3.4 Farm Machinery

Increasingly complex farm machinery is an essential contributor to the productivity gains of U.S. agriculture. Expenditures on farm machinery in 1995 made up 13 percent of total production expenditures. Farm machinery sales in 1995 and 1996 leveled off somewhat after showing significant increases in 1993 and 1994. The increased value of farm assets and higher farm cash receipts have helped maintain farm machinery sales.

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Farm machinery and equipment are increasing in complexity, price, and, in many cases, size. Expenditures on farm machinery make up 13 percent of total production expenditures and farm machinery assets are 9 percent of total farm assets (USDA, ERS, 1996b; USDA, NASS, 1996b). Trends toward conservation tillage and no-till have prompted inventions such as the air drill and the coulter chisel plow. Precision farming is the impetus for new inventions, including continuous yield monitoring equipment and variable-input gaging devices, and will likely inspire more inventions in the near future.

Operation of farm machinery can cause soil compaction and contribute to engine emissions. These environmental effects can be lessened by using specific farming practices and special exhaust systems and fuels. Engine exhaust emissions will be reduced as new tractors meet EPA requirements by the year 2000 (USDA, ERS, 1994b). The risks in operating farm machinery make agriculture one of the Nation's most hazardous occupations, but improved safety measures are reducing accidents and injuries (see box, "Farm Machinery Safety").

Farm Machinery Sales

After showing a significant increase in 1994, purchases of farm machinery continued to increase through 1996, but at a slower rate. Farm tractor purchases increased 9 percent from 1993 (57,800 units) to 1994 (63,200). From 1994 to 1995, the increase in purchases was 2 percent (to 64,600 units) (table 3.4.1, fig. 3.4.1). Purchases increased 4 percent in 1996. Combine sales were also up in 1995, increasing by 8 percent, but slowed in 1996. Tractor and combine sales are indicators of the general farm machinery economy; retail sales data on other machinery are not available.

Several demand factors were favorable for increased purchases of tractors and farm machinery in 1996, and purchases increased in most horsepower classes. Tractor sales in the 40-99 horsepower category increased 4 percent in 1996. Tractor sales in the 100-and-over horsepower category also increased 4 percent. Purchases of four-wheel-drive tractors stayed the same.

Farm Machinery Safety

Agriculture is one of the Nation's most hazardous occupations. Estimates of annual agricultural deaths vary between 26 and 50 workers per 100,000, compared with an annual rate of 11 for all industries combined (USDHHS, 1992; MMS, 1995).

Little data are available on farm accidents, injuries, and illnesses. The census of agriculture included questions on the number of injuries and deaths on farms for the first time in 1992. Runyan, in 1993, published a review and synopsis of data sources on farm accidents. Nationally, some data are available from several sources: the Department of Labor, Department of Commerce, Product Safety Commission, Department of Health and Human Services, National Safety Council, Department of Agriculture, and the State Workers' Compensation Systems. Also, some data are available from State and local sources, including newspapers, coroners, hospitals, and medical personnel.

Farm-related injuries totaled 64,813 in 1992 according to the census of agriculture (USDC, 1994a). There were 673 farm-related deaths. The census does not report the cause of injuries and deaths, but many were likely related to machinery use. A recent study of farm accidents in Kentucky found that 82 percent of tractor-related fatalities were due to rollovers. Most of these occurred while mowing (32 percent). All the victims were male. The median age of the tractors was 23 years, ranging from 2 to 41 years. Most of the fatalities could have been prevented had the tractor been equipped with rollover protection (ROPS) and seatbelts. ROPS and seatbelts were not required on new tractors until 1976 (MMS, 1995).

The farm machinery industry has done much to improve farm safety. Rollover protection is provided on new tractors. Fully enclosed cabs offer protection on most larger tractors, combines, and other self-propelled equipment. Power take-off shields have been standard equipment for many years. Warning decals are placed near hazardous locations. More effort to educate farmers, their families, and farmworkers about the dangers in operating farm machinery and equipment could help reduce injuries and fatalities.

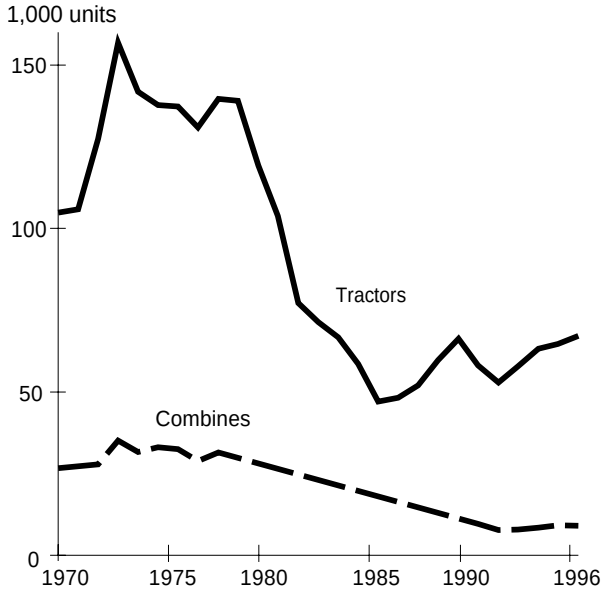
There are economic costs associated with deaths, injuries, and illnesses from farm-related causes. A New York study of people killed in farm accidents estimated that from $218,001 to $362,047 (adjusted to 1987 dollars) of lifetime expected income and opportunity costs (per person) were foregone due to farm accidents (Kelsey, 1991). Costs include health care, discounted future earnings, and special devices such as wheelchairs and lifts. In some cases, the farm has to be sold to help pay for medical expenses. Society also bears many of the costs of farm accidents when the family is unable to pay medical costs and expenses.

Table 3.4.1—Domestic farm machinery unit sales, 1986-96

Machinery category	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
						Units					
Tractors:											
Two-wheel-drive--											
40-99 hp	30,800	30,700	33,100	35,000	38,400	33,900	34,500	35,500	39,100	39,700	41,200
100 hp and over	14,300	15,900	16,100	20,600	22,800	20,100	15,600	19,000	20,400	20,500	21,400
Four-wheel-drive	2,000	1,700	2,700	4,100	5,100	4,100	2,700	3,300	3,700	4,400	4,400
All farm wheel tractors	47,100	48,400	51,700	59,700	66,300	58,100	52,800	57,800	63,200	64,600	67,000
Self-propelled combines	7,700	7,200	6,000	9,100	10,400	9,700	7,700	7,850	8,500	9,200	9,000

Source: USDA, ERS, based on Equipment Manufacturers Institute, various years.

Figure 3.4.1--Farm tractor and combine unit sales, 1970-96



Tractors-40 HP & up and self-propelled combines.

Source: USDA, ERS, based on Equipment Manufacturers Institute, various years.

Table 3.4.2—Plant capacity utilization in the farm machinery and equipment industry (fourth quarter)

Year	Capacity utilization rates[1]
	Percent
1980	62
1981	48
1982	31
1983	38
1984	41
1985	37
1986	24
1987	43
1988	54
1989	66
1990	66
1991	64
1992	56
1993	59
1994	66

[1]For 1989 and later, percent of full production; for 1988 and earlier, percent of "practical capacity."

1993 and 1994 estimated.

Source: USDA, ERS, based on USDC, 1994b and Federal Reserve, 1995.

Farm machinery plant capacity being utilized was estimated at 66 percent for 1994, compared with 24 percent in 1986 (table 3.4.2). Plant capacity utilization increased every year since 1992. The low rate in 1986 followed several years of low demand for farm machinery and large dealer inventories. Total or full production capacity was low throughout most of the 1980's as farm machinery manufacturers cut back, consolidated, and merged in response to low sales and economic pressures. The same capacity utilization rate in the 1970's produced more farm machinery since full production for the industry was higher. Also, capacity utilization was higher, 83-85 percent throughout the 1970's, as the farm machinery industry responded to high demand caused by high farm incomes, large exports, and high real estate asset values (USDC, 1994b).

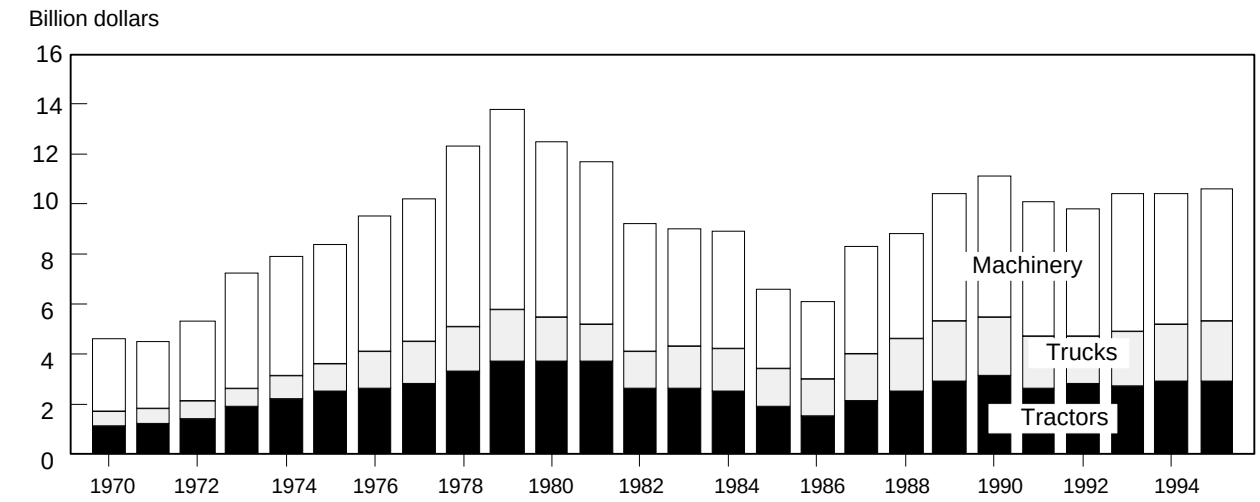
Capital Expenditures and Depreciation

Another indicator of the economic health of the farming sector is the difference between capital expenditures and depreciation, which represents the amount of capital accumulation or depletion. Capital expenditures are the dollar value investment in tractors, trucks, farm autos, and farm machinery as opposed to *units* of tractors and combines sold. Capital expenditures are the purchases of new and used durable machinery and equipment (less trade-ins) that will be used (and depreciated) over a number of years (USDA, ERS, 1988). Depreciation, also referred to as economic depreciation or capital consumption (as opposed to depreciation for income tax purposes), measures the amount of capital stock used up in the production process (McGath and Strickland, 1995).

Capital expenditures on tractors, trucks, and farm machinery, in nominal dollars, reached a peak in 1979 and, despite recent gains, are still $3 billion below that peak (fig. 3.4.2, table 3.4.3). In real terms (adjusted for inflation), depreciation of farm machinery has exceeded capital expenditures every year since 1980 (fig. 3.4.3). In 1985, real depreciation reached $8.5 billion and real capital expenditures were $4.2 billion, a gap of $4.3 billion. In 1995, capital depletion was $1.1 billion, about the same as in 1994.

Capital depletion in the farming sector may be due to several reasons. The mechanization of agriculture is changing. Tractors, combines, and other powered machinery have been getting larger and more efficient. Tillage practices have been changing from conventional tillage, which involved working the soil many times prior to planting, to reduced and no-till

Figure 3.4.2--Farm machinery capital expenditures, 1970-95

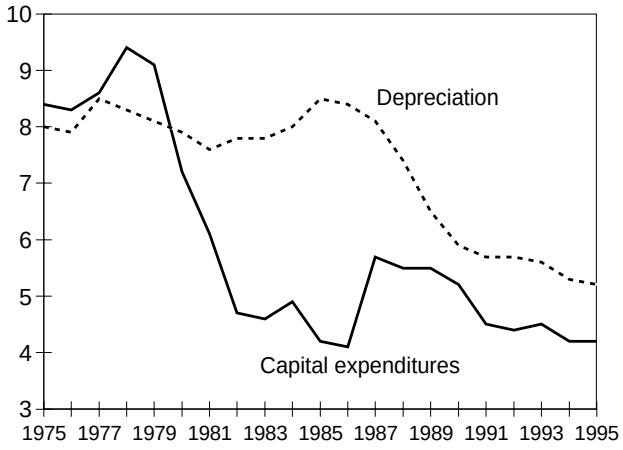


1995 forecast.
Nominal dollars.

Source: USDA, ERS, 1994a and other ERS sources.

practices, which require fewer times over the soil, help conserve soil, and prolong the useful life of tractors and equipment. Also, farming was very profitable in the late 1970's, which encouraged farmers to buy more and larger tractors and machinery than needed for efficient operations. More than 157,000 farm tractors were sold in 1973, compared with only 47,000 in 1986. In the early 1980's, farm income declined, farmers bought less machinery, and the farming sector remained productive by keeping old machinery in repair and using the extra machinery capacity built up during the late 1970's. Delaying expenditures on farm machinery can result in higher repair costs, but there is usually a period of time when the difference in cost between keeping an old machine and buying a new one is small.

Figure 3.4.3--Machinery capital expenditures and depreciation, 1975-95



Adjusted to 1975 dollars; 1995 estimated.

Source: USDA, ERS, 1994a and other ERS sources.

At some point in the future, capital investment should equal and surpass depreciation. The gap between capital expenditures and depreciation narrowed in the late 1980's, but increased again in 1991. Capital depletion has been a little over $1 billion each year since 1993. However, this was only about 3 percent of the total capital inventory stock of machinery on farms and likely represents adjustments due to efficiencies in technology and changes in farming practices. More farmers are buying the specialized machinery needed to comply with conservation plans. Also, capital expenditures likely increased in 1996. These factors should soon bring back capital accumulation in the farming sector.

Factors Affecting Machinery Demand

Farm machinery demand is affected by various factors, including machinery prices, interest rates, farm equity, farm income, and cropland used for crops (see box, "Factors Affecting Demand for Farm Machinery," p. 148). Machinery prices and interest rates determine the cost of purchasing farm equipment. Farm equity is the result of assets minus debt and is a measure of the collateral available to

Table 3.4.3—Trends in U.S. farm investment expenditures and factors affecting farm investment demand, 1988-96

Item	1988	1989	1990	1991	1992	1993	1994	1995	1996F
Capital expenditures:					*$ billion*				
Tractors	2.54	2.90	3.12	2.59	2.83	2.69	2.89	2.91	2.90-2.98
Other farm machinery	4.22	5.09	5.59	5.41	5.13	5.49	5.18	5.05	5.15-5.30
Total	6.76	7.99	8.71	8.00	7.96	8.18	8.07	7.96	8.05-8.28
Repairs	4.16	4.71	4.50	4.55	4.18	4.46	4.35	4.56	4.49-4.60
Trucks and autos	2.37	2.58	2.63	2.40	2.30	2.50	2.56	2.80	2.62-2.82
Farm buildings[1]	2.39	2.53	2.80	2.75	2.37	3.39	3.25	3.01	3.10-3.23
Factors affecting demand:									
Interest expenses	14.3	13.9	13.4	12.1	11.2	10.8	11.8	12.8	13.0
Production expenses	137.8	144.9	153.7	153.4	152.5	160.5	167.4	175.6	183.1
Farm business assets:									
Real estate assets[2]	595.5	615.7	618.4	624.4	642.8	673.4	706.9	755.7	808.6
Other assets[2]	205.6	214.1	220.3	219.4	226.1	231.1	231.2	222.3	226.5
Farm business debt[2,3]	139.4	137.2	138.0	139.2	139.0	141.9	146.8	150.8	155.4
Equity[2]	661.7	692.4	700.7	704.6	729.9	762.6	791.3	827.2	879.7
Agricultural exports[4]	35.3	39.6	39.4	39.2	42.9	42.6	45.7	55.8	60.4
Cash receipts	151.2	161.1	169.4	167.8	171.3	177.6	180.8	185.8	200.4
Net farm income	38.0	47.9	44.8	38.4	48.0	43.6	48.4	34.8	51.7
Net cash income	54.5	54.2	52.9	50.4	55.5	58.9	50.5	48.8	57.4
Government payments	14.5	10.9	9.3	8.2	9.2	13.4	7.9	7.3	7.8
					Million acres				
Idled acres[5]	77.7	60.8	61.6	64.5	54.9	59.8	49.2	54.8	34.4
Interest rates:					*Percent*				
Real prime rate[6,7]	5.4	6.5	5.7	4.5	3.5	3.4	4.8	6.3	6.2
Nominal farm machinery loan rate[7]	11.7	12.8	12.3	11.3	9.3	8.7	8.6	10.3	9.7
Real farm machinery loan rate[6,7]	8.4	8.4	8.0	7.5	6.5	5.3	6.3	7.8	7.6
Debt-asset ratio[8]	17.4	16.5	16.4	16.5	16.0	15.7	15.6	15.4	15.0

F-forecast.

[1] Includes service buildings, structures, and land improvements.

[2] Calculated using nominal dollar balance sheet data, excluding farm households, for December 31 of each year.

[3] Excludes Commodity Credit Corporation loans.

[4] Fiscal year.

[5] Includes acres idled through commodity programs and acres enrolled in the Conservation Reserve Program.

[6] Deflated by the Gross Domestic Product deflator.

[7] Average annual interest rate. From the quarterly sample survey of commercial banks: Agricultural Financial Databook, Board of Governors of the Federal Reserve System.

[8] Outstanding farm debt divided by the sum of farm real and nonreal estate asset values.

Sources: USDA, ERS, 1997, 1996b, 1994a; FRS, 1995.

Table 3.4.4—Prices paid indexes for selected production items and interest, annual averages[1]

Year	Farm machinery	Trucks and autos	Fuels	Feed	Livestock and poultry	Interest	Production items, interest, taxes and wage rates	GDP price deflator
				1990-92 = 100				*1992=100*
1984	85	78	93	112	73	124	91	76
1985	85	83	93	95	74	106	87	78
1986	83	86	76	88	73	98	85	81
1987	85	88	76	83	85	96	87	83
1988	89	90	77	104	91	100	92	86
1989	94	93	83	110	93	106	97	90
1990	96	97	100	103	102	107	99	94
1991	100	100	104	98	102	100	100	97
1992	104	102	96	99	96	93	101	100
1993	107	105	93	101	104	87	102	103
1994	113	107	95	105	94	94	105	105
1995	121	107	94	105	82	101	109	108
1996	125	108	105	130	75	105	114	110
1997, Jan.-Apr., avg.	127	110	109	125	89	106	116	111

[1] Indexes are current, actual (undeflated) prices, weighted by the relative importance of component items that make up each individual category and converted to the base year 1990-92=100 (USDA, 1990). First quarter, for 1997 GDP.

Source: USDA, ERS, based on NASS, 1996a, 1997; Council of Economic Advisers, 1997.

back farm machinery loans. Farm income is determined from cash receipts, less production expenses, and is an indication of cash flow available to purchase farm machinery.

Farm machinery prices rose 4 percentage points from 1995 to 1996 (table 3.4.4). Increased machinery prices depress farm machinery demand (Conley, 1992; Cromarty, 1959). The April 1997 prices-paid index (1990-92=100) for farm machinery was 127, 2 points above 1996; prices for trucks and autos also rose 2 points. The price index for all production items rose only 2 points.

The farm machinery nominal interest rate decreased to 8.6 percent in 1994, the lowest in 9 years. However, the real prime rate (adjusted for inflation) reached a low in 1993 and steadily rose to 6.3 percent in 1995 (table 3.4.3). Both the nominal and real farm machinery interest rates lag behind the prime rate and fell in 1996—to 9.7 percent and 7.6 percent. Higher interest rates have a negative effect on farm machinery investments (Kolajo and Adrian, 1986). As interest rates rise, the total cost of machinery bought on credit increases, dampening purchases. While the real rate reflects the actual cost of borrowing, the nominal rate likely has more effect on machinery purchases because it is more obvious to farmers. The importance of real versus nominal interest rates depends on the extent that farmers take into account expectations about inflation rates.

One of the more favorable farm machinery demand indicators has been sizable increases every year since 1991 in the value of farm equity (assets minus debt). Equity increased from $705 billion in 1991 to $880 billion in 1996. The increase in equity is due to large jumps in asset values, primarily real estate. The value of farm real estate assets has also increased every year since 1991 (table 3.4.3). Total assets include both real estate and nonreal estate items, and, when increasing, have a positive effect on farm machinery demand (Cromarty, 1959). Farm business assets were $1,035 billion in 1996, an increase of $57 billion (6 percent) from 1995. Farm business debt, which has a dampening effect on farm machinery demand, was up $4.6 billion in 1996, an increase of 3 percent. When farm equity increases, more collateral is available to finance farm machinery capital expenditures. Farm equity increased again in 1996. The ratio of debts to assets decreased to 15 percent

Factors Affecting Demand for Farm Machinery

Agricultural exports—Exports of U.S. agricultural products (fiscal year October 1 through September 30).

Cash receipts—Sales of all crop and livestock commodities. Cash receipts are like "money in the pocket" and correlate closely with purchases of farm machinery.

Debt-asset ratio—Farm business debt divided by farm business assets. Lower debt/asset ratios mean more favorable borrowing positions and more investment in tractors, combines, and other farm machinery.

Equity—Total assets minus debt. Farm equity represents a farmer's net worth; the greater the equity, the more collateral the farmer has available to back loans for capital investment.

Farm business debt—Real estate and nonreal estate debt.

Farm machinery loan rate—Average annual interest rate as reported in the quarterly survey of commercial banks by the Federal Reserve System (FRS, 1995). An inverse relationship exists between interest rates and the purchase of farm machinery. Lower interest rates imply greater purchases of farm machinery.

Idled acres—Cropland idled through commodity programs or enrolled in the Conservation Reserve Program. More land idled means less cropland to be cultivated, seeded, and harvested. Machinery is used less, prolonging useful life.

Interest expenses—Interest on both real estate and nonreal estate debt.

Net cash income—Gross cash income (cash receipts, direct government payments, and farm-related income) minus cash expenses.

Net farm income—Gross cash income, nonmoney income, and inventory adjustments minus total production expenses. Net farm income has a high correlation with machinery purchases when purchases are lagged several months behind income.

Nonreal estate assets—Includes livestock, crops, machinery, motor vehicles, and financial assets.

Real estate assets—Land and service structures. Increasing assets place a farmer in a more favorable position for obtaining capital investment loans.

Real prime rate—Bank prime rate, adjusted for inflation by the gross domestic product deflator.

Total production expenses—Total of cash expenses (inputs purchased, such as feed, seed, fertilizer, pesticides, fuel, repairs, custom work, and labor; interest; rent; and property taxes) plus noncash expenses, which include capital replacement and accidental damage.

from 1995 to 1996, the lowest ratio since the early 1960's, indicating a favorable borrowing position.

Farm income has a lagged effect on machinery sales, with higher purchases a year or more from the year of increased income (Rayner and Cowling, 1968). Increases in income have a positive effect on farmers' expectations about future income, which spurs machinery demand. Net farm income is cash income plus or minus the value of inventory changes, nonmoney income, noncash expenses, and operator dwelling expenses. Net farm income was up 7 percent in 1996 to $51.7 billion, from the previous high of $48.4 billion in 1994 (table 3.4.3). Cash receipts were up every year, 1992-96.

Commodity prices, a major determinant of cash receipts, rose significantly in 1996, especially for wheat, corn, and soybeans. Increased commodity prices, alone, with no changes in other input factors, would normally brighten the outlook for the farm economy and increase the demand for farm machinery. Higher crop prices, coupled with large inventory adjustments, resulted in high net farm income in 1996. Higher commodity prices are the result of low world carryover stocks, primarily caused by drought and adverse weather conditions in major

grain growing countries. High prices also reflect the high export demand for several major commodities. Commodity exports were $60.4 billion in 1996, up $4.6 billion from 1995, an 8-percent increase (table 3.4.3). This is the highest level of commodity exports in at least 10 years. Wheat, feedgrains, and oilseeds compose the largest share of commodity exports. The upward trend in commodity exports favors increased investment in farm machinery.

In 1996, idled land decreased to 34 million acres from a high of 77.7 million in 1988. As Conservation Reserve Program (CRP) contracts expire, some of that land will come into production, possibly spurring demand for farm machinery. Some farmers will still have the same complement of machinery that existed before they signed up for the CRP. Others who may have put the entire farm in the CRP and reduced their machinery inventories will need to obtain more equipment. The overall effect of reductions in CRP acreage should be some increase in demand for farm machinery.

Changes in Farming Practices and Machinery

Two major change factors influencing the farm machinery industry are the emerging interest in precision farming and the continuing adoption of conservation tillage and crop residue management practices.

Precision Agriculture

The newest innovation in agriculture is the trend toward computerized equipment that allows precise quantity and placement of inputs such as fertilizer, seed, and pesticides (Christensen and Krause, 1995). This new technology is known variously as precision farming, site-specific farming, soil-specific crop management, prescription farming, focused fertilizing, spatially variable controlled crop production, and site-specific nutrient management systems. Ideally, precision farming will improve input efficiency and reduce the use of chemicals and fertilizers.

However, unresolved questions need further research. For example, what size of farming operation will benefit most from precision farming? The complexity and expense of the machinery and operations may make precision farming more plausible by large-scale operations, perhaps further concentrating U.S. agriculture. On the other hand, the costs of yield monitors, global positioning computers, and other precision farming equipment is decreasing. And expensive variable-rate fertilizer, pesticide, and seeding equipment is being increasingly supplied by dealers on a custom or rental basis, forestalling large investments at the farm level for equipment that will quickly become obsolete as newer technology is developed. The issue then becomes one of managerial time required to learn and apply the technology. Large-scale farmers may not be able to spend as much time on this technology as medium-scale farmers. Also, small-scale farmers who spend a lot of time working off the farm may not be able to devote much time to precision farming.

Precision farming generally employs satellite technology, which tracks equipment location within a few meters in a field. Site-specific information is important because crop yields can differ significantly throughout a field. Computers record crop yields, soil characteristics, and other data continuously within each field. Fertilizers and pesticides can then be specified from information in the computer data base. This information is used to vary seed, fertilizer, and pesticide quantities to site-specific field locations (Robert and others, 1992).

Precision farming is still in its infancy. Equipment is expensive; variable-rate fertilizer applicators cost as much as $250,000. However, prices are declining as manufacturers develop more efficient ways of producing the specialized computers, receivers, metering devices, and variable-rate seeders, sprayers, and fertilizing equipment. Farmers also face time constraints in learning precision farming. Few courses or training sessions are available and most of the subject matter is highly technical, involving computers and space-age locating, monitoring, and metering equipment.

Researchers at ARS (Agricultural Research Service, USDA) and several universities are investigating the relationships between soil conditions, moisture, nutrient balances, and crop yields, and how these relationships bear on input applications (USDA, NAL, 1994). The farm equipment industry also researches precision farming and has outpaced public research in many areas. Preliminary research indicates improved efficiencies in the use of fertilizers and pesticides. Instead of broadcasting nutrients and chemicals across the field, precision farming prescribes appropriate amounts by soil, moisture, nutrient balance, and other site-specific factors. In addition to improving input inefficiency, precision farming has the potential to lessen adverse environmental effects of current farming practices. By improving input efficiency, precision farming can reduce residual quantities that may otherwise enter streams and groundwater.

While precision farming more commonly refers to site-specific field tracking technology and computerized metering equipment, it may also apply to other innovations. Among the newest is a cultivator that tills between plants within a row (Paulson, 1995). It incorporates video cameras and computer technology with robotics to eliminate weeds to within one-third inch of the plant. It can operate at speeds of up to 10 miles per hour, can be used at night, and can distinguish between weeds and crops. While still in the testing stage, it has promise for the cultivation of row crops such as corn, cotton, lettuce and tomatoes. This technology could reduce the need for herbicides used to eliminate weeds.

Crop Residue Management

The other major change occurring in the farm machinery industry is the continuing development of conservation tillage machinery and equipment used for crop residue management. Tillage equipment used to practice conservation tillage involves several designs aimed at leaving at least 30 percent of the soil surface covered with crop residue. This new and innovative machinery goes by various names, including air drill, mulchmaster, mulch tiller, and conservation disk chisel. Machinery is designed to leave residue on the surface by tilling the ground under the past crop residue instead of turning the ground over and burying residue as was done with moldboard plows and large offset disks.

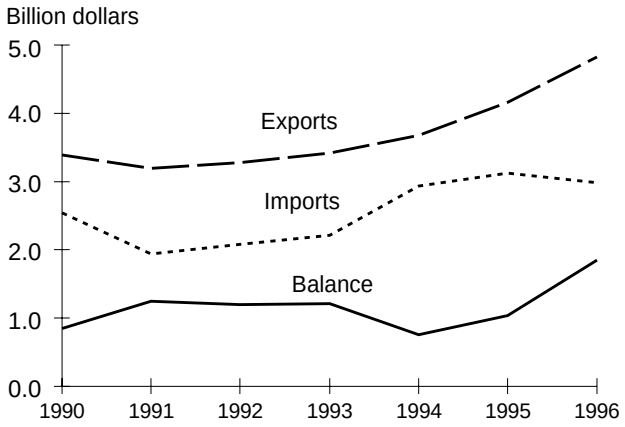
With conservation tillage, the ground is worked fewer times during a crop cycle than with conventional tillage, leaving more residue on the surface. Increased residue helps prevent soil erosion. No-till engages the ground just once, when planting the seed.

Other benefits of crop residue management (and fewer times over the field) are less machinery and equipment wear and lower maintenance. Capital expenditures are reduced as are fuel and labor costs. (See chapter 4.2, *Crop Residue Management*, for a discussion of trends in conservation tillage. See also USDA, ERS, 1994b, page 114, for a discussion of the effects of these trends on farm machinery purchases.)

Farm Machinery Trade

The United States had a trade surplus in farm machinery of $1.85 billion in 1996, up from $1.04 billion in 1995. Exports of farm machinery have exceeded imports for the last 7 years (fig. 3.4.4). Major export and import countries were Canada, the United Kingdom, Germany, and Japan.

Figure 3.4.4--Farm machinery exports, imports, and trade balance (exports minus imports), 1990-96



Source: USDA, ERS, based on unpublished U.S. Department of Commerce data.

Total imports and exports, and consequently the farm machinery trade balance, can be volatile from year to year. A single large sale of combines or irrigation equipment can significantly affect total exports. Changes in factors that affect U.S. demand for farm machinery will affect import totals. Both imports and exports can increase and the trade balance decrease, as happened in 1994 (fig. 3.4.4).

Exports of farm machinery totaled $4.8 billion in 1996, up 16 percent from 1995 (table 3.4.5). Imports for 1996, $3.0 billion, decreased 4 percent from 1995 (table 3.4.6).

The largest export category—tractor gear boxes, axles, chassis, engines, brakes, differentials, wheels, mufflers, exhausts, steering assembles, and parts and accessories not elsewhere classified—accounted for 22 percent of farm machinery exports ($1.0 billion) in 1996. Farm tractors over 100 horsepower made up 14 percent of 1996 exports. Other big export items included combines and harvesters, horticultural equipment, irrigation equipment, and agricultural engines.

Canada was the major export market in 1996, accounting for 32 percent of U.S. farm machinery exports. Canada was also the major supplier of farm machinery imports into the United States, accounting for 22 percent of all 1996 imports (USDA, ERS, 1996b).

Table 3.4.5—U.S. farm machinery exports, 1990-96[1]

Item	1990	1991	1992	1993	1994	1995	1996
				Million dollars			
Total	3,392	3,196	3,280	3,419	3,684	4,158	4,830
Tractors							
Wheel tractors, 40-100 HP	16	12	18	31	45	98	109
Wheel tractors, over 100 HP	331	335	356	445	417	525	691
Wheel tractors, used & misc.	91	84	76	88	87	86	103
Crawlers, less than 160 HP[2]	13	14	13	16	15	16	12
Crawlers, over 160 HP[2]	296	356	327	232	312	310	325
Crawlers, used[2]	17	25	21	16	21	18	16
Self-propelled combines	182	163	205	310	275	288	496
Other combines and harvesters	196	171	141	162	200	218	257
Balers	74	60	66	77	78	68	71
Mowers	42	46	47	55	65	51	42
Other haying equipment	49	34	34	52	52	46	43
Moldboard plows	2	1	1	1	1	0	0
Disc and other plows	9	10	11	15	15	12	17
Harrows and cultivators	28	27	29	43	45	40	50
Seeders and planters	36	29	34	46	52	39	82
Fertilizing equipment	18	22	22	23	27	22	26
Spraying equipment	10	22	24	22	23	25	26
Other seeding, fert., & spray equipment	61	80	84	94	119	116	124
Irrigation equipment	183	174	185	200	157	154	197
Horticultural equipment	179	95	154	176	180	185	229
Crop market preparation equipment	57	65	69	78	61	91	75
Cleaning and grading equipment	21	18	21	17	20	23	27
Dairy equipment	53	54	58	64	72	82	79
Poultry equipment	65	95	101	88	113	132	142
Other livestock equipment	43	49	48	56	60	54	70
Agricultural tools	24	27	41	21	22	20	24
Agricultural engines[2]	315	269	312	253	197	316	427
Gear boxes, axles, and assemblies[2]	969	846	758	711	925	1,096	1,046
Trailers, wagons and parts	13	13	20	27	26	25	24

[1] Some items may not be comparable to previous ERS trade data due to reclassification. Total exports may differ from those derived by other agencies due to inclusion or exclusion of specific categories.

[2] Includes industrial and other non-agricultural uses.

Source: USDA, ERS, based on unpublished U.S. Department of Commerce data.

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Table 3.4.6—U.S. farm machinery imports and trade balance, 1990-96[1]

Item	1990	1991	1992	1993	1994	1995	1996
				Million dollars			
Total	2,545	1,945	2,083	2,210	2,932	3,120	2,981
Tractors							
Wheel tractors, 40-100 HP	718	547	569	565	699	722	623
Wheel tractors, over 100 HP	183	172	188	137	202	220	232
Wheel tractors, used & misc.	97	46	38	59	129	133	115
Crawlers, less than 160 HP	129	82	93	149	204	187	184
Crawlers, over 160 HP	9	2	47	15	36	140	82
Crawlers, used	4	1	1	5	8	4	4
Self-propelled combines	22	18	15	16	25	25	17
Other combines and harvesters	124	95	93	121	113	130	136
Balers	79	71	62	55	67	77	55
Mowers	77	60	60	64	72	73	65
Other haying equipment	33	26	21	33	45	50	35
Moldboard plows	6	6	3	3	1	1	1
Disc and other plows	44	32	27	22	22	21	24
Harrows and cultivators	190	128	118	122	143	138	155
Seeders and planters	40	19	26	56	53	47	66
Fertilizing equipment	17	14	15	16	16	14	14
Spraying equipment	20	12	13	14	14	15	19
Other seeding, fert., & spray equipment	22	21	22	25	29	26	33
Irrigation equipment	7	13	19	17	11	12	16
Horticultural equipment	37	27	27	36	43	44	41
Crop market preparation equipment	20	16	19	20	23	24	29
Cleaning and grading equipment	8	9	9	15	17	12	10
Dairy equipment	18	11	19	18	18	21	20
Poultry equipment	21	27	25	22	25	25	31
Other livestock equipment	25	18	21	23	28	31	29
Agricultural tools	55	35	39	40	43	44	45
Agricultural engines	87	58	71	69	104	127	80
Gear boxes, axles, and assemblies	446	376	419	468	734	746	804
Trailers, wagons and parts	7	4	4	6	8	9	12
Balance: exports minus imports	847	1,251	1,197	1,209	753	1,039	1,849

[1] Some items may not be comparable to previous ERS trade data due to reclassification. Total imports may differ from those derived by other agencies due to inclusion or exclusion of specific categories.

Source: USDA, ERS, based on unpublished U.S. Department of Commerce data.

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