member benefits

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Farm Machinery Co-operatives

An Idea Worth Sharing

Andrea Harris
Murray Fulton

September 2000

autonomy

participation

University of Saskatchewan
Centre for the Study of Co-operatives

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Foreword

THIS BOOKLET DOCUMENTS the results of a simple financial model developed to compare the costs of owning selected types of farm machinery as individual farmers and as members of a farm machinery co-operative. This is one of a series of three booklets documenting the results of a study examining the applicability of different types of farm machinery co-operatives to Saskatchewan agriculture. A second booklet, *The CUMA Farm Machinery Co-operatives,* focusses on a type of farm machinery co-operative successfully used by a large number of farmers in Québec. The third booklet, *Farm Machinery Co-operatives in Saskatchewan and Québec,* describes different organizational structures used by members of farm machinery co-operatives in Saskatchewan and Québec, and provides some guidelines for forming successful farm machinery co-operatives.

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Introduction

Farm machinery is becoming more expensive to purchase and own. Its high cost is making it difficult for smaller farm operations in Saskatchewan to remain economically viable, to replace major machinery, and to access new farming technologies, which require large investments in machinery and equipment. The movement towards direct seeding, for example (see page 4), requires purchasing specially adapted equipment and substantial capital investment in new farm machinery.

The combination of increasing machinery costs and the need for continued technological innovation has motivated many farmers to examine new arrangements for sharing equipment. One such arrangement is machinery co-operatives.

Co-operatives are a type of business that is owned and controlled by the people who use the services provided by the business. Farm machinery co-operatives are organized by farmers who wish to reduce the purchasing and operating costs of their equipment. Each member has one vote in the control of the business regardless of how much capital they have invested in the co-operative.

The members of a farm machinery co-operative pool their money to buy machinery, and share costs and operating expenses. The co-operative owns the machinery on behalf of its members, while the members retain their land, buildings, and permit books. Some farm machinery co-operatives also pool farm receipts in order to ensure that machinery use is equitable. The pooling of farm receipts is optional, however, and depends upon the needs of the members involved in the co-operative.

Sharing farm machinery through machinery co-operatives can provide farmers with a number of benefits, including:

- lower costs—the costs of owning and operating machinery co-operatively are estimated to be 35 percent lower than the costs associated with individual ownership;
- greater efficiency—by purchasing machinery as a group, members can achieve economies of scale by purchasing larger, more efficient machines;
- access to new technology—group purchases can provide individuals faster access to technology they would otherwise not be able to afford;
- access to a greater pool of knowledge and resources—the pooling of machinery in an organized manner can also facilitate the pooling of other resources, such as labour, experience, and ideas.

This booklet documents the results of a financial model that quantifies some of the benefits that Saskatchewan grain farmers can expect to achieve through farm machinery co-operatives. Specifically, the model compares the costs of owning farm machinery as individual farmers with the costs of owning machinery as members of a farm machinery co-operative. Since the optimal size of machinery varies for an individual farm as opposed to a co-operative made up of several farms, the time required to complete operations under both scenarios is also examined.

The model considers cost and efficiency variables for selected machines and equipment typical to a Saskatchewan mixed grain farm, including:

- time requirement (hours needed for farm operation);
- fixed costs;
- operating costs;
- total machine costs;
- rental costs; and
- complement costs.

The first part of this booklet examines the overall costs associated with whole machinery sets corresponding to both a conventional seeding system and a direct seeding system. The second part presents cost comparisons on a machine-by-machine basis. This second comparison is similar to the analysis done by members of a CUMA-style farm machinery co-op popular

in Québec and Ontario. In the CUMA co-ops, individual machines and pieces of equipment are shared among subgroups of members according to their farm needs.

The CUMA system of sharing farm machinery differs from the system typical to farm machinery co-operatives in Saskatchewan, where members of these co-operatives generally share whole machinery sets, rather than individual machines or pieces of equipment. The comparison of machinery sets illustrated in the first part of this booklet is more reflective of the analysis made by members of Saskatchewan farm machinery co-operatives.

For more information on the organizational structure of both CUMAs and Saskatchewan farm machinery co-operatives, interested readers are referred to two additional booklets in this series entitled *The CUMA Farm Machinery Co-operatives* and *Farm Machinery Co-operatives in Saskatchewan and Québec.*

The Movement Towards Direct Seeding in Saskatchewan

The movement towards direct seeding is one of several factors affecting Saskatchewan agriculture's capital investment trends. The move to this new system of farming requires many equipment changes and large investments in machinery. Some of these changes and investments include the following:

- Special straw chopping and spreading equipment—the straw and chaff must be spread evenly across the field to reduce plugging and bunching during direct seeding.
- A reliable sprayer—a reliable sprayer is necessary due to the greater reliance on chemicals in a direct seeding system and the fact that a chemical burn-off of plant growth is sometimes done.
- A windscreen—a windscreen may be required on the sprayer to complete the spraying job at the optimum time.
- A specially adapted swather with pickup reels, or a combine with a straight cut flex header and pickup reels. Rotations require special attention with a direct seeding system. It may be beneficial to rotate from a cereal to an oilseed or pulse and back to a cereal. Most pulses such as lentils and peas require either a specially adapted swather with pickup reels, or a combine with a straight cut flex header and pickup reels.
- In many cases the switch to straight combining requires a switch from a pull type to a self-propelled combine.

Most farmers find that they are moving towards a completely different system of farming when they adopt direct seeding—it is not an isolated operation. The large costs associated with purchasing the required machinery and equipment make it difficult for many farms to adopt this new technology, regardless of the possible gains in production.

Reference: Saskatchewan Agriculture and Food. *Farmfacts—Machinery Arrangements.* Available on the Internet at http://www.agr.gov.sk.ca/saf.

Summary of Results

Part I: Cost Comparisons by Machinery Set

Part I presents the costs associated with the ownership of two distinct machinery sets—one for conventional seeding and one for direct seeding. The cost of owning the individual pieces of equipment is examined in Part II. The costs of independently owning a set of machinery typically used under a conventional seeding system (Table 1, overleaf) are compared with the costs associated with co-operatively owning the same set of machinery. Table 2, overleaf, outlines a similar comparison using a set of machinery typically used under a direct seeding system.

The cost comparison assumes that the individual farmer operates a mixed grain farm with fifteen hundred cultivated acres. The co-operative is assumed to be made up of three such farmers; i.e., the co-op has forty-five hundred cultivated acres.

Key results from the comparison of machinery sets include:

- Under a conventional seeding system, annual fixed costs are 45 percent lower and operating costs are 14 percent lower for the co-op member. As a result, total annual machinery costs are 36 percent lower for the co-op member as compared to the individual owner (see Table 3, overleaf).
- Under a direct seeding system, the combination of 44 percent lower fixed costs and 6 percent lower operating costs translates into an estimated overall saving in total annual machinery costs of 33 percent for a co-op member versus an individual farmer-owner (see Table 4, overleaf).

Table 1: Machinery Set—Conventional Seeding

	Individual	Co-operative
Large Tractor	160–179 HP 2WD	250–299 HP 4WD
Small Tractor	60–69 HP 2WD	180+ HP 2WD
Air Seeder, Minimum Till	28′–30′ Air Seeder	46′–47′ Air Seeder
HD Cultivator	34′–35′ HD Cultivator	58′–60′ HD Cultivator
Harrow Packer	70′ Harrow Packer	80′ Harrow Packer
PTO Sprayer	60′ PTO Sprayer	105′ PTO Sprayer
Combine SP Conventional with pickup	Small 190 HP	Larger 280 HP

Table 2: Machinery Set—Direct Seeding

	Individual	Co-operative
Large Tractor	160–179 HP 2WD`	250–299 HP 4WD
Small Tractor	60–69 HP 2WD	180+HP 2WD
Air Seeder, Zero Till	28′–30′ Air Seeder	46′–47′ Air Seeder
PTO Sprayer	60′ PTO Sprayer	105′ PTO Sprayer
Combine SP Conventional with pickup	Small 190 HP	Large 280 HP

Table 3: Machinery Set Costs—Conventional Seeding

	Individual Farmer	Co-op Member	Co-op Total
Total Replacement Cost ($)	424,800	203,367	610,100
Annual Fixed Costs ($)	45,996	25,108	75,325
Annual Operating Costs ($)	20,996	18,023	54,069
Total Annual Machinery Costs ($)	66,992	43,131	129,394
Total Annual Machinery Costs Per Acre ($/acre)	44.66	28.75	28.75

Table 4: Machinery Set Costs—Direct Seeding

	Individual Farmer	Co-op Member	Co-op Total
Total Replacement Cost ($)	379,900	185,533	547,600
Annual Fixed Costs ($)	40,691	22,822	68,466
Annual Operating Costs ($)	16,207	15,223	45,669
Total Annual Machinery Costs ($)	56,898	38,045	114,135
Total Annual Machinery Costs Per acre ($/acre)	37.93	25.36	25.36

The greater field efficiency of the drawn equipment suitable to the co-operative also translates into lower complement costs per farm for co-op members. Complement costs are defined as the costs of an individual piece of equipment plus the cost of a compatible power unit. In all cases (except for the PTO sprayer under the direct seeding system) the complement costs per acre were lower for the co-op member than for the individual farmer due to the fewer hours needed to complete each operation.

Under the conventional seeding scenario, complement costs per acre were on average 32 percent lower for the co-op member. Under the direct seeding system, per-acre complement costs of the air seeder were 46 percent lower for the co-op member than the individual farmer, although per-acre complement costs of the sprayer were 23 percent higher for the co-op member, due to the higher costs associated with the tractor used by the co-operative.

Part II: Cost Comparisons by Machine

Table 5, overleaf, provides a listing of the types and size of equipment compared in Part II. Machines are compared separately for both an individual farmer and a co-op member. Table 6 provides a summary of the total (fixed and operating) annual machinery costs per acre associated with the equipment listed in Table 5.

The results indicate that a mixed grain farmer with fifteen hundred cultivated acres can expect to save an average of 35 percent in total machinery costs per acre by sharing a piece of machinery with at least two other farms of equal size, as opposed to owning the machine individually. The savings in total machinery costs are due to the combination of lower fixed costs per hour and reduced hours required to operate the machine. These savings occur even though operating costs per hour are higher per machine for a member of the co-operative. The greater operating costs are due to the selection of larger machines suitable for a combined acreage of forty-five hundred acres.

Table 5: Types of Machines and Equipment Compared in Part 2

	Individual	Co-operative
Air Seeder, Conventional	28′–30′ Air Seeder	46′–47′ Air Seeder
Air Seeder, Zero Till	28′–30′ Air Seeder	46′–47′ Air Seeder
HD Cultivator	34′–35′ HD Cultivator	58′–60′ HD Cultivator
Harrow Packer	70′ Harrow Packer	80′ Harrow Packer
PTO Sprayer	60′ PTO Sprayer	105′ PTO Sprayer
Combine SP Conventional w/pickup	Small 190 HP	Large 280 HP
Tractor	160–179 HP 2WD	250–299 HP 4WD

Table 6: Summary of Total Annual Machinery Costs by Machine

	Total Annual Machine Costs ($/Acre)	
Machine	**Individual**	**Co-op Member**
Air Seeder, Zero Till	5.47	3.35
Air Seeder, Minimum Till	4.72	2.77
HD Cultivator	1.15	0.88
Harrow Packer	1.76	0.88
PTO Sprayer (1 pass per year)	1.57	1.04
PTO Sprayer (2 passes per year)	1.09	0.84
Combine SP Conventional w/pickup	19.19	12.20
Tractor—Moderate Use*	12.49	6.91
Tractor—Heavy Use**	14.79	8.39

*Moderate Use = 300 hours annual use for the individual farmer and 600 hours annual use for the co-operative.

**Heavy Use = 400 hours annual use for the individual farmer and 800 hours annual use for the co-operative.

Key results from comparing the costs associated with the individual machines selected include:

- a saving of approximately 40 percent in total machinery costs per acre, and a 37 percent gain in field efficiency from sharing either a conventional or zero till air seeder;
- a 24 percent saving in total machinery costs per acre from sharing a heavy duty cultivator, due entirely to the greater work rate associated with a larger machine;

- a 50 percent saving in total machinery costs per acre from sharing a harrow packer, due primarily to significant savings in fixed costs;
- a $7 saving in total machine costs per acre from sharing the combine —the combined result of saving $28 in hourly fixed costs and requiring 30 percent less time to harvest;
- a 34 percent saving in total machinery costs per acre from sharing a PTO sprayer used for only one pass per year, and a 24 percent saving for a sprayer used for two passes a year;
- a saving of 23 percent in total machine costs per acre from sharing a large tractor, assuming moderate hours of use per year (300 hours for the individual farmer, 600 hours for the co-operative); and
- a saving of 36 percent in total machine costs per acre from sharing a large tractor, assuming heavy hours of use per year (400 hours for the individual farmer, 800 hours for the co-operative).

It is important to note that although the number of hours of equipment use per farmer is reduced significantly through the sharing of larger equipment, the total hours of equipment use for all members of the co-operative is still larger in each case than for the individual. For example, an individually owned combine is estimated to be used for 188 hours per year. A member of a farm machinery co-op requires the co-op's combine for only 130 hours a year. The combined need by all co-op members, however, is 391 hours. As a result, the need for a larger window of opportunity for all co-op members to complete certain operations must be considered and weighed against the cost savings realized through machinery sharing. In other words, the potential loss in income from not being able to use a machine at the most optimal time must be compared with the cost savings realized. While this is not likely to be an issue with field preparation equipment, it may be with seeding and harvesting operations.

Methodology

Farm Size and Distribution

Each individual farm operation is assumed to be a mixed grain farm of fifteen hundred acres. It is assumed that the co-operative is composed of three individual farm operators with fifteen hundred acres each.

It is assumed that the distance between the farms involved in the co-op is minimal. As a result, the cost of transporting equipment among members is negligible and not included in the analysis.

Size of Machines and Equipment

The sizes of the machines compared vary according to whether they are being used by an individual farmer or by a member of the farm machinery co-operative. As a result, the size of machinery chosen for the co-op corresponds to the needs of a forty-five-hundred-acre mixed grain farm. The size of farm machinery for the individual farmer is selected according to the typical choice for a mixed grain farm of fifteen hundred cultivated acres. Machinery selection is based on: (a) interviews with members of Saskatchewan farm machinery co-operatives; and (b) information contained in selected publications from Saskatchewan Agriculture and Food.

To facilitate the analysis, some very specific assumptions were made about machine use. While these assumptions were made to capture a typical farming operation, it is recognized that machine use will vary substantially in practice. The numbers presented in this booklet can be viewed as the starting point for more detailed analysis.

Time Requirement

The annual hours of machinery use for all machines except the tractors is calculated according to the work rate for the size of machine selected as published in Saskatchewan Agriculture and Food's *Farm Machinery Custom and Rental Rate Guide 1998*. For example, the work rate for a small 190 HP self-propelled conventional combine with pickup is reported as eight acres per hour. An individual farmer with fifteen hundred acres will therefore use the combine for an estimated 187.50 hours per year.

Fixed, Operating, and Total Machine Costs

The basis for calculating the machine cost data is the cost of new equipment as reported in Saskatchewan Agriculture and Food's *Farm Machinery Custom and Rental Rate Guide 1998*. In calculating costs:

- Total Fixed Costs (TFC) are the sum of depreciation, investment costs, and insurance and housing costs. Fixed costs are calculated on a per-hour basis and then multiplied by the annual hours used to get the Total Fixed Costs per farmer or co-op member, and Total Fixed Costs per farm or co-operative.
- Total Operating Costs (TOC) per hour include repair costs and, in the case of self-propelled machines, fuel, lube, and oil costs.
- Total Machinery Costs (TMC) are the sum of fixed costs and operating costs. They are calculated on a per-hour, per-acre, per-farmer/member, and per-farm/co-op basis. Per-farmer/member calculations are the TMC per hour multiplied by the hours of use per farmer. Per-farm and per-co-op calculations are the TMC per hour multiplied by the hours of use by the individual farm and by the total hours used by all the members of the co-op, respectively.

Rental Costs

The comparison of selected equipment also examines average rental costs. For drawn equipment, the costs are the average rental rates as presented in Saskatchewan Agriculture and Food's *Farm Machinery Custom and Rental Rate Guide 1998.* The rental rates include fixed costs, repair

costs, and a 15 percent margin to cover risk, profit, and management for the rental agent. In the case of powered equipment, the rental costs also include fuel, oil, and lubrication, as these are the responsibility of the renter.

The rental costs are specific to each piece of equipment. If a complement (tractor and machine) is rented, the costs would be the total of the two machine rental costs. The rental costs of various types of tractors are provided in the Appendix.

Complement Costs

The first part of this booklet calculates and presents the complement costs per acre associated with drawn equipment. Complement costs are the total machinery cost of individual pieces of equipment in a set plus the costs of the power unit.

Part I

Cost Comparison of Machinery Sets

In this section the costs associated with individually owning and using a typical machinery set are compared with the costs of owning a similar machinery set co-operatively. Two types of machinery sets are compared. The first corresponds to mixed grain production based on a conventional seeding system, the second to mixed grain production based on direct seeding.

Machinery Set for Conventional Seeding

Table 7 outlines the machines included in the machinery complement set for a conventional seeding operation. Under a conventional seeding system, tillage equipment is required to prepare the seedbed and pack the ground once the field has been seeded. For this reason, a heavy-duty cultivator and a harrow packer are included. It is assumed that a minimum till air seeder is used and that a PTO sprayer is also used for one field pass.

Table 7: Machinery Set—Conventional Seeding

	Individual	**Co-operative**
Large Tractor	160–179 HP 2WD	250–299 HP 4WD
Small Tractor	60–69 HP 2WD	180+ HP 2WD
Air Seeder, Minimum Till	28′–30′ Air Seeder	46′–47′ Air Seeder
HD Cultivator	34′–35′ HD Cultivator	58′–60′ HD Cultivator
Harrow Packer	70′ Harrow Packer	80′ Harrow Packer
PTO Sprayer	60′ PTO Sprayer	105′ PTO Sprayer
Combine SP Conventional with pickup	Small 190 HP	Large 280 HP

Two tractors, a large and a small one, are also included in the set. The size of the tractors is based on farm interviews and the power needs of the other equipment in the set. For the individual farmer, the large tractor is assumed to draw the air seeder, cultivator, and harrow packer. The small tractor is assumed to draw the sprayer. For the co-operative, the large tractor is assumed to draw the air seeder and cultivator. The smaller, two-wheel-drive tractor is assumed to draw the harrow packer and the sprayer.

Both tractors are assumed to be used only for the operations included in our analysis (i.e., seeding, cultivating, harrow packing, and spraying). The total hours for the individual farmer are estimated at 325 for the large tractor and 55 for the small tractor. The total hours for the co-operative are estimated at 514 for the large tractor and 222 for the smaller one. The cost comparisons of the two tractors under these assumptions are provided in the Appendix.

As later illustrated in Table 22, total machine costs per hour for tractors drop significantly as the annual hours of use increase. One can therefore expect tractor costs to be less if other operations are considered.

Table 8 summarizes the estimated costs associated with the machinery set laid out in Table 7. For the individual farmer, total replacement cost (original purchase price) of the machines listed is $424,800. The purchase price of the co-operative machinery set is estimated at $610,100. The co-op member's share of that set is $203,367.

Table 8: Machinery Set Costs—Conventional Seeding

	Individual Farmer	Co-op Member	Co-op Total
Total Replacement Cost ($)	424,800	203,367	610,100
Annual Fixed Costs ($)	45,996	25,108	75,325
Annual Operating Costs ($)	20,996	18,023	54,069
Total Annual Machinery Costs ($)	66,992	43,131	129,394
Total Annual Machinery Costs Per Acre ($/acre)	44.66	28.75	28.75

The difference in capital outlay translates into a savings of 45 percent in annual fixed costs for the co-op member when compared to the individual farmer. Annual operating costs are 14 percent lower for the co-op mem-

ber, and overall, total annual machinery costs are 36 percent lower for the co-op member than for the individual owner.

Table 9 outlines total machine cost per machine. The co-op member's total machine costs are significantly lower for each of the machines in the set, with the exception of the small tractor, the costs for which are higher for the co-op member because a larger, more expensive tractor is assumed for the co-op.

Table 9: Total Machine Costs per Machine—Conventional Seeding

	Individual Farmer	Co-op Member	Co-op Total
Air Seeder, Minimum Till	7,086	4,152	12,456
HD Cultivator	3,453	2,628	7,883
Harrow Packer	2,640	1,316	3,948
PTO Sprayer	2,359	1,565	4,696
Combine SP Conventional with Pickup	28,787	18,303	54,908
Large Tractor	19,408	9,408	28,225
Small Tractor	3,261	5,759	17,278
Total Machine Cost of Machinery Set	66,992	43,131	129,394

Table 10 outlines the complement cost per acre for the drawn equipment included in the machinery set. Complement costs are the total machinery cost of the equipment plus the average fixed and operating costs of the power unit required to draw the equipment.

Table 10: Complement Costs per Acre—Conventional Seeding

	Individual Farmer	Co-op Member
Air Seeder, Minimum Till	9.14	5.32
HD Cultivator	4.56	2.74
Harrow Packer	3.46	2.82
PTO Sprayer	3.75	2.94

Per-acre complement costs are lower for the co-op member than the individual farmer for all drawn equipment, as outlined below:

- 42 percent lower for the air seeder;
- 40 percent lower for the cultivator;
- 19 percent lower for the harrow packer; and
- 22 percent lower for the sprayer.

These savings are the result of the co-op member requiring less time to complete each operation due to the larger equipment used by the co-operative as compared to the individual farmer.

Machinery Set for Direct Seeding

Table 11 outlines the machines included in the machinery complement set for a direct seeding operation. Although tillage equipment is not required under a direct seeding system, heavier use of the sprayer contributes to increased machinery costs. It is assumed that the PTO sprayer is used for two field passes and that a zero till air seeder is used for seeding. A conventional self-propelled combine is used for harvest.

Table 11: Machinery Set—Direct Seeding

	Individual	**Co-operative**
Large Tractor	160–179 HP 2WD	250–299 HP 4WD
Small Tractor	60–69 HP 2WD	180+ HP 2WD
Air Seeder, Zero Till	28′–30′ Air Seeder	46′–47′ Air Seeder
PTO Sprayer	60′ PTO Sprayer	105′ PTO Sprayer
Combine SP Conventional with pickup	Small 190 HP	Large 280 HP

Two tractors, a large and a small one, are included in this machinery set as well. The size of the tractors is based on farm interviews and the power needs of the other equipment included in the set. In both the individual and the co-operative case, the large tractor is used to draw the air seeder and the small tractor is used to draw the sprayer.

As in the earlier example, both tractors are assumed to be used only for the operations included in this analysis (i.e., seeding and spraying). The total hours for the individual farmer are estimated at 136 hours for the large tractor and 111 for the small tractor. The total hours for the co-operative are estimated at 257 hours for the large tractor and 219 for the smaller

one. The cost comparisons of the two tractors under these assumptions are provided in the Appendix.

As further illustrated in Table 22, total machine costs per hour drop significantly for tractors the greater the number of annual hours of use. One can therefore expect tractor costs to be less if other operations are considered.

Table 12 summarizes the estimated costs associated with the machinery set laid out in Table 11. Total replacement cost (original cash value) of the machines listed in Table 11 is $379,900 for the individual farmer. The co-operative's replacement costs are estimated at $547,600, and the co-op member's share of that set is $182,533.

Table 12: Machinery Set Costs—Direct Seeding

	Individual Farmer	Co-op Member	Co-op Total
Total Replacement Cost ($)	379,900	182,533	547,600
Annual Fixed Costs ($)	40,691	22,822	68,466
Annual Operating Costs ($)	16,207	15,223	45,669
Total Annual Machinery Costs ($)	56,898	38,045	114,135
Total Annual Machinery Costs Per Acre ($/acre)	37.93	25.36	25.36

The difference in capital outlay by the co-op member compared to the individual owner translates into a savings of 44 percent in annual fixed costs for the co-op member. Total operating costs are also slightly (6 percent) lower for the co-op member than the individual farmer.

The combination of lower fixed costs and lower operating costs translates into an overall saving in total annual machinery costs of 33 percent associated with the sharing of farm machinery under a direct seeding system.

Table 13 outlines the total machine cost per machine. As was the case with the conventional set, the co-op member's total machine costs are significantly lower for each of the machines in the set, with the exception of the small tractor, which are higher for the co-op member because a larger sized tractor is used by the co-op.

Table 14 outlines the complement cost per acre for the air seeder and

the sprayer. Complement costs are the total machinery cost of the equipment plus the average fixed and operating costs of the power unit needed to draw the equipment.

Table 13: Total Machine Costs per Machine—Direct Seeding

	Individual Farmer	Co-op Member	Co-op Total
Air Seeder, Zero Till	8,200	5,028	15,083
PTO Sprayer	3,284	2,515	7,544
Combine SP Conventional with pickup	28,787	18,303	54,908
Large Tractor— Direct Seeding System	12,748	6,385	19,154
Small Tractor— Direct Seeding System	3,879	5,816	17,447
Total Machine Cost of Machinery Set	56,898	38,045	114,123

Table 14: Complement Costs per Acre—Direct Seeding

	Individual Farmer	Co-op Member
Air Seeder, Zero Till	13.97	7.61
PTO Sprayer	2.39	2.94

The air seeder's per-acre complement costs are 46 percent lower for the co-op member than the individual farmer. This saving is the result of the co-op member needing fewer hours to seed each acre since the co-op's seeder is larger than that of the individual member. Per-acre complement costs are 23 percent higher for the co-op member for the sprayer. This is because the per-acre tractor costs for the smaller tractor are higher for the co-op member than the individual farmer.

Part II

Cost Comparison of Selected Equipment

This section summarizes the cost comparisons of selected, individual machines.

Air Seeder, Conventional Seeding

Air seeders used under a conventional seeding system are equipped with sweep-type openers using an air system to deliver the seed and fertilizer. This type of seeder is typically preceded by a cultivator and followed by a harrow packer. The speed used in calculating the work rate for minimum till air seeders is approximately 5.5 mph.

In Table 15 (overleaf) the cost of owning a 28-30-foot conventional air seeder as an individual farmer is compared with the cost of owning a 46-47-foot air seeder as a member of a co-operative.

Total fixed costs are 47 percent lower for the co-op member than the individual owner, while total operating costs are 18 percent lower for the co-op member. The co-op member requires the air seeder for only 70 hours, compared to 111 hours for the individual farmer, due to greater field efficiency. This lower time requirement for the co-op member results in a 41 percent saving in total machinery costs. On a per-acre basis, the individual farmer pays $4.72 per acre, while the co-op member pays $2.77. Comparing rental costs with total machinery costs, the individual farmer would be better off renting an air seeder, since doing so would save 19 percent in machinery costs.

Table 15: Cost Comparison—Air Seeder, Conventional

		Individual Farmer	Co-op Member
Number of Farms/Members		1	3
Acreage per Farm		1,500	1,500
Total Acres		1,500	4,500
Equipment			
Type		28′–30′ Air Seeder	46′–47′ Air Seeder
Original Cash Cost		58,600	76,600
Salvage Value		5,860	7,660
Years Lifetime		17.00	12.00
Repair Cost Factor		0.20	0.20
Time Requirement			
Work Rate	acres per hour	13.50	21.50
Annual Hrs. Use	total	111.11	209.30
Annual Hrs. Use	per farm	111.11	69.77
Fixed Costs			
Depreciation	per hour	27.92	27.45
Investment Cost	per hour	18.85	13.08
Insurance & Housing	per hour	5.27	3.66
TFC	per hour	52.05	44.19
TFC	per farm	5,783.30	3,083.15
TFC	per farm or co-op	5,783.30	9,249.45
Operating Costs			
Repair Costs	per hour	11.72	15.32
TOC	per hour	11.72	15.32
TOC	per farm	1,302.22	1,068.84
TOC	per farm or co-op	1,302.22	3,206.51
Total Machine Costs			
TMC	per hour	63.77	59.51
TMC	per farm	7,085.53	4,151.99
TMC	per farm or co-op	7,085.53	12,455.96
TMC	per acre	4.72	2.77
Rental Costs (Air Seeder Only—Based on 200 hours annual use)			
Rental Cost	per hour	51.36	67.13
Rental Cost	per farm	5,706.67	4,683.49
Rental Cost	per acre	3.80	3.12

Although the larger air seeder results in approximately 37 percent less time required to seed each farm, total annual hours of use are estimated at 209 for the co-op versus 111 for the individual farm. This implies that the co-op will need to rely on a greater number of workdays than the individual farmer to ensure that all fields are seeded in a timely fashion.

Zero Till Air Seeder, Direct Seeding

Zero till air seeders are capable of seeding directly into untilled soil using narrow openers to minimize soil disturbance. Table 16 summarizes the costs associated with owning and operating a 28-30-foot zero till air seeder as an individual farmer compared with the costs of co-operatively owning and operating a 46-47-foot zero till air seeder. The speed used in the work rate calculation for these seeders is approximately 4.5 mph.

While there is only a 2 percent difference in total machine costs per hour between the co-op member and the individual farmer in this comparison, the co-op member requires the air seeder for only 86 hours, compared to 136 hours for the individual farmer, due to greater field efficiency. The lower time requirement for the co-op member results in a 39 percent saving in total machinery costs. On a per-acre basis, the individual farmer pays $5.47 per acre, while the co-op member pays $3.35. Comparing rental costs with total machinery costs, the individual farmer would be better off renting an air seeder as it represents a 5 percent saving in machinery costs.

Although the larger air seeder results in approximately 37 percent less time required to seed each farm, total annual hours of use are estimated at 257 for the co-op versus 136 for the individual farm. This implies that a greater number of workdays are required by the co-op to ensure that all of its members can seed their fields in a timely fashion.

Heavy Duty Cultivator, Conventional Seeding

Table 17 (page 23) summarizes the cost of individually owning a 34-35-foot heavy-duty cultivator compared with co-operatively owning a 58-60-foot heavy-duty cultivator.

It is assumed that the cultivator is used twice a year by each farmer under a conventional seeding system. Cultivators are not required under a

Table 16: Cost Comparison—Air Seeder, Zero Till

		Individual Farmer	Co-op Member
Number of Farms/Members		1	3
Acreage per Farm		1,500	1,500
Total Acres		1,500	4,500
Equipment			
Type		28′–30′ Air Seeder	46′–47′ Air Seeder
Original Cash Cost		65,100	87,600
Salvage Value		6,510	8,760
Years Lifetime		17.00	12.00
Repair Cost Factor		0.20	0.20
Time Requirement			
Work Rate	acres per hour	11.00	17.50
Annual Hrs. Use	total	136.36	257.14
Annual Hrs. Use	per farm	136.36	85.71
Fixed Costs			
Depreciation	per hour	25.27	25.55
Investment Cost	per hour	17.07	12.18
Insurance & Housing	per hour	4.77	3.41
TFC	per hour	47.12	41.14
TFC	per farm	6,424.80	3,525.90
TFC	per farm or co-op	6,424.80	10,577.70
Operating Costs			
Repair Costs	per hour	13.02	17.52
TOC	per hour	13.02	17.52
TOC	per farm	1,775.45	1,501.71
TOC	per farm or co-op	1,755.45	4,505.14
Total Machine Costs			
TMC	per hour	60.14	58.66
TMC	per farm	8,200.25	5,027.61
TMC	per farm or co-op	8,200.25	15,082.84
TMC	per acre	5.47	3.35
Rental Costs (Air Seeder Only – Based on 200 hours annual use)			
Rental Cost	per hour	57.05	76.77
Rental Cost	per farm	7,779.55	6,580.29
Rental Cost	per acre	5.19	4.39

direct seeding system. The smaller cultivator has an estimated work rate of 17.5 acres per hour, while the larger one is expected to cultivate 29.5 acres per hour. The annual hours of use for the individual farm are estimated at 171, while the co-op member will use the larger cultivator for approximately 101 hours a year.

Although total fixed costs are 34 percent lower for the co-op member than the individual farmer, the co-op farmer's total operating costs per hour are almost double those of the individual. Because the co-op member uses the cultivator for fewer hours, however, total operating costs per farm are about the same.

Because of the greater field efficiency of the larger cultivator, total machine costs per farm are 24 percent lower for the co-op member than the individual farmer, even though per-hour total machine costs are 28 percent higher for the co-op member. On a per-acre basis, the individual farmer pays $1.15 in total machine costs while the co-op member pays $0.88. In comparing rental costs, the individual farmer would be only slightly better off renting a cultivator as this would save only $208 (or 6 percent) in total machinery costs.

Table 17: Cost Comparison—Heavy Duty Cultivator

		Individual Farmer	Co-op Member
Number of Farms/Members		1	3
Acreage per Farm		1,500	1,500
Total Acres		3,000	9,000
Equipment			
Type		34′–35′ HD Cultivator	58′–60′ Cultivator
Original Cash Cost		25,600	44,500
Salvage Value		2,560	4,450
Years Lifetime		17.50	14.00
Repair Cost Factor		0.22	0.22
Time Requirements			
Work Rate	acres per hour	17.50	29.50
Annual Hrs. Use	total	171.43	305.08
Annual Hrs. Use	per farm	171.43	101.69

Fixed Costs			
Depreciation	per hour	7.68	9.38
Investment Cost	per hour	5.34	5.21
Insurance & Housing	per hour	1.49	1.46
TFC	per hour	14.51	16.05
TFC	per farm	2,487.77	1,632.20
TFC	per farm or co-op	2,487.77	4,896.59
Operating Costs			
Repair Costs	per hour	5.63	9.79
TOC	per hour	5.63	9.79
TOC	per farm	965.49	995.59
TOC	per farm or co-op	965.49	2,986.78
Total Machine Costs			
TMC	per hour	20.14	25.84
TMC	per farm	3,453.26	2,627.79
TMC	per farm or co-op	3,453.26	7,883.37
TMC	per acre	1.15	0.88
Rental Cost (Cultivator Only – Based on 250 hours annual use)			
Rental Cost	per hour	18.93	32.91
Rental Cost	per farm	3,245.14	3,346.78
Rental Cost	per acre	1.08	1.12

Harrow Packer, Conventional Seeding

Table 18 compares the cost of individually owning a 70-foot harrow packer with co-operatively owning an 80-foot harrow packer. This equipment is typically used under a conventional seeding system but is not used under a direct seeding system. The smaller harrow packer has an estimated work rate of 35 acres per hour, while the larger one has an expected work rate of 40 acres per hour.

It is estimated that the individual farmer requires the smaller harrow packer for 43 hours a year, while the co-op member will use the larger one for 38 hours a year. Total operating costs per hour are 12 percent higher for the co-op member, but due to greater field efficiency, the total operating costs of both the individual farmer and the co-op member are almost equal.

Table 18: Cost Comparison—Harrow Packer

		Individual Farmer	Co-op Member
Number of Farms/Member		1	3
Acreage per Farm		1,500	1,500
Total Acres		1,500	4,500
Equipment			
Type		70′ Harrow Packer	80′ Harrow Packer
Original Cash Cost		25,800	29,000
Salvage Value		2,580	2,900
Years Lifetime		20.00	15.00
Repair Cost Factor		0.27	0.27
Time Requirement			
Work Rate	acres per hour	35.00	40.00
Annual Hrs. Use	total	42.86	112.50
Annual Hrs. Use	per farm	42.86	37.50
Fixed Costs			
Depreciation	per hour	27.09	15.47
Investment Cost	per hour	21.52	9.22
Insurance & Housing	per hour	6.02	2.58
TFC	per hour	54.63	27.26
TFC	per farm	2,341.35	1,022.25
TFC	per farm or co-op	2,341.35	3,066.75
Operating Costs			
Repair Costs	per hour	6.97	7.83
TOC	per hour	6.97	7.83
TOC	per farm	298.54	293.63
TOC	per farm or co-op	298.54	880.88
Total Machine Costs			
TMC	per hour	61.60	35.09
TMC	per farm	2,639.89	1,315.88
TMC	per farm or co-op	2,693.89	3,947.63
TMC	per acre	1.76	0.88
Rental Cost (Harrow Packer Only – Based on 100 hours annual use)			
Rental Cost	per hour	37.29	41.92
Rental Cost	per farm	1,598.14	1,572.00
Rental Cost	per acre	1.07	1.05

Total fixed costs are 56 percent lower for the co-op member than the individual farmer. This is primarily due to the significant savings in depreciation and investment costs. Total machine costs per farmer are 50 percent lower for the co-op member. On a per-acre basis, the individual farmer pays $1.76 in total machine costs while the co-op member pays $0.88. The average rental costs for a 70-foot harrow packer indicate that the individual farmer would likely be better off renting, as this could save an estimated 39 percent in machinery costs.

PTO Sprayer

The cost of individually owning a 60-foot (400–500 gallon) PTO sprayer is compared with co-operatively owning a 105-foot (700–800 gallon) PTO sprayer. The 60-foot sprayer has an estimated work rate of 27 acres per hour, while the 105-foot sprayer has an average work rate of 41 acres per hour. A power unit of approximately 65 HP is required to draw the smaller sprayer, while the larger sprayer typically requires an 85 HP unit. The cost of hauling water for field spraying is not included in the analysis.

The costs associated with the sprayer are compared under two different scenarios. Under the first, the sprayer is used once a year (one field pass). This scenario corresponds to farms that use a conventional seeding system, where fields are cultivated and harrow-packed in addition to being sprayed. Under the second scenario, it is assumed that the sprayer is used twice a year, as is typical for direct seeding systems.

Under the first scenario, summarized in Table 19, it is estimated that the individual farmer requires the 60-foot sprayer for 56 hours a year. The co-op member is calculated to use the 105-foot sprayer 37 hours a year. Although the total machine costs per hour are the same for both, the total machine costs per acre are much (34 percent) lower for the co-op member due to greater field efficiency. The individual farmer is estimated to spend $2,359 per year to own the smaller sprayer, while the co-op member spends $1,565 per year by jointly owning the larger sprayer with two other farmers.

The individual farmer could save approximately 26 percent in machinery costs by renting as opposed to owning, while the co-op member is slightly better off owning the sprayer.

Table 19: Cost Comparison—PTO Sprayer (one pass per year)

		Individual Farmer	Co-op Member
Number of Farms/Members		1	3
Acreage per Farm		1,500	1,500
Total Acres		1,500	4,500
Equipment			
Type		60′ PTO Sprayer	105′ PTO Sprayer
Original Cash Cost		17,000	24,400
Salvage Value		1,700	2,440
Years Lifetime		14.00	10.00
Repair Cost Factor		0.5167	0.5167
Time Requirement			
Work Rate	acres per hour	27.00	41.00
Annual Hrs. Use	total	55.56	109.76
Annual Hrs. Use	per farm	55.56	36.59
Fixed Costs			
Depreciation	per hour	19.67	20.01
Investment Cost	per hour	10.94	7.95
Insurance & Housing	per hour	3.06	2.22
TFC	per hour	33.67	30.18
TFC	per farm	1,870.61	1,104.10
TFC	per farm or co-op	1,870.61	3,312.30
Operating Costs			
Repair Costs	per hour	8.78	12.61
TOC	per hour	8.78	12.61
TOC	per farm	487.99	461.25
TOC	per farm or co-op	487.99	1,383.75
Total Machine Costs			
TMC	per hour	42.45	42.79
TMC	per farm	2,358.60	1,565.35
TMC	per farm or co-op	2,358.60	4,696.05
TMC	per acre	1.57	1.04
Rental Cost (Sprayer Only – Based on 120 hours annual use)			
Rental Cost	per hour	31.52	45.24
Rental Cost	per farm	1,751.11	1,655.12
Rental Cost	per acre	1.17	1.10

Table 20: Cost Comparison—PTO Sprayer (two passes per year)

		Individual Farmer	Co-op Member
Number of Farms/Members		1	3
Acreage per Farm		1,500	1,500
Total Acres		3,000	9,000
Equipment			
Type		60′ PTO Sprayer	105′ PTO Sprayer
Original Cash Cost		17,000	24,400
Salvage Value		1,700	2,440
Years Lifetime		10.00	6.00
Repair Cost Factor		0.5167	0.5167
Time Requirement			
Work Rate	acres per hour	27.00	41.00
Annual Hrs. Use	total	111.11	219.51
Annual Hrs. Use	per farm	111.11	73.17
Fixed Costs			
Depreciation	per hour	13.77	16.67
Investment Cost	per hour	5.47	3.97
Insurance & Housing	per hour	1.53	1.11
TFC	per hour	20.77	21.76
TFC	per farm	2,307.75	1,592.10
TFC	per farm or co-op	2,307.75	4,776.30
Operating Costs			
Repair Costs	per hour	8.78	12.61
TOC	per hour	8.78	12.61
TOC	per farm	975.99	922.50
TOC	per farm or co-op	975.99	2,767.50
Total Machine Costs			
TMC	per hour	29.55	34.37
TMC	per farm	3,283.74	2,514.60
TMC	per farm or co-op	3,283.74	7,543.80
TMC	per acre	1.09	0.84
Rental Cost (Sprayer Only – Based on 120 hours annual use)			
Rental Cost	per hour	31.52	45.24
Rental Cost	per farm	3,502.22	3,310.24
Rental Cost	per acre	1.17	1.10

Under the second scenario, summarized in Table 20, it is estimated that the individual farmer requires the 60-foot sprayer for 111 hours a year, while the co-op member will use the 105-foot sprayer 73 hours a year. Although the total machine costs per hour for the co-op member are 16 percent higher than those of the individual farmer, the total machine costs per acre are 23 percent lower due to greater field efficiency. The individual farmer is estimated to spend $3,283 per year to own and use the smaller sprayer twice a year, while the co-op member spends $2,514 per year jointly sharing the larger sprayer with two other farmers. In this case, because the sprayer is used twice a year, neither the individual farmer nor the co-op member would be better off renting the same equipment.

Combine

Table 21 compares the cost of individually owning a small 190 HP self-propelled conventional combine with pickup with co-operatively owning a 280 HP version of the same equipment.

The smaller combine has an estimated work rate of 8 acres per hour, while the larger one's rate is about 11.5 acres per hour. Annual combine use for the individual farmer with fifteen hundred acres is therefore estimated at 188 hours. The co-op member, also with fifteen hundred acres, is expected to require the larger combine for 130 hours a year. To cover all three members' combining requirements requires 391 hours.

Total fixed costs per hour are 27 percent lower for the co-op member than the individual farmer, although total operating costs per hour for the co-op farmer are 46 percent higher. However, because the co-op member uses the combine for fewer hours per year, total machine costs amount to $18,303 per year for the co-op member and $28,787 per year for the individual farmer. On a per-acre basis, the individual farmer pays $19 for a combine, as compared to $12 for the co-op member.

The average rental cost for a 190 HP combine is $130 per hour, which works out to a total cost of $24,382 for the individual farmer, who could therefore expect to save 15 percent by renting a combine as opposed to owning one. The rental cost for a 280 HP combine is $148 per hour, which makes it cheaper for the co-op member to own a combine co-operatively than to rent one.

Table 21: Cost Comparison—Combine SP Conventional

		Individual Farmer	Co-op Member
Number of Farms/Members		1	3
Acreage per Farm		1,500	1,500
Total Acres		1,500	4,500
Equipment			
Type		Small 190 HP	Large 280 HP
Large Original Cash Cost		156,500.00	191,900.00
Salvage Value		15,650.00	19,190.00
Years Lifetime		11.00	8.00
Repair Cost Factor		0.2133	0.2133
Time Requirement			
Work Rate	acre per hour	8.00	11.50
Annual Hrs. Use	total	187.50	391.30
Annual Hrs. Use	per farm	187.50	130.43
Fixed Costs			
Depreciation	per hour	68.29	55.17
Investment Cost	per hour	29.84	17.53
Insurance & Housing	per hour	8.35	4.90
TFC	per hour	106.48	77.61
TFC	per farm	19,964.42	10,122.73
TFC	per farm or co-op	19,964.42	30,368.18
Operating Costs			
Repair Costs	per hour	33.38	40.93
Fuel Cost	per hour	13.00	20.80
Lube & Oil Cost	per hour	0.67	0.98
TOC	per hour	47.05	62.71
TOC	per farm	8,822.15	8,179.86
TOC	per farm or co-op	8,822.15	24,539.58
Total Machine Costs			
TMC	per hour	153.53	140.32
TMC	per farm	28,786.57	18,302.59
TMC	per farm or co-op	28,786.57	54,907.76
TMC	per acre	19.19	12.20
Rental Cost (Based on 350 hours annual use)			
Rental Cost	per hour	130.04	148.22
Rental Cost	per farm	24,382.50	19,333.04
Rental Cost	per acre	16.26	12.89

Tractors

Table 22 outlines the total machine costs per hour of various sizes of tractors under different assumptions of annual hours of use. The figures clearly indicate that the more a tractor is used in a year, the less it costs to own and operate.

Table 22: Total Machine Cost Comparison—Tractors

Machine Size	Original Cost	Total Machine Cost Per Hour Annual Hours of Use 200	300	400	600	800
60-69 HP 2WD	33,600	24.49	20.48	18.30	15.68	14.45
80-89 HP 2WD	49,600	34.73	28.80	25.59	21.73	19.91
140-159 HP 2WD	93,800	64.57	53.37	47.29	39.99	36.55
160-179 HP 2WD	107,700	75.31	62.45	55.47	47.08	43.13
180+ HP 2WD	118,100	84.24	70.13	62.49	53.28	48.96
250-299 HP 4WD	125,600	84.72	69.72	61.58	51.79	47.19

While it is difficult to estimate the total number of hours a farmer will use a tractor in a given year, we can assume that:

- a tractor owned co-operatively will be used for a greater number of hours per year than one owned by an individual;
- according to the equipment cost comparisons illustrated earlier, a farmer who belongs to a co-operative in which all major pieces of farm equipment are shared can expect to spend, on average, 32 percent less time completing farm operations; and
- a co-operative requires a larger tractor than that required by an individual, in order to draw the size of equipment suitable for a larger land base.

Based on the above assumptions, Tables 23 and 24 illustrate cost comparisons for a 160–179 HP 2WD tractor owned by an individual farmer versus the costs of owning a 250–299 HP 4WD tractor co-operatively. Table 23 assumes a moderate annual rate of use, with a total of 300 hours assumed for the individual farmer and 600 hours for the co-operative (200 hours per member per year). Table 24 assumes a heavier rate of annual use, with a total of 400 hours for the individual farmer and 800 hours for the co-operative (approximately 267 hours per member per year).

Table 23: Cost Comparison—Large Tractor, Moderate Use*

		Individual Farmer	Co-op Member
Number of Farms/Members		1	3
Acreage per Farm		1,500	1,500
Total Acres		1,500	4,500
Annual Hrs. Use	total	300.00	600.00
Annual Hrs. Use	per farmer	300.00	200.00
Tractor			
Type		160–179 HP 2WD	250–299 HP 4WD
Original Cash Cost		107,700.00	125,600.00
Salvage Value		10,770.00	12,560.00
Years Lifetime		16.50	13.00
Repair Cost Factor		0.0517	0.0433
Fixed Costs			
Depreciation	per hour	19.58	14.49
Investment Cost	per hour	12.83	7.48
Insurance & Housing	per hour	3.59	2.09
TFC	per hour	36.01	24.07
TFC	per farm	10,801.82	4,813.86
TFC	per farm or co-op	10,801.82	14,441.58
Operating Costs			
Repair Costs	per hour	5.57	5.44
Fuel Cost	per hour	20.28	21.32
Lube & Oil Cost	per hour	0.60	0.96
TOC	per hour	26.45	27.72
TOC	per farm	7,934.43	5,543.70
TOC	per farm or co-op	7,934.43	16,631.09
Total Machine Costs			
TMC	per hour	62.45	51.79
TMC	per farm	18,736.25	10,357.56
TMC	per farm or co-op	18,736.25	31,072.67
TMC	per acre	12.49	6.91
Rental Cost (Based on 800 hours annual use)			
Rental Cost	per hour	46.48	50.93
Rental Cost	per farm	13,944.00	10,186.00
Rental Cost	per acre	9.30	6.79

*300 hours annual use for the individual farmer and 600 hours annual use for the co-operative.

Table 24: Cost Comparison—Large Tractor, Heavy Use*

		Individual Farmer	Co-op Member
Number of Farms/Members		1	3
Acreage per Farm		1,500	1,500
Total Acres		1,500	4,500
Annual Hrs. Use	total	400.00	800.00
Annual Hrs. Use	per farmer	400.00	266.67
Tractor			
Type		160–179 HP 2WD	250–299 HP 4WD
Original Cash Cost		107,700.00	125,600.00
Salvage Value		10,770.00	12,560.00
Years Lifetime		14.50	11.50
Repair Cost Factor		0.0517	0.0433
Fixed Costs			
Depreciation	per hour	16.71	12.29
Investment Cost	per hour	9.63	5.61
Insurance & Housing	per hour	2.69	1.57
TFC	per hour	29.03	19.47
TFC	per farm	11,612.10	5,191.92
TFC	per farm or co-op	11,612.10	15,575.77
Operating Costs			
Repair Costs	per hour	5.57	5.44
Fuel Cost	per hour	20.28	21.32
Lube & Oil Cost	per hour	0.60	0.96
TOC	per hour	26.45	27.72
TOC	per farm	10,579.24	7,391.59
TOC	per farm or co-op	10,579.24	22,174.78
Total Machine Costs			
TMC	per hour	55.48	47.19
TMC	per farm	22,191.34	12,583.52
TMC	per farm or co-op	22,191.34	37,750.55
TMC	per acre	14.79	8.39
Rental Cost (Based on 800 hours annual use rate)			
Rental Cost	per hour	46.48	50.93
Rental Cost	per farm	18,592.00	13,598.31
Rental Cost	per acre	12.39	9.07

*400 hours annual use for the individual farmer and 800 hours annual use for the co-operative.

Under the scenario illustrated in Table 23, the hourly operating costs are slightly higher for the co-op member due to the larger tractor owned by the co-operative. However, the co-op member's share of the fixed costs associated with the larger tractor is lower than the fixed costs facing the individual farmer. As a result, the total machine costs per hour are 17 percent lower for the co-op member, which translates into a 45 percent saving in total machinery costs per farm for the co-op member when compared with the per-farm costs of the individual farmer.

Similarly, under the scenario shown in Table 24, the total machine costs per hour are 15 percent lower for the co-op member, with total machine costs per farm being 43 percent lower for the co-op member.

In both scenarios, the lower rental costs per hour suggest that the individual farmer may be better off renting a tractor as opposed to owning one as a sole proprietor. In the first scenario, the co-op member may also realize a slight savings by renting a tractor rather than owning one as part of the co-operative. However, it is doubtful that a saving of less than one dollar per hour of use could offset the convenience of ownership.

Appendix

Cost Calculations

Fixed Costs

Total Fixed Costs (TFC) are the sum of (i) depreciation, (ii) investment costs, and (iii) insurance and housing. Fixed costs are calculated on a per-hour basis and then multiplied by the annual hours used to get the Total Fixed Costs per farmer or co-op member, and Total Fixed Costs per farm or co-op.

i) Depreciation per hour = $\frac{\text{((Original Cash Cost – Salvage Value)/Years Lifetime)}}{\text{Annual Hours of Use}}$

Original Cash Cost is the cash price paid for a new machine without a trade as reported in the *Farm Machinery Custom and Rental Rate Guide 1998*.

Salvage Value is assumed to be 10 percent of Original Cash Cost.

ii) Investment cost per hour = $\frac{\text{((Original Cash Cost – Salvage Value)/2) x 6.5 percent}}{\text{Annual Hours of Use}}$

An interest rate of 6.5 percent is assumed.

iii) Insurance and housing per hour = $\frac{\text{Original Cash Cost x 1 percent}}{\text{Annual Hours of Use}}$

Operating Costs

Total operating costs (TOC) per hour include (i) repair costs and, in the case of self-propelled machines, (ii) fuel costs and (iii) lube and oil costs.

i) Repair costs are calculated on an hourly basis per $1,000 of original cost.

$$\frac{\text{Original Cash Cost}}{1000} \times \text{Applicable Cost Factor}$$

The Applicable Cost Factor is developed by the American Society of Agricultural Engineers to estimate average annual repair costs for various types of machines and levels of use (listed in Appendix F, Column E, of the *Farm Machinery Custom and Rental Rate Guide 1998)*.

ii) Fuel costs per hour are based on those reported in the *Farm Machinery Custom and Rental Rate Guide 1998* for the combines and tractors of the appropriate size and annual hours used.

Diesel fuel is charged at $0.52 per litre; gasoline at $0.55 per litre.

The 7 percent GST was deducted in calculating the gasoline and diesel prices because farmers can apply for an input tax credit on these items.

iii) Insurance and housing per hour = $\frac{\text{Original Cash Cost} \times 1 \text{ percent}}{\text{Annual Hours Use}}$

Hourly Tractor Rental Costs

Machine Size	Original Cost	Rental Costs ($/Hour) Annual Hours of Use 200	300	400	600	800
60–69 HP 2WD	33,600	27.04	22.42	19.92	16.91	15.50
80–89 HP 2WD	49,600	38.49	31.68	27.98	23.54	21.45
140–159 HP 2WD	93,800	71.69	58.81	51.82	43.41	39.46
160–179 HP 2WD	107,700	83.48	68.69	60.66	51.01	46.48
180+ HP 2WD	118,100	93.19	76.97	68.18	57.59	52.62
250–299 HP 4WD	125,600	94.08	76.83	67.47	56.22	50.93

Tractor Cost Estimates for Machinery Sets

The cost comparisons of the two tractors under the assumptions discussed for the conventional seeding system are illustrated in Table A (overleaf). As is shown, the total machinery cost per farmer per year for both tractors is similar for both the individual farmer and the co-op member, with the co-op member saving $1,450 per year (or 5 percent).

The cost comparisons of the two tractors under the assumptions discussed for the direct seeding system are illustrated in Table B (page 39). As is shown, the total machinery cost per farmer per year for both tractors is lower for the co-op member than the individual farmer, with the co-op member saving close to 21 percent in total machinery costs per year.

Table A: Cost Comparison—Tractors, Conventional Seeding System

		Large Tractor		Small Tractor	
		Individual Farmer	Co-op Member	Individual Farmer	Co-op Member
Number of Farms/Members		1	3	1	3
Acreage per Farm		1,500	1,500	1,500	1,500
Total Acres		1,500	4,500	1,500	4,500
Equipment					
Type		160–179 HP 2WD	250–299 HP 4WD	60–69 HP 2WD	180+ HP 2WD
Original Cash Cost		107,700.00	125,600.00	33,600.00	118,100.00
Salvage Value		10,770.00	12,560.00	3,360.00	11,810.00
Years Lifetime		16.50	13.75	25.00	21.00
Repair Cost Factor		0.0517	0.0433	0.0517	0.0517
Time Requirement					
Work Rate		------	------	------	------
Annual Hrs. Use	total	325.00	514.00	55.00	222.00
Annual Hrs. Use	per farm	325.00	171.33	55.00	74.00
Fixed Costs					
Depreciation	per hour	18.08	15.99	21.99	22.80
Investment Cost	per hour	11.85	8.74	21.84	19.02
Insurance/Housing	per hour	3.31	2.44	6.11	5.32
TFC	per hour	33.24	27.17	49.94	47.14
TFC	per farm	10,801.82	4,655.76	2,746.80	3,488.17
TFC	per farm or co-op	10,801.82	13,967.29	2,746.80	10,464.50
Operating Costs					
Repair Costs	per hour	5.57	5.44	1.74	6.11
Fuel Cost	per hour	20.28	21.31	7.28	23.92
Lube & Oil Cost	per hour	0.60	0.96	0.23	0.63
TOC	per hour	26.45	27.72	9.25	30.66
TOC	per farm	8,595.63	4,749.10	508.59	2,268.53
TOC	per farm or co-op	8,595.63	14,247.30	508.59	6,805.58
Total Machine Costs					
TMC	per hour	59.68	54.89	59.19	77.79
TMC	per farm	19,397.45	9,404.86	3,255.39	5,756.69
TMC	per farm or co-op	19,397.45	28,214.59	3,255.39	17,270.08
TMC	per acre	12.93	6.27	2.17	3.84

Table B: Cost Comparison—Tractors, Direct Seeding System

		Large Tractor		Small Tractor	
		Individual Farmer	Co-op Member	Individual Farmer	Co-op Member
Number of Farms/Members		1	3	1	3
Acreage per Farm		1,500	1,500	1,500	1,500
Total Acres		1,500	4,500	1,500	4,500
Equipment					
Type		160–179 HP 2WD	250–299 HP 4WD	60–69 HP 2WD	180+ HP 2WD
Original Cash Cost		107,700.00	125,600.00	33,600.00	118,100.00
Salvage Value		10,770.00	12,560.00	3,360.00	11,810.00
Years Lifetime		23.00	18.00	23.00	20.00
Repair Cost Factor		0.0517	0.0433	0.0517	0.0517
Time Requirement					
Work Rate		------	------	------	------
Annual Hrs. Use	total	136.00	257.00	111.00	219.00
Annual Hrs. Use	per farm	136.00	85.67	111.00	73.00
Fixed Costs					
Depreciation	per hour	30.99	24.44	11.84	24.27
Investment Cost	per hour	28.31	17.47	10.82	19.28
Insurance/Housing	per hour	7.92	4.89	3.03	5.39
TFC	per hour	67.22	46.79	25.69	48.94
TFC	per farm	9,141.62	4,008.73	2,851.98	3,572.53
TFC	per farm or co-op	9,141.62	12,026.20	2,851.98	10,717.58
Operating Costs					
Repair Costs	per hour	5.57	5.44	1.74	6.11
Fuel Cost	per hour	20.28	21.32	7.28	23.92
Lube & Oil Cost	per hour	0.60	0.96	0.23	0.63
TOC	per hour	26.45	27.72	9.25	30.66
TOC	per farmer	3,596.94	2,374.55	1,026.43	2,237.87
TOC	per farm or co-op	3,596.94	7,123.65	1,026.43	6,713.61
Total Machine Costs					
TMC	per hour	93.67	74.51	34.94	79.59
TMC	per farmer	12,738.56	6,383.28	3,878.41	5,810.40
TMC	per farm or co-op	12,738.56	19,149.85	3,878.41	17,431.19
TMC	per acre	8.49	4.26	2.59	3.87

References

Saskatchewan Agriculture and Food. *Farm Business Arrangements,* March 1997; *Farm Machinery Custom and Rental Rate Guide 1998*; *Farmfacts—Comparing the Cost of Conventional and Direct Seeding,* January 1998; *Farmfacts—Machinery Arrangements,* available on the Internet at http://www.agr.gov.sk.ca/saf.

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