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Machinery Costs on Typical Wheat Farms in North Eastern South Dakota: Beadle, Clark, Codington, Day, Marshall, and Roberts Counties

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Machinery Costs on Typical Wheat Farms

In North Eastern South Dakota

Beadle, Clark, Codington, Day, Marshall Counties and Roberts

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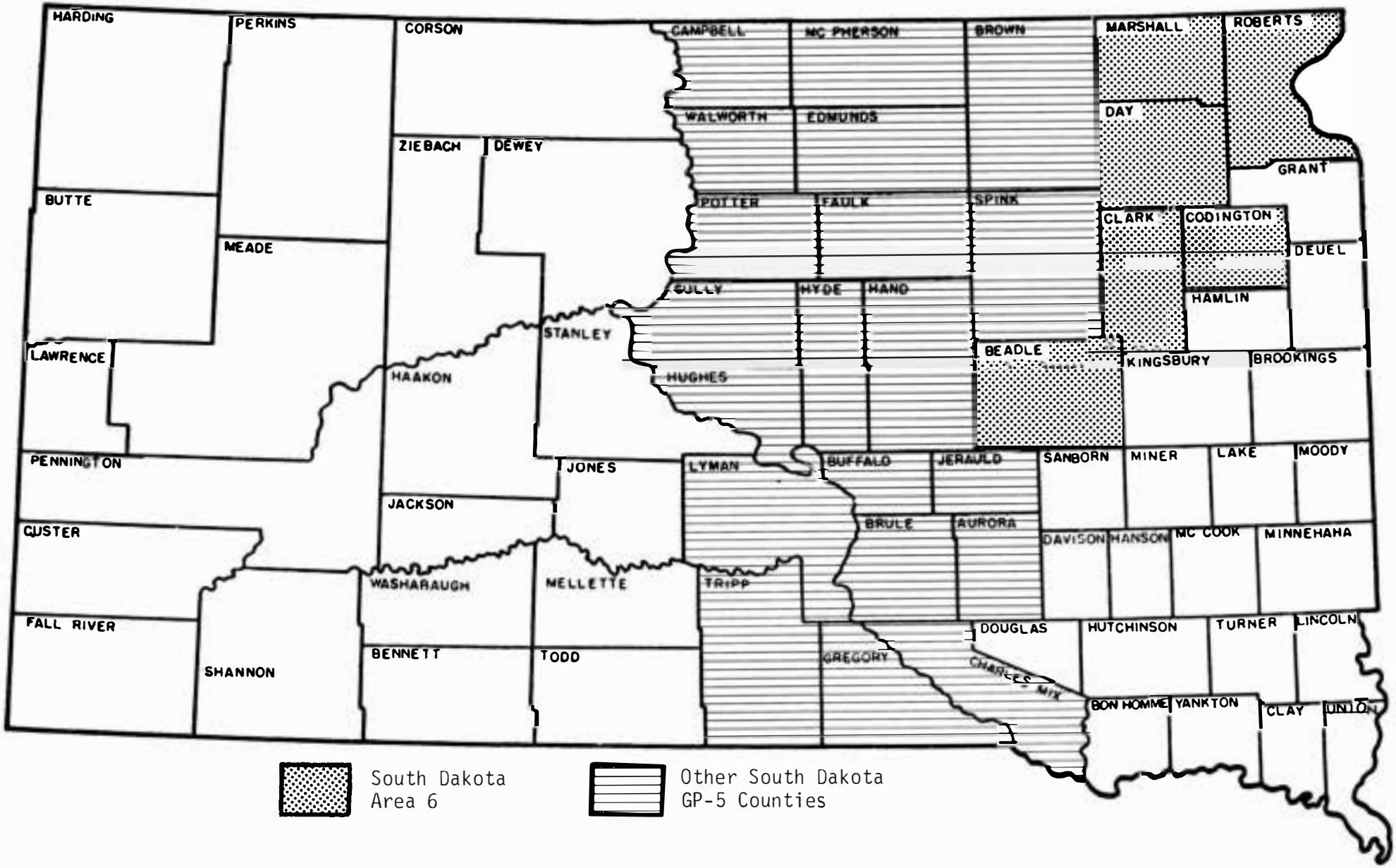
Figure 1. South Dakota GP-5 Study Area



PREFACE

The data presented in this report were gathered and compiled in a cooperative research project between the South Dakota Agricultural Experiment Station and the Farm Production Economics Division, Economic Research Service, U.S. Department of Agriculture. This research contributes to a larger project--GP-5, "Economic Problems in the Production and Marketing of Great Plains Wheat."

The general objectives of the research undertaken in South Dakota were (1) to provide economic data needed by farmers and to make adjustments in their farming systems and production practices and (2) to develop a research background for evaluating government farm programs under varying assumptions.

Similar contributing projects to GP-5 are simultaneously being conducted in most of the other Great Plains States. Specific objectives as stated in the regional research project are:

1. To develop information on technical production relationships and opportunities for grain farms in the Great Plains.

2. To determine the nature and magnitude of adjustments needed in specific farm situations which will achieve the most profitable systems of farming under a range of conditions with respect to prices of major products and quantities of available resources such as land, labor and capital and to determine the quantities of resources required to provide selected levels of farm income.

3. To determine the effect upon total agricultural production, farm income, farm organization and resources employed in the Great Plains if selected percentages of all farmers adjust to their most profitable farming systems for various assumed product demand conditions, factor supply conditions and specific agricultural programs and institutional arrangements.

4. To estimate wheat supply potentials for non-domestic wheat producers under varying economic and political conditions in international areas.

The South Dakota study area included 26 counties in Central South Dakota (Figure 1). This area normally accounts for about 68 per cent of the state's wheat acreage, 43 per cent of the feed grain acreage, 60 per cent of the state's flax acreage and about 55 per cent of the total tame- and native-hay acreage. For analytical purposes, the GP-5 study area was divided into eight sub-areas on the basis of selected farm and soil characteristics and cropping practices.

The analysis of this study was based on possible adjustments on individual farming units. Thus, model farms were developed to represent a significant number, group or segment of farms within a defined geographic area. Model

farms were grouped on the basis of similar characteristics, plus similar alternative production opportunities.

Determining characteristics for grouping farms into model or typical farms included: Farm size, proportion of cropland to native hay and rangeland, soil characteristics, land use and tillage practices, farm organization and enterprise, labor use and labor availability.

In all, 14 model farms were developed in the eight sub-areas of the 26 county study--characteristics were so similar in four sub-areas that only one model farm was needed in each, but in the remaining areas there existed enough diversity to require three model farms in each of two sub-areas and two model farms in each of the other two.

Data used to develop model farms for each South Dakota study area and costs for crop and livestock enterprises for each model farm were derived from a variety of sources, which included: Farm surveys, Agricultural Stabilization and Conservation Service county office records, county assessor's records, U.S. Agricultural Census, S.D. State-Federal Crop and Livestock Reporting Service statistics, from the South Dakota State University Economics Department, and actual cost data from machine dealers and insurance agents.

HOW THIS DATA MAY BE USED

Information gathered on machine costs for the model farm in Area 6 (Figure 1) for this publication should prove useful in planning and budgeting work and should be helpful in other production and farm management studies.

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DESCRIPTION OF AREA 6

BEADLE, CLARK, CODINGTON, DAY, MARSHALL, AND ROBERTS COUNTIES

SOILS

The soils in this six-county area are chernozems. The first major soils series are the Houdek-Bonilla soils which are undulating to nearly level and are well to moderately well drained. Developed from calcareous loam till, these loams are dark grayish-brown and slightly acid. The major problems in soil and water management are the maintenance of organic matter and the conservation of moisture. Major soil uses are: (1) cash grain production, (2) livestock farming, and (3) general farming.

The Beotia-Aberdeen soils are nearly level, well to imperfectly drained, dark grayish-brown silt loams, and silty clay loams. The Beotia soils developed from lacustrine silts of the Lake Dakota plain. The Aberdeen soils are solodized solonetz soils which also developed from these materials. The major problems in soil and water management are: (1) the maintenance of soil fertility, (2) moisture conservation, and (3) seasonal ponding and drainage of low areas due to slow permeability. The major soil uses are cash grain and general farming.

The Hecla-Ulen chernozems are nearly level to hummocky and somewhat excessively to moderately well drained. These grayish-brown soils, which developed from sandy fluvial-eolian materials, are slightly acid sandy loams. Hecla-Ulen soils are low in organic matter, subject to wind erosion and subject to seasonal ponding and drainage problems in low areas due to slow permeability. The major soil uses are for livestock and general farming.

The series found most extensively in the Beadle, Clark, Codington, Day, Marshall and Roberts County area are the Poinsett-Sinai soils which are undulating, nearly level, well drained, slightly acid silt loams, silty clay loams, and silty clays. These soils developed from Cary drift and lacustrine silts and clays. The Poinsett soils are found on undulating terrain and the Sinai soils occur on the tops of steep-sided, flat-topped hills. The soil and water management problems are: (1) maintenance of organic matter and nitrogen supply, (2) maintenance of soil fertility, (3) moisture conservation, and (4) control of water erosion and run-off. These soils are best suited to general farming.

Kranzburg-Vienna soils are sloping and well drained. These soils are black, slightly acid silt loams, silty clay loams, and loams. The Kranzburg soils developed from moderately deep loess mantle over calcareous glacial till; the Vienna soils developed from a loam or light clay loam calcareous glacial till. The major problems in soil and water management associated with these soils are: (1) maintenance of organic matter and supply of nitrogen, (2) maintenance of soil fertility, and (3) moisture conservation. The Kranzburg-Vienna soils are best suited to general farming.

The Barnes-Aastad soils, occurring in most of Roberts County, are nearly level to rolling and developed from calcareous loam till. These black or nearly-black loams to clay loams range from neutral to alkaline and are productive, responding to phosphate and nitrogen fertilizers. The major problems of these soils are: (1) maintenance of organic matter and nitrogen, (2) maintenance of soil fertility, and (3) conservation of moisture. These soils are suitable for cash grain farming.

TYPE OF FARMING CHARACTERISTICS

The average farm in the Beadle, Clark, Codington, Day, Marshall and Roberts County area averaged 558 acres, ranging from 427 acres (in Roberts County) to 673 acres (in Marshall County), according to the 1964 census. Of the area's 6,650 acres in 1964, 17.8 per cent were classified as cash grain, 45.7 per cent were livestock, and 10.5 per cent were general farms. The remaining farms (26.0 per cent) were poultry, dairy and miscellaneous.

Farms in this six-county area are well diversified with cash grains, feed grains and livestock. Crops grown strictly for cash including wheat, flax, rye and soybeans--occupied nearly 40 per cent of the cropland allotted to grains in 1964. In addition, significant amounts of corn grain, oats, and barley were sold

as cash crops. In 1964, about 53 per cent of the corn harvested was picked for grain. Nearly 40 per cent of the corn grain harvested was sold. Thirty-nine per cent of the oats and 66 per cent of the barley harvested in 1964 also was sold off the farm. The remainder of all the feed grains were fed to livestock on the farm.

Table 1 shows the number of farmers, in the six-county area that raised and harvested grain crops in 1964.

Table 1. Number and Per Cent of Farms That Raised and Harvested Major Grain Crops in 1964 in Beadle, Clark, Codington, Day, Marshall and Roberts Counties

	No. of Farms	Percentage of Farms	Number of Acres Harvested	Percentage of Acres Harvested
Corn[1/]	4,754	71.5	372,857	28.3
All Wheat[2/]	4,262	64.1	252,012	19.1
Oats	4,878	73.4	342,835	26.0
Barley	1,196	18.0	47,335	3.6
Flax	3,116	46.9	203,817	15.4
Rye	858	12.9	35,215	2.7
Other[3/]	-----	----	64,288	4.9

1/ Includes corn harvested for grain, silage and other purposes.
2/ Includes 9,742 acres of winter wheat and 44,756 acres of durum.
3/ Includes proso, emmer and speltz, soybeans and sorghum.
Source: U.S. Census of Agriculture, 1964.

Although only 46 per cent of the area's farms were classified as livestock farms, livestock was found on about 80 per cent of the farms. Slightly more than half of the farms maintained a beef-cow herd but, two-thirds of these herds had fewer than 35 cows. Production of dairy products was important in this area--half of the farms kept one or more dairy cows. Although some of these enterprises were maintained for home production, whole milk was sold from 20 per cent of these farms. Cream was also sold by some 17 per cent of the area's farms in 1964. Much of the dairy production was from herds of 12 to 20 cows.

Nearly 3 in 10 farms kept sows or gilts for farrowing in 1964. A large part of the production came from sow herds of 3 to 9 sows in 1964, although the average number of sows on farms keeping hogs was 12.

Ewe flocks were found on about 23 per cent of the farms in this area in 1964 the flocks averaging 58 head. The bulk of production came from 20- to 75-head flocks. Very few flocks were as large as 200 head.

MODEL WHEAT FARM AND BASIS FOR MACHINERY COSTS

The farm selected as being a typical wheat farm was one of 640 acres (476 acres of cropland and 129 acres of native hay and pasture). The average farm size for the six-county area was calculated at 558 acres in 1964. Fifty-eight per cent of the farms were less than 500 acres, 32 per cent were between 500 and 1,000 acres, and only 1.2 per cent of the farms were 2,000 acres or larger.

The model farm serving as the basis for determining machine costs and labor use, had the following crops:

Crop	Acres	Crop	Acres
Spring Wheat	73	Summer Fallow	50
Flax	48	Alfalfa	89
Oats and Other Small Grain	106	Tame Pasture	17
Corn Grain	53	Native Hay	45
Corn Silage	40	Native Pasture	84

The machinery and implements, listed in Table 2, represent those most frequently found on the group of farms from which the model or representative farm was determined. Occasionally, in this study, an arbitrary judgment was necessary in selecting the size or type of machinery or implement.

PURCHASE PRICE

The purchase price of machinery (in Table 2) represents an "average" price of major models of the particular implement or machine listed. The price listed assumes only standard equipment was used. Extras or optional features such as power steering on tractors were not included.

USEFUL LIFE

The standard depreciation schedule (see 1964 Agricultural Engineers Yearbook), widely used as a guide by agricultural engineers and others, served as a base in determining depreciation costs.

Since depreciation is a function of use, obsolescence, or a combination of both, depreciation costs were determined on the hours of use or the useful life in years, which ever was least.

MACHINE COSTS

Farm operators and others concerned with the development of farm budgets must consider two important aspects of machine costs; (1) total annual machine costs and (2) machine costs per unit of the various individual enterprises.

Total annual machine costs represent a major portion of the total annual farm expenses, and thus are of primary importance in determining net farm income.

Annual machine costs include fixed costs (often termed ownership costs) and variable costs. Fixed costs are those which remain relatively constant from year to year, regardless of the amount of use of the machine; variable costs depend directly upon the amount of use.

Table 2. Size, Purchase Price, Expected Useful Life, and Annual Use of Machinery on a Hypothetical 640-Acre Model Farm in the Beadle, Clark, Codington, Day, Marshall, and Roberts County Area[1/]

Machine	Size	Purchase Price[2/]	Useful Life[3/]		Annual Use	
		Dollars	Years	Hours	Acres	Hours
Tractor	3-Plow	$3,475	25	12,000	1,665	330
Tractor	4-Plow	4,500	18	12,000	1,755	659
Moldboard Plow	4-14-Inch	800	18	2,500	296	142
Tandem Disc	10-Foot	750	24	2,500	312	106
Field Cultivator	12-Foot	500	20	2,000	216	43
Drag Harrow	5-Sect.	150	30	2,500	327	33
Pony Press Drill	5-Foot	590	30	1,200	60	34
Press Drill	12-Foot	1,900	30	1,200	167	35
Swather PTO	12-Foot	1,075	20	1,200	213	43
Combine PTO	9-Foot	3,600	15	2,000	213	85
Corn Planter	4-Row	1,200	25	1,200	93	19
Corn Cultivator	4-Row	450	20	2,500	186	37
Cornpicker	2-Row	2,675	15	2,000	53	32
Forage Harvester	1-Row	2,450	15	2,000	40	42
Mower	7-Foot	475	20	2,000	223	67
Side Rake		550	25	2,500	223	40
Baler		2,025	15	2,500	180	63
Three Trailers or Wagons		900	25		233	116
Farmhand & Attachments		800	25		65	20
Sprayer	30-Foot	450	30	1,500	320	32

1/ Representative farm size is 640 acres with 476 acres of cropland.
2/ Approximate new cost in 1964.
3/ Agricultural Engineers Yearbook.

The allocation of machine costs to individual enterprises requires that these costs be expressed in terms of costs per hour or per acre for the types of machine operations used. Machine costs per unit of individual enterprises are necessary considerations in determining the most profitable organization of the farm business.

Total annual costs for each machine assumed to be used on the model farm, as well as per-acre and per-hour machine-operations costs are presented in Tables 3 through 8. The costs shown in these tables were determined on the basis of the model farm having 227 acres of small grain, 93 acres of corn, 50 acres of summer fallow, two cuttings of hay from 89 acres of alfalfa, and one cutting on 45 acres of native hay.

FIXED COSTS

Fixed machine costs include depreciation, interest on investment, insurance, and taxes. Total annual fixed costs are constant for any given year, without regard to the amount of use during that year. However, when this fixed sum is charged as a cost against crops, the cost per hour, per acre, or unit of output may show a variation with the amount of use.

Depreciation--Depreciation in this study is recognized as a cost since "wear and tear" due to use necessitates eventual replacement. New innovations and methods of tillage, planting, or harvesting also necessitate replacement of outmoded or obsolete machinery.

Interest--Interest often is not easily recognized or understood as a cost, unless funds are borrowed and an interest rate actually is charged for the use of borrowed money. In this study, a 7 per cent interest rate charged on the "average annual investment" as a cost of machine ownership. Even if a farm operator has full equity in an implement or machine, and thus pays no direct interest charge, his capital is frozen. Normally, there are alternative uses for these funds, either in other farm enterprises or in nonfarm investments, which may yield an even greater rate of return. This could be especially true with respect to harvesting equipment, particularly if the harvested acreage is relatively small and custom harvesting can be obtained when needed. For example, the investment in the hay baler assumed for the model farm (Table 2) freezes the purchase cost of $2,025. If placed in a savings account, this would return about $93 per year at an interest rate of 4½ per cent. Perhaps, after adding up the earned interest and costs of the baling operation (including the prorated tractor costs) the farm operator will find it more economical to hire a custom baler.

Insurance and Taxes--Insurance and personal property taxes are cash costs which do not vary with the amount a machine is used during the year, and thus are considered fixed costs. Insurance, as such, is not a required expenditure. However, since losses do occasionally occur, and if insurance is not actually carried, an amount sufficient to cover the expected annual rate of loss must be included as a cost.

Allocation of Fixed Costs--Each category of fixed costs can be allocated to individual enterprises in the same manner. The allocation of annual depreciation costs, for example, among individual enterprises requires a conversion of the annual cost to an hourly depreciation cost, which is based upon the expected number of hours of use of the machine during the year. Hourly depreciation charges, coupled with machine time requirements per acre, are then used to establish depreciation charges per acre for each crop enterprise.

Fixed Costs on the Model Farm--Fixed costs, with few exceptions, are considerably higher than variable costs for individual machines and implements. This may be illustrated by the examples on the next page.

Recovering fixed-machine costs to insure a profitable long run operation is not important over the short-run. It is important in the long run, however, that fixed costs be covered from the standpoint of replacing worn-out and obsolete machinery. In an era of increasing costs and rapidly changing technology it becomes increasingly important to reduce machine costs as much as possible; particularly so, for machine items which have a high original cost such as tractors and harvesting equipment. Since total annual fixed costs remain the same, fixed-machine costs can effectively be reduced per acre or per unit of production by spreading these costs over as many acres as possible.

FIXED COSTS EXAMPLES

Implement	Purchase Price	Number of Acres Covered	Per Cent of Total Costs Per Acre	
			Fixed	Variable
Moldboard Plow	$ 800	296	38.8%	61.2%
Field Cultivator	500	216	57.1	42.9
Pony Press Drill	590	60	58.5	41.5
Press Drill	1,900	167	86.1	13.9
Swather	1,075	213	78.3	21.7
Combine	3,600	213	71.0	29.0
Corn Planter	1,200	93	88.5	11.5
Cornpicker	2,675	53	89.2	10.8
Forage Harvester	2,450	40	83.3	16.7
Baler	2,025	180	73.9	26.1

To own and use machinery with a capacity greater than is actually needed, on a given acreage, will needlessly raise both the fixed and variable costs. Whether or not the reduction in the amount of labor and machine time will offset the increase in machine costs is questionable. To illustrate the increase in per acre machine costs which results when larger machines are used without an increase in acreage, the following tabulation contains machine costs for selected sizes of tractors and combines:

EXAMPLES

Machine	Acres Covered	Machine Costs 1/		Per Cent Increase
		Annual	Per Acre	
Tractor, 3-Plow	1,256	$ 563.74	$0.45	
Tractor, 4-Plow	1,256	715.89	.57	26.7%
Tractor, 5-Plow	1,256	890.92	.71	57.8
Combine, 6-Foot	187	350.98	1.88	
Combine, 9-Foot	187	483.09	2.58	37.2
Combine, 12-Foot	187	790.01	4.22	124.5
Combine, 14-Foot S.P.	187	1,158.76	6.20	229.8

1/ Includes depreciation, interest, taxes, insurance and repairs.

VARIABLE COSTS

In contrast to fixed costs, annual variable costs depend directly upon the amount of use during the year. When machine use increases from, 800 acres to 1,000 acres, the variable costs per acre will remain the same, but total annual variable

costs will increase by 25 per cent. This is in contrast to fixed costs which are reduced 20 per cent on the per acre basis while total annual fixed costs remains the same.

Variable machine costs include repairs, fuel, oil, and lubricants. These costs have been first expressed as hourly costs for each machine or type of operation. Time requirements for each operation and machine are then used to convert the variable costs of each enterprise into per acre costs and total annual variable costs.

MACHINE COSTS BY CROPS

The cost-data and machine-time requirements can be used to determine the costs per acre (or unit of production) for each crop.

The costs shown in Tables 4 through 8 were used in preparation of Table 9. With only a small change in acreage, there will only be a negligible increase or decrease in the fixed costs and hence the cost data will still be reasonably accurate.

Table 9 was produced using specific assumptions with regard to tillage practices. A governing assumption was one of "minimum tillage," which included pony plow and drilling on summer fallow as well as on small grain stubble, fall or spring plowing and a tandem discing for small grains and row crops, and two cultivations on row crops. Other assumptions included a discing for corn stalks and fall plowing of alfalfa.

SUMMARY

Machine costs for this "representative wheat farm" were developed under assumptions which included specific crop acreages, tillage practices and prices paid for new machinery. Significant changes in fixed costs per acre will result from a significant change in cropland acreage, number of tillage operations or machinery prices. Consequently, the machine costs presented cannot be construed as being representative of all 640-acre farms in this six-county area, although they should be somewhat similar. However, the usefulness of these costs need not be impaired since they provide a basis for estimating machine costs and, also, offer a basis for comparing costs of operating varying sizes and types of machines and implements.

Table 3. Annual Machine Costs by Machine or Implement Used on the 640-Acre Model Farm; Beadle, Clark, Codington, Day, Marshall, and Roberts Counties

Machine	Size	Annual Use Acres	Annual Use Hours	Depreciation	Insurance & Taxes	Interest	Repairs	Fuel, Oil, & Lubricant	Total
Tractor	3-Plow	1,665	330	$ 125.08	$ 59.84	$ 133.77	$ 97.65	$ 21.45[1]	$ 437.79
Tractor	4-Plow	1,755	659	225.00	77.97	173.25	301.50	39.54[1]	817.26
Moldboard Plow	4-14-Inch	296	142	40.00	13.86	30.80	45.44	88.04	218.14
Tandem Disc	10-Foot	312	106	28.13	12.96	28.88	11.66	37.10	118.73
Field Cultivator	12-Foot	216	43	22.50	8.69	19.25	3.44	34.40	88.28
Drag Harrow[1]	5-Sect.	327	33	4.50	2.59	5.78	.66	13.20	26.73
Press Drill[2]	12-Foot	167	35	57.00	32.91	73.15	14.00	12.25	189.31
Pony Press Drill	5-Foot	60	34	17.70	10.22	22.72	8.16	27.68	86.48
Swather PTO[1]	12-Foot	213	43	48.35	18.64	41.39	10.75	19.35	138.48
Combine PTO	9-Foot	213	85	216.00	62.40	138.60	61.20	108.80	587.00
Corn Planter[3]	4-Row	93	19	43.20	20.80	46.20	5.70	8.55	124.45
Corn Cultivator	4-Row	186	37	20.35	7.81	17.33	2.59	18.50	66.58
Cornpicker	2-Row	53	32	160.47	46.38	102.99	17.28	20.16	347.28
Forage Harvester	1-Row	40	42	147.00	42.48	94.33	31.08	26.04	340.93
Mower[3]	7-Foot	223	67	21.35	8.25	18.29	12.06	20.10	80.05
Side Rake[3]		223	40	19.80	9.61	21.18	7.20	8.80	66.59
Baler		180	63	121.47	41.59	77.96	20.16	64.89	326.07
Front End Loader & Attachments[3]		65	20	28.80	13.86	30.80	3.20	8.00	84.66
Three Trailers or Wagons		233	116	32.40	15.63	34.65	18.79	62.44	163.91
Sprayer (trailer)[3]	30-Foot	320	32	13.50	7.81	17.33	2.88	9.60	51.12
Total Costs				$1,392.60	$514.30	$1,128.65	$675.40	$648.89	$4,359.84

[1] Overhead maintenance.
[2] Used one-half time with 4-plow and one-half time with 3-plow tractor.
[3] Used with 3-plow tractor.

Table 4. Machine Costs Per Hour of Use by Machine and Implement Used, 640-Acre Model Farm; Beadle, Clark, Codington, Day, Marshall, and Roberts Counties

Machine or Implement	Size	Annual Use Hours	Dollar Cost Per Hour				
			Depreciation	Insurance & Taxes	Int.	Repairs	Total
Moldboard Plow	4-14-Inch	142	$0.28	$0.10	$0.22	$0.32	$0.92
Tandem Disc	10-Foot	106	.27	.12	.27	.11	.77
Field Cultivator	12-Foot	43	.52	.20	.45	.08	1.25
Drag Harrow	5-Sect.	33	.14	.08	.18	.02	.42
Press Drill	12-Foot	35	1.63	.94	2.09	.40	5.06
Pony Press Drill	5-Foot	34	.52	.30	.67	.24	1.73
Swather PTO	12-Foot	43	1.12	.43	.96	.25	2.76
Combine PTO	9-Foot	85	2.54	.73	1.63	.72	5.62
Corn Planter	4-Row	19	2.27	1.09	2.43	.30	6.09
Corn Cultivator	4-Row	37	.55	.21	.47	.07	1.30
Cornpicker	2-Row	32	5.01	1.45	3.22	.54	10.22
Forage Harvester	1-Row	42	3.50	1.01	2.25	.74	7.50
Mower	7-Foot	67	.32	1.23	.27	.18	2.00
Side Rake		40	.50	.24	.53	.18	1.45
Baler		63	1.93	.66	1.24	.32	4.15
Front End Loader & Attachments		20	1.44	.69	1.54	.16	3.83
Three Trailers or Wagons		116	.28	.13	.30	.16	.87
Sprayer (trailer)	30-Foot	32	.42	.24	.54	.09	1.29

Table 5. Tractor, Machine and Implement Costs Per Hour of Use, 640-Acre Model Farm; Beadle, Clark, Codington, Day, Marshall, and Roberts Counties

Machine or Implement	Size	Dollar Cost Per Hour					
		Depreciation	Insurance & Taxes	Int.	Repairs	Fuel, Oil, & Lubricant	Total
Moldboard Plow	4-14-Inch	$0.62	$0.22	$0.48	$0.78	$0.68	$2.78
Tandem Disc	10-Foot	.61	.24	.53	.57	.41	2.36
Field Cultivator	12-Foot	.86	.32	.71	.54	.86	3.29
Drag Harrow[1/]	5-Sect.	.52	.26	.59	.32	.47	2.16
Press Drill	12-Foot	1.97	1.06	2.35	.86	.43	6.67
Press Drill[1/]	12-Foot	2.01	1.12	2.50	.70	.39	6.72
Pony Press Drill	5-Foot	.86	.42	.93	.70	.27	3.18
Swather PTO[1/]	12-Foot	1.50	.61	1.37	.55	.52	4.55
Combine PTO	9-Foot	2.88	.85	1.89	1.18	1.34	8.14
Corn Planter[1/]	4-Row	2.65	1.27	2.84	.60	.52	7.88
Corn Cultivator	4-Row	.89	.33	.73	.53	.56	3.04
Cornpicker	2-Row	5.35	1.57	3.48	1.00	.69	12.09
Forage Harvester	1-Row	3.84	1.13	2.51	1.20	.68	9.36
Mower[1/]	7-Foot	.70	1.41	.68	.48	.37	3.64
Side Rake[1/]		.88	.42	.94	.48	.29	3.01
Baler		2.27	.78	1.50	.78	1.09	6.42
Front End Loader & Attachments[1/]		1.82	.87	1.95	.46	.47	5.57
Trailer or Wagon		.62	.25	.56	.62	.62	2.67
Trailer or Wagon[1/]		.66	.31	.71	.46	.58	2.72
Sprayer (trailer)[1/]	30-Foot	.80	.42	.95	.39	.37	2.93

[1/] Three-plow tractor--all other implements and machines pulled with a 4-plow tractor.

Table 6. Tractor Costs Per Acre of Use for Specific Machines and Implements, 640-Acre Model Farm; Beadle, Clark, Codington, Day, Marshall, and Roberts Counties

Machine or Implement	Size	Dollar Cost Per Acre					
		Depre-ciation	Insurance & Taxes	Int.	Repairs	Fuel, Oil, & Lubricant	Total
Moldboard Plow	4-14-Inch	$0.164	$0.057	$0.126	$0.220	$0.029	$0.596
Tandem Disc	10-Foot	.116	.040	.089	.156	.020	.421
Field Cultivator	12-Foot	.068	.024	.053	.092	.012	.249
Drag Harrow	5-Sect.	.038	.018	.041	.030	.007	.134
Press Drill	12-Foot	.078	.027	.060	.105	.014	.284
Press Drill[1/]	12-Foot	.037	.042	.093	.068	.015	.305
Pony Press Drill	5-Foot	.191	.066	.147	.256	.034	.694
Swather PTO[1/]	12-Foot	.076	.036	.081	.059	.013	.265
Combine PTO	9-Foot	.136	.047	.105	.183	.024	.495
Corn Planter[1/]	4-Row	.076	.036	.081	.059	.013	.265
Corn Cultivator	4-Row	.068	.024	.053	.092	.012	.249
Cornpicker	2-Row	.205	.071	.158	.275	.036	.745
Forage Harvester	1-Row	.358	.124	.276	.481	.063	1.302
Mower[1/]	7-Foot	.114	.054	.122	.089	.020	.399
Side Rake[1/]		.068	.033	.073	.053	.012	.239
Baler		.119	.041	.092	.160	.021	.433
Front End Loader & Attachments[1/]		.114	.054	.122	.089	.020	.399
Trailer or Wagon		.171	.059	.132	.229	.030	.621
Trailer or Wagon[1/]		.190	.091	.203	.148	.033	.665
Sprayer (trailer)[1/]	30-Foot	.038	.018	.041	.030	.007	.134

[1/] Three-plow tractor--all other implements and machines pulled with a 4-plow tractor.

Table 7. Machine Costs Per Acre by Machine and Implement Used, 640-Acre Model Farm; Beadle, Clark, Codington, Day, Marshall, and Roberts Counties

Machine or Implement	Size	Annual Use in Acres	Dollar Cost Per Acre					
			Depre-ciation	Insurance & Taxes	Int.	Repairs	Fuel, Oil, & Lubricant	Total
Moldboard Plow	4-14-Inch	296	$0.135	$0.047	$0.104	$0.154	$0.297	$0.737
Tandem Disc	10-Foot	312	.090	.041	.093	.037	.119	.380
Field Cultivator	12-Foot	216	.104	.040	.089	.016	.159	.408
Drag Harrow	5-Sect.	327	.014	.008	.018	.002	.040	.082
Press Drill	12-Foot	167	.341	.197	.438	.084	.073	1.133
Pony Press Drill	5-Foot	60	.295	.170	.379	.136	.119	1.099
Swather PTO	12-Foot	213	.227	.088	.194	.050	.091	.650
Combine PTO	9-Foot	213	1.014	.293	.651	.287	.511	2.756
Corn Planter	4-Row	93	.464	.224	.497	.061	.092	1.338
Corn Cultivator	4-Row	186	.109	.042	.093	.014	.100	.358
Cornpicker	2-Row	53	3.028	.875	1.943	.326	.380	6.552
Forage Harvester	1-Row	40	3.675	1.062	2.358	.777	.651	8.523
Mower	7-Foot	223	.096	.037	.082	.054	.090	.359
Side Rake		223	.089	.043	.095	.032	.040	.299
Baler		180	.675	.231	.433	.112	.360	1.811
Front End Loader & Attachments		65	.443	.213	.474	.049	.123	1.302
Three Trailers or Wagons		223	.139	.067	.149	.081	.268	.704
Sprayer (trailer)	30-Foot	320	.042	.025	.054	.009	.030	.160

Table 8. Combined Tractor, Machine and Implement Costs Per Acre of Use, 640-Acre Model Farm; Beadle, Clark, Codington, Day, Marshall, and Roberts Counties

Machine or Implement	Size	Annual Use in Acres	Dollar Cost Per Acre: Depreciation	Insurance & Taxes	Int.	Repairs	Fuel, Oil, & Lubricant	Total
Moldboard Plow	4-14-Inch	296	$0.299	$0.104	$0.230	$0.374	$0.326	$1.333
Tandem Disc	10-Foot	312	.206	.081	.182	.193	.139	.801
Field Cultivator	12-Foot	216	.172	.064	.142	.108	.171	.657
Drag Harrow[1/]	5-Sect.	327	.052	.026	.059	.032	.047	.216
Press Drill	12-Foot	84	.419	.224	.498	.189	.131	1.461
Press Drill[1/]	12-Foot	83	.428	.239	.531	.152	.141	1.491
Pony Press Drill	5-Foot	60	.486	.236	.526	.392	.153	1.793
Swather PTO[1/]	12-Foot	213	.303	.124	.275	.109	.104	.915
Combine PTO	9-Foot	213	1.150	.340	.756	.470	.535	3.251
Corn Planter[1/]	4-Row	93	.540	.260	.578	.120	.105	1.603
Corn Cultivator	4-Row	186	.177	.066	.146	.106	.112	.607
Cornpicker	2-Row	53	3.233	.946	2.101	.601	.416	7.297
Forage Harvester	1-Row	40	4.033	1.186	2.634	1.258	.714	9.825
Mower[1/]	7-Foot	223	.210	.091	.204	.143	.110	.758
Side Rake[1/]		223	.157	.076	.168	.085	.052	.538
Baler		180	.794	.272	.525	.272	.381	2.244
Front End Loader & Attachments[1/]		65	.557	.267	.596	.138	.143	1.701
Trailer or Wagon		116	.310	.126	.281	.310	.341	1.368
Trailer or Wagon[1/]		117	.329	.158	.352	.229	.320	1.388
Sprayer (trailer)[1/]	30-Foot	320	.080	.043	.095	.039	.037	.294

[1/] Three-plow tractor--all other implements and machines pulled with a 4-plow tractor.

Table 9. Machine Costs Per Acre by Crop and by Type of Operation on 640-Acre Model Farm; Beadle, Clark, Codington, Day, Marshall, and Roberts Counties

Crop	Type of Operation	Machine Time Hours Per Acre	Dollar Cost Per Acre: Depreciation	Insurance & Taxes	Int.	Repairs	Fuel, Oil, & Lubricant	Total
Summer Fallow	Tillage	1.28	$0.99	$0.36	$0.80	$0.81	$1.38	$ 4.34
Wheat or Flax After Summer Fallow	Pony Plow & Drill	.56	.49	.24	.53	.39	.15	1.80
	Spraying	.10	.08	.04	.10	.04	.04	.30
	Harvest	.60	1.45	.46	1.03	.58	.64	4.16
	Total	1.26	2.02	.74	1.66	1.01	.83	6.26
Wheat or Flax After Small Grain or Corn Silage	Pony Plow & Drill (½)	.28	.24	.13	.26	.20	.08	.90
	Tillage (½)	.46	.28	.11	.23	.30	.26	1.18
	Planting (½)	.12	.21	.12	.26	.08	.07	.74
	Spraying	.10	.08	.04	.10	.04	.04	.30
	Harvest	.60	1.45	.46	1.03	.58	.64	4.16
	Total	1.56	2.26	.85	1.88	1.20	1.03	7.28
Wheat, Flax, or Other Small Grain After Small Grain or Corn Silage	Tillage	.92	.56	.21	.47	.60	.51	2.35
	Planting	.23	.42	.23	.52	.17	.14	1.48
	Spraying	.10	.08	.04	.10	.04	.04	.30
	Harvest	.60	1.45	.46	1.03	.58	.64	4.16
	Total	1.85	2.51	.94	2.12	1.39	1.33	8.29
Small Grain After Corn Grain	Tillage	1.31	.79	.31	.68	.81	.67	3.26
	Planting	.23	.42	.23	.52	.17	.14	1.48
	Spraying	.10	.08	.04	.10	.04	.04	.30
	Harvest	.60	1.45	.46	1.03	.58	.64	4.16
	Total	2.24	2.74	1.04	2.33	1.60	1.49	9.20
Small Grain After Alfalfa	Tillage	1.36	.82	.32	.71	.82	.70	3.37
	Planting	.23	.42	.23	.52	.17	.14	1.48
	Spraying	.10	.08	.04	.10	.04	.04	.30
	Harvest	.60	1.45	.46	1.03	.58	.64	4.16
	Total	2.29	2.77	1.04	2.36	1.61	1.52	9.31
Corn After Summer Fallow	Tillage	.94	.66	.26	.59	.47	.46	2.44
	Planting	.20	.54	.26	.58	.12	.11	1.61
	Spraying	.10	.08	.04	.10	.04	.04	.30
	Subtotal	1.24	1.28	.56	1.27	.63	.61	4.35
Corn Grain	Harvest	.60	3.23	.95	2.10	.60	.42	7.30
	Total	1.84	4.51	1.51	3.37	1.23	1.03	11.65
Corn Silage	Harvest	1.05	4.03	1.19	2.63	1.26	.71	9.82
	Total	2.29	5.31	1.75	3.90	1.89	1.32	14.17
Corn After Small Grain	Tillage	1.42	.96	.37	.82	.84	.78	3.77
	Planting	.20	.54	.26	.58	.12	.11	1.61
	Spraying	.10	.08	.04	.10	.04	.04	.30
	Subtotal	1.72	1.58	.67	1.50	1.00	.93	5.68
Corn Grain	Harvest	.60	3.23	.95	2.10	.60	.42	7.30
	Total	2.32	4.81	1.62	3.60	1.60	1.35	12.98
Corn Silage	Harvest	1.05	4.03	1.19	2.63	1.26	.71	9.82
	Total	2.77	5.61	1.86	4.13	2.26	1.64	15.50
Corn After Corn Grain	Tillage	1.81	1.20	.46	1.02	1.06	.96	4.70
	Planting	.20	.54	.26	.58	.12	.11	1.61
	Spraying	.10	.08	.04	.10	.04	.04	.30
	Subtotal	2.11	1.82	.76	1.70	1.22	1.11	6.61
Corn Grain	Harvest	.60	3.23	.95	2.10	.60	.42	7.30
	Total	2.71	5.05	1.71	3.80	1.82	1.53	13.91
Corn Silage	Harvest	1.05	4.03	1.19	2.63	1.26	.71	9.82
	Total	3.16	5.85	1.95	4.33	2.48	1.82	16.43
Corn After Corn Silage	Tillage	1.47	1.00	.38	.83	.87	.82	3.90
	Planting	.20	.54	.26	.58	.12	.11	1.61
	Spraying	.10	.08	.04	.10	.04	.04	.30
	Subtotal	1.77	1.62	.68	1.51	1.03	.97	5.81
Corn Grain	Harvest	.60	3.23	.95	2.10	.60	.42	7.30
	Total	2.37	4.85	1.63	3.61	1.63	1.39	13.11
Corn Silage	Harvest	1.05	4.03	1.19	2.63	1.26	.71	9.82
	Total	2.82	5.65	1.87	4.14	2.29	1.68	15.63
Corn After Alfalfa	Tillage	1.49	1.02	.38	.85	.91	.93	4.09
	Planting	.20	.54	.26	.58	.12	.11	1.61
	Spraying	.10	.08	.04	.10	.04	.04	.30
	Subtotal	1.79	1.64	.68	1.53	1.07	1.08	6.00
Corn Grain	Harvest	.60	3.23	.95	2.10	.60	.42	7.30
	Total	2.39	4.87	1.63	3.63	1.67	1.50	13.30
Corn Silage	Harvest	1.05	4.03	1.19	2.63	1.26	.71	9.82
	Total	2.84	5.67	1.82	4.16	2.33	1.79	15.82
Tame Hay[1/]	Mow, Rake, Bale	.83	1.16	.44	.90	.50	.54	3.54
	Mow, Rake, Stack	.78	.92	.43	.97	.37	.31	3.00
Native Hay[1/]	Mow, Rake, Stack	.78	.92	.43	.97	.37	.31	3.00

1/ Per cutting per acre.