Self-Propelled Spraying: Machinery Ownership versus Custom Hire

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Most crop producers prefer to own their own spraying equipment. Ownership and operating costs include depreciation, interest, insurance and housing, repairs and maintenance, fuel, lubrication, and labor. In addition to cost considerations, it is important to consider timeliness, quality of work performed, and initial investment requirements. To make ownership feasible, some producers spray fields for others.

An alternative to ownership of a self-propelled sprayer is to custom hire field operations pertaining to spraying. Custom hiring allows a crop producer to utilize cutting-edge technology without investing a large amount of capital. Custom hiring also relieves a producer of being responsible for operating and maintenance of the machine, and the time involved in spraying fields.

When making decisions regarding ownership versus custom hiring, it is important to compute machine ownership costs and compare these costs to custom charges. This exercise can also help producers determine whether they need to generate custom hire income to make machine ownership feasible and determine whether they are charging enough for custom work.

This article uses a case farm in west central Indiana to illustrate the computations pertaining to machine ownership costs for a self-propelled sprayer. These machine ownership costs are compared to custom hire charges, and the minimum acres of crops needed to break even is computed. Finally, the sensitivity of breakeven acres to changes in farm size and custom hire income is explored.

Comparing Ownership and Custom Hiring

A case farm with 3000 crop acres (1500 acres of rotation corn and 1500 acres of rotation soybeans) located in west central Indiana is used in the illustration. The case farm sprays both corn and soybean acres twice during the growing season. The case farm is examining the use of a self-propelled sprayer with a 100-foot boom.

Capital recovery factors are commonly used to compute depreciation and interest costs. A capital recovery factor converts a present value into a stream of equal annual payments over a specified useful life. Table 1, adapted using information in Edwards (2015), contains capital recovery factors for interest rates ranging from 4 to 10 percent, and for a useful life ranging from 2 years to 20 years.

Table 2 illustrates a worksheet that can be used to compare ownership and custom hiring costs associated with a self-propelled sprayer with a 100-foot boom. This table was adapted using information in Edwards (2015). Section A in table 2 reports annual use of the self-propelled sprayer. As noted above, each corn and soybean acre is sprayed twice during the growing season. Information pertaining to acres per hour and fuel used per acre were taken from Lattz and Schnitkey (2017). Annual fuel use is estimated to be 240.0 gallons.

Section B in table 2 computes ownership costs. The new list price was taken from Lattz and Schnitkey (2017). Purchase cost was assumed to be 85 percent of the list price. The capital recover cost reflects an interest rate of 4 percent and useful machine life of 10 years. The expected salvage value was obtained using the remaining value for a 10-year self-propelled sprayer reported in Edwards (2015). Total annual ownership costs for the self-propelled sprayer are estimated to be $26,345.

Operating costs are computed in section C of table 2. The total hours of use are multiplied by the useful life to obtain the estimated hours of accumulated use at the end of the ownership period. Total hours of use are used along with information reported in Edwards (2015) pertaining to repair and maintenance costs to obtain that annual repair cost of 7 percent of new list price. Annual labor costs are estimated using a wage rate of $15 per hour. Management time is not included in table 2. Management time could be incorporated on line C10. Total annual operating costs for the self-propelled sprayer are estimated to be $4,295.

Section D of table 2 computes the cost of custom hiring the spray operations on the case farm. Information in Langemeier (2017) is used to estimate the custom charge per acre. In this example, extra or reduced field loss is assumed the same as the situation in which the case farm owned the machine. In addition, management labor (which would be included in line D7) is assumed to be zero. The total estimated annual cost for custom hire was $40,200. Custom hire income is assumed to be zero for the case farm. If this income was not zero, it would be included in section E of table 2.

A summary of ownership and operating costs associated with owning the sprayer and the total custom hire cost are compared in section F of table 2. In this instance, it is cheaper to own the machine than it would be to custom hire the spraying operations (note that the value in line F7 is negative). Breakeven acre computations are reported in section G of table 2. The minimum acres that would need to be sprayed to justify ownership is 4402 acres. As noted above, the case farm sprays 6000 acres annually.

Sensitivity of Breakeven Acres to Farm Size

The analysis above assumed a 3000-acre farm. Based on the assumptions made above, this case farm could afford to own a 100-foot boom self-propelled sprayer. This would not be the case if were examining a 1500-acre farm with similar production assumptions. Two scenarios are examined for this smaller farm. The first scenario assumes that an 80-foot boom self-propelled sprayer is utilized. The second scenario assumes an 80-foot boom self-propelled sprayer and a situation where the farm uses their machine to custom spray an additional 80 acres of corn and 80 acres of soybeans. The feasibility of owning the 80-foot sprayer will be evaluated below under each of these two scenarios. The computations discussed below used appropriately modified examples of table 2.

Under the first scenario, the farm with 1500 crop acres is examining the feasibility of purchasing a self-propelled sprayer with an 80-foot boom. In this instance, it is relatively more expensive to own the sprayer than use custom operators. Without custom hire income, the minimum acres of own crops needed to breakeven on machine ownership is 3087 acres. The 1500-acre crop farm sprays 3000 acres annually.

The second scenario assumes that the 1500-acre crop farm has the opportunity to custom spray an additional 160 acres. Under this scenario, the farm will custom spray each corn and soybean acre twice during the growing season. In this instance, it is relatively cheaper to own the sprayer than is to use custom operators. Under the custom spray assumptions, the minimum acres of own crops needed to break even on machine ownership is 2740 acres. Alternatively, if 3000 acres were sprayed on the farm, the farm would need to at least custom spray an additional 60 acres to breakeven on machine ownership.

Conclusions

When crop producers are determining whether it is feasible to purchase a self-propelled sprayer, it is imperative to compare machine ownership costs to custom hire charges. If machine ownership costs are relatively high, a producer should consider either increasing their custom hire income to help pay for the machine or utilizing the services of custom operators. As noted in this article, breakeven acres needed to justify machine ownership are sensitive to own acres sprayed and custom acres sprayed.

References

Edwards, William. “Self-Propelled Harvesting and Spraying: Machinery Ownership versus Custom Hire.” Iowa State University Extension and Outreach, Ag Decision Maker, A3-33, July 2015.

Langemeier, Michael. 2017 Indiana Farm Custom Rates." Purdue University, Center for Commercial Agriculture, May 2017.

Lattz, Dale and Gary Schnitkey. "Machinery Cost Estimates: Field Operations." University of Illinois Extension, Farm Business Management, June 2017.

Table 1. Capital Recovery Factors for Interest and Depreciation Costs

	Interest Rate						
Year	**4%**	**5%**	**6%**	**7%**	**8%**	**9%**	**10%**
2	0.530	0.538	0.545	0.553	0.561	0.568	0.576
3	0.360	0.367	0.374	0.381	0.388	0.395	0.402
4	0.275	0.282	0.289	0.295	0.302	0.309	0.315
5	0.225	0.231	0.237	0.244	0.250	0.257	0.264
6	0.191	0.197	0.203	0.210	0.216	0.223	0.230
7	0.167	0.173	0.179	0.186	0.192	0.199	0.205
8	0.149	0.155	0.161	0.167	0.174	0.181	0.187
9	0.134	0.141	0.147	0.153	0.160	0.167	0.174
10	0.123	0.130	0.136	0.142	0.149	0.156	0.163
11	0.114	0.120	0.127	0.133	0.140	0.147	0.154
12	0.107	0.113	0.119	0.126	0.133	0.140	0.147
13	0.100	0.106	0.113	0.120	0.127	0.134	0.141
14	0.095	0.101	0.108	0.114	0.121	0.128	0.136
15	0.090	0.096	0.103	0.110	0.117	0.124	0.131
16	0.086	0.092	0.099	0.106	0.113	0.120	0.128
17	0.082	0.089	0.095	0.102	0.110	0.117	0.125
18	0.079	0.086	0.092	0.099	0.107	0.114	0.122
19	0.076	0.083	0.090	0.097	0.104	0.112	0.120
20	0.074	0.080	0.087	0.094	0.102	0.110	0.117

Adapted from Edwards (2015).

Table 2. Worksheet for Comparing Ownership and Custom Hiring, Self-Propelled Sprayer.

	Corn	Soybeans	Total	Units
A. Annual Use				
1. Acres sprayed annually	3,000	3,000	6,000	Acres
2. Acres sprayed annually for others	0	0	0	Acres
3. Total acres (A1 + A2)	3,000	3,000	6,000	Acres
4. Acres per hour	80.6	80.6		
5. Total annual hours of use (A3 / A4)	37.2	37.2	74.4	Hours
6. Fuel used per acre	0.04	0.04		
7. Annual fuel use	120.0	120.0	240.0	Gallons
B. Ownership Costs				
1. Total purchase cost of machine			$283,385	
2. New list price of comparable machine			$333,394	
3. Age of machine at purchase (zero if purchased new)			0	Years
4. Expected number of years machine will be owned			10	Years
5. Age of machine at end of ownership period (B3 + B4)			10	Years
6. Expected salvage value at end of ownership period (% of B2)			$136,692	
7. Total depreciation (B1 - B6)			$146,693	
8. Interest rate minus inflation rate			4.0%	
9. Capital recovery factor for interest rate (B8) and years (B4)			0.123	
10. Annual capital recovery charge (B6 * B8) + (B7 * B9)			$23,511	
11. Annual charge for insurance and housing (1% * B1)			$2,834	
12. Total annual ownership cost (B10 + B11)			$26,345	
C. Operating Costs				
1. Annual fuel cost (A7 * price per gallon) $2.25			$540	
2. Annual lubrication cost (C1 * 0.15)			$81	
3. Accumulated hours of use on machine when purchased (zero if new)			0	Hours
4. Repair cost (% of C3)			0.0%	
5. Estimated hours of accumulated use at end of ownership period (A5 * B4) + C3			744.4	Hours
6. Repair cost (% of C5)			7.0%	
7. Net repair cost % (C6 - C4)			7.0%	
8. Annual repair costs (B2 * C7) / B4			$2,334	
9. Labor value (A5 * 1.2 * wage rate; wage rate = $15 per hour in this example)			$1,340	
10. Value of other labor			$0	
11. Total annual operating costs (C1 + C2 + C8 + C9 + C10)			$4,295	

Table 2. Continued

	Corn	Soybeans	Total	Units
D. Custom Hire Costs				
1. Custom Charge per Acre	$6.70	$6.70		
2. Custom Charge per Year (A1 * D1)	$20,100	$20,100	$40,200	
3. Extra (+) or reduced (-) field loss from custom hire	0.0%	0.0%		
4. Expected yield (bushels per acre)	170.0	52.0		
5. Expected crop price (per bushel)	$3.80	$9.10		
6. Change in value of field loss (A1 * D3 * D4 * D5)	$0	$0	$0	
7. Value of other labor	$0	$0	$0	
8. Total annual cost for custom hire (D2 + D6 + D7)			$40,200	
E. Custom Hire Income Received				
1. Custom hire charge per acre	$6.70	$6.70		
2. Annual custom hire income	$0	$0	$0	
F. Summary				
1. Total annual ownership costs (B12)			$26,345	
2. Total annual operating costs (C11)			$4,295	
3. Total annual ownership and operating costs (F1 + F2)			$30,640	
4. Total custom hire income (E2)			$0	
5. Net cost for ownership (F3 - F4)			$30,640	
6. Total custom hire cost (D8)			$40,200	
7. Difference between ownership cost and custom hire cost			-$9,560	
If line F7 is negative, it is cheaper to own than custom hire.				
G. Breakeven Acres				
1. Average custom hire cost per acre (D8 / A1)			$6.70	
2. Average operating cost per acre (C11 / A3)			$0.72	
3. Average custom hire income per acre (E2 / A2)			$0.00	
4. Added income per acre of custom work done (G3 - G2)			-$0.72	
5. Minimum acres of own crops needed to break even on machine ownership (F1 - (A2 * G4)) / (G1 - G2)			4,402	Acres
6. Minimum acres of custom work needed to break even on machine ownership ((A1 * G2) + F1 - F6) / G4			0	Acres

