Machinery Ownership and Leasing

Kevin C. Dhuyvetter
Terry L. Kastens

Department Agricultural Economics
Kansas State University

kcd@ksu.edu --- 785-532-3527
tkastens@kastensinc.com --- 785-626-9000

www.AgManager.info

MAST

Purpose of module

- Develop an understanding of the costs associated with owning and operating machinery
- Trying to reduce decisions to numbers
  - Custom hire
  - Own vs. rent
  - Lease vs. purchase
  - Trading strategies
- … targeting the decision tools:
  - "OwnSeries" (Excel spreadsheets)
    - *OwnBaler.xls*, *OwnCombine.xls*, *OwnSprayer.xls*, and *OwnTractor.xls*
  - *KSU-MachCost.xls*
  - *KSU-GPSguidance.xls*
  - *GuidanceSectionControlProfitCalculator.xls* and *.swf*

Module:
Machinery Ownership and Leasing

Session:
Using the machinery decision tools and machinery homework

Recorded fall of 2010

Machinery Decision Tools at www.agmanager.info

OwnCombine.xls

KSU-GPSguidance.xls

OwnBaler.xls

OwnSprayer.xls

KSU-MachCost.xls

OwnTractor.xls

4

OwnSprayer.xls, OwnTractor.xls, OwnCombine.xls …

- Excel spreadsheets developed to help producers calculate the cost of owning and operating self-propelled sprayers, tractors, and combines.
- Sprayer & Combine
  - costs per year, per hour, and per acre
- Tractor
  - costs per year and per hour
- Analysis is based on after-tax net present value of costs but summary costs are converted back to pre-tax for rent/hire comparison purposes.
- OwnSprayer.pdf and OwnTractor.pdf – supporting papers available on the web (OwnCombine is standalone)

6

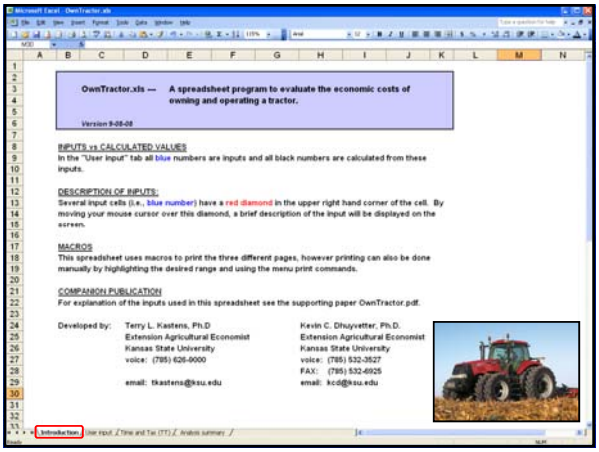
Machinery Market Valuation Methods

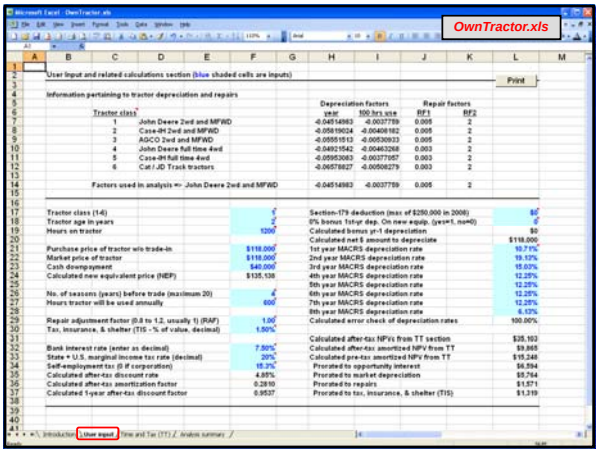
- **KSU – use industry values from "Blue Book" to estimate depreciation for different classes/brands**
  - **Calculated against advertised / "Resale Cash" price for new**
  - **$RVP_{age} = 100*\exp[B_1(age)+B_2(accumulated\ hrs/100)]$**

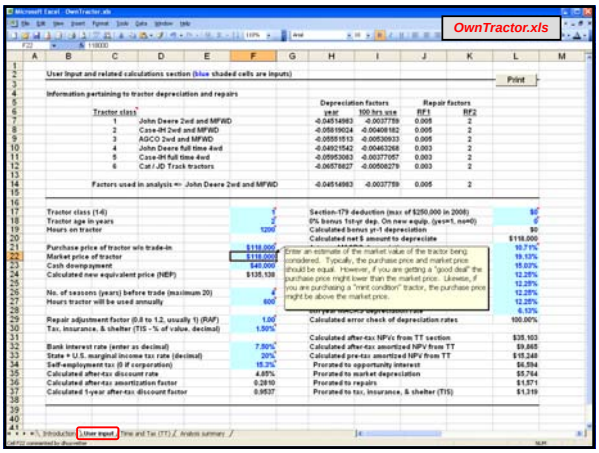
Example KSU market depreciation parameters:

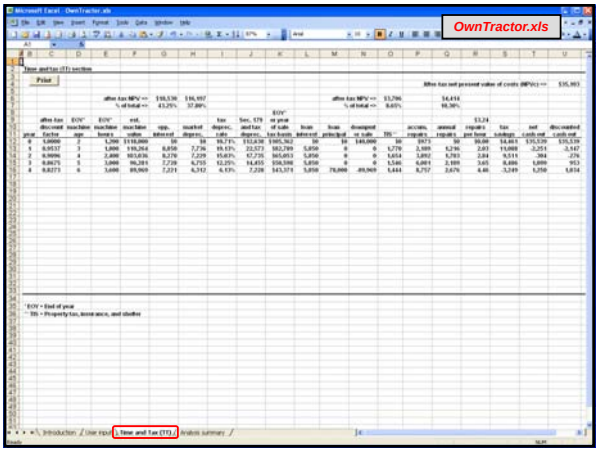
	B_1	B_2	
CaseIH-3185 sprayer	-0.034234	-0.007216	(*OwnSprayer*)
JD 2wd/MFWD	-0.045150	-0.003776	(*OwnTractor*)
Case-IH 4wd	-0.059531	-0.003771	(*OwnTractor*)
JD 9670STS combine	-0.093717	-0.028173	(*OwnCombine*)

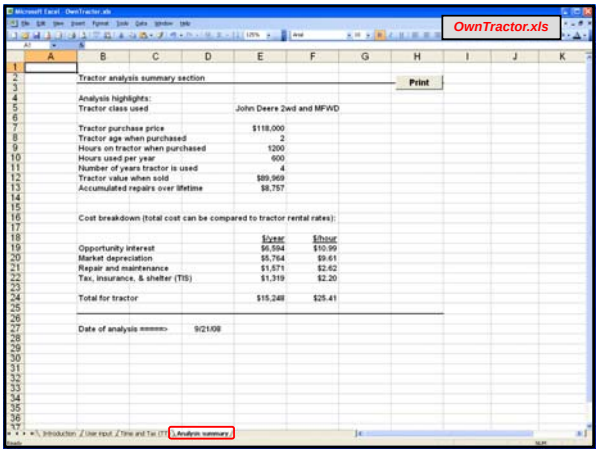
(also includes an interaction term (B_3 = -0.001521)






OwnTractor.xls
User Input and related calculations section (blue shaded cells are inputs)
Print
Information pertaining to tractor depreciation and repairs
Tractor class
1 John Deere 2wd and MFWD
2 Case-IH 2wd and MFWD
3 AGCO 2wd and MFWD
4 John Deere full time 4wd
5 Case-IH full time 4wd
6 Cat / JD Track tractors
Depreciation factors
year
100 hrs use
Repair factors
RF1
RF2
Factors used in analysis => John Deere 2wd and MFWD
-0.04514983
-0.0037759
0.005
2
Tractor class (1-6)
Tractor age in years
Hours on tractor
1200
Purchase price of tractor w/o trade-in
$118,000
Market price of tractor
$118,000
Cash downpayment
$40,000
Calculated new equivalent price (NEP)
$135,138
No. of seasons (years) before trade (maximum 20)
4
Hours tractor will be used annually
600
Repair adjustment factor (0.8 to 1.2, usually 1) (RAF)
1.00
Tax, insurance, & shelter (TIS - % of value, decimal)
1.50%
Bank interest rate (enter as decimal)
7.80%
State + U.S. marginal income tax rate (decimal)
20%
Self-employment tax (0 if corporation)
15.3%
Calculated after-tax discount rate
4.85%
Calculated after-tax amortization factor
0.2810
Calculated 1-year after-tax discount factor
0.9537
Enter an estimate of the market value of the tractor being considered. Typically, the purchase price and market price should be equal. However, if you are getting a "good deal" the purchase price might lower than the market price. Likewise, if you are purchasing a "mint condition" tractor, the purchase price might be above the market price.
Section-179 deduction (max of $250,000 in 2008)
0% bonus 1st-yr dep. On new equip. (yes=1, no=0)
Calculated bonus yr-1 depreciation
Calculated net $ amount to depreciate
$118,000
Calculated after-tax NPVs from TT section
$35,103
Calculated after-tax amortized NPV from TT
$9,865
Calculated pre-tax amortized NPV from TT
$15,248
Prorated to opportunity interest
$6,594
Prorated to market depreciation
$5,764
Prorated to repairs
$1,571
Prorated to tax, insurance, & shelter (TIS)
$1,319
Calculated error check of depreciation rates
100.00%
1. Introduction
2. User input
3. Time and Tax (TT)
4. Analysis summary


OwnTractor.xls
Print
Time and tax (TT) section
After tax net present value of costs (NPVc) =>
$35,103
1. Introduction
2. User input
3. Time and Tax (TT)
4. Analysis summary


OwnTractor.xls
Tractor analysis summary section
Print
Analysis highlights:
Tractor class used
John Deere 2wd and MFWD
Tractor purchase price
$118,000
Tractor age when purchased
2
Hours on tractor when purchased
1200
Hours used per year
600
Number of years tractor is used
4
Tractor value when sold
$89,969
Accumulated repairs over lifetime
$8,757
Cost breakdown (total cost can be compared to tractor rental rates):
$/year
$/hour
Opportunity interest
$6,594
$10.99
Market depreciation
$5,764
$9.61
Repair and maintenance
$1,571
$2.62
Tax, insurance, & shelter (TIS)
$1,319
$2.20
Total for tractor
$15,248
$25.41
Date of analysis ======>
9/21/08
1. Introduction
2. User input
3. Time and Tax (TT)
4. Analysis summary

Machinery homework …

Example scenarios to give you an opportunity to use *OwnSprayer.xls* to evaluate sprayer ownership and operating costs.

OwnTractor.xls, *OwnCombine.xls*, and *GPS-Guidance.xls* will be used in a following session to examine machinery trading strategies.

13

Situation:

- You are a crop producer moving to no-till and you want to analyze the cost of purchasing your own sprayer and compare that to custom rates.
- Because your acres sprayed annually has varied over the last several years, you want your analysis to examine how cost varies with acres (you also want to consider costs versus sprayer use efficiency).
- You have some flexibility with regards to tax management so you want to look at how cost varies with regards to the use of Section 179. You also want to consider various years-of-use-before-trading strategies.

14

Base scenario:

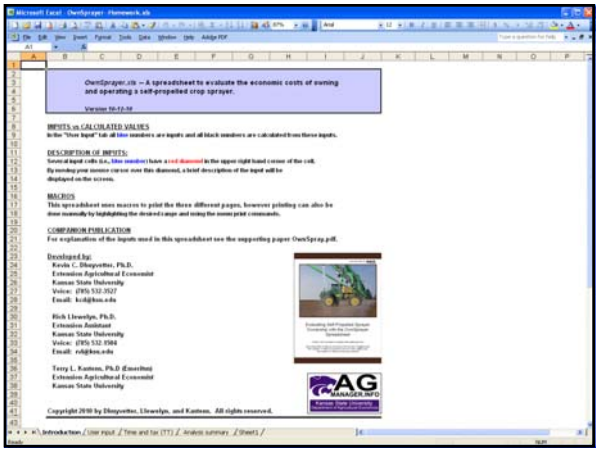
- New JD 4830 sprayer cost is $230,000
- Down payment of $75,000 and finance rest at 5.0%
- Expect to use sprayer on 15,000 acres/year for 7 years
- Boom width of 90 ft, travel speed of 12 mph, 325 hrs/year
- Fuel consumption of 10 gph @ $2.75/gal (+10% for lube)
- Taxes, insurance, and shelter (TIS) of 1.5% of value
- Labor hours of 1.25 hours/sprayer engine hour
- Labor cost of $16/hr for sprayer op, $13 for tendering
- Tendering cost of $1.25/acre (plus labor)
- Income tax rate of 20% (15% fed + 5% state), SE = 15.3%
- Expect to use Sec 179 of $0
- Depreciation rates are MACRS for 7-yr life asset

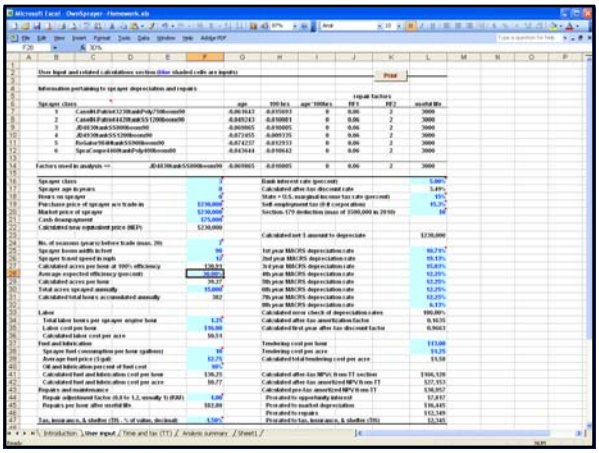
15

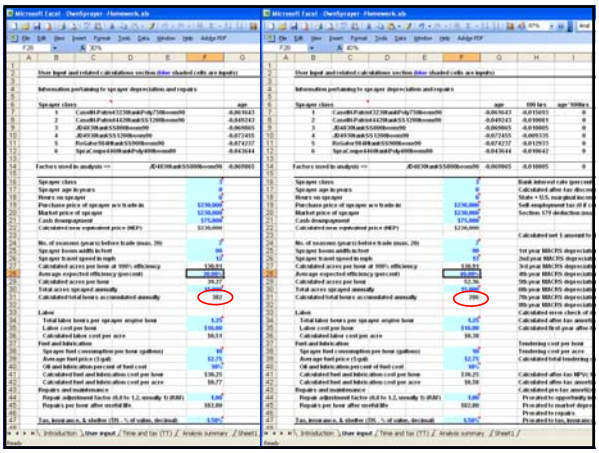
Machinery Ownership and Leasing
Homework #1 – question #1 …

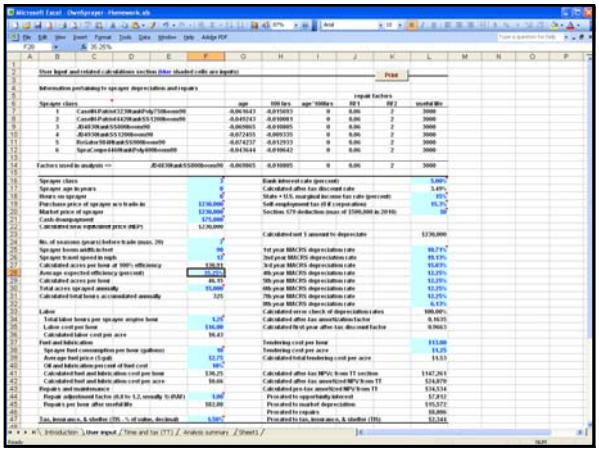
1. **Given the base scenario, what is the annualized cost per acre of owning this sprayer for the next 7 years?**

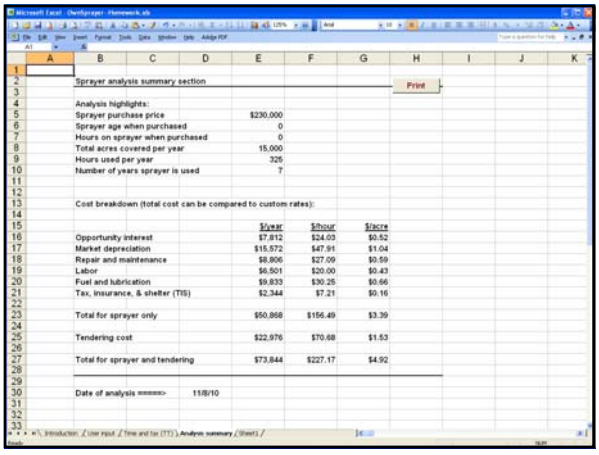
   Hint: you need to "solve" for *Average expected efficiency* by iterating until you get a *Calculated total hours accumulated annually* of exactly 325.







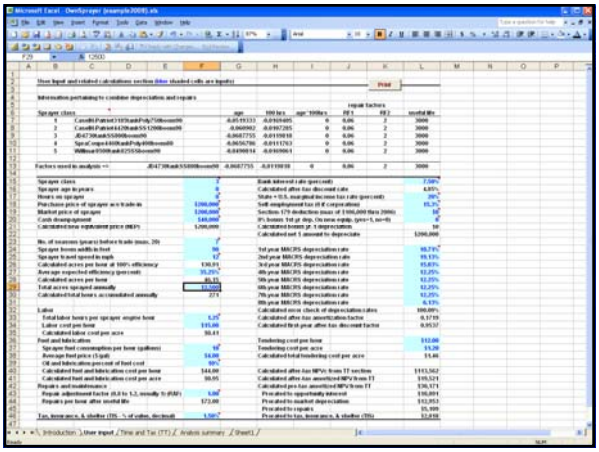


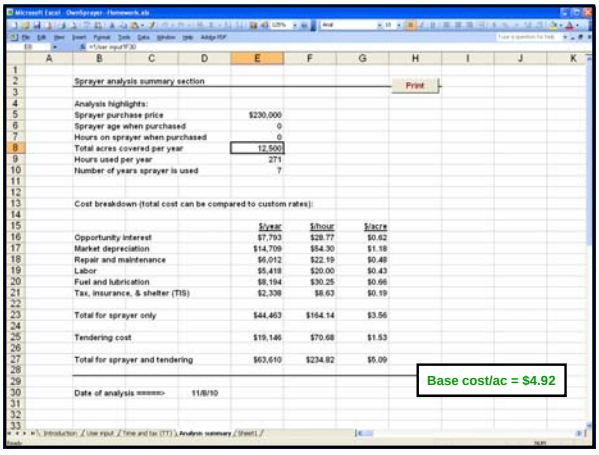

Microsoft Excel - Overhsprayer - Homework.xls
Sprayer analysis summary section
Print
Analysis highlights:
Sprayer purchase price $230,000
Sprayer age when purchased 0
Hours on sprayer when purchased 0
Total acres covered per year 15,000
Hours used per year 325
Number of years sprayer is used 7
Cost breakdown (total cost can be compared to custom rates):
$/year $/hour $/acre
Opportunity interest $7,912 $24.03 $0.52
Market depreciation $15,572 $47.91 $1.04
Repair and maintenance $8,806 $27.09 $0.59
Labor $6,501 $20.00 $0.43
Fuel and lubrication $9,833 $30.25 $0.66
Tax, insurance, & shelter (TIS) $2,344 $7.21 $0.16
Total for sprayer only $50,868 $156.49 $3.39
Tendering cost $22,976 $70.68 $1.53
Total for sprayer and tendering $73,844 $227.17 $4.92
Date of analysis ======> 11/8/10

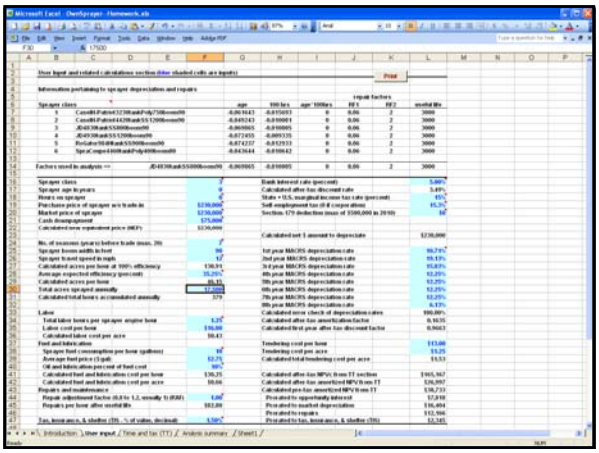
Machinery Ownership and Leasing Homework #1 – question #2 …

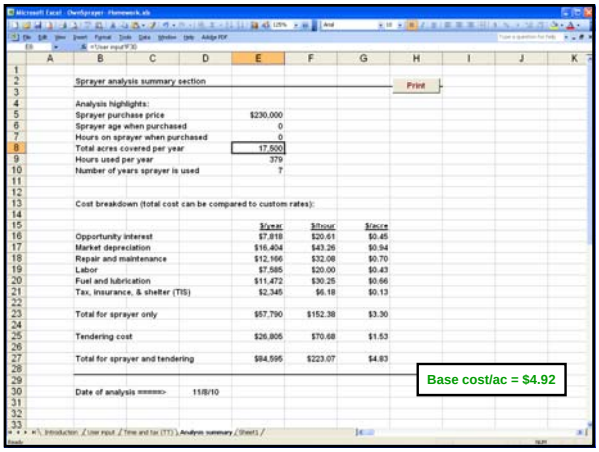
2. **Beginning with the base scenario, what would per acre costs be if you only sprayed 12,500 acres per year rather than 15,000? What about if you sprayed 17,500 acres? Does a +/- 2,500 acres change from the base have the same impact? What is your intuition as to why we get this result?**

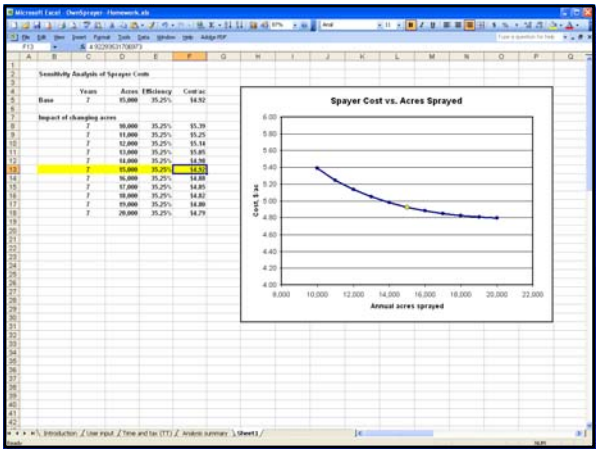
   For those who want an additional challenge, graph the cost/acre (y-axis) versus acres sprayed annually (x-axis) varying acres sprayed from 10,000 - 20,000.








Sprayer analysis summary section
Print
Analysis highlights:
Sprayer purchase price $230,000
Sprayer age when purchased 0
Hours on sprayer when purchased 0
Total acres covered per year 17,500
Hours used per year 379
Number of years sprayer is used 7
Cost breakdown (total cost can be compared to custom rates):
$/year $/hour $/acre
Opportunity interest $7,818 $20.61 $0.45
Market depreciation $16,404 $43.26 $0.94
Repair and maintenance $12,166 $32.08 $0.70
Labor $7,585 $20.00 $0.43
Fuel and lubrication $11,472 $30.25 $0.66
Tax, insurance, & shelter (TIS) $2,345 $6.18 $0.13
Total for sprayer only $57,790 $152.38 $3.30
Tendering cost $26,805 $70.68 $1.53
Total for sprayer and tendering $84,595 $223.07 $4.83
Base cost/ac = $4.92
Date of analysis ==> 11/8/10

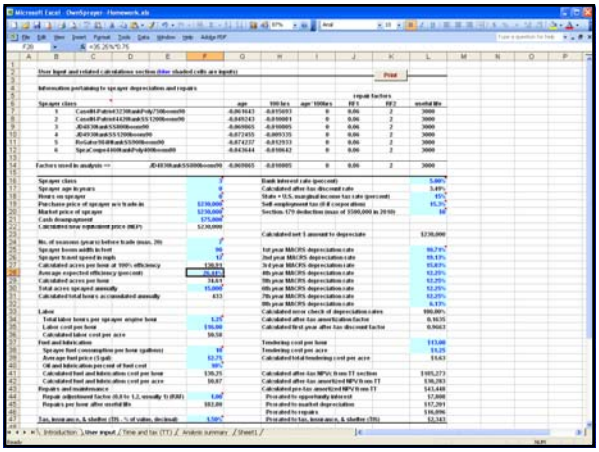

Sensitivity Analysis of Sprayer Costs
Spayer Cost vs. Acres Sprayed
Cost, $/ac
Annual acres sprayed

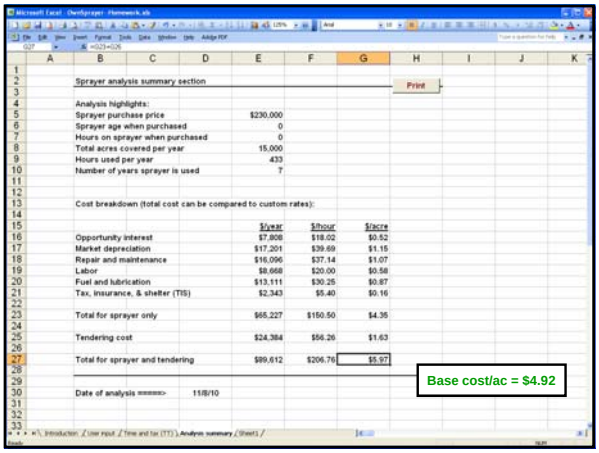
Machinery Ownership and Leasing Homework #1 – question #3 …

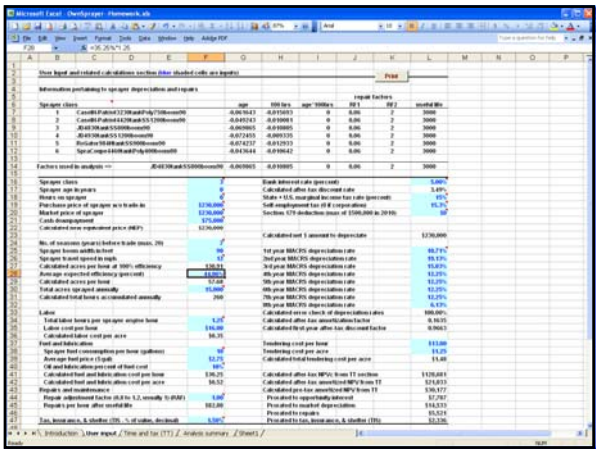
3. **Beginning with the base scenario, what is the per acre cost if efficiency drops from 35.25% (base) to 26.44% (75% of base)? What if it increases to 44.06% (125% of base)? Which has the greater impact on cost per acre, relative to the base?**

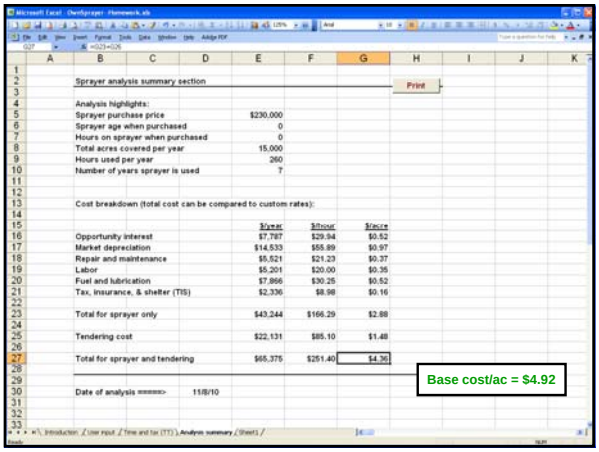
   For those who want an additional challenge, graph the cost/acre (y-axis) versus expected sprayer efficiency levels (x-axis) varying from approximately 20% to 50%.

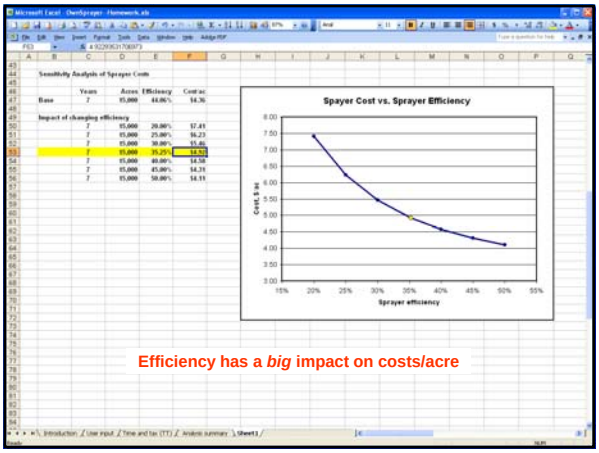
   Note: when efficiency changes with acres held constant, engine hours must change accordingly





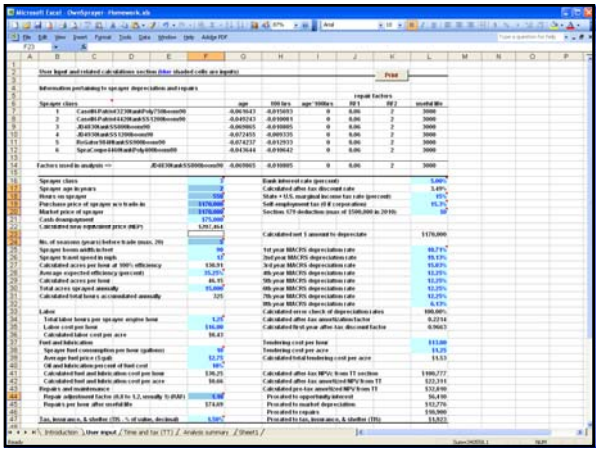


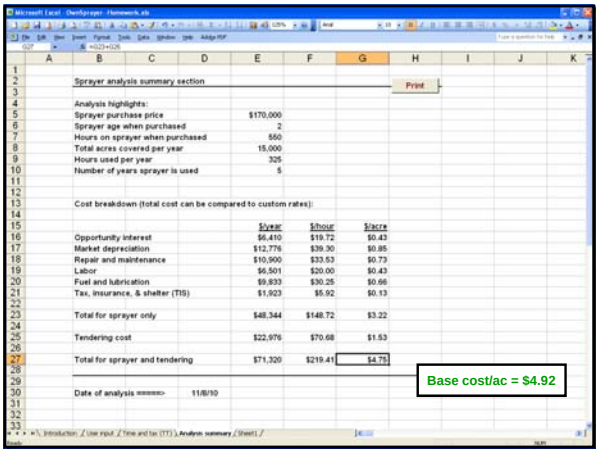

Sprayer analysis summary section
Print
Analysis highlights:
Sprayer purchase price $230,000
Sprayer age when purchased 0
Hours on sprayer when purchased 0
Total acres covered per year 15,000
Hours used per year 260
Number of years sprayer is used 7
Cost breakdown (total cost can be compared to custom rates):
$/year $/hour $/acre
Opportunity interest $7,787 $29.94 $0.52
Market depreciation $14,533 $55.89 $0.97
Repair and maintenance $5,521 $21.23 $0.37
Labor $5,201 $20.00 $0.35
Fuel and lubrication $7,866 $30.25 $0.52
Tax, insurance, & shelter (TIS) $2,336 $8.98 $0.16
Total for sprayer only $43,244 $166.29 $2.88
Tendering cost $22,131 $85.10 $1.48
Total for sprayer and tendering $65,375 $251.40 $4.36
Base cost/ac = $4.92
Date of analysis ==> 11/8/10


Sensitivity Analysis of Sprayer Costs
Sprayer Cost vs. Sprayer Efficiency
Cost, $ ac
Sprayer efficiency
Efficiency has a *big* impact on costs/acre

Machinery Ownership and Leasing Homework #1 – question #4 …

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 increase repair adjustment factor (RAF) from 1.0 to 1.1?**

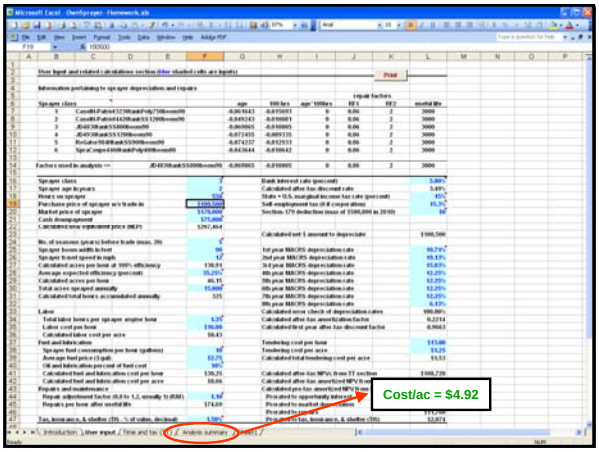




Machinery Ownership and Leasing Homework #1 – question #4 …

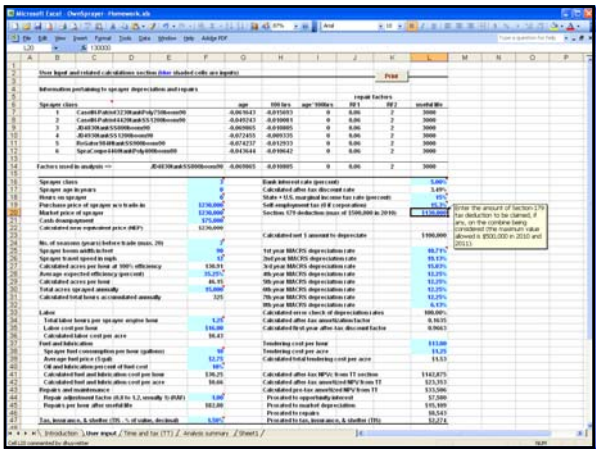
4. Make sure efficiency is back to the base level (i.e., 35.25%). What is the annual cost if you purchased the 2-year old machine with 550 hours on it for $170,000 and used it for 5 years before trading (and increasing RAF to 1.1)?

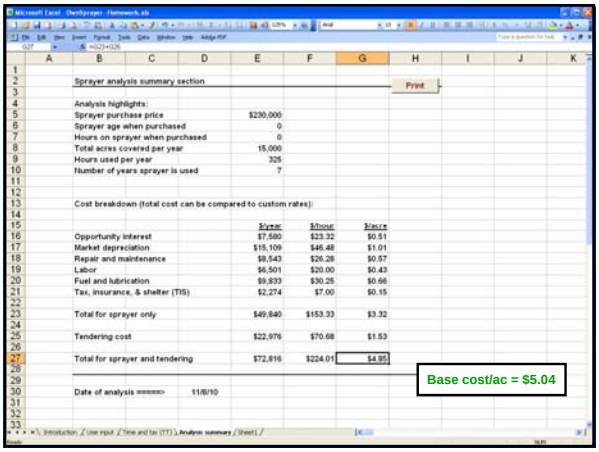
   At what purchase price, holding *market price* constant at $170,000, is the cost per acre of the used sprayer equal to the new sprayer? That is, how "good of a deal" do you need or how much of a "premium" can you pay?



Machinery Ownership and Leasing Homework #1 – question #5 …

5. Start back with the base scenario, what happens to cost per acre if you can take Section 179 of $130,000?

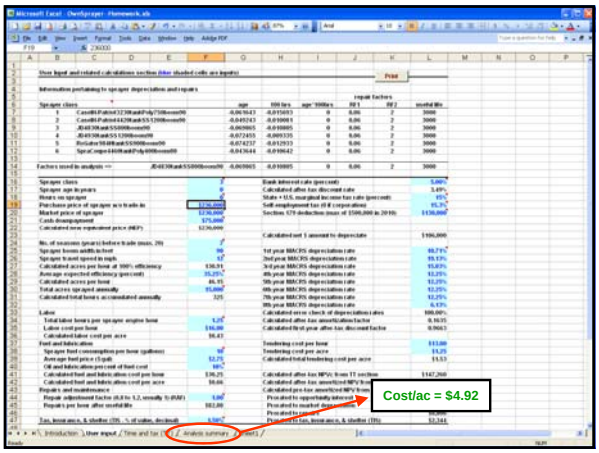




Machinery Ownership and Leasing Homework #1 – question #5 …

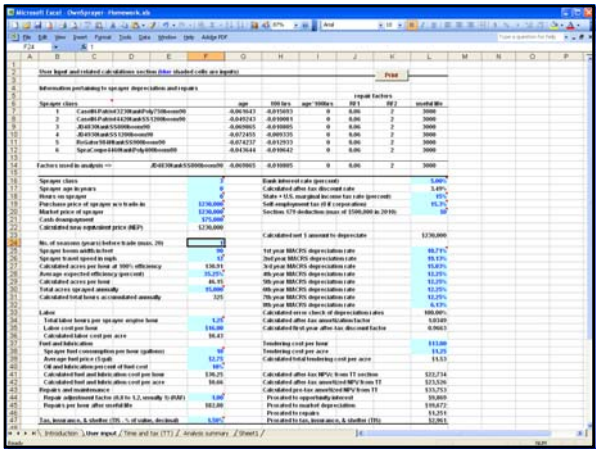
5. **Start back with the base scenario, what happens to cost per acre if you can take Section 179 of $100,000?**

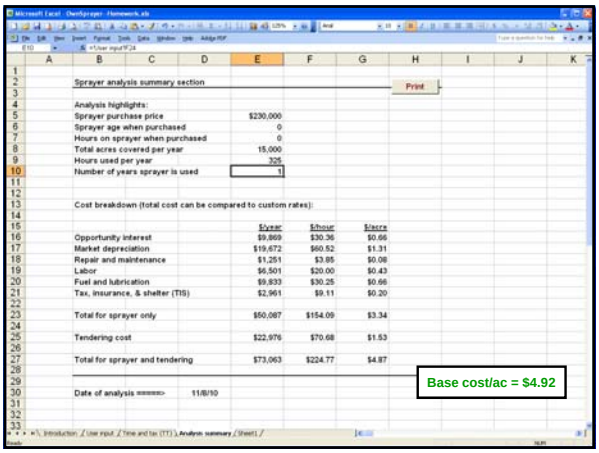
   What is the $100,000 Section 179 tax benefit worth in terms of purchase price? That is, how much more could you pay for the new sprayer such that cost per acre is equal to the base scenario?



Machinery Ownership and Leasing Homework #1 – question #6 …

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?





Sprayer analysis summary section

Print

Analysis highlights:

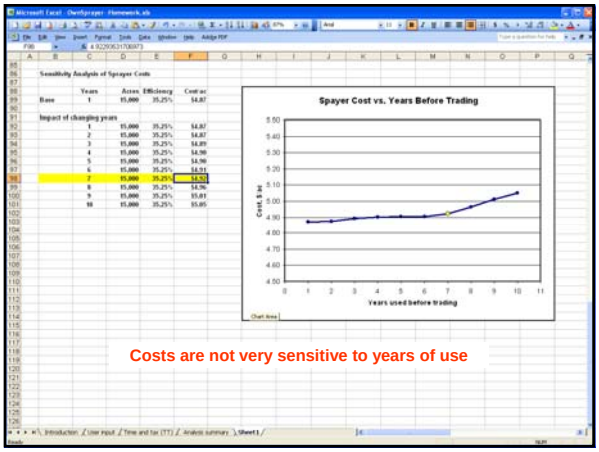
Sprayer purchase price	$230,000
Sprayer age when purchased	0
Hours on sprayer when purchased	0
Total acres covered per year	15,000
Hours used per year	325
Number of years sprayer is used	1

Cost breakdown (total cost can be compared to custom rates):

	$/year	$/hour	$/acre
Opportunity interest	$9,869	$30.36	$0.66
Market depreciation	$19,672	$60.52	$1.31
Repair and maintenance	$1,251	$3.85	$0.08
Labor	$6,501	$20.00	$0.43
Fuel and lubrication	$9,833	$30.25	$0.66
Tax, insurance, & shelter (TIS)	$2,961	$9.11	$0.20
Total for sprayer only	$50,087	$154.09	$3.34
Tendering cost	$22,976	$70.68	$1.53
Total for sprayer and tendering	$73,063	$224.77	$4.87

Date of analysis ======> 11/8/10

Base cost/ac = $4.92



Sensitivity Analysis of Sprayer Costs

	Years	Acres	Efficiency	Cost/ac
Base	1	15,000	35.25%	$4.87
Impact of changing years				
	1	15,000	35.25%	$4.87
	2	15,000	35.25%	$4.87
	3	15,000	35.25%	$4.89
	4	15,000	35.25%	$4.90
	5	15,000	35.25%	$4.90
	6	15,000	35.25%	$4.91
	7	15,000	35.25%	$4.92
	8	15,000	35.25%	$4.76
	9	15,000	35.25%	$5.81
	10	15,000	35.25%	$5.85

Costs are not very sensitive to years of use

End of Session:

Using the machinery decision tools and machinery homework

AG MANAGER.INFO
Kansas State Research & Extension
www.agmanager.info