel to $29 per barrel (bbl.). Each OPEC member agreed to observe a production quota to prevent further price declines.

There is uncertainty about OPEC's ability to maintain the $29 price level. This will, in part, depend upon the weather throughout the world for the rest of the winter and the resulting effect on the demand for heating oil. Mild weather for the remainder of the winter and modest economic growth could depress petroleum demand. This, in turn, could prompt some OPEC members who face large budget deficits to cut oil prices and breach their self-imposed crude oil quotas. Non-OPEC countries, such as the United Kingdom and the Soviet Union, also may lower their prices to gain a larger share of the world oil market. In addition, Iraq, an OPEC member, has had difficulty exporting crude oil through the Persian Gulf because of its war with Iran. However, by mid-1984, the completion of the Iraq-Turkey pipeline could add 400,000 bbls. per day of crude oil to the world supply. One or more of these events could force OPEC to lower the official price of crude oil below $29 per bbl.

Natural Gas

The deregulation of natural gas wellhead prices is important to U.S. agriculture because natural gas is used in fertilizer production, irrigation, and crop drying. Natural gas price changes can affect the price of these inputs and thus influence food prices. Fertilizer production is the major agricultural market for natural gas, using about four times more natural gas than is used directly as fuel in agriculture.

The Natural Gas Policy Act of 1978 (NGPA) established a formula by which wellhead prices of about one-half of the gas produced in the U.S. would be increased until they reached what Congress believed would be the market-clearing price in 1985. It now appears that the NGPA will not result in an orderly transition to market-based pricing (a decontrolled market), so Congress is considering proposals to amend the law. If the NGPA remains in effect, wellhead prices will continue to rise until January 1985, increasing prices to end users.

The NGPA created 28 categories of natural gas, each with different price provisions, resulting in wide disparities in wellhead prices. In 1981, wellhead prices ranged from less than $1 to $10 per 1,000 cubic feet (mcf). This price variation and certain provisions of long-term producer-pipeline contracts have resulted in confusion in natural gas pricing to end users. Significant price disparities resulted among residential, commercial, and industrial users. Take-or-pay and other escalator clauses in contracts between gas producers and distributors are contributing to higher end use prices despite current excess gas supplies.

Natural gas is the feedstock for anhydrous ammonia, the basis of nearly all nitrogen fertilizer produced in the U.S. In 1981, ammonia producers paid an average of $2.30 per mcf for natural gas, with prices for individual producers ranging from $0.25 to $4.60 per mcf. (2). Many fertilizer producers face large increases in natural gas costs over the next year or two as low-priced, long-term gas contracts expire and new ones must be negotiated.

The NGPA protects fertilizer producers and other essential agricultural users of gas from the full effects of higher prices resulting from phased deregulation. In 1985, however, fertilizer manufacturers will no longer have this protection. Not all fertilizer producers will be affected equally by deregulation because of differences in plant efficiency, prices paid, and proximity to gas sources and market areas. In addition, selected ammonia plants may be able, as preferred users, to renegotiate gas prices below prevailing prices.

Lower-priced nitrogen imports limit the ability of domestic fertilizer producers to pass natural gas price increases through to farmers. As low priced natural gas contracts expire, U.S. fertilizer producers are expected to become less competitive in international markets. Within the last two years, about 20 percent of the U.S. ammonia production capacity was shut down.

Currently, there are two major legislative proposals to amend NGPA—Senate bill, S. 1715, and House bill, H.R. 2154. The Senate bill would decontrol all gas by 1987, encourage renegotiation of gas contracts, and thereby permit gas to approach a "market clearing price" by the time it is fully implemented. H.R. 2154 seeks to roll back natural gas prices and delay final implementation of the partial deregulation specified in NGPA by two years to 1989.

The effects of proposed changes in natural gas deregulation are the subject of considerable debate among energy analysts. According to the Congressional Budget Office (CBO), continuation of the NGPA or passage of S. 1715 or H.R. 2151 would result in only slight differences in wellhead gas prices in 1990. Both the Senate and House proposals result in higher economic output (Gross Domestic Product) in the mid-1980's when compared to NGPA (1).

The CBO analysis points out that since gas prices to some users already exceed the Btu equivalent price of heating oil, a reasonably good substitute for natural gas, accelerated deregulation should cause gas prices to decline over the next two years, assuming crude oil prices continue to decline. If crude oil prices remain at $29 per bbl., wellhead gas prices should decline to the Btu equivalent price and remain constant thereafter.

The Department of Energy (DOE), however, maintains that gas prices will continue to rise in the aftermath of further deregulation because higher prices at the wellhead will be required to provide economic incentives to increase gas supplies (3). The DOE analysts point out that the costs of finding, pumping, and distributing gas are increasing. Major technical change or new gas finds are unlikely to shift the aggregate domestic gas supply sufficiently to reduce gas prices in the meantime.

Proposals to amend or extend the NGPA will continue to be debated in 1984. The impacts of any future policy changes depend on specific legislative language and market reactions. Due to uncertainty about the impacts of legislative proposals and other factors, congressional action could be deferred until after 1984. If this occurs, gas prices will continue to rise except for selected ammonia plants and other major industrial users that, as preferred users, may be in a position to renegotiate gas prices slightly below prevailing industrial prices.

REFERENCES

Fertilizer

(1) Fertilizer Institute. *Ammonia Production Cost Survey.* Washington, D.C. March 1983.
(2) Potash/Phosphate Institute. Selected reports. Washington, D.C.
(3) United Nations, Food and Agricultural Organization. *Current World Fertilizer Situation and Outlook 1981/82 to 1987/88.* Rome 1983.
(4) U.S. Dept. of Agriculture. Econ. Res. Serv., *Food and Agricultural Outlook.* December 1983. Unpublished.
(5) ________, Stat. Rep. Serv. *Agricultural Prices.* Pr 1 (10-83). October 31, 1983 and earlier issues.
(6) ________, Stat. Rep. Serv. *Commercial Fertilizers, Consumption for year ended June 30, 1983,* SpCr 7 (11-83) and earlier issues.
(7) ________, Stat. Rep. Serv. *Crop Production - 1982 Annual Summary.* CrPr 2-1 (84), January 1984 and earlier issues.
(8) ________, Stat. Rep. Serv. *Crop Production.* CrPr 2-2 (9-83). September 12, 1983 and earlier issues.
(9) ________, Stat. Rep. Serv. *Objective Yield Survey,* 1983.
(10) U.S. Dept. of Commerce, Bureau of Census. *U.S. Exports, Commodity and Country.* Report FT-410. October 1983 and earlier issues.
(11) ________, Bureau of Census. *U.S. Imports, Commodity and Country.* Report FT-135. October 1983 and earlier issues.
(12) ________, Bureau of Census. *Inorganic Fertilizer Materials and Related Products.* M28-B. September 1983 and earlier issues.

Special Article

(1) Crosson, Pierre. *Conservation Tillage and Conventional Tillage: A Comparative Assessment.* Soil Conservation Society of America, Ankeny, Iowa. 1981.
(2) Duffy, Michael/Michael Hanthorn. *Returns to Corn and Soybean Tillage Practices.* AER-508. U.S. Dept. of Agr., Econ. Res. Serv., January 1984.

Pesticides

(1) U.S. Dept. of Agriculture. Econ. Res. Serv. *Food and Agricultural Outlook.* December 1983. Unpublished.
(2) ________, Econ. Res. Serv. *Inputs Outlook and Situation.* IOS-2. October 1983.
(3) ________, Econ. Res. Serv. *1980 Corn and Soybean Pesticide Use Survey.*
(4) ________, Econ. Res. Serv. *1982 Crop and Livestock Pesticide Usage Survey.*

Farm Machinery

(1) Farm and Industrial Equipment Institute. *Monthly Flash Reports.* Chicago, Illinois. November 1983 and earlier issues.
(2) ________. *U.S. Retail Sales of Wheel Tractors and Selected Farm Machinery.* Chicago, Illinois. November 14, 1983 and earlier issues.
(3) Gabriel, Stephen C. *1984 Agricultural Outlook Conference.* Session No. 29. Washington, D.C. U.S. Dept. of Agr., Econ. Res. Serv., November 2, 1983.
(4) Johnson, James and Gary Lucier. *1984 Agricultural Outlook Conference.* Session No. 29, Washington, D.C. U.S. Dept. of Agr., Econ. Res. Serv., November 2, 1983.
(5) U.S. Dept. of Agriculture. Stat. Rep. Serv. *Agricultural Prices* Pr-1 (11-83). November 30, 1983 and earlier issues.
(6) U.S. Dept. of Commerce. Bureau of Census. Ind. Div. *Farm Machinery and Lawn and Garden Equipment.* Cur. Ind. Rept. MA-35A. September 1983 and earlier issues.
(7) ________. Bureau of Census. Ind. Div. *Tractors (Except Garden Tractors).* Cur. Ind. Rept. M35S series, annual summaries for 1979-1982 and January-November 1983 monthly reports.

Energy

(1) Congressional Budget Office. *Natural Gas Price Decontrol.* A Comparison of Two Bills. November 1983.
(2) Lutton, T. and P. Andrilenas. *Natural Gas Deregulation and U.S. Ammonia Production.* Econ. Res. Serv. Staff Report. Forthcoming.
(3) U.S. Department of Energy. *Analysis of the Natural Gas Policy Act and Several Alternatives.* DOE/EIA-0366. Washington, D.C. May 1983.
(4) U.S. Daprtment of Energy. *Short-Term Energy Outlook.* DOE/EIA-0202. Washington, D.C. November 1983.

Appendix table 1.—U.S. fertilizer imports: Declared value of selected materials, years ending June 30, 1981 to 1984

Material	1981	1982	1983[1]	1984[1, 2]
		Million dollars		
Nitrogen:				
Anhydrous ammonia	226	296	296	164
Urea	128	156	226	73
Ammonium nitrate	27	35	34	18
Ammonium sulfate	24	29	27	6
Sodium nitrate	15	16	13	3
Calcium nitrate	8	10	10	4
Nitrogen solutions	18	19	15	8
Other	19	15	13	6
Total[3]	464	576	635	282
Phosphate:				
Ammonium phosphates	66	54	39	12
Crude phosphates	6	*	1	*
Phosphoric acid	9	3	*	*
Normal and triple superphosphate	8	4	2	*
Other	5	2	2	*
Total[3]	95	64	44	14
Potash:				
Potassium chloride	736	687	546	215
Potassium sulfate	6	5	5	3
Potassium nitrate[4]	14	11	11	3
Total[3]	755	704	552	221
Mixed fertilizers	27	28	23	5
Total[3]	1,341	1,372	1,254	522

* = Less than $1 million.

[1]Preliminary. [2]Data for July-November 1983. [3]Totals may not add due to rounding. [4]Includes potassium sodium nitrate.

Source: (11).

Appendix table 2.—U.S. fertilizer exports: Declared values of selected materials, years ending June 30, 1981 to 1984

Material	1981	1982	1983[1]	1984[1, 2]
		Million dollars		
Nitrogen:				
Anhydrous ammonia	114	102	58	19
Urea	345	264	166	42
Ammonium nitrate	11	11	4	2
Ammonium sulfate	64	50	48	18
Sodium nitrate	0	3	3	1
Nitrogen solutions	65	34	11	1
Other[3]	19	7	6	1
Total[4]	618	471	297	84
Phosphate:				
Phosphate rock	489	403	393	177
Normal superphosphate	1	*	1	1
Triple superphosphate	192	181	183	64
Diammonium phosphate	1,021	710	722	313
Other ammonium phosphate	112	55	51	31
Phosphoric acid	378	455	392	136
Other	4	2	1	*
Total[4]	2,297	1,807	1,742	722
Potash:				
Potassium chloride	114	65	52	13
Other	51	52	55	14
Total[4]	165	117	107	27
Mixed fertilizers	93	70	48	17
Total[4]	3,169	2,463	2,193	850

* = Less than $1 million.

[1]Preliminary. [2]Data for July-November 1983. [3]Includes aqua ammonia. [4]Totals may not add due to rounding.

Source: (10).

Appendix table 3.—Plant nutrient use, by State, for years ending June 30, 1982 and 1983[1]

State and region	1982			1983		
	Nitrogen (N)	Phosphate (P_2O_5)	Potash (K_2O)	Nitrogen (N)	Phosphate (K_2O)	Potash (K_2O)
	Thousand tons					
Maine	12.2	12.4	12.7	11.4	11.2	11.7
New Hampshire	3.0	2.1	3.2	2.8	1.9	2.9
Vermont	6.6	6.0	7.4	5.9	5.3	6.8
Massachusetts	8.6	5.1	6.7	7.7	4.0	5.2
Rhode Island	1.5	1.1	1.2	1.6	1.0	1.2
Connecticut	6.4	3.7	4.5	6.6	3.6	4.1
New York	90.7	75.9	87.7	82.1	78.4	88.4
New Jersey	26.8	18.1	21.7	21.0	15.0	16.7
Pennsylvania	89.0	68.6	68.7	78.4	63.1	62.9
Delaware	18.3	9.8	20.5	17.5	8.5	17.9
Maryland	56.9	36.5	47.7	52.2	33.2	44.0
Dist. of Columbia	1.4	.4	.5	1.3	.6	.3
Northeast	321.4	239.7	282.5	288.5	225.8	262.1
Michigan	258.7	178.8	244.2	205.0	144.0	224.9
Wisconsin	257.4	158.6	357.4	191.8	148.6	321.0
Minnesota	558.2	287.1	385.6	406.2	197.9	274.8
Lake States	1,074.3	624.5	987.2	803.0	490.5	820.7
Ohio	414.5	251.9	389.3	375.4	217.6	316.3
Indiana	531.5	290.7	451.7	415.3	257.3	410.0
Illinois	1,038.4	531.9	775.5	778.7	424.8	632.4
Iowa	1,048.9	382.5	585.0	740.4	282.3	409.9
Missouri	324.7	148.3	237.2	304.1	147.8	220.8
Corn Belt	3,358.0	1,605.3	2,438.7	2,613.9	1,329.8	1,989.4
North Dakota	248.2	112.0	19.1	216.8	112.7	17.7
South Dakota	151.9	58.3	15.7	78.7	39.3	10.0
Nebraska	679.8	161.9	54.6	576.1	122.8	37.8
Kansas	588.6	170.9	44.2	525.9	153.0	41.1
Northern Plains	1,668.5	503.1	133.6	1,397.5	427.8	106.6
Virginia	100.4	69.4	95.6	80.1	59.5	80.0
West Virginia	13.0	9.9	9.8	9.6	10.1	10.3
North Carolina	234.7	127.4	211.8	206.7	114.1	192.8
Kentucky	202.8	138.8	171.4	159.3	118.4	145.2
Tennessee	127.8	91.9	113.9	117.1	88.6	115.6
Appalachia	678.7	437.4	602.5	572.8	390.7	543.9
South Carolina	90.1	46.3	93.9	77.9	44.1	84.8
Georgia	249.5	109.1	180.8	213.8	104.4	171.7
Florida	235.2	98.8	254.4	230.2	96.3	252.9
Alabama	148.8	87.8	104.1	122.4	66.4	81.5
Southeast	723.6	342.0	633.2	644.3	311.2	590.9
Mississippi	176.9	68.1	86.6	150.5	63.4	87.1
Arkansas	218.2	55.5	75.0	196.7	58.7	77.9
Louisiana	134.8	53.8	67.3	116.9	48.9	63.4
Delta States	529.9	177.4	228.9	464.1	171.0	228.4
Oklahoma	272.8	95.1	28.9	247.2	93.6	29.7
Texas	686.8	234.1	101.2	654.8	225.9	108.2
Southern Plains	959.6	329.2	130.1	902.0	319.5	137.9
Montana	114.7	76.1	12.1	118.8	75.2	11.1
Idaho	181.1	62.3	7.5	186.7	49.5	6.0
Wyoming	40.5	17.4	1.1	40.5	11.1	.4
Colorado	172.2	44.9	11.0	139.3	35.7	7.7
New Mexico	29.5	12.2	2.7	28.2	11.8	3.8
Arizona	106.7	35.3	.9	79.3	29.2	.5
Utah	33.8	15.4	.8	29.2	16.7	.6
Nevada	4.1	1.9	.4	4.4	2.0	.3
Mountain	682.6	265.5	36.5	626.4	231.2	30.4
Washington	236.4	58.4	37.5	231.3	55.7	34.8
Oregon	148.5	50.6	24.1	143.9	43.6	22.1
California	567.5	164.9	61.9	476.1	147.9	54.8
Pacific	952.4	273.9	123.5	851.3	247.2	111.7
48 States and D.C.	10,949.0	4,798.0	5,596.7	9,163.8	4,144.7	4,822.0
Alaska	1.7	.9	.6	2.0	1.5	1.0
Hawaii	22.1	11.0	24.1	18.5	11.9	19.6
Puerto Rico	10.8	4.4	9.4	10.7	4.6	9.8
U.S. total	10,983.6	4,814.3	5,630.8	9,195.0	4,162.7	4,852.4

[1]Totals may not add due to rounding.

Source: (6).

Appendix table 4.—Fertilizer use on corn acreage harvested for grain, selected States, 1983

State	Acres for harvest	Fields in survey	Harvested acres receiving: Any fertilizer	N	P_2O_5	K_2O	Application rates: N	P_2O_5	K_2O	Proportion fertilized: At or before seeding	After seeding	Both
	Thousand	*No.*	*Percent*				*Pounds*			*Percent*		
Michigan	1,850	82	100	100	100	98	111	64	94	59	2	39
Minnesota	4,370	151	97	97	89	89	100	48	66	82	2	16
Wisconsin	2,400	131	97	97	96	96	97	56	86	76	1	23
Total	8,620	364	97	98	94	93	102	54	78	75	2	23
Illinois	7,800	216	99	99	94	94	155	81	111	75	4	21
Indiana	4,600	176	99	99	98	89	149	75	107	59	1	40
Iowa	8,400	204	95	95	84	85	141	62	76	84	4	12
Missouri	1,500	124	98	98	81	82	131	61	79	77	4	19
Ohio	2,850	161	98	98	97	96	157	78	98	64	0	36
Total	25,150	881	97	97	91	90	148	73	96	74	3	23
Nebraska	4,900	198	98	98	72	45	158	42	24	63	1	36
South Dakota	1,700	83	66	66	52	31	80	38	18	62	16	22
Total	6,600	281	90	90	67	42	143	41	23	63	4	33
10 State total	40,370	1,526	96	96	88	83	137	64	85	72	3	25

Sources: (8, 9).

Appendix table 5.—Fertilizer use on harvested cotton acreage, selected States, 1983

State	Acres for harvest	Fields in survey	Harvested acres receiving: Any fertilizer	N	P_2O_5	K_2O	Application rates: N	P_2O_5	K_2O	Proportion fertilized: At or before seeding	After seeding	Both
	Thousand	*No.*	*Percent*				*Pounds*			*Percent*		
Missouri	93	60	100	100	100	100	44	39	68	47	0	53
Tennessee	215	99	100	100	100	100	91	65	71	58	0	42
Alabama	195	96	100	100	86	89	79	62	72	53	10	37
Georgia	125	56	100	100	91	100	72	53	73	41	0	59
South Carolina	69	60	100	100	83	100	107	42	102	2	0	98
Total	389	212	100	100	88	94	94	56	79	40	5	55
Arkansas	310	176	100	97	68	70	69	34	46	54	10	36
Louisiana	410	95	100	100	62	70	69	42	58	57	25	18
Mississippi	750	298	99	99	45	50	98	50	63	39	20	41
Total	1,470	569	99	99	55	60	84	44	58	48	19	33
Oklahoma	350	84	57	57	52	26	45	36	18	100	0	0
Texas	3,520	550	41	41	31	14	52	40	22	75	14	11
Total	3,870	634	43	43	33	15	51	39	21	79	12	9
Arizona	32	82	90	90	45	11	113	43	14	4	50	46
New Mexico	60	74	54	54	30	9	88	49	0	52	38	10
Total	92	156	85	85	43	9	111	44	14	9	49	42
California	965	246	95	95	33	6	117	52	38	35	40	25
13 State total	7,094	1,976	68	68	44	30	81	45	52	53	20	27

Sources: (8, 9).

Appendix table 6.—Fertilizer use on soybean acreage, harvested for beans selected States, 1983

State	Acres for harvest	Fields in survey	Harvested acres receiving: Any fertilizer	N	P_2O_5	K_2O	Application rates: N	P_2O_5	K_2O	Proportion fertilized: At or before seeding	After seeding	Both
	Thousand	*No.*			*Percent*			*Pounds*			*Percent*	
Minnesota	4,600	102	23	19	21	20	16	38	56	100	0	0
Illinois	8,850	170	32	13	23	32	17	63	96	96	4	0
Indiana	3,920	114	43	31	38	42	9	35	67	90	6	4
Iowa	7,920	154	12	8	12	11	14	46	49	100	0	0
Missouri	5,100	153	19	11	16	18	23	49	68	93	7	0
Ohio	3,280	103	42	23	34	40	10	37	73	93	2	5
Total	29,070	694	27	15	22	26	14	48	77	94	4	2
Nebraska	2,100	83	21	18	19	13	21	33	22	100	0	0
North Carolina	1,630	94	65	57	63	65	20	35	70	98	2	0
Tennessee	1,920	85	67	38	65	67	20	48	60	100	0	0
Total	3,550	179	66	47	64	66	20	42	65	99	1	0
Alabama	1,400	83	77	51	77	77	22	54	61	98	2	0
Georgia	1,950	95	79	59	76	78	35	47	79	97	3	0
South Carolina	4,730	98	71	32	65	71	11	37	81	100	0	
Total	8,080	276	76	49	73	76	26	47	74	98	2	0
Arkansas	3,900	136	27	13	26	26	15	38	52	94	6	0
Louisiana	2,570	109	28	11	28	28	13	47	68	93	7	0
Mississippi	3,020	109	29	12	29	28	12	42	61	100	0	0
Total	9,490	354	28	12	28	27	14	42	59	96	4	0
15 State total	56,890	1,688	33	20	30	32	18	45	70	96	3	1

Sources: (8, 9)

Appendix table 7.—Fertilizer use on harvested wheat acreage, selected States, 1983

State	Acres for harvest	Fields in survey	Harvested acres receiving: Any fertilizer	N	P_2O_5	K_2O	Application rates: N	P_2O_5	K_2O	Proportion fertilized: At or before seeding	After seeding	Both
	Thousand	*No.*			*Percent*			*Pounds*			*Percent*	
Michigan	700	40	100	100	98	100	64	54	53	30	13	57
Minnesota	2,208	65	95	95	80	63	72	39	35	96	2	2
Total	2,908	105	97	97	84	72	70	44	42	80	4	16
Illinois	1,350	78	85	82	82	77	76	76	85	36	5	59
Indiana	970	65	97	95	91	88	68	61	69	27	14	59
Missouri	1,850	95	94	93	73	73	76	53	59	40	21	39
Ohio	1,150	79	99	99	91	91	58	59	65	23	21	56
Total	5,320	317	93	92	82	81	70	62	69	33	16	51
Kansas	10,800	263	82	82	49	11	52	33	41	75	6	19
Nebraska	2,300	111	59	59	25	5	49	34	3	77	17	6
North Dakota	7,190	241	71	71	60	11	46	27	10	99	1	0
South Dakota	2,677	63	44	43	41	6	32	27	16	100	0	0
Total	22,967	678	73	73	50	10	49	30	27	84	5	11
Oklahoma	4,300	191	70	70	36	12	56	36	18	74	7	19
Texas	4,600	185	54	54	33	11	91	46	41	52	12	36
Total	8,900	376	62	62	34	12	72	41	29	64	9	27
Colorado	3,010	87	23	23	1	1	44	18	9	80	20	0
Idaho	1,275	112	94	93	48	7	89	33	27	52	20	28
Montana	4,345	181	59	59	58	6	32	31	19	94	1	5
Total	8,630	380	51	51	37	4	48	31	20	81	9	10
Oregon	1,055	109	95	95	24	19	87	42	38	55	12	34
Washington	2,620	160	100	100	18	6	76	30	31	74	4	21
Total	3,675	269	99	99	19	10	80	34	35	69	6	25
17 State total	52,400	2,125	73	72	48	20	60	39	48	71	8	21

Sources: (8, 9)

Appendix table 8.—Projected world supply-demand balance of nitrogen fertilizers, 1983 to 1988[1]

World regions	1983	1984	1985	1986	1987	1988
	Million metric tons					
Developed market economies:						
Supply	21.21	23.53	24.21	24.53	24.55	24.43
Demand	20.88	21.54	22.79	23.45	23.98	24.50
Balance	.33	1.99	1.42	1.08	.57	−0.07
North America-						
Supply	10.07	12.29	12.47	12.63	12.61	12.57
Demand	9.58	10.24	11.29	11.65	11.88	12.10
Balance	.49	2.05	1.18	.98	.73	.47
Western Europe-						
Supply	9.76	9.93	10.42	10.54	10.59	10.55
Demand	9.80	9.80	9.40	10.20	10.50	10.80
Balance	−0.04	.13	1.02	.34	.09	−0.25
Oceania-						
Supply	.21	.21	.25	.27	.28	.27
Demand	.30	.30	.30	.30	.30	.30
Balance	−0.09	−0.09	−0.05	−0.03	−0.02	−0.03
Other countries-						
Supply	1.17	1.10	1.07	1.09	1.07	1.04
Demand	1.20	1.20	1.30	1.30	1.30	1.30
Balance	−0.03	−0.10	−0.23	−0.21	−0.23	−0.26
Developing market economies:						
Supply	11.01	11.97	13.29	14.71	15.80	16.58
Demand	13.60	14.50	15.50	16.40	17.40	18.40
Balance	−2.59	−2.53	−2.21	−1.69	−1.60	−1.82
Africa-						
Supply	.15	.20	.30	.38	.42	.44
Demand	.70	.80	.90	.90	1.00	1.00
Balance	−0.55	−0.60	−0.60	−0.52	−0.58	−0.56
Latin America-						
Supply	3.00	3.28	3.73	3.98	4.15	4.21
Demand	3.10	3.20	3.40	3.60	3.80	4.00
Balance	−0.10	.08	.33	.38	.35	21
Near East-						
Supply	2.09	2.39	2.65	2.75	2.97	3.12
Demand	2.30	2.50	2.70	2.80	3.00	3.10
Balance	−0.21	−0.11	−0.05	−0.05	−0.03	.02
Far East-						
Supply	5.77	6.10	7.60	7.60	8.26	8.81
Demand	7.50	8.00	9.10	9.10	9.60	10.30
Balance	−1.73	−1.90	−1.50	−1.50	−1.34	−1.49
Centrally planned countries of Asia:						
Supply	11.31	11.53	11.65	11.81	12.09	12.37
Demand	13.00	13.50	13.70	13.70	14.10	14.50
Balance	−1.69	−1.97	−2.05	−1.89	−2.01	−2.13
Eastern Europe and USSR:						
Supply	18.84	20.49	21.59	22.12	22.33	22.31
Demand	13.90	14.50	15.20	15.80	16.30	16.86
Balance	4.94	5.99	6.39	6.32	6.03	5.45
WORLD TOTAL:						
Supply	62.37	67.52	70.74	73.17	74.77	75.69
Demand	61.38	63.74	66.99	69.35	71.78	74.20
Balance	.99	3.78	3.75	3.82	2.99	1.49

[1]Forecasts for year ending June 30.

Source: (3).

Appendix table 9.—Projected world supply-demand balance of phosphate fertilizers, 1983 to 1988[1]

World regions	1983	1984	1985	1986	1987	1988
			Million metric tons			
Developing market economies:						
Supply	19.09	19.53	19.65	19.59	19.53	19.53
Demand	12.02	12.68	13.48	14.00	14.37	14.73
Balance	7.07	6.85	6.17	5.59	5.16	4.80
North America-						
Supply	10.52	10.82	10.86	10.85	10.83	10.89
Demand	4.50	4.80	5.30	5.64	5.80	5.89
Balance	6.02	6.02	5.56	5.21	5.03	5.00
Western Europe-						
Supply	5.41	5.51	5.57	5.55	5.52	5.48
Demand	5.26	5.55	5.78	5.89	6.01	6.13
Balance	.15	−0.04	−0.21	−0.34	−0.49	−0.65
Oceania-						
Supply	1.34	1.37	1.39	1.39	1.39	1.39
Demand	1.04	1.08	1.13	1.17	1.22	1.28
Balance	.30	.29	.26	.22	.17	.11
Other countries-						
Supply	1.83	1.83	1.82	1.80	1.79	1.77
Demand	1.23	1.25	1.28	1.30	1.34	1.37
Balance	.60	.58	.54	.50	.45	.40
Developing market economies:						
Supply	5.63	6.22	6.68	7.17	7.78	8.52
Demand	6.28	6.77	7.25	7.73	8.33	8.99
Balance	−0.65	−0.55	−0.57	−0.56	−0.55	−0.47
Africa-						
Supply	1.81	1.99	2.18	2.44	2.75	3.20
Demand	.50	.55	.58	.62	.64	.71
Balance	1.31	1.44	1.60	1.82	2.11	2.49
Latin America-						
Supply	1.52	1.59	1.65	1.76	1.89	1.96
Demand	2.14	2.29	2.44	2.58	2.84	3.10
Balance	−0.62	−0.70	−0.79	−0.82	−0.95	−1.14
Near East-						
Supply	.89	1.27	1.39	1.45	1.45	1.45
Demand	1.14	1.23	1.33	1.43	1.55	1.68
Balance	−0.25	.04	.06	.02	−0.10	−0.23
Far East-						
Supply	1.41	1.41	1.46	1.53	1.69	1.92
Demand	2.70	2.70	2.90	3.10	3.30	3.50
Balance	−1.29	−1.29	−1.44	−1.57	−1.61	−1.58
Centrally planned countries of Asia:						
Supply	2.85	2.96	3.06	3.17	3.28	3.44
Demand	3.28	3.47	3.58	3.69	3.80	3.92
Balance	−0.43	−0.51	−0.52	−0.52	−0.52	−0.48
Eastern Europe and USSR:						
Supply	8.10	8.53	8.83	9.11	9.35	9.55
Demand	9.32	9.57	9.82	10.07	10.31	10.55
Balance	−1.22	−1.04	−0.99	−0.96	−0.96	−1.00
WORLD TOTAL:						
Supply	35.67	37.24	38.05	39.05	39.93	41.04
Demand	30.90	32.49	34.13	35.49	36.81	38.19
Balance	4.77	4.75	3.92	3.56	3.12	2.85

[1]Forecasts for year ending June 30

Source: (3).

Appendix table 10.—Projected world supply-demand balance of potash fertilizers, 1983 to 1988[1]

World regions	1983	1984	1985	1986	1987	1988
			Million metric tons			
Developing market economies:						
Supply	15.65	15.40	15.76	16.15	17.06	17.22
Demand	11.08	11.71	12.28	12.83	13.15	13.51
Balance	4.57	3.69	3.48	3.32	3.91	3.71
North America-						
Supply	9.21	9.10	9.37	9.71	10.67	10.82
Demand	4.82	5.24	5.69	6.14	6.34	6.58
Balance	4.39	3.86	3.68	3.57	4.33	4.24
Western Europe-						
Supply	5.49	5.36	5.36	5.31	5.27	5.27
Demand	5.25	5.39	4.32	5.55	5.65	5.75
Balance	.24	.03	1.04	−0.24	−0.38	−0.48
Oceania-						
Supply	.00	.00	.00	.00	.00	0.00
Demand	.25	.26	.26	.27	.28	.29
Balance	−0.25	−0.26	−0.26	−0.27	−0.28	−0.29
Other countries-						
Supply	.95	.95	1.04	1.13	1.13	1.13
Demand	.76	.82	.86	.87	.88	.89
Balance	.19	.13	.18	.26	.25	.24
Developing market economies:						
Supply	.13	.29	.39	.52	.65	0.72
Demand	3.19	3.41	3.70	3.90	4.21	4.42
Balance	−3.06	−3.12	− 3.31	−3.38	−3.56	3.70
Africa-						
Supply	0.00	0.00	0.00	0.00	0.00	0.00
Demand	.28	.30	.32	.34	.36	.38
Balance	−0.28	−0.30	−0.32	−0.34	−0.36	−0.38
Latin America-						
Supply	.02	.02	.02	.07	.13	.17
Demand	1.45	1.56	1.72	1.81	1.99	2.10
Balance	−1.43	−1.54	−1.70	−1.74	−1.86	−1.93
Near East-						
Supply	.11	.27	.37	.45	.52	.55
Demand	.06	.06	.07	.07	.08	.08
Balance	.05	.21	.30	.38	.44	.47
Far East-						
Supply	.00	.00	.09	.00	.00	.00
Demand	1.40	1.49	1.59	1.68	1.78	1.86
Balance	−1.40	−1.49	−1.59	−1.68	−1.78	−1.86
Centrally planned countries of Asia:						
Supply	.02	.02	.02	.02	.02	.02
Demand	.70	.81	.86	.92	.98	1.04
Balance	−0.68	−0.79	−0.84	−0.90	−0.96	−1.02
Eastern Europe and USSR:						
Supply	11.03	11.23	11.73	12.36	12.78	13.01
Demand	8.80	9.15	9.50	9.90	10.30	10.70
Balance	2.23	2.08	2.23	2.46	2.48	2.31
WORLD TOTAL:						
Supply	26.83	26.94	27.90	29.04	30.51	30.97
Demand	23.77	25.08	26.34	27.55	28.64	29.67
Balance	3.06	1.86	1.56	1.49	1.87	1.30

[1]Forecasts for year ending June 30.

Source: (3).

LIST OF TABLES

APPENDIX TABLES

☆ U.S. GOVERNMENT PRINTING OFFICE: 1984-420-930:ERS-85

UNITED STATES DEPARTMENT OF AGRICULTURE
WASHINGTON, D.C. 20250

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

To stop mailing ☐ or to change your address ☐ send this sheet with label intact, showing new address, to EMS Information, Rm. 440-GHI, USDA, Washington, D.C. 20250.

Postage and Fees Paid
United States
Department of Agriculture
AGR-101

FIRST CLASS

ELECTRONIC INFORMATION

Economic Outlook and Situation report summaries are available to subscribers of electronic mail systems and data systems.

The summaries highlight the latest USDA supply/demand and price forecasts for U.S. and world crops and livestock, and prospects for exports and the agricultural economy.

The summaries are on line by 3:30 p.m., Washington, D.C. time, on the dates listed (release dates are subject to change). Full reports are on the electronic mail systems in a few days.

For information on providers of this service, call (202) 382-9754, or write EMS Information, USDA, Room 440 GHI, Washington, D.C. 20250.

January

16 World Supply & Demand
24 Word Supply & Demand
25 Inputs
26 Oil Crops
30 Vegetables

February

1 Agricultural Outlook
2 Wheat
8 Livestock & Poultry
13 World Supply & Demand
21 Export Outlook
22 Feed
27 Cotton & Wool
29 World Agriculture

March

1 Agricultural Outlook
7 Sugar & Sweetener
8 Tobacco
12 World Supply & Demand
14 Fruit
21 Dairy
22 Rice

April

3 Agricultural Outlook
10 World Supply & Demand
24 World Supply & Demand
25 Inputs
26 Oil Crops
27 Vegetables