

FARM MACHINERY ECONOMIC COST ESTIMATES FOR 2002

by William Lazarus
 Extension Economist - Farm Management
 Department of Applied Economics, University of Minnesota
 and
 Roger Selley
 Extension Farm Management Specialist
 South Central Research and Extension Center, University of Nebraska

The tables in this publication contain estimates of farm machinery operation costs for 2002. The estimates use an economic engineering approach. The data are intended to show a representative farming industry cost for specified machines and operations.

Machine costs are separated into time-related and use-related categories. Use-related costs are incurred only when a machine is used. They include fuel, lubrication, use-related repairs and labor. Time-related costs, also often referred to as overhead costs, accrue to the owner whether or not a machine is used. Overhead includes time-related economic costs: interest, insurance, personal property taxes, and housing. There are no personal property taxes in Minnesota. Depreciation is both a use- and a time-related cost. Depreciation will be related to use to the extent that increased annual usage shortens years of life and/or reduces salvage value. While not entirely use-related, depreciation is included along with operating expenses and labor costs in the columns labelled "use-related cost/acre".

OVERHEAD COSTS: Time-related costs are prorated over a 12 year economic life except where otherwise indicated. Trade-in values are estimated based on American Society of Agricultural Engineers formulas. Purchase prices are discounted from manufacturers' list prices. A ten percent discount off list price appears "normal." Income tax implications are ignored. A housing charge of 33 cents per square foot of shelter space needed per year is made.

A six percent "real" (inflation-adjusted) interest rate is used in the cost estimates. This real rate is calculated by taking a nominal rate charged by lenders, minus a measure of the inflation rate per year expected over the years of ownership. Insurance is charged at 0.85 percent of the undepreciated value. The interest and insurance cost formulas are slightly different from those used in previous years. Adding one year's depreciation to the numerator in effect bases the costs on the value at the beginning of each year owned. This gives a slightly more accurate calculation of the actual costs over the years owned. In states where farm machinery is taxed as personal property, property tax could be calculated in a similar manner, depending on how taxes are assessed.

Formulas used to compute machinery overhead costs:

$$\text{Depreciation, \$/year} = \frac{\text{purchase cost} - \text{salvage value}}{\text{years you will use machine}}$$

$$\text{Interest, \$/year} = \frac{\text{purchase cost} + \text{salvage value} + \text{depreciation (\$/year)}}{2} \times \text{"real" interest rate}$$

$$\text{Insurance, \$/year} = \frac{\text{purchase cost} + \text{salvage value} + \text{depreciation (\$/year)}}{2} \times \text{insurance rate}$$

Housing, \\$/year = price per sq. foot x sq. feet shelter space required

Taxes per year = 0 (no taxes on personal property in Minnesota)

OPERATING COSTS: Fuel cost is calculated by multiplying the fuel consumption by the price of fuel, with fuel consumption assumed to be 0.044 gallons of diesel fuel per PTO horsepower-hour on average for each implement type. Fuel consumption per acre is averaged across sizes within a given implement type. The price of farm diesel fuel is projected at \$1.00 per gallon. All power units, tractors, combines, trucks, etc., use diesel fuel. Lubrication cost is assumed to be 15 percent of fuel cost.

The formulas for repair and maintenance costs estimate total accumulated repair costs based on accumulated hours of lifetime use. Repair and maintenance calculations are based on American Society of Agricultural Engineers formulas. The total cost is then divided by accumulated hours to arrive at an average per hour cost estimate. The amount of annual use of a machine is an estimate of the number of hours a commercial farmer would use that particular machine in one year.

Labor is charged at an hourly wage rate, which includes 30 percent benefits. Charge rates are \$10.50 per hour for unskilled labor and \$13.00 per hour for skilled labor. The skilled labor rate is generally used with the planting and harvesting equipment and sprayers. Labor per acre for an operation such as plowing or disking is calculated by using the work rate on the implement. Less labor per acre is used in a disking operation that covers more acres per hour than in a plowing operation. A small amount of extra labor is added over and above machine time to allow for downtime for tasks such as making adjustments and filling sprayers and planters. The labor adjustment ranges from 2 percent additional time for tillage to 33 percent for spraying.

These estimates will not represent any given individual's cost. Differences in buying power, repair programs, average annual use, and overall replacement programs should be considered when making adjustments. It may be useful to record actual expenses for at least a few of your implements and compare your costs to these estimates. These estimates will differ from records because they are estimates, but also because they are averaged over the use period and are expressed in today's dollars. If these estimates are compared to recorded costs that include repairs or depreciation based on historical costs, one adjustment that would be required for comparability would be to index the historical cost to current prices.

THE COST IMPACT OF ANNUAL USAGE AND TRADE-IN AGE: The adoption of modern equipment such as combines in recent decades has reduced the need for farmers to cooperate with their neighbors in activities such as "threshing bees" and "barn raisings" that were common earlier. As equipment gets larger and more expensive, the practices of using custom operators, purchasing equipment jointly, and trading work may return as more producers are priced out of the market for individual ownership. Record summaries from the Southeastern Minnesota Farm Business Management Association seem to confirm this trend as they show an increase in custom operator use, at least in the case of corn silage on owned land. Custom hiring expenses for corn silage averaged 3 percent of total machinery-related expenses in 1985 and 8 percent in 1990. Custom hiring expenses as a share of total machinery expenses for that crop had grown to 25 percent in 1999 and 19 percent in 2000.

The table below shows how covering more acreage with a piece of equipment can help control costs. The other variable that enters into the cost calculations is how long the machine will be used before being traded in. Trade-in decisions probably depend on the degree of wear and tear placed on the machine, in case using it over more acres each year probably means trading it sooner than otherwise.

One machine that some producers have considered owning jointly is a baler for the large rectangular bales (in the range of 30" to 36" square by 6' to 8' feet long) that are sometimes used where hay is shipped longer distances.

These high-capacity machines can cover quite a few acres in an hour, so annual hours of use would be quite low if used on only one farm.

The top section of the table shows how increased annual use shortens the expected trade-in age, if traded at a given number of hours. For example, if the baler covered 16 acres/hour and the farm had 815 acres to harvest/year (two cuttings x 407 acres/cutting), annual usage would be 50 hours. If traded at 600 hours, a baler used 50 hours/year would be traded at twelve years. If usage is increased to 100 hours/year, the same 600 hour trade-in decision rule would point to a trade-in after only six years instead of twelve. The bottom section of the table shows how the increased usage would affect the total cost per acre to own and operate the baler. (The costs shown are for the baler only, not including the tractor or operator labor.) The 600 hour trade-in rule is shown in the first column. Following the first column down to the 50 hours/year shown on the third line, we estimate that the cost/acre would be \$7.93/acre. The third line shows the cost if usage were increased to 100 hours or 1,630 acres, cost/acre would fall to \$5.69/acre.

Again, both of these cost estimates assume that the baler is traded after 600 hours of use. They also assume that the salvage or trade-in value is determined by the years of age at trade-in, rather than the amount of wear-and-tear. So, the baler is worth more when traded at six years and 600 hours than it would be at twelve years and 600 hours. To be specific, the ASAE formula estimates that after 12 years of use the baler would be worth around 25% of the new price. Trading after only six years, the formula estimates a trade-in value equal to 37% of new.

The ASAE formulas for estimating machinery trade-in values are very useful general guides for estimating machinery costs, but they do have their limitations. One particular limitation is that they only factor in the amount of wear-and-tear (accumulated hours) for tractors and combines, not most implements like balers. The reason they don't consider wear-and-tear for these implements is that the formulas were estimated by economic researchers using auction prices of used equipment as a source (a reference to the original research is available upon request). The database of auction prices also included reported tach hours for tractors and combines that come equipped with tachometers. For other machines without tachometers, wear-and-tear is not factored into the formulas. Wear-and-tear likely does affect trade-in values, however, even though the formulas don't incorporate it. If wear-and-tear is significant, there would be less economic advantage to using the baler more hours/year.

Impact of Annual Usage on Trade-in Age and Cost Per Acre to Own and Operate a Large Rectangular Baler

	<u>Accumulated hours at trade-in</u>			
	600	900	1,200	1,800
Annual use, hrs	- - - Expected years to trade-in - - -			
50	12	18	24	36
75	8	12	16	24
100	6	9	12	18
150	4	6	8	12
Annual use, hrs	- - Cost/acre (not including tractor, fuel or labor) ^a - -			
50	\$7.93	\$6.69	\$6.00	\$5.26
75	\$6.51	\$5.48	\$4.91	\$4.33
100	\$5.69	\$4.78	\$4.29	\$3.80
150	\$4.76	\$3.98	\$3.58	\$3.19

^aTractor, fuel, and labor costs would add \$2.32/acre to the amounts shown.

Sugar beet harvesting equipment is another category that is often used in custom work situations. To explore how annual usage affects costs, the 8-row sugar beet lifter on page 11 is shown at two usage levels - 324 acres and 1,013 acres per year, with the latter rate intended to reflect a custom work situation. The custom operator trades the lifter after three years and expects to receive 32% of the list price as a trade. At the lower 80-hour usage level, it is traded at 12 years with a trade-in value 26% of list. The increased usage reduces the total per-acre cost by 11%, from \$58.44 down to \$51.84 per acre.

THE BOTTOM LINE: Machinery costs are substantial; control of them is important. Custom charges are often based upon them. No one should do custom work unless the charge will cover operating costs and use-related depreciation plus a return for one's risk and time. Ideally, all allocated per acre or hour overhead costs should also be covered by anyone offering to do custom work. The market for custom work usually does not cover all costs. The market is usually somewhere in between the Use-related costs and total costs.

ACCESS TO EDUCATIONAL PROGRAMS AND MATERIALS:

The University, including the University of Minnesota Extension Service, is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, color, creed, religion, national origin, sex, age, marital status, disability, public assistance status, veteran status, or sexual orientation.

Summary of Per Acre Use-Related Costs and Total Cost for Implements with Associated Power Units,
Averaged Over All Sizes by Implement Type

	Use-Related Cost/Acre ¹	Total Cost/Acre		Use-Related Cost/Acre ¹	Total Cost/Acre
Chisel Plow	3.65	5.19	Corn Stalk Chopper	5.99	7.58
Chisel Plow, Front Dsk	5.92	8.46	Potato Shredder	6.06	8.22
Moldboard Plow	10.39	13.75	Stalk Shredder	5.75	7.85
Field Cultivator	2.19	3.02	Rock Picker	31.05	41.40
Tandem Disk	4.03	5.33	Mower-Conditioner	6.86	9.19
Tandem Disk H.D.	4.64	6.56	Rotary Hay Mower	6.55	7.80
Offset Disk	5.96	8.07	Rotary Mow/Cond	5.46	7.48
V-Ripper	5.39	7.51	Hay Rake (Hyd)	5.32	6.32
Comb Fld Cult Incomp	3.88	5.45	Hay Swather-Cond	6.11	8.51
Comb Disk & V-Ripper	8.08	11.58	Swather-Cond, Self- Prop	8.32	13.25
Disk, Fld Cult Finish	4.49	6.38	Grain Swather, Pull Type	3.28	4.60
Roller Harrow	3.81	5.03	Grain Swather, Self- Prop	6.24	9.96
Row Crop Planter	4.80	6.90	Hay Baler PTO Twine	7.64	9.11
Min-Til Planter	6.23	8.74	Round Baler	9.52	11.20
Potato Planter Filler	2.81	5.23	Rd Baler/Wrap	14.60	17.25
Potato Row Marker	8.57	13.10	Large Rectangular Baler	4.41	6.61
Potato Planter	18.08	27.16	Forage Harvester	35.05	48.51
Beet Planter	15.47	24.19	Forage SP Harvstr	41.84	65.54
Beet Planter, Vacuum	6.87	11.93	Combine Grain Head	10.83	13.78
Grain Drill	5.15	7.56	Combine Soybean Hd	16.67	21.26
Presswheel Drill	6.75	9.86	Combine Corn Hd	17.73	22.91
Air Seeder Drill	6.66	10.13	Potato Windrower	31.56	45.01
No-Till Drill	8.64	12.74	Potato Harvester Seed	60.48	75.29
Cultivator	2.84	3.79	Potato Harvester	53.69	67.69
Cultivator High Residue	4.08	5.63	Disk Bean Top Cutter	6.52	8.85
Rotary Hoe	1.15	1.52	Sugar Beet Lifter	43.93	60.38
Potato Cultivator	4.09	5.15	Sugar Beet Lifter (Custom Work)	44.19	51.84
Sugar Beet Cult	6.71	10.06	Sugar Beet Topper	8.13	11.41
Boom Sprayer, Self- Prop	2.95	4.27	Sugar Beet Wagon	13.17	18.76
Boom Sprayer	1.44	1.76			
Sprayer High Pressure	2.10	2.82			
Hooded Sprayer	2.84	3.55			
Anhydrous Applicator	5.67	8.47			
Fert Spreader	1.83	2.73			

¹ Use-related cost/acre includes fuel, lubricants, repairs and maintenance, labor, and power and implement depreciation (depreciation is both time-related and use-related). The difference between use-related cost and total cost is that total cost also includes overhead costs (interest, insurance, and housing).

Tractor or Combine HP ¹	Net Cost of a New Power Unit ²	Annual Hours of Use	Fuel & Oil Cost Per Hour	Maintenance & Repair Cost/Hr	Depreciation Cost Per Hour	--Overhead ³ -- Cost Per Year	Cost Per Hour	--Total Cost-- Per Year Of Use	Per Hour Of Use	Diesel Use/Hr Gallons
Tractors and Combines (Without Heads)										
40	18,800	400	2.02	0.63	2.76	902	2.25	3,069	7.67	1.76
60	24,300	400	3.04	0.82	3.57	1,161	2.90	4,130	10.33	2.64
75	30,300	400	3.80	1.07	4.35	1,457	3.64	5,146	12.86	3.30
105 MFWD	57,300	450	5.31	1.72	6.66	2,837	6.30	9,000	20.00	4.62
130 MFWD	76,200	450	6.58	2.29	8.86	3,760	8.36	11,737	26.08	5.72
160 MFWD	94,200	500	8.10	3.14	10.96	4,454	8.91	15,552	31.10	7.04
200 MFWD	112,600	500	10.12	3.75	13.10	5,315	10.63	18,801	37.60	8.80
225 MFWD	125,000	400	11.39	3.33	18.04	5,926	14.81	19,030	47.58	9.90
225 Tracked Tractor	139,200	400	11.39	2.23	20.09	6,590	16.47	20,072	50.18	9.90
260 4WD (226 PTO)	117,800	400	11.45	1.88	17.00	5,589	13.97	17,723	44.31	9.95
310 4WD (270 PTO)	123,800	400	13.65	1.98	17.87	5,870	14.67	19,269	48.17	11.87
360 4WD (313 PTO)	141,000	400	15.85	2.26	20.35	6,674	16.68	22,056	55.14	13.78
425 4WD (370 PTO)	156,200	400	18.71	2.50	22.55	7,384	18.46	24,886	62.22	16.27
220 HP Combine	130,000	300	11.13	21.69	29.29	5,726	19.09	24,360	81.20	9.68
275 HP Combine	156,500	300	13.92	26.11	35.26	6,900	23.00	29,485	98.28	12.10

¹HP shown for the smaller tractors is PTO horsepower. Engine HP is shown for the larger tractors. PTO HP for the larger tractors runs about 87% of engine HP, and is shown in parentheses. Fuel use is estimated at 0.044 gallons of diesel fuel per hour per PTO HP.

²Net cost of a new unit assumes no trade-in. Farm machinery is exempt from sales tax in Minnesota so no sales tax is included.

³Overhead costs include interest, insurance, and housing but not depreciation, which is shown separately because it varies to some extent with use. Overhead per hour will vary with annual use.

Implement	Tractor Size (HP)	Net Cost of A New Implement ¹	-- Estimated -- Work Performed Acres/hr	Acres/yr	Power Cost Per Acre	Labor Cost Per Acre	--Implement Cost/Acre-- Repairs	Deprec- iation	Over- head ²	Total Cost /Acre ³	Use-related Cost /Acre ⁴	Diesel Fuel Gal/Acre
Tillage Equipment												
Chisel Plow 15 Ft	130 MFWD	7,800	8.50	680	2.99	1.26	0.28	0.62	0.66	5.81	4.17	0.60
Chisel Plow 23 Ft	200 MFWD	17,100	13.03	1,043	2.80	0.82	0.40	0.89	0.87	5.78	4.10	0.60
Chisel Plow 37 Ft	310 4WD	24,600	20.97	1,677	2.34	0.51	0.36	0.79	0.78	4.78	3.31	0.60
Chisel Plow 57 Ft	425 4WD	39,900	32.30	2,584	2.04	0.33	0.38	0.84	0.79	4.38	3.02	0.60

¹See footnotes at end of table.

Implement	Tractor Size (HP)	Net Cost of A New Implement ¹	-- Estimated -- Work Performed Acres/hr Acres/yr		Power Cost Per Acre	Labor Cost Per Acre	--Implement Cost/Acre-- Depreciation Over- head ²			Total Cost /Acre ³	Use-related Cost /Acre ⁴	Diesel Fuel Gal/Acre
Tillage Equipment (continued)												
Chisel Plow, Front Dsk 16.3 Ft	200 MFWD	18,600	9.21	737	4.10	1.16	0.39	1.50	1.27	8.42	6.00	0.97
Chisel Plow, Front Dsk 21.3 Ft Fold	310 4WD	28,200	12.04	963	3.98	0.89	0.46	1.73	1.43	8.49	5.84	0.97
Moldboard Plow 4 Bottom-18, 6 Ft	75	11,700	2.78	334	4.74	3.85	1.81	1.90	1.76	14.06	10.99	1.29
Moldboard Plow 5 Bottom-18, 7.5 Ft	105 MFWD	14,500	3.48	417	5.70	3.08	1.80	1.88	1.75	14.22	10.65	1.29
Moldboard Plow 6 Bottom-18, 9 Ft	130 MFWD	17,200	4.17	542	6.16	2.57	1.90	1.72	1.61	13.94	10.33	1.29
Moldboard Plow 8 Bottom-18, 12 Ft	160 MFWD	23,100	5.56	723	5.62	1.93	1.91	1.73	1.60	12.79	9.58	1.29
Field Cultivator 18 Ft	105 MFWD	11,000	12.98	1,558	1.50	0.83	0.29	0.38	0.38	3.38	2.51	0.32
Field Cultivator 28 Ft	160 MFWD	19,400	20.19	2,423	1.51	0.53	0.33	0.43	0.43	3.23	2.36	0.32
Field Cultivator 47 Ft	260 4WD	33,500	33.90	4,068	1.34	0.32	0.34	0.45	0.43	2.87	2.03	0.32
Field Cultivator 60 Ft	310 4WD	41,500	43.27	5,193	1.16	0.25	0.33	0.43	0.41	2.59	1.84	0.32
Tandem Disk 11 Ft Rigid	60	6,800	6.40	640	1.71	1.67	0.36	0.63	0.57	4.94	3.91	0.49
Tandem Disk 21 Ft Rigid	160 MFWD	20,400	12.22	1,222	2.45	0.88	0.56	0.99	0.84	5.72	4.15	0.49
Tandem Disk H.D. 30 Ft Fold	360 4WD	34,400	17.45	1,745	3.16	0.61	0.66	1.17	0.96	6.56	4.64	0.79
Offset Disk 12 Ft	105 MFWD	10,700	5.56	556	3.59	1.93	0.44	1.14	0.98	8.07	5.96	0.83
V-Ripper 25" O.C., 10 Ft	160 MFWD	12,100	6.18	618	4.84	1.73	0.63	1.06	1.02	9.28	6.82	0.97
V-Ripper 25" O.C., 18 Ft	260 4WD	18,800	11.13	1,113	4.07	0.96	0.55	0.92	0.89	7.38	5.23	0.97
V-Ripper 25" O.C., 25 Ft	360 4WD	22,800	15.45	1,545	3.66	0.69	0.48	0.80	0.79	6.41	4.54	0.97
V-Ripper 30" O.C., 17 Ft	260 4WD	12,800	10.51	1,051	4.24	1.02	0.39	0.66	0.66	6.97	4.98	0.97
Comb Fld Cult Incorp 16 Ft	160 MFWD	18,200	11.54	1,154	2.63	0.93	0.51	0.93	0.79	5.79	4.23	0.55
Comb Fld Cult Incorp 25 Ft	260 4WD	32,300	18.03	1,803	2.46	0.59	0.58	1.06	0.89	5.58	3.92	0.55
Comb Fld Cult Incorp 33 Ft	310 4WD	41,200	23.80	2,380	2.09	0.45	0.56	1.03	0.86	4.98	3.51	0.55
Comb Disk & V-Ripper 17.5 Ft	360 4WD	28,200	9.02	902	6.04	1.19	0.71	1.85	1.54	11.34	7.95	1.47
Comb Disk & V-Ripper 22.5 Ft	425 4WD	48,800	11.59	1,159	5.44	0.92	0.96	2.49	2.02	11.83	8.22	1.47
Disk,Fld Cult Finish 22 Ft	200 MFWD	24,200	11.33	1,133	3.22	0.95	0.49	1.27	1.08	7.00	4.98	0.69
Disk,Fld Cult Finish 38 Ft	310 4WD	39,300	19.58	1,958	2.56	0.55	0.46	1.19	1.00	5.75	4.00	0.69
Roller Harrow 12 Ft	75	10,200	7.42	742	1.73	1.44	0.31	0.81	0.72	5.03	3.81	0.44

Implement	Tractor Size (HP)	Net Cost of A New Implement ¹	-- Estimated -- Work Performed Acres/hr Acres/yr		Power Cost Per Acre	Labor Cost Per Acre	--Implement Cost/Acre-- Depreciation Over-head ²			Total Cost /Acre ³	Use-related Cost /Acre ⁴	Diesel Fuel Gal/Acre
Planting Equipment												
Row Crop Planter 6 Row-30, 15 Ft	60	13,700	7.00	490	1.45	2.15	0.57	1.36	1.52	7.05	5.12	0.35
Row Crop Planter 8 Row-30, 20 Ft	75	21,500	9.33	653	1.38	1.62	0.68	1.60	1.75	7.02	4.88	0.35
Row Crop Planter 12 Row-30, 30 Ft	105 MFWD	32,700	14.00	980	1.46	1.08	0.69	1.62	1.78	6.62	4.39	0.35
Min-Til Planter 6 Row-30, 15 Ft	75	17,600	6.36	509	2.04	2.37	0.94	1.68	1.85	8.87	6.46	0.53
Min-Til Planter 8 Row-30, 20 Ft	105 MFWD	24,400	8.48	594	2.34	1.78	0.84	2.00	2.17	9.13	6.22	0.53
Min-Til Planter 12 Row-30, 30 Ft	160 MFWD	47,300	12.73	1,273	2.42	1.18	1.61	1.80	1.93	8.95	6.33	0.53
Min-Til Planter 16 Row-30, 40 Ft	200 MFWD	60,800	16.97	2,206	2.23	0.89	2.07	1.34	1.44	7.98	5.91	0.53
Potato Planter Filler 19 Ft	None	14,300	5.75	322	0.04	-	0.64	2.16	2.40	5.23	2.81	0.02
Potato Row Marker 4 Row, 12.6 Ft	130 MFWD	13,400	4.98	214	4.99	3.24	0.23	3.04	3.23	14.72	9.82	0.93
Potato Row Marker 6 Row, 19 Ft	160 MFWD	20,900	7.47	321	4.15	2.16	0.24	3.16	3.35	13.06	8.52	0.93
Potato Row Marker 8 Row, 25.3 Ft	160 MFWD	26,800	9.97	429	3.38	1.62	0.23	3.04	3.24	11.50	7.37	0.93
Potato Planter 4 Row, 12.6 Ft	130 MFWD	34,400	3.83	214	6.40	7.61	2.06	7.79	8.13	31.99	21.67	1.14
Potato Planter 6 Row, 19 Ft	130 MFWD	45,900	5.75	322	4.70	5.07	1.83	6.93	7.25	25.78	17.08	1.14
Potato Planter 8 Row, 25.3 Ft	160 MFWD	59,600	7.67	429	4.31	3.80	1.79	6.74	7.07	23.70	15.47	1.14
Beet Planter 12 Row, 22 Ft	105 MFWD	40,100	4.67	280	4.29	3.45	2.13	6.95	7.37	24.19	15.47	0.99
Beet Planter, Vacuum 24 Row, 44 Ft	160 MFWD	91,700	22.40	1,008	1.39	0.72	0.74	4.42	4.67	11.93	6.87	0.31
Grain Drill 25 Ft	130 MFWD	26,100	10.61	848	2.40	1.36	0.84	1.49	1.63	7.72	5.30	0.49
Grain Drill 30 Ft	130 MFWD	34,600	12.73	1,018	2.09	1.13	0.92	1.65	1.78	7.59	5.14	0.49
Grain Drill 35 Ft	160 MFWD	39,700	14.85	1,188	2.11	0.97	0.91	1.62	1.75	7.36	5.01	0.49
Presswheel Drill 16 Ft	105 MFWD	24,700	6.79	509	2.90	2.13	1.15	2.36	2.53	11.06	7.60	0.64
Presswheel Drill 20 Ft	130 MFWD	26,600	8.48	636	3.03	1.70	0.99	2.03	2.19	9.95	6.77	0.64
Presswheel Drill 30 Ft	160 MFWD	39,000	12.73	1,018	2.54	1.13	1.04	1.86	2.00	8.58	5.87	0.64
Air Seeder Drill 36 Ft	260 4WD	60,200	15.27	1,222	2.90	0.94	1.34	2.39	2.55	10.13	6.66	0.65
Air Seeder Drill 36 Ft	260 4WD	60,200	15.27	1,222	2.90	0.94	1.34	2.39	2.55	10.13	6.66	0.65
No-Till Drill 15 Ft	130 MFWD	26,800	6.36	509	3.99	2.27	1.43	2.56	2.75	12.99	8.94	0.81
No-Till Drill 20 Ft	160 MFWD	42,000	8.48	679	3.64	1.70	1.68	3.00	3.20	13.23	8.98	0.81
No-Till Drill 30 Ft	200 MFWD	62,200	12.73	1,018	3.09	1.13	1.66	2.97	3.14	11.99	8.01	0.81

Implement	Tractor Size (HP)	Net Cost of A New Implement ¹	-- Estimated -- Work Performed Acres/hr Acres/yr	Power Cost Per Acre	Labor Cost Per Acre	--Implement Cost/Acre-- Repairs Depreciation Over-head ²	Total Cost /Acre ³	Use-related Cost /Acre ⁴	Diesel Fuel Gal/Acre			
Crop Maintenance Equipment												
Cultivator 6 Row-30, 15 Ft	60	4,900	7.73 773	1.45	1.41	0.15 0.34 0.35	3.71	2.99	0.44			
Cultivator 8 Row-30, 20 Ft	130 MFWD	6,600	10.30 1,030	2.40	1.06	0.15 0.35 0.35	4.31	3.15	0.44			
Cultivator 12 Row-30, 30 Ft	160 MFWD	12,600	15.45 1,545	2.00	0.71	0.19 0.44 0.42	3.76	2.76	0.44			
Cultivator 16 Row-30, 40 Ft	200 MFWD	16,000	20.61 2,061	1.85	0.53	0.18 0.42 0.40	3.38	2.46	0.44			
Cultivator High Residue 6 Row-30, 15 Ft	105 MFWD	9,500	7.73 773	2.64	1.41	0.29 0.67 0.63	5.64	4.19	0.64			
Cultivator High Residue 8 Row-30, 20 Ft	160 MFWD	12,900	10.30 1,030	2.97	1.06	0.29 0.68 0.64	5.64	4.14	0.64			
Cultivator High Residue 12 Row-30, 30 Ft	225 MFWD	21,900	15.45 1,545	3.08	0.71	0.33 0.77 0.71	5.60	3.93	0.64			
Rotary Hoe 21 Ft	105 MFWD	6,100	25.96 2,596	0.77	0.42	0.06 0.14 0.13	1.52	1.15	0.18			
Potato Cultivator 4 Row, 12.6 Ft	75	4,900	5.36 778	2.38	2.04	0.34 0.34 0.31	5.40	4.41	0.59			
Potato Cultivator 6 Row, 19 Ft	105 MFWD	7,500	8.04 1,126	2.51	1.36	0.33 0.36 0.35	4.90	3.77	0.59			
Sugar Beet Cult 12 Row, 22 Ft	105 MFWD	14,900	5.60 336	3.55	1.95	0.34 2.40 2.28	10.52	7.11	0.81			
Sugar Beet Cult 24 Row, 44 Ft	200 MFWD	31,500	11.20 672	3.38	0.98	0.36 2.54 2.35	9.60	6.30	0.81			
Boom Sprayer, Self-Prop 47 Ft	None	61,600	25.92 2,592	0.24	0.63	1.14 1.15 1.22	4.38	3.05	0.11			
Boom Sprayer, Self-Prop 60 Ft	None	76,700	33.09 3,309	0.24	0.49	1.12 1.13 1.18	4.16	2.85	0.11			
Boom Sprayer 30 Ft	40	5,000	15.36 1,229	0.49	1.06	0.15 0.20 0.24	2.14	1.75	0.11			
Boom Sprayer 50 Ft	60	5,500	25.61 2,561	0.41	0.63	0.10 0.10 0.13	1.39	1.14	0.11			
Sprayer High Pressure 50 Ft	60	26,800	23.64 2,364	0.44	0.69	0.55 0.55 0.60	2.82	2.10	0.11			
Hooded Sprayer 8 Row, 20 Ft	40	7,000	10.24 819	0.75	1.59	0.31 0.41 0.49	3.55	2.84	0.17			
Anhydrous Applicator 30 Ft	160 MFWD	20,300	12.73 509	2.44	1.10	0.90 1.94 2.10	8.47	5.67	0.55			
Fert Spreader 4 T, 40 Ft	60	10,400	23.76 713	0.43	0.59	0.23 0.71 0.77	2.73	1.83	0.11			
Corn Stalk Chopper 12 Ft	60	9,300	4.65 465	2.22	2.48	0.67 1.25 0.96	7.58	5.99	0.57			
Potato Shredder 18 Ft	130 MFWD	13,600	6.98 698	3.74	1.65	0.65 1.22 0.96	8.22	6.06	0.82			
Stalk Shredder 20 Ft	130 MFWD	16,000	7.76 776	3.36	1.49	0.69 1.29 1.03	7.85	5.75	0.74			
Rock Picker 6 Ft	75	13,600	1.42 85	9.07	8.88	5.70 9.97 7.77	41.40	31.05	2.33			

Implement	Tractor Size (HP)	Net Cost of A New Implement ¹	-- Estimated --		Power Cost Per Acre	Labor Cost Per Acre	--Implement Cost/Acre--			Total Cost /Acre ³	Use-related Cost /Acre ⁴	Diesel Fuel Gal/Acre
			Work Performed Acres/hr	Acres/yr			Repairs	Deprec- iation	Over- head ²			
Harvesting Equipment												
Mower-Conditioner 9 Ft	40	13,300	4.36	349	1.76	2.65	0.59	2.38	1.81	9.19	6.86	0.40
Rotary Hay Mower 6 Ft	40	2,600	2.91	291	2.64	3.61	0.52	0.56	0.47	7.80	6.55	0.61
Rotary Mow/Cond 9 Ft	75	16,300	6.55	524	1.97	1.68	0.43	1.94	1.46	7.48	5.46	0.50
Hay Rake (Hyd) 9 Ft	40	4,600	3.49	698	2.20	3.01	0.35	0.41	0.35	6.32	5.32	0.50
Hay Swather-Cond 12 Ft	60	18,100	5.82	465	1.77	1.80	0.61	2.43	1.90	8.51	6.11	0.45
Swather-Cond, Self-Prop 16 Ft	None	59,800	7.76	621	0.92	1.35	0.49	6.01	4.47	13.25	8.32	0.40
Grain Swather, Pull Type 18 Ft	75	10,800	8.73	698	1.44	1.20	0.08	0.96	0.84	4.53	3.27	0.35
Grain Swather, Pull Type 21 Ft	75	16,000	10.18	815	1.29	1.03	0.10	1.23	1.02	4.68	3.29	0.35
Grain Swather, Self-Prop 21 Ft	None	58,600	10.18	815	0.70	1.03	0.37	4.49	3.38	9.96	6.24	0.30
Hay Baler PTO Twine 12 Ft	40	16,800	4.36	873	1.76	3.31	1.94	1.15	0.95	9.11	7.64	0.40
Round Baler 1000 Lb, 9 Ft	60	11,600	3.01	603	3.30	3.87	3.31	1.15	0.94	12.57	10.67	0.77
Round Baler 1500 Lb, 12 Ft	60	12,100	4.02	804	2.70	2.90	2.59	0.90	0.74	9.82	8.36	0.77
Rd Baler/Wrap 1000 Lb, 9 Ft	60	21,500	3.01	603	3.43	3.87	6.13	2.14	1.69	17.25	14.60	0.88
Large Rectangular Baler 24 Ft	130 MFWD	58,200	16.29	1,629	1.60	0.72	0.46	2.14	1.69	6.61	4.41	0.35
Forage Harvester 2 Row, 5 Ft	105 MFWD	25,700	1.38	138	14.51	10.47	3.47	11.18	8.89	48.51	35.05	3.35
Forage SP Harvstr 2 Row, 5 Ft	None	164,700	1.70	255	6.23	8.50	5.82	41.04	29.16	90.76	58.48	2.71
Forage SP Harvstr 3 Row, 7.5 Ft	None	159,100	2.55	382	6.23	5.67	3.75	26.43	18.85	60.93	38.97	2.71
Forage SP Harvstr 6 Row, 15 Ft	None	233,100	5.09	764	6.23	2.83	2.75	19.36	13.74	44.92	28.06	2.71
Combine Grain Head20 Ft	220 HP Combine	11,000	6.79	1,358	11.83	2.13	0.19	0.52	0.38	15.04	11.85	1.31
Combine Grain Head30 Ft	275 HP Combine	19,900	10.18	2,036	9.79	1.42	0.23	0.63	0.45	12.51	9.81	1.31
Combine Soybean Hd 15 Ft	220 HP Combine	14,900	4.45	891	18.05	3.24	0.39	1.08	0.77	23.53	18.48	2.02
Combine Soybean Hd 18 Ft	275 HP Combine	16,400	5.35	1,069	18.11	2.70	0.36	0.99	0.71	22.87	17.86	2.02
Combine Soybean Hd 25 Ft	275 HP Combine	19,400	7.42	1,485	13.69	1.94	0.30	0.85	0.60	17.38	13.68	2.02
Combine Corn Hd 6 -30, 15 Ft	220 HP Combine	25,100	4.20	840	18.90	3.44	0.70	1.93	1.37	26.33	20.42	1.93
Combine Corn Hd 8 -30, 20 Ft	220 HP Combine	32,400	5.09	1,018	15.98	2.83	0.74	2.06	1.46	23.07	17.87	1.93
Combine Corn Hd 12 -30, 30 Ft	275 HP Combine	47,600	7.64	1,527	13.27	1.89	0.73	2.02	1.41	19.31	14.89	1.93
Potato Windrower 2 Row, 6.3 Ft	75	34,300	1.49	149	8.23	7.59	5.21	14.32	10.77	46.13	32.92	1.88
Potato Windrower 4 Row, 12.6 Ft	105 MFWD	75,300	2.99	299	7.08	3.80	5.72	15.72	11.56	43.88	30.21	1.88

Implement	Tractor Size (HP)	Net Cost of A New Implement ¹	-- Estimated --		Power Cost Per Acre	Labor Cost Per Acre	--Implement Cost/Acre--			Total Cost /Acre ³	Use-related Cost /Acre ⁴	Diesel Fuel Gal/Acre
			Work Performed Acres/hr	Acres/yr			Repairs	Deprec- iation	Over- head ²			
Potato Harvester Seed 2 Row, 6.3 Ft	130 MFWD	72,600	1.38	295	17.72	30.82	16.21	14.76	11.49	91.00	73.45	3.11
Potato Harvester Seed 4 Row, 12.6 Ft	130 MFWD	114,800	2.76	590	10.65	15.41	12.81	11.67	9.03	59.57	47.51	3.11
Potato Harvester 2 Row, 6.3 Ft	130 MFWD	59,300	1.84	294	14.19	23.12	8.84	12.09	9.45	67.69	53.69	3.11
Disk Bean Top Cutter 6 Row, 11 Ft	105 MFWD	14,200	6.40	512	3.13	2.25	0.48	1.64	1.34	8.85	6.52	0.72
Sugar Beet Lifter 4 Row, 7.3 Ft	105 MFWD	51,700	2.02	162	9.70	7.14	16.56	18.94	14.96	67.30	49.23	2.11
Sugar Beet Lifter 6 Row, 11 Ft	130 MFWD	64,200	3.03	243	8.86	4.76	13.71	15.68	12.41	55.41	40.25	2.11
Sugar Beet Lifter 8 Row, 14.7 Ft (Lower Usage ⁵)	200 MFWD	93,900	4.05	324	9.21	3.56	15.00	17.16	13.51	58.44	42.31	2.11
Sugar Beet Lifter 8 Row, 14.7 Ft (Higher Usage ⁵)	200 MFWD	93,900	4.05	1,013	9.28	3.56	13.93	20.05	5.02	51.84	44.19	2.17
Sugar Beet Topper 6 Row, 11 Ft	75	20,500	5.33	427	2.44	2.44	1.18	2.85	2.33	11.22	8.21	0.64
Sugar Beet Topper 12 Row, 22 Ft	160 MFWD	48,600	10.67	853	2.89	1.22	1.39	3.37	2.72	11.60	8.05	0.64
Sugar Beet Wagon 8 Ton, 7.3 Ft	75	11,000	3.47	277	4.36	3.03	0.66	2.38	2.03	12.46	9.38	1.52
Sugar Beet Wagon 20 Ton, 11 Ft	200 MFWD	44,700	5.20	520	7.03	2.02	1.92	5.16	4.10	20.23	14.08	1.52
Sugar Beet Wagon 24 Ton, 11 Ft	225 MFWD	51,600	5.20	520	8.70	2.02	2.21	5.95	4.71	23.60	16.04	1.52

¹Net cost of a new unit assumes no trade-in. Farm machinery is exempt from sales tax in Minnesota so no sales tax is included.

²Overhead per acre will vary with annual use.

³Total cost per acre is total cost per hour divided by acres per hour. Includes fuel, lubricants, repairs and maintenance, labor, and overhead costs including depreciation. Fuel is included in power cost.

⁴Use-related cost/acre includes fuel, lubricants, power and equipment repairs and maintenance, labor, and power and equipment depreciation (depreciation is both time-related and use-related). The difference between use-related cost and total cost is that total cost also includes overhead costs (interest, insurance, and housing).

⁵Cost data for the 8 row sugar beet lifter is calculated for two levels of annual usage, 80 and 250 hours. The 250 hours/year is intended to reflect a custom work situation. At the higher usage, the machine is traded after 3 years with a trade-in value of 32% of list price. At the lower 80-hour usage level, it is traded at 12 years with a trade-in value 26% of list.

Implement	Tractor Size (HP)	Net Cost of A New Implement	-- Estimated -- Work Performed Hours/yr	Power Cost Per Hour	Labor Cost Per Hour	--Implement Cost/Hour-- Deprec- iation Overhead	Repairs	Total Cost Per Hour	Use-related Cost Per Hour	Diesel Fuel Gal/Hour	
Miscellaneous - Per Hour Calculations Only											
Rd Bale Wrapper Silage	60	18,800	150	10.33	10.50	14.08	7.52	5.88	48.31	39.52	2.64
Bale Wrapper Dry Hay	40	8,100	150	7.67	10.50	6.07	3.24	2.61	30.09	25.22	1.76
Forage Blower	60	6,300	50	10.33	10.50	1.02	7.56	5.98	35.39	26.51	2.64
Manure Spreader 150 Bu	75	7,400	100	12.86	10.71	5.47	4.03	3.75	36.82	29.43	3.30
Manure Spreader 300 Bu	105 MFWD	11,500	100	20.00	10.71	8.50	6.26	5.78	51.25	39.17	4.62
Manure Spreader 400 Bu	130 MFWD	14,500	100	26.08	10.71	10.72	7.90	7.29	62.70	47.05	5.72
Liquid Manure Spreader 9500 Gal	225 Tracked Tractor	45,600	70	50.18	10.71	30.29	35.47	32.44	159.09	110.18	9.90
Grain Cart 500 Bu	60	15,800	130	10.33	10.50	3.81	7.29	6.09	38.01	29.03	2.64
Gravity Grain Box 240 Bu	75	3,500	130	12.86	10.50	0.84	1.62	1.77	27.59	22.18	3.30
Baled Hay Wagon	40	3,500	250	7.67	21.00	1.03	0.84	0.91	31.45	28.29	1.76
Forage Wagon 14 Ft Long	40	11,700	130	7.67	10.50	2.72	5.40	4.64	30.93	24.03	1.76
Forage Wagon 16 Ft Long	40	13,100	130	7.67	10.50	3.04	6.04	5.01	32.26	25.00	1.76
Soil scraper bucket 12 Cu Yd	260 4WD	38,000	80	44.31	14.43	7.39	25.73	22.85	114.69	77.88	9.95