ANSWER KEY for Machinery Ownership and Leasing – Homework #1 (MAST 10-11)

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This homework is based on using the *OwnSprayer.xls* spreadsheet. This spreadsheet is available on the website: www.agmanager.info.

Question #1:

It is early 2011 and you are considering purchasing a self-propelled sprayer that will cost $230,000 (JD 4830 with 800 gallon stainless steel tank and 90 foot booms) and require a downpayment of $75,000. The sprayer you are considering is new (i.e., zero hours and zero years old). You intend to use this sprayer 325 hours per year for 7 years covering an average of 12,000 acres per year. The sprayer has a boom width of 90 feet and your expected travel speed is 12 miles per hour. Fuel consumption is expected to average 10 gallons per hour and cost $2.75 per gallon with an additional 10% for lubrication costs. You anticipate repairs will accumulate according to the formulas developed by ASAE (repair adjustment factor (RAF) of 1.0) and you expect TIS charges will be 1.5% of the market value. You expect it will take 1.25 hours of labor per engine hour of the sprayer and your labor costs are $16 per hour for the sprayer operator and $13 per hour for tendering costs. In addition to labor, tendering also has a flat per acre cost of $1.25. The current interest rate for sprayer loans is assumed to be 5.5%, the income tax rate is assumed to be 20% (15% federal + 5% state), and the self-employment tax rate is 15.3%. You do not plan to use the Section 179 expensing deduction, however, you could use up to $130,000 if you feel the benefit is large enough (maximum of $500,000 can be taken in 2011, but you do not want to use all of this on one piece of equipment). Set the *OwnSprayer* spreadsheet up to match this **base scenario**. What is the annualized cost per acre of owning this sprayer for the next 7 years?

Hint: you need to "solve" for *Average expected efficiency* by iterating until you get a *Calculated total hours accumulated annually* of exactly 325.

Answer:

The *OwnSprayer* spreadsheet should be set up accordingly:
3 – sprayer class (3=JD4830 tankSS800 boom90)
0 – sprayer age
0 – sprayer hours
$230,000 – purchase price
$230,000 – market price
7 – seasons before trade
90 – sprayer boom width in feet
12 – sprayer travel speed in mph
35.25% – average expected efficiency (value that results in 325 calculated annual hours)
15,000 – total acres sprayed annually
1.25 – total labor hours per sprayer engine hour
$16.00 – labor cost per hour
10 – sprayer fuel consumption per hour (gallons)
$2.75 – average fuel price ($/gal)
10% – oil and lubrication percent of fuel cost
1.0 – repairs adjustment factor (RAF)

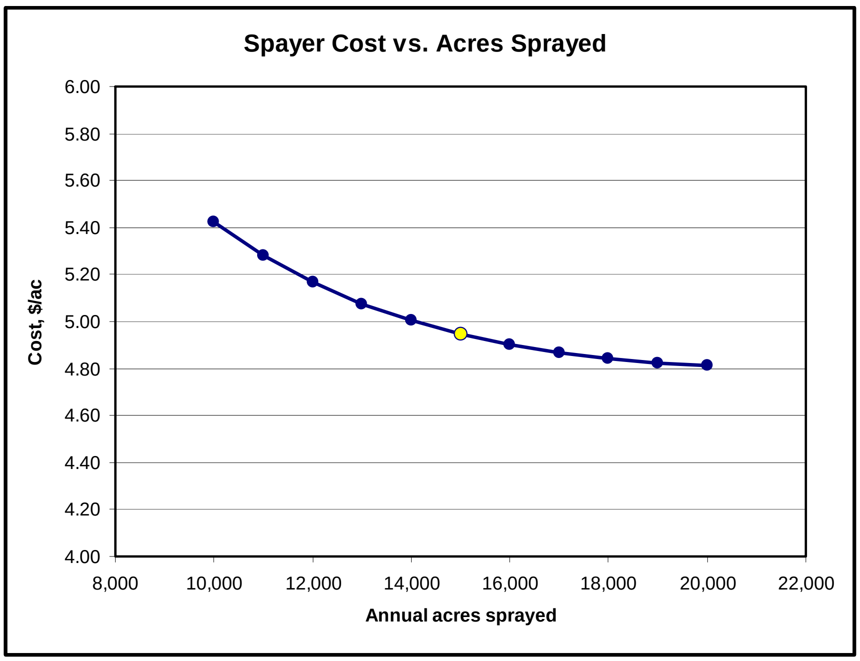
1.5% – TIS
5.5% – bank interest rate
20% – state and fed income tax rate
15.3% – self-employment tax rate
$0 – Sec. 179
$75,000 – downpayment
$13.00 – tendering cost per hour
$1.25 – tendering cost per acre

With the above assumptions, the per acre cost is $4.95.

Question #2:
Beginning with the base scenario, what would per acre costs be if you only sprayed 12,500 acres per year rather than 15,000? What about if you sprayed 17,500 acres? Does a +/- 2,500 acres change from the base have the same impact? What is your intuition as to why we get this result?

For those who want an additional challenge, graph the cost/acre (y-axis) versus acres sprayed annually (x-axis) varying acres sprayed from 10,000 - 20,000.

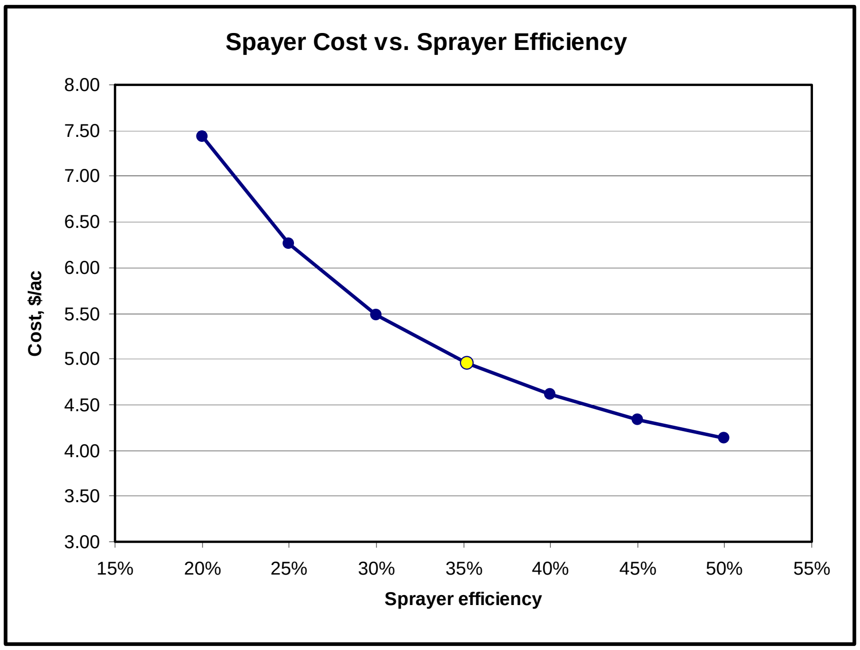
Answer:
The answer can be found by inserting 12,500 for annual acres sprayed (cell F30 in **User input** tab) giving a cost of $5.12/acre. At 17,500 acres sprayed, the per acre cost is $4.86. Decreasing acres sprayed by 2,500 increases cost MORE than increasing acres sprayed by 2,500 lowers cost. This is because the "fixed costs" associated with sprayer ownership are not directly related to usage rate (e.g., the depreciation component that is tied to years, as opposed to the portion tied to hours) are spread over more acres.



Question #3:
Beginning with the base scenario, what is the per acre cost if efficiency drops from 35.25% (base) to 26.44% (75% of base)? What if it increases to 44.06% (125% of base)? Which has the greater impact on cost per acre, relative to the base?

For those who want an additional challenge, graph the cost/acre (y-axis) versus expected sprayer efficiency levels (x-axis) varying from approximately 20% to 50%.

Answer:
Changing the expected efficiency to 26.44% results in cost of $6.00/acre while increasing it to 44.06% implies a cost of $4.38/acre. As with acres sprayed annually, decreasing the efficiency has a bigger impact on increasing costs than increasing efficiency has on decreasing costs. In this example, if efficiency was reduced to 75% of the base value, costs rose by $1.05/acre ($6.00 minus $4.95). However, if efficiency was increased to 125% of the base value, costs decreased by only $0.57/acre ($4.38 minus $4.95).



Question #4:
Make sure efficiency is back to the base level (i.e., 35.25%). What is the annual cost if you purchased a 2-year old machine with 550 hours on it for $170,000 and used it for 5 years before trading and increasing the repair adjustment factor (RAF) from 1.0 to 1.1? At what purchase price, holding *market price* constant at $170,000, is the cost per acre of the used sprayer equal to the new sprayer? That is, how "good of a deal" do you need or how much of a "premium" can you pay?

Answer:
Changing the age from 0 to 2, hours on machine from 0 to 550, purchase price and market value to $170,000, years of use from 7 to 5, and RAF from 1.0 to 1.1 results in a cost/acre of $4.78 (decrease of $0.17 per acre from the base scenario). By iterating with different values for the purchase price, you can determine that a purchase price of $180,500 results in a cost/acre of $4.95. Thus, you could pay about a $10,000 premium for this used sprayer and still be as well off as with the new sprayer.

Question #5:
Start back with the base scenario, what happens to cost per acre if you take Section 179 of $130,000? What is the $130,000 Section 179 tax benefit worth in terms of purchase price? That is, how much more could you pay for the new sprayer such that cost per acre is equal to the base scenario?

Answer:
By taking $130,000 of the Section 179 deduction, cost per acre decreases from $4.95 (base) to $4.86/acre. By iterating with different values for the purchase price, you can determine that the purchase price could increase to $238,000 (holding market price at $230,000) before costs increase above the base scenario of $4.95/acre. Thus, the Section 179 tax "benefit" is worth the equivalent of $8,000 in purchase price.

Question #6:
Start back with the base scenario (Sec 179 = $0), how does cost per acre vary as the years the sprayer is used before trading varies from 1 to 10?

Answer:
By changing the number of years before trading from 7 to 1, 2, 3 ...10, the cost for various trading strategies can be determined. The cost per acre for trading every year decreases from $4.95 (base) to $4.91. However, if there was a big "first year hit" on depreciation this might not hold, but the important thing to recognize is that costs are quite stable for strategies of holding the sprayer for 1-7 years. In other words, the market is quite efficient in terms of pricing used machines. If the sprayer is held longer than 7 years the repairs start increasing faster such that costs begin to increase.