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Uses of Agricultural Machinery in 1964

- Custom and Exchange Work
- Machine Rental

U.S. Department of Agriculture • Economic Research Service • Statistical Reporting Service

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USES OF AGRICULTURAL MACHINERY IN 1964

- Custom and Exchange Work
- Machine Rental

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INTRODUCTION

In the United States, farmers have traditionally owned most of the machinery needed in their farming operations. Joint or cooperative ownership has existed for many years, but with the introduction of larger, specialized, and more expensive machines, hiring a machine and operator to do a particular piece of work--called custom hiring--has increased. Neighboring farmers may each buy a different type of specialized machine, and two or more of them may exchange machine work to spread the use of their machines over more acreage. Thus, they are able to take advantage of the larger and more efficient machines and yet minimize their costs. Another method of purchasing machine services without an operator is short-term rental or leasing.

This report is based on information supplied by crop reporters of the Statistical Reporting Service, and presents data for 1964. These reporters supplied the information on custom and exchange work for their farm operations and for the machines that they rented.

A comprehensive study of the extent of custom work was made in 1956.1/ Comparisons of the extent of custom work on specific farm operations have been made as part of more recent studies, but few of them include exchange work. The extent of exchange work varies considerably by region and by type of farm. For example, in 1961 hay baling exchange work by States ranged from 1 percent in Florida to 10 percent in North Dakota. No previous information is available on the extent of machine rental.

1/ Parsons, Merton S. Farm Machinery: A Survey of Ownership and Custom Work. U. S. Dept. Agr. Statis. Bul. 279, 26 pp., Mar. 1961.

HARVESTING OPERATIONS

Most crops should be harvested as rapidly as weather and crop maturity permit. High-cost machines with a high capacity are required to do a timely job, but this high capacity limits their annual use. Custom or exchange work extends the use of machines for the owner and makes available the use of relatively new machinery to harvest or supplement the harvest of other farmers' crops. More farmers would take advantage of custom machine work if they could be assured of having a machine and operator when needed. Nevertheless, a relatively high percentage of harvesting operations is done by custom operators or by exchange work.

Combining--All Crops

The combine, in terms of acreage covered, is the most important harvesting machine in use in the United States today. The use of the combine, and particularly the self-propelled combine, is increasing with the shift during the last decade to field-shelling of corn. Most of the acreage of other grains, 2/ soybeans, sorghum grain, flaxseed, and dry edible beans, together with one-fourth of the corn for grain, and a wide variety of seed crops, are field-harvested with combines. Custom and exchange work play an important part in the harvesting of these crops.

Of the 153 million acres that were combined in 1964, 28 percent (43 million acres) was harvested with custom or exchange machines (table 1). The practice of custom or exchange combining ranged from 14 percent of the total operations in Oregon to 42 percent in Arizona and North Carolina. The regional averages ranged from 23 percent in the Pacific region to 37 percent in the Southern Plains.

Soybeans

The acreage of soybeans harvested and the use of custom and exchange combines for harvesting soybeans were more important in the Corn Belt than in any of the other regions. Of the 31 million acres harvested in 1964, 17 million acres were in the Corn Belt States (table 1). Nearly one-third of the Corn Belt acreage, or 5.4 million acres, was harvested by custom or exchange arrangement. Nationwide, custom or exchange equipment was used to harvest more than 9 million acres of soybeans. The combining of soybeans with custom or exchange equipment ranged from 18 percent in North Dakota to 44 percent in Wisconsin.

Wheat

Rather wide variations exist in combining wheat by form of machine ownership. Custom or exchange operations accounted for 29 percent of the acreage over the country or 14 million of the 49 million acres harvested. Among the more important wheat-producing States, the range in use of custom or exchange equipment was from 18 percent of the acreage in Washington to 42 percent in Texas (table 2).

2/ Wheat, oats, rye, barley, and rice.

Table 1.--All crops and soybeans: Combining by form of machine ownership, by State and region, 1964

State and region	All crops 1/			Soybeans		
	Acreage of all crops combined	Percentage of acreage combined by--		Acreage of soybeans combined	Percentage of acreage combined by--	
		Own equipment	Custom and exchange equipment		Own equipment	Custom and exchange equipment
	1,000 acres	Percent	Percent	1,000 acres	Percent	Percent
New England	71	68	32	---	---	---
New York	1,068	68	32	4	65	35
New Jersey	146	68	32	42	70	30
Pennsylvania	1,404	65	35	8	65	35
Delaware	312	78	22	196	80	20
Maryland	704	73	27	239	77	23
Northeast	3,705	69	31	489	77	23
Michigan	2,894	72	28	343	74	26
Wisconsin	2,579	72	28	125	56	44
Minnesota	9,038	76	24	2,852	70	30
Lake States	14,511	74	26	3,320	70	30
Ohio	4,670	72	28	1,860	72	28
Indiana	6,706	70	30	2,817	68	32
Illinois	12,545	72	28	5,734	72	28
Iowa	8,209	66	34	4,254	65	35
Missouri	6,423	68	32	2,730	66	34
Corn Belt	38,553	70	30	17,395	69	31
North Dakota	14,579	82	18	192	82	18
South Dakota	6,715	71	29	252	69	31
Nebraska	8,127	72	28	523	73	27
Kansas	15,119	73	27	691	78	22
Northern Plains	44,540	75	25	1,658	76	24
Virginia	1,028	70	30	382	71	29
West Virginia	58	60	40	---	---	---
North Carolina	1,684	58	42	681	60	40
Kentucky	817	73	27	260	74	26
Tennessee	978	66	34	586	64	36
Appalachian	4,565	65	35	1,909	65	35
South Carolina	1,291	69	31	746	70	30
Georgia	1,000	68	32	120	73	27
Florida	226	59	41	62	60	40
Alabama	411	75	25	161	80	20
Southeast	2,928	69	31	1,089	71	29
Mississippi	1,704	73	27	1,291	72	28
Arkansas	4,044	75	25	2,981	75	25
Louisiana	1,123	68	32	423	65	35
Delta States	6,871	73	27	4,695	73	27
Oklahoma	6,108	62	38	136	60	40
Texas	10,835	64	36	63	75	25
Southern Plains	16,943	63	37	199	65	35
Montana	6,071	77	23	---	---	---
Idaho	2,401	75	25	---	---	---
Wyoming	478	74	26	---	---	---
Colorado	2,708	66	34	---	---	---
New Mexico	445	70	30	---	---	---
Arizona	385	58	42	---	---	---
Utah	422	66	34	---	---	---
Nevada	38	61	39	---	---	---
Mountain	12,948	73	27	---	---	---
Washington	3,089	84	16	---	---	---
Oregon	1,578	86	14	---	---	---
California	2,844	65	35	---	---	---
Pacific	7,511	77	23	---	---	---
48 States	153,075	72	28	30,754	70	30

1/ Includes small grains, soybeans, sorghum grain, flaxseed, dry edible beans, corn, and miscellaneous crops for seed.

Table 2.--Wheat and other grains: Combining by form of machine ownership, by State and region, 1964

State and region	Wheat			Other grains 1/		
	Acreage of wheat combined	Percentage of acreage combined by--		Acreage of other grains combined	Percentage of acreage combined by--	
		Own equipment	Custom and exchange equipment		Own equipment	Custom and exchange equipment
	1,000 acres	Percent	Percent	1,000 acres	Percent	Percent
New England	---	---	---	53	65	35
New York	203	70	30	596	66	34
New Jersey	39	69	31	47	60	40
Pennsylvania	477	63	37	741	65	35
Delaware	22	74	26	32	72	28
Maryland	141	68	32	155	72	28
Northeast	882	66	34	1,624	66	34
Michigan	1,007	70	30	721	70	30
Wisconsin	58	65	35	2,132	73	27
Minnesota	925	82	18	4,268	80	20
Lake States	1,990	75	25	7,121	77	23
Ohio	1,373	76	24	697	69	31
Indiana	1,410	70	30	445	65	35
Illinois	1,842	74	26	1,192	77	23
Iowa	97	74	26	2,393	70	30
Missouri	1,429	71	29	593	73	27
Corn Belt	6,151	73	27	5,320	78	28
North Dakota	6,236	79	21	6,842	85	15
South Dakota	2,139	65	35	3,615	75	25
Nebraska	2,953	68	32	3,059	74	26
Kansas	9,576	71	29	3,934	77	23
Northern Plains	20,904	72	28	17,450	79	21
Virginia	215	68	32	211	72	28
West Virginia	20	60	40	29	60	40
North Carolina	262	60	40	296	60	40
Kentucky	160	67	33	92	70	30
Tennessee	150	69	31	106	67	33
Appalachian	807	65	35	734	63	37
South Carolina	85	70	30	230	73	27
Georgia	74	75	25	202	78	22
Florida	42	70	30	17	80	20
Alabama	59	75	25	66	75	25
Southeast	260	73	27	515	76	24
Mississippi	153	78	22	157	80	20
Arkansas	445	70	30	535	75	25
Louisiana	66	70	30	550	70	30
Delta States	664	72	28	1,242	73	27
Oklahoma	4,201	60	40	1,440	67	33
Texas	3,017	58	42	6,526	65	35
Southern Plains	7,218	59	41	7,966	66	34
Montana	3,724	78	22	1,828	75	25
Idaho	1,110	76	24	727	70	30
Wyoming	224	76	24	210	74	26
Colorado	1,707	65	35	699	65	35
New Mexico	132	80	20	212	67	33
Arizona	33	60	40	288	55	45
Utah	203	70	30	160	60	40
Nevada	21	65	35	16	55	45
Mountain	7,154	74	26	4,140	70	30
Washington	2,019	82	18	665	88	12
Oregon	763	85	15	563	88	12
California	309	74	26	2,021	65	35
Pacific	3,091	82	18	3,249	74	26
48 States	49,121	71	29	49,361	74	26

1/ Includes oats, barley, rice, rye, flaxseed, and sorghum grain. Acreages combined include relatively small amounts which were harvested by other methods but are considered to be insignificant in regard to determining percentages harvested with the farmers' equipment and with custom and exchange equipment.

Other Grains

About 49 million acres of oats, barley, rye, rice, flaxseed, and sorghum grain were harvested by combines in 1964 (table 2). Custom or exchange machines accounted for 26 percent of this harvesting. North Dakota, with 14 percent of the total acreage combined in the 48 States, hired or exchanged work on only 15 percent of this acreage, whereas Texas, with 13 percent of the 48-State total, used custom or exchange operations for 35 percent of its acreage.

Corn

Methods of harvesting corn have changed quite rapidly in the last decade. Harvesting corn by mechanical picker is declining while harvesting with field-shellers is increasing. In 1964, 32 percent of the corn harvested for grain was field-shelled (table 3). For comparison, field-shelling accounted for 15 percent of the acreage of corn in 1960 and only 3 percent in 1956.3/

While the Corn Belt had the largest acreage harvested by machine, it ranked fifth in percentage of field-shelled corn. The Pacific and Mountain regions showing the smallest acreage had the highest percentage of field-shelling. The proportion field-shelled varied widely among the States (table 3). Generally, field-shelling is most important in those States where corn acreage per farm is large and much of the corn is sold off the farm as cash grain.

In 1964, the combine was the most important machine used to field-shell corn, accounting for three-fourths of all corn field-shelled compared with two-thirds in 1960.3/ The other machines used to field-shell corn were the picker-sheller and conventional ear cornpickers with either mounted, semimounted, or trailing shellers. Although these machines were the first to be used to field-shell corn, they have declined in relative importance since the introduction of the corn head attachment for the combine in 1954.

The proportion of the corn field-shelled by combines is high in those States where field-shelling is relatively more important. This reflects the relationship between the larger capacity and higher investments in the combines and their use on the larger farms in the cash-grain areas of the Corn Belt and the Northern Plains. Pickers and shellers tend to be used on smaller farms and on livestock farms.

In many instances combining corn involves adding another attachment to a basic unit already owned. Data on field-shelling units (complete machines, attachments for cornpickers, and corn heads for combines) indicate that about 100,000 units were produced and shipped by the end of 1964, of which 75,000 were corn head attachments for combines.

Farmers generally hire custom or exchange machine work for harvesting corn because they do not have sufficient acres to justify ownership of adequate equipment. The acreage required to justify the use of field-shelling equipment is higher than it

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3/ Csorba, Julius J., and Kirkbride, John W. Harvesting of Corn, Small Grains and Related Crops: Data on Practices. U. S. Dept. Agr. Statis. Bul. 354, Dec. 1964.

Table 3.--Corn for grain: Harvesting by type of machine, by State and region, 1964

State and region	Total acreage harvested by machine	Percentage of acreage harvested by--		Percentage of field-shelled corn harvested by--	
		Mechanical picker	Field shellers	Combine	Other 1/
	1,000 acres	Percent	Percent	Percent	Percent
Northeast	1,612	75	25	63	37
Michigan	1,557	79	21	67	33
Wisconsin	1,456	88	12	58	42
Minnesota	4,498	78	22	60	40
Lake States	7,511	80	20	61	39
Ohio	2,888	76	24	72	28
Indiana	4,627	55	45	86	14
Illinois	9,134	55	45	84	16
Iowa	9,708	81	19	68	32
Missouri	2,933	54	46	80	20
Corn Belt	29,290	66	34	80	20
North Dakota	183	53	47	81	19
South Dakota	2,556	81	19	63	37
Nebraska	4,094	63	37	78	22
Kansas	1,015	46	54	74	26
Northern Plains	7,848	66	34	75	25
Virginia	417	52	48	75	25
West Virginia	40	82	18	45	55
North Carolina	1,150	48	52	55	45
Kentucky	983	73	27	68	32
Tennessee	791	79	21	45	55
Appalachian	3,381	63	37	60	40
South Carolina	361	40	60	79	21
Georgia	1,328	46	54	70	30
Florida	324	50	50	55	45
Alabama	882	89	11	64	36
Southeast	2,895	59	41	69	31
Delta States	555	82	18	78	22
Southern Plains	694	76	24	71	29
Mountain	234	57	43	83	17
Pacific	145	43	57	83	17
48 States	54,165	68	32	75	25

1/ Includes corn field-shelled by pickers with sheller attachments and picker-shellers.

is for equipment to pick ear corn. Thus, the percentage of corn harvested by custom or exchange machines in 1964 was higher for field-shelling--34 percent--than for picking ear corn--18 percent (table 4). Custom or exchange field-shelling generally is used to harvest the corn that is marketed direct from the field. Some farmers field-shell and market direct corn that exceeds their farm storage capacity for ear corn.

Hay

Slightly less than a third of the hay acreage baled was custom-baled (table 5). The extent of custom baling varied from 10 percent in New York to 45 percent in Texas and North Carolina. With sales of balers relatively high and numbers on farms increasing, a decline in custom baling has occurred. The increasing use of bale throwers could cause custom baling to become more important. Some farmers with a usable baler without a thrower now hire or exchange baling.

No specific information is available on the extent to which farmers use custom or exchange work for other haying operations. Windrowing and conditioning of hay are likely to be next in order of importance after baling.

Silage

Comments of farmers indicate that custom harvesting of silage is increasing. In 1964, it represented 27 percent of the acreage, or about the same proportion as for hay at that time (table 5). Silage is made from corn, grass, sorghum, and miscellaneous byproducts from processing plants. It is usually chopped and is a bulky, high-moisture product that must be handled rapidly to be preserved by its own fermentation process. Power-operated equipment is most economical and efficient, but it requires a large investment which cannot be justified without large acreages.

OTHER OPERATIONS

Corn-Drying

Most of the field-shelled corn is harvested before the moisture content is low enough for safe storage as corn for grain. Part of the drying is done by the elevator operators who buy the corn. Farmers either dry the remainder or hire someone to dry it.

Nearly all corn that was artificially dried was field-shelled. In 1964, 17 percent of the corn that was harvested for grain was dried by or for farmers before being sold or used (table 6). Since 32 percent of the acreage of corn was field-shelled (table 3), it follows that slightly more than half of this corn was artificially dried by the farmer or was custom-dried for him. The remainder was stored by farmers as high-moisture corn, or dried or conditioned by the elevator operators who bought the corn.

Farmers dried an estimated 609 million bushels of corn in 1964; about 65 percent was in the Corn Belt States (table 6). Custom operation accounted for 24 percent of the artificial drying. Of this custom-dried corn, 73 percent was dried off the farm where grown before being sold, stored, or used.

Table 4.--Corn for grain: Harvesting by type of machine and form of ownership, by State and region, 1964

State and region	Total acreage harvested by machine	Mechanical picker			Field sheller		
		Acreage	Percentage of acreage picked by--		Acreage	Percentage of acreage shelled by--	
			Own equipment	Custom and exchange equipment		Own equipment	Custom and exchange equipment
	1,000 acres	1,000 acres	Percent	Percent	1,000 acres	Percent	Percent
Northeast	1,612	1,213	74	26	399	64	36
Michigan	1,557	1,230	77	23	327	69	31
Wisconsin	1,456	1,281	70	30	175	71	29
Minnesota	4,498	3,508	83	17	990	60	40
Lake States	7,511	6,019	79	21	1,492	64	36
Ohio	2,888	2,195	82	18	693	64	36
Indiana	4,627	2,545	83	17	2,082	70	30
Illinois	9,134	5,024	89	11	4,110	67	33
Iowa	9,708	7,863	82	18	1,845	64	36
Missouri	2,933	1,584	85	15	1,349	62	38
Corn Belt	29,290	19,211	85	15	10,079	66	34
North Dakota	183	97	87	13	86	79	21
South Dakota	2,556	2,070	88	12	486	74	26
Nebraska	4,094	2,579	90	10	1,515	72	28
Kansas	1,015	467	84	16	548	68	32
Northern Plains	7,848	5,213	89	11	2,635	72	28
Virginia	417	217	79	21	200	66	34
West Virginia	40	33	65	35	7	57	43
North Carolina	1,150	548	74	26	602	53	47
Kentucky	983	714	68	32	269	69	31
Tennessee	791	621	68	32	170	65	35
Appalachian	3,381	2,133	71	29	1,248	60	40
South Carolina	361	159	70	30	202	55	45
Georgia	1,328	609	75	25	719	65	35
Florida	324	163	70	30	161	61	39
Alabama	882	769	75	25	113	67	33
Southeast	2,895	1,700	74	26	1,195	62	37
Delta States	555	475	67	33	80	54	46
Southern Plains	694	480	67	33	214	44	56
Mountain	234	131	67	33	103	56	44
Pacific	145	63	80	20	82	61	39
48 States	54,165	36,638	82	18	17,527	66	34

Table 5.--Hay and silage: Harvesting operations by form of machine ownership, by State and region, 1964

State and region	Hay			Silage 2/		
	Estimated acreage baled 1/	Percentage baled by--		Estimated acreage	Percentage harvested by--	
		Own equipment	Custom and exchange equipment		Own equipment	Custom and exchange equipment
	1,000 acres	Percent	Percent	1,000 acres	Percent	Percent
New England	1,500	87	13	202	73	17
New York	2,650	90	10	648	81	19
New Jersey	185	82	18	73	81	19
Pennsylvania	2,000	85	15	466	72	28
Delaware	40	83	17	14	79	21
Maryland	370	85	15	138	72	18
Northeast	6,745	87	13	1,541	79	21
Michigan	1,580	78	22	422	78	22
Wisconsin	3,370	83	17	1,668	77	23
Minnesota	3,140	77	23	1,337	68	32
Lake States	8,090	80	20	3,427	73	27
Ohio	1,740	77	23	433	76	24
Indiana	1,160	60	40	187	72	28
Illinois	1,750	65	35	497	77	23
Iowa	2,990	63	37	629	65	35
Missouri	2,950	60	40	388	69	31
Corn Belt	10,590	64	36	2,134	70	30
North Dakota	2,370	85	15	773	81	19
South Dakota	2,320	76	24	1,062	68	32
Nebraska	2,500	71	29	521	71	29
Kansas	2,180	66	34	755	72	28
Northern Plains	9,370	73	27	3,111	73	27
Virginia	1,100	70	30	206	74	26
West Virginia	540	68	32	41	60	40
North Carolina	560	55	45	122	75	25
Kentucky	1,500	58	42	90	76	24
Tennessee	1,260	57	43	76	78	22
Appalachian	4,960	61	39	535	75	25
South Carolina	290	63	37	36	81	19
Georgia	520	70	30	90	81	19
Florida	100	73	27	11	82	18
Alabama	500	70	30	57	81	19
Southeast	1,410	69	31	194	81	19
Mississippi	680	60	40	54	80	20
Arkansas	700	65	35	35	77	23
Louisiana	400	61	39	23	83	17
Delta States	1,780	62	38	112	79	21
Oklahoma	1,580	58	42	128	80	20
Texas	2,000	55	45	140	79	21
Southern Plains	3,580	56	44	268	79	21
Montana	1,700	86	14	---	---	---
Idaho	1,140	79	21	---	---	---
Wyoming	870	85	15	---	---	---
Colorado	1,400	83	17	---	---	---
New Mexico	230	79	21	---	---	---
Arizona	230	85	15	---	---	---
Utah	500	76	24	---	---	---
Nevada	270	60	40	---	---	---
Mountain	6,340	82	18	515	71	29
Washington	820	73	27	---	---	---
Oregon	890	75	25	---	---	---
California	1,770	64	36	---	---	---
Pacific	3,480	69	31	265	77	23
48 States	56,345	72	28	12,102	73	27

1/ Hay acreage from "Crop Production," 1965 annual summary, adjusted by an estimated percentage baled.
2/ Includes mainly corn, grass, sorghum, and miscellaneous products.

Table 6.--Corn: Drying by type of machine ownership, by region and rank of States, 1964

Region 1/	Total bushels harvested	Artificially dried		Percentage of total dried artificially by--		Percentage of custom drying--	
	Quantity	Percentage	Quantity	Own equipment	Custom equipment	On-farm	Off-farm
	Mil. bu.	Percent	Mil. bu.	Percent	Percent	Percent	Percent
Northeast: Pa., Del., Md., N.Y., N.J., N.Eng.	98	16	16	76	24	17	83
Lake States: Minn., Mich., Wis.	479	15	72	75	25	16	84
Corn Belt: Ill., Iowa, Ind., Ohio, Mo.	2,181	18	393	75	25	29	71
Northern Plains: Nebr., S. Dak., Kans., N. Dak.	353	21	74	85	15	27	73
Appalachian: Ky., Va., N.C., Tenn., W. Va.	225	13	29	72	28	29	71
Southeast: Ga., Ala., S.C., Fla.	153	12	18	78	22	32	68
States reporting: Calif., Tex., Colo., Miss., Oreg., Wash., La., Idaho	95	10	9	73	27	35	65
48 States	3,584	17	609	76	24	27	73

1/ States within regions are listed according to volume of corn.

Hauling Farm Products

Transporting farm products to market or to off-farm storage often requires heavier equipment than is needed for regular on-the-farm duties. For the heavy loads and long hauls many farmers hire trucks. In 1964, the extent of custom hauling of farm products varied widely among the States, from 15 percent in North Dakota to 75 percent in Wisconsin, Pennsylvania, and the New England States (table 7). By regions, the range of the products being custom hauled was from 34 percent in the Delta States to 68 percent in the Northeast. Leading products for custom hauling were milk, livestock, grains, sugarbeets, and hay. Milk is nearly all custom hauled. Thus, States where milk production is important generally had a high proportion of the products hauled by custom haulers.

Grinding Feed

Farmers often have the feed grinding done by a portable mill or at a local mill. In addition, many of them have their own grain blended and mixed into a balanced ration when it is custom ground. Almost two-thirds (64 percent) of the hired grinding in 1964 was at off-the-farm mills (table 7). Farmers frequently store grain at the mill and have grinding and mixing done as their needs require. Grinding feed with custom equipment comprised about 57 percent of the total tonnage ground in 1964.

Fertilizer Application

To get total machine use for the application of fertilizer, acreage was counted each time fertilizer was applied (table 8). Of the acreage covered, about 108 million received dry fertilizer and about 50 million received liquid fertilizer. The use of custom equipment was not widespread for dry fertilizer. About 17 percent of the acreage receiving dry fertilizer utilized the services of custom operators or equipment, whereas custom operators applied liquid fertilizer to one-third of the acreage that received this type of fertilization. The Corn Belt was highest in the use of custom work for both types of treatment.

Many dealers or distributors of liquid fertilizer are equipped to apply it. Farmers take advantage of this service, as shown by the relatively high percentage applied by machines other than their own.

Tillage and Planting

Traditionally, most farmers do their own tillage and planting. Thus, custom and exchange work account for a relatively small amount of tillage and planting operations. In the States reporting, custom and exchange equipment was used for 4 percent of the plowing, 2 percent of the disking and harrowing, and 4 percent of the planting (table 9). With the increasing size of machines, some farmers who did not hire tillage operations in 1964 expressed interest in doing so in the future.

Custom or exchange work was relatively unimportant for disking and harrowing in most of the States, however, in some of the Appalachian and Southeastern States the range was from 5 to 8 percent of the operations.

Table 7.--Hauling farm products and grinding feed by type of machine ownership, by State and region, 1964

State and region	Hauling			Grinding feed				
	Total tons hauled	Percentage of tonnage by--		Total tons ground	Percentage of tonnage by--		Percentage of tonnage custom ground--	
		Own equipment	Custom equipment 1/		Own equipment	Custom equipment	On-farm	Off-farm
	Million tons	Percent	Percent	Million tons	Percent	Percent	Percent	Percent
New England	5.0	25	75	0.1	12	88	28	72
New York	10.2	35	65	1.2	14	86	30	70
New Jersey	.8	30	70	.2	16	84	43	57
Pennsylvania	6.0	25	75	2.3	30	70	43	57
Delaware	.4	60	40	---	35	65	45	55
Maryland	1.6	55	45	.3	22	78	27	73
Northeast	24.0	32	68	4.1	24	76	37	63
Michigan	11.0	45	55	2.7	24	76	28	72
Wisconsin	15.0	25	75	4.8	17	83	18	82
Minnesota	17.0	40	60	6.4	44	56	50	50
Lake States	43.0	36	64	13.9	31	69	32	68
Ohio	11.0	50	50	4.1	27	73	21	79
Indiana	11.0	55	45	3.7	39	61	18	82
Illinois	20.0	50	50	5.2	58	42	45	55
Iowa	18.0	35	65	11.5	48	52	58	42
Missouri	8.0	45	55	3.5	59	41	46	54
Corn Belt	68.0	46	54	28.0	47	53	42	58
North Dakota	9.0	85	15	1.9	60	40	40	60
South Dakota	6.0	50	50	2.7	64	36	56	44
Nebraska	11.0	55	45	4.1	72	28	61	39
Kansas	14.0	70	30	2.7	40	60	25	75
Northern Plains	40.0	66	34	11.4	61	39	33	67
Virginia	3.0	35	65	.7	26	74	32	68
West Virginia	.5	40	60	.2	43	57	26	74
North Carolina	3.5	45	55	1.0	26	74	24	76
Kentucky	3.5	45	55	1.2	23	77	25	75
Tennessee	3.0	50	50	.7	28	72	26	74
Appalachian	13.5	44	56	3.8	56	74	26	74
South Carolina	1.0	55	45	.2	26	74	34	66
Georgia	2.3	55	45	1.1	45	55	42	58
Florida	3.0	75	25	.2	12	88	40	60
Alabama	2.2	55	45	.5	43	57	28	72
Southeast	8.5	62	38	2.0	39	61	37	63
Mississippi	2.0	65	35	.4	23	77	27	73
Arkansas	4.0	65	35	.4	18	82	35	65
Louisiana	2.5	70	30	.1	31	69	31	69
Delta States	8.5	66	34	.9	22	78	32	68
Oklahoma	6.0	50	50	1.0	38	62	32	68
Texas	19.0	55	45	1.2	52	48	23	77
Southern Plains	25.0	54	46	2.2	46	54	28	72
Montana	5.5	75	25	.4	52	48	21	79
Idaho	7.5	65	35	.5	54	46	50	50
Colorado	7.5	65	35	1.1	58	42	24	76
Other States 2/	9.5	43	57	.7	66	34	14	86
Mountain	30.0	60	40	2.7	58	42	27	73
Washington	8.0	60	40	.3	40	60	13	87
Oregon	6.5	65	35	.3	32	68	13	87
California	25.0	20	80	.3	77	23	44	56
Pacific	39.5	36	64	.9	49	51	18	82
48 States	300.0	48	52	70.0	43	57	36	64

1/ Leading products for custom hauling were milk, livestock, grains, sugarbeets, and hay.
2/ Wyoming, New Mexico, Arizona, Utah, and Nevada.

Table 8.--Fertilizer: Designated operations by type of fertilizer and form of machine ownership, by region, 1964

Region	Dry fertilizer			Liquid fertilizer		
	Acreage fertilized 1/	Percentage of acreage fertilized by--		Acreage fertilized 1/	Percentage of acreage fertilized by--	
		Own equipment	Custom equipment		Own equipment	Custom equipment
	Million acres	Percent	Percent	Million acres	Percent	Percent
Northeast	6.5	86	14	0.9	67	33
Lake States	13.7	84	16	3.9	59	41
Corn Belt	28.9	78	22	14.7	55	45
Northern Plains	15.2	87	13	7.8	67	33
Appalachian	9.3	84	16	2.6	65	35
Southeast	10.0	86	14	3.5	60	40
Delta States	5.1	80	20	2.8	75	25
Southern Plains	8.4	83	17	5.2	83	17
Mountain	5.3	81	19	2.1	71	29
Pacific	5.5	84	16	6.3	84	16
48 States	107.9	83	17	49.8	67	33

1/ Acreage was counted each time fertilizer was applied.

Table 9.--Tillage and planting: Designated operations by type of machine ownership, by State and region, 1964

State and region	Plowing			Disking and harrowing			Planting, drilling, etc.		
	Acreage	Percentage of acreage by--		Acreage covered	Percentage of acreage by--		Total acreage	Percentage of acreage by--	
		Own equipment	Custom and exchange equipment		Own equipment	Custom and exchange equipment		Own equipment	Custom and exchange equipment
	Million acres	Percent	Percent	Million acres	Percent	Percent	Million acres	Percent	Percent
New England	0.3	97	3	0.4	97	3	0.4	94	6
New York	1.8	97	3	2.6	98	2	1.9	93	7
New Jersey	.3	98	2	.4	99	1	.4	96	4
Pennsylvania	2.2	97	3	3.2	98	2	2.6	94	6
Delaware	.4	99	1	.4	---	---	.5	95	5
Maryland	1.1	94	6	1.5	96	4	1.2	93	7
Northeast	6.1	97	3	8.5	98	2	7.0	94	6
Michigan	4.5	97	3	7.0	98	2	5.0	96	4
Wisconsin	5.0	97	3	6.5	99	1	5.1	94	6
Minnesota	14.5	96	4	20.5	97	3	14.5	96	4
Lake States	24.0	96	4	34.0	98	2	24.6	96	4
Ohio	6.8	96	4	9.0	98	2	7.5	96	4
Indiana	7.7	96	4	13.0	97	3	10.0	95	5
Illinois	15.0	97	3	25.0	98	2	19.0	96	4
Iowa	13.5	94	6	27.0	98	2	18.0	94	6
Missouri	7.5	94	6	11.0	96	4	9.3	94	6
Corn Belt	50.5	95	5	85.0	98	2	63.8	95	5
North Dakota	10.0	98	2	14.0	99	1	15.0	98	2
South Dakota	7.3	98	2	14.0	99	1	10.3	97	3
Nebraska	5.7	97	3	18.0	99	1	12.3	98	2
Kansas	14.5	96	4	23.0	98	2	18.5	98	2
Northern Plains	37.5	97	3	69.0	99	1	56.1	98	2
Virginia	1.5	94	6	2.0	95	5	1.9	92	8
West Virginia	.1	92	8	.2	94	6	.2	91	9
North Carolina	1.8	93	7	2.2	92	8	3.7	91	9
Kentucky	1.5	93	7	2.6	96	4	2.0	94	6
Tennessee	2.0	96	4	2.9	96	4	2.8	95	5
Appalachian	6.9	94	6	9.9	95	5	10.6	93	7
South Carolina	1.5	93	7	1.8	93	7	2.6	93	7
Georgia	3.6	96	4	3.8	97	3	3.5	96	4
Florida	1.1	94	6	2.2	93	7	.7	95	5
Alabama	1.4	92	8	1.7	93	7	2.7	93	7
Southeast	7.6	94	6	9.5	95	5	9.5	94	6
Mississippi	3.2	96	4	4.1	96	4	4.1	95	5
Arkansas	2.5	96	4	4.2	97	3	5.6	97	3
Louisiana	1.3	94	6	1.5	95	5	2.0	91	9
Delta States	7.0	96	4	9.8	96	4	11.7	95	5
Oklahoma	10.4	94	6	11.3	96	4	8.3	96	4
Texas	21.8	95	5	17.1	96	4	20.8	96	4
Southern Plains	32.2	95	5	28.4	96	4	29.1	96	4
Montana	2.5	97	3	3.8	99	1	6.2	98	2
Idaho	2.1	95	5	3.3	98	2	2.8	97	3
Wyoming	.7	94	6	1.2	95	5	.7	97	3
Colorado	3.3	97	3	5.5	99	1	5.2	98	2
New Mexico	1.4	98	2	2.1	98	2	.9	97	3
Arizona	.7	87	13	1.3	94	6	.8	95	5
Utah	.6	94	6	.7	97	3	.5	95	5
Nevada	.1	98	2	.2	97	3	.1	95	5
Mountain	11.4	95	5	18.1	98	2	17.2	97	3
Washington	2.4	97	3	3.3	99	1	3.2	97	3
Oregon	2.4	97	3	3.4	99	1	1.7	97	3
California	3.0	94	6	6.3	98	2	4.6	95	5
Pacific	7.8	96	4	13.0	98	2	9.5	96	4
48 States	191.0	96	4	285.2	98	2	239.1	96	4

Cultivating, Land Clearing, and Leveling

Most of the cultivating of crops and land--97 percent--was done by farmers with their own equipment (table 10).

For land clearing, heavy specialized equipment is usually required. Largely because of this, custom and exchange equipment was used for 50 percent of the acreage cleared. Land leveling and forming is in a similar category. The extent of hiring or exchanging for this work amounted to 28 percent of the acreage involved. Regionally the range was from 21 percent in the Southern Plains to 40 percent in the Appalachian.

MACHINE RENTAL OR LEASE

While machine renting or leasing is still relatively unimportant, interest is spreading among farmers, machinery dealers, and others in the farm machinery industry. There is wide variety in machines rented or leased by farmers. The four machines most often rented or leased were tractors, trucks, fertilizer distributors, and sprayers (table 11). In addition to the machines shown in table 11, at least 15 other types of machines and attachments were reported used by farmers. These include sheller attachments to cornpickers, rockpickers, forage blowers, auger wagons, airhammers, posthole diggers, corn driers, ditching machines, gopher killers, grain binders, sheepshears, saw rigs, barn sprayers, emergency generators, and harrows.

The source of rental equipment is mainly dealers, but farmers rent out their equipment in some States. Recently some banks have offered equipment for rent or lease. Most of the machines were rented on a short-term basis, such as a combine to hasten a harvest. However, some farmers reported leasing equipment on an annual basis, usually tractors.

The economics of leasing is analyzed in a recent publication: "Economics of Leasing Farm Machinery and Buildings," Bulletin No. 450, Department of Agricultural Economics, N. Dak. State Univ. Agr. Expt. Sta., Fargo, N. Dak., Sept. 1964.

Table 10.--Cultivating, land clearing, and land leveling and forming, type of machine ownership, by region, 1964

Region	Cultivating			Land clearing			Land leveling and forming		
	Acreage covered	Percentage of acreage by--		Total acreage	Percentage of acreage by--		Total acreage	Percentage of acreage by--	
		Own equipment	Custom and exchange equipment		Own equipment	Custom and exchange equipment		Own equipment	Custom and exchange equipment
	1,000 acres	Percent	Percent	1,000 acres	Percent	Percent	1,000 acres	Percent	Percent
Northeast	4,321	97	3	61	55	45	54	73	27
Lake States	23,021	98	2	116	37	63	298	78	22
Corn Belt	59,959	97	3	327	35	65	368	65	35
Northern Plains	44,684	98	2	100	53	47	447	64	36
Appalachian	7,400	96	4	229	49	51	92	60	40
Southeast	6,959	96	4	165	55	45	183	73	27
Delta States	8,779	98	2	301	52	48	691	75	25
Southern Plains	22,388	96	4	540	63	53	1,230	79	21
Mountain	19,788	99	1	292	67	33	1,068	73	27
Pacific	11,548	99	1	95	60	40	709	62	38
48 States	208,847	97	3	2,226	50	50	5,140	72	28

Table 11.--Machines rented or leased: Number per 1,000 farms, by regions, 1964

Region	Tractors	Trucks	Fertilizer distributors		Sprayers	Forage harvesters	Hay conditioners	Windrowers	Stalk cutters	Grain drills	Grain combines	Plows	Disks	Planters & seeders	Cultivators & weeders
			Dry	Liquid											
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Northeast	10	12	10	1/	12	3	2	1	1	5	3	1/	1/	4	1
Lake States	14	6	18	4	20	1	4	3	4	4	4	1	3	4	1
Corn Belt	10	5	17	10	10	1/	5	---	4	2	1	2	1	1	1
Northern Plains	13	10	15	12	14	2	1	4	4	5	3	3	2	1/	3
Appalachian	8	9	1	2	7	1	3	---	1/	1	2	---	1/	1/	---
Southeast	10	2	4	1/	2	1/	1/	---	---	---	1	1	1	1/	1/
Delta States	10	4	3	1/	4	---	2	---	---	1	2	---	1	1	1
Southern Plains	10	12	12	8	5	---	3	1/	3	7	3	2	2	1	1
Mountain	14	15	14	5	14	3	1	4	1/	6	7	2	2	1	1
Pacific	15	20	8	10	17	1	1	2	---	3	3	3	3	1	1
48 States	11	8	10	5	10	1	3	1	2	3	2	1	1	1	1

1/ Less than 0.5.

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