

## Machinery Ownership and Leasing

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### 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*

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### Module: Machinery Ownership and Leasing

**Session: Impact of field size, shape and distance on machinery costs**

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## Motivation

As operations continue to expand and consolidate, producers will routinely be looking at land farther away from their home base. While this is a complex issue, quantifying as many factors as possible will help ensure producers make good management decisions (e.g., how much they can bid for varying land acquisition opportunities).

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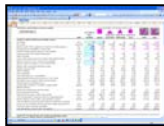
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## Machinery decision-tools available from KSU...

[www.AgManager.info](http://www.AgManager.info)



*OwnCombine.xls*



*KSU-GPSguidance.xls*



*OwnBaler.xls*



*OwnSprayer.xls*



*KSU-MachCost.xls*



*OwnTractor.xls*

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## Guidance & Section Control Profit Calculator

Instructions | Whole Farm Data | Sprayer | Planter | Fertilizer | Other | Whole Farm Results

To Get Started, Click the Instructions Tab

welcome to the  
**Guidance & Section Control Profit Calculator**

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## Machinery cost categories

- Repair and maintenance
- Labor
- Depreciation (market, not tax depreciation)
- Interest (opportunity interest)
- Fuel and lubrication
- Taxes, insurance, and shelter
- Custom hire – a reasonable proxy for average machinery cost

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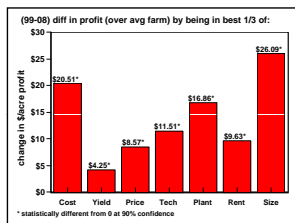
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## Key drivers of profitability differences among producers...

- Costs
- Tech adoption
- Farm size



...machinery investment and costs are directly related to these three factors.

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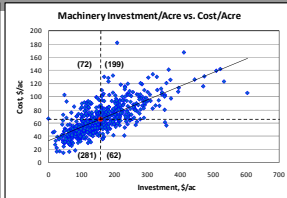
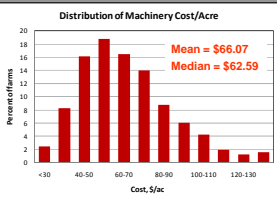
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## Machinery investment and cost/acre are highly variable...



How do I manage machinery to have below average costs?

- Hard to beat intensity of use as a cost reducer...
- Hard to beat machinery size as a cost reducer...
- Having good fields to farm (i.e., good fortune)...
- Farm size and technology adoption affect several of these

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### Machinery size issues...

- **Large equipment requires major investment**
  - investment is not the same as cost
  - ability to use capacity is critical
- **Per acre, larger machines require**
  - similar or a bit lower investment
  - much lower labor costs (the big driver)
- **But, since field size has not kept up with machine size, per acre, larger machines:**
  - require more road time (reduces efficiency)
  - have more headland overlap (reduces efficiency)

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***Impact of field size on machinery and input costs***

Analysis based on *KSU-GPSguidance.xls*  
(similar values could be derived from *GuidanceSectionControlProfitCalculator.xls*)

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### Field size & shape are basically headland issues

- **Headlands cause economic problems:**
  - Increase cost of machine operations
    - Doubling up of machine operations
    - Machines need to slow down for turnaround
  - Increase crop input costs due to doubling up
  - Double-planting, -applying, -tilling, and extra compaction can reduce crop yield, thus revenue
- **Portion of field covered by headlands:**
  - Affects *costs* and *revenues*
  - Greatly affected by field size and shape
  - Especially affected by width of machine

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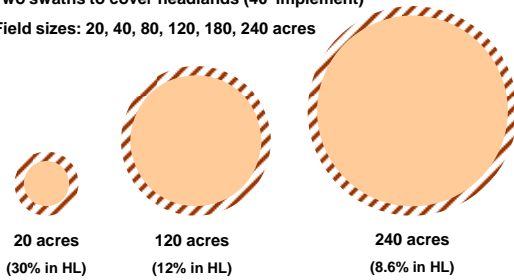
## Larger fields have less area in headlands...

### Assumptions for this example:

All fields have average angle of approach to headland of 39.5

Two swaths to cover headlands (40' implement)

Field sizes: 20, 40, 80, 120, 180, 240 acres



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## Impact of field size on costs...

### • Machinery costs

- percent machinery costs vary relative to base field (120 acres)
- vary due to "covering" acres more than once (i.e., overlap and area in headlands)
- slowing down to turn increases costs

### • Crop inputs

- percent crop inputs (e.g., seed, fertilizer, chemicals) vary relative to base field
- vary due to "doubling up" on overlap acres and areas in headlands

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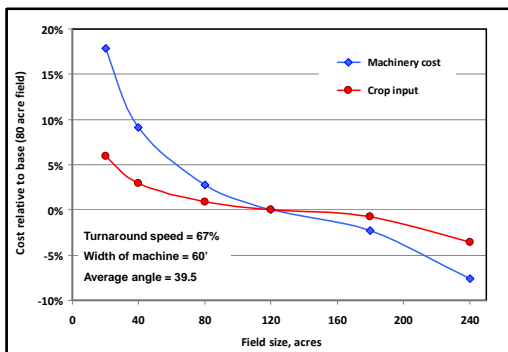
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## Machinery and input costs as field size varies



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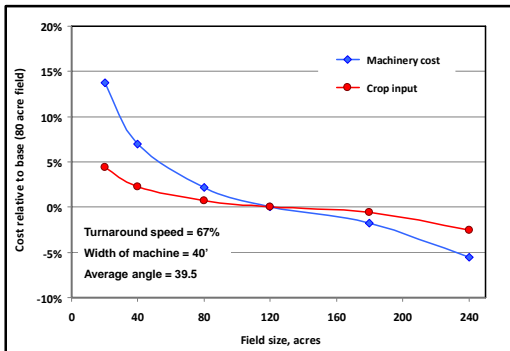
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**Machinery and input costs as field size varies**



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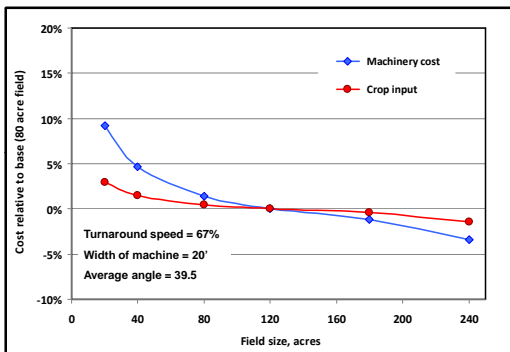
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**Machinery and input costs as field size varies**



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***Impact of field shape on machinery and input costs***

Analysis based on *KSU-GPSguidance.xls*  
(similar values could be derived from *GuidanceSectionControlProfitCalculator.xls*)

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## Large (wide) machine issues

- Need large turnaround area, increasing headland size (problem is compounded with small fields)
- By using section controllers we can make larger machines behave as though they were smaller, at least in terms of the portion of a headland affected by input doubling-up (but we still “cover the acres” with the machine)

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Technology reduces the “over applied input” problem...



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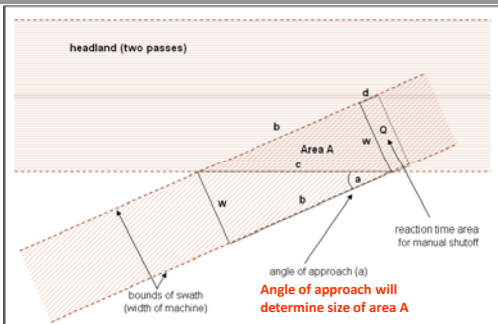
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## Overlap and headlands geometry



Areas A and Q and turnaround counterparts will have a) doubling-up of inputs and b) possible yield losses due to this doubling-up. After the turnaround there will be overlap along b, also accounted for.

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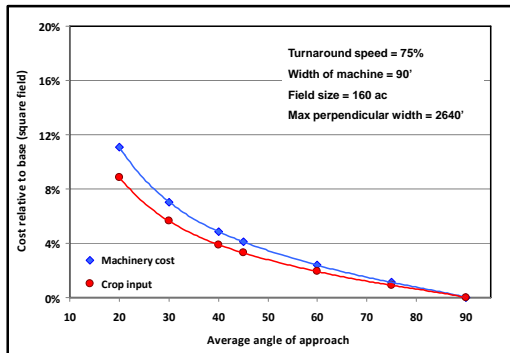
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### Machinery and input costs as field shape varies



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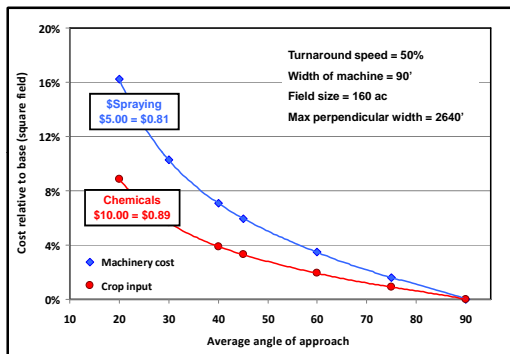
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### Machinery and input costs as field shape varies



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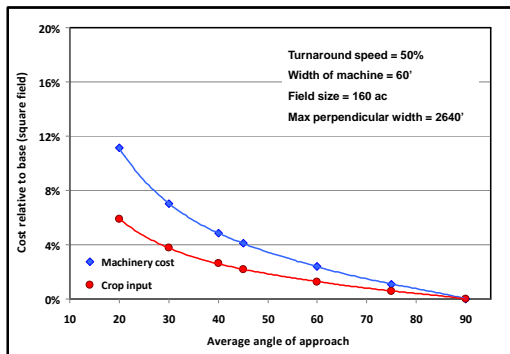
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### Machinery and input costs as field shape varies



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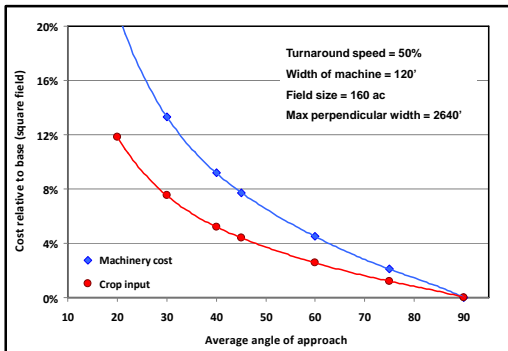
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### Machinery and input costs as field shape varies



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### Field shape significantly impacts costs...

- Section controller technology can help significantly with regard to crop input usage
- All else equal, reducing machine size will lower machinery cost associated with irregular shaped fields (for same reason as with small fields)
- While you may not be able to do a lot about the impact of field shape on machinery costs, it is still important to be aware of this issue for other management decisions

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### *Impact of distance from headquarters on costs*

Analysis based on *KSU-DistanceToFields.xls*

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**Field distance increases travel costs...**

**Travel costs are a function of:**

- Crop acres and rotation
- Distance from headquarters
- Distance from elevator/input source
- Labor costs per hour
- Vehicle speed (pickup, semi, and machines)
- Vehicle cost per mile
- Field operations and machine capacity
- Use of pickup for travelling back and forth
- Input levels required and yield (trips with semi)

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**Base assumptions...**

- Acres – 150, 300, 600, and 1200
- Crop rotation -- corn/soybean/wheat  
(plant each crop each year and rotate by year (300 acres or less))
- Distance from HQ – 5, 10, 20, 35, 50 (current fields 2.5)
- Distance from elevator/input source – 15 miles
- Labor costs per hour – \$15
- Vehicle speed – pickup=55, semi=40, machines=17-26
- Vehicle cost per mile – pickup=\$0.50, semi=\$2.00
- Field operations and machine capacity – no-till
- Use pickup for all operations except spraying

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**Factors not accounted for (there are many)...**

- Impact on overall costs (i.e., EOS benefit)




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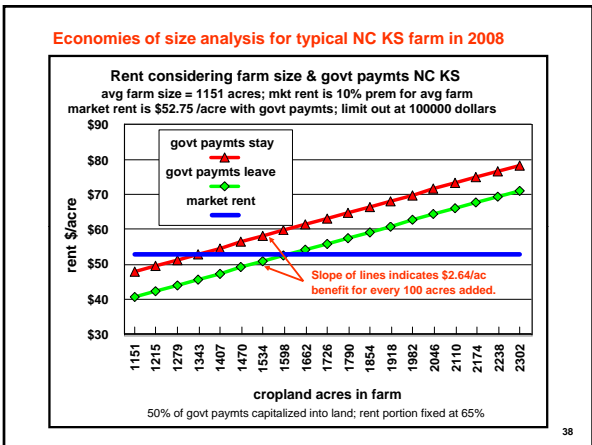
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**Factors not accounted for (there are many)...**

- Impact on overall costs (i.e., EOS benefit)
- Geographical diversification
  - Spread weather risk over larger area
  - More visibility (double-edged sword)
- Manage less intensively at greater distance?
  - Weed escapes, replant acres, repairs, etc.
- Hire some operations, stay overnight, separate line of equipment (costs might not be linear)?
- Costs decrease as you “fill in the gap”
- Other?

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Summary...

- Given economies of size that exist, a growth strategy makes sense for long-term sustainability
- Adding acres that are (1) in small fields, (2) irregular shaped fields, and (3) far away can increase costs potentially offsetting EOS benefits
- Machinery technologies available can help reduce some of the negative effects of small and odd-shaped fields (e.g., section controllers, auto-steer)
- The economics of expansion opportunities is complex, but producers should quantify the benefits and costs where they can

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End of Session:

Impact of field size, shape and distance on machinery costs



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