



Guidance & Section Control Profit Calculator

(and some other machinery cost related stuff)



Ag Technology Field Day
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Great Bend, KS

Kevin C. Dhuyvetter, *Extension Ag Economist*
and

Craig M. Smith, *Graduate Research Assistant*

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This tool is a cooperative effort between Kansas State University and the PrecisionAg Institute

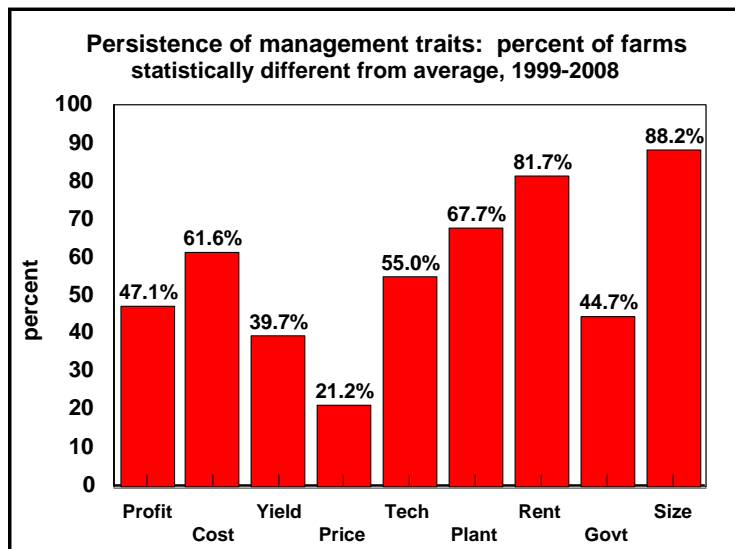


Persistence --

Something is said to be persistent if it is consistently different (better or worse) than average. Thus, the less persistent something is, the more random it is.

Implications for management efforts?

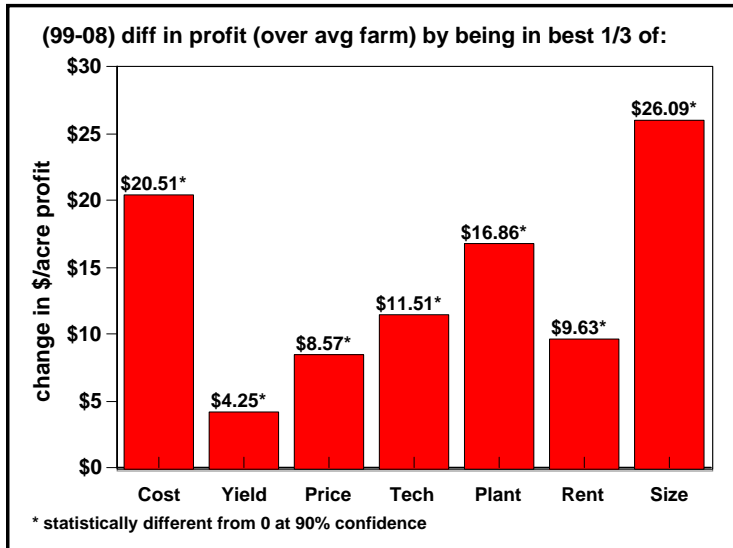
Persistence of management traits...



Key drivers of profitability differences among producers...

- Costs
- Technology adoption
- Farm size

Factors impacting profitability differences...

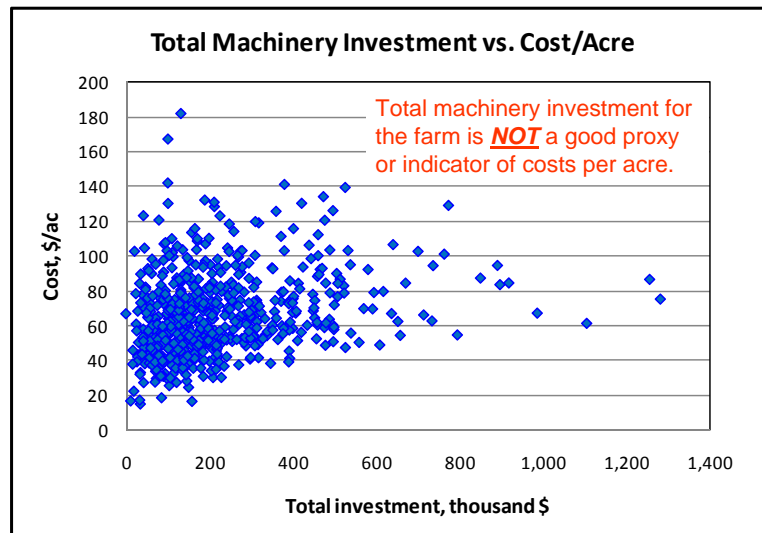


Key drivers of profitability differences among producers...

- Costs
- Technology adoption
- Farm size

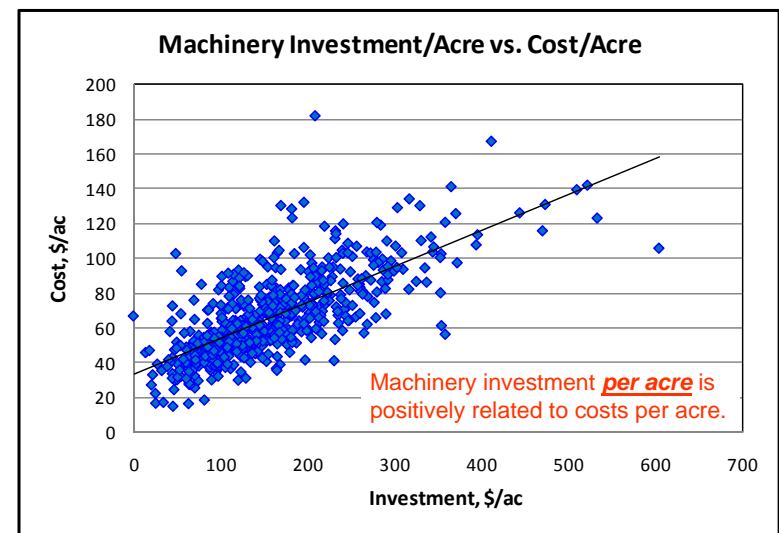
Machinery investment and costs are directly related to these three factors...

Machinery investment is not the same as machinery cost



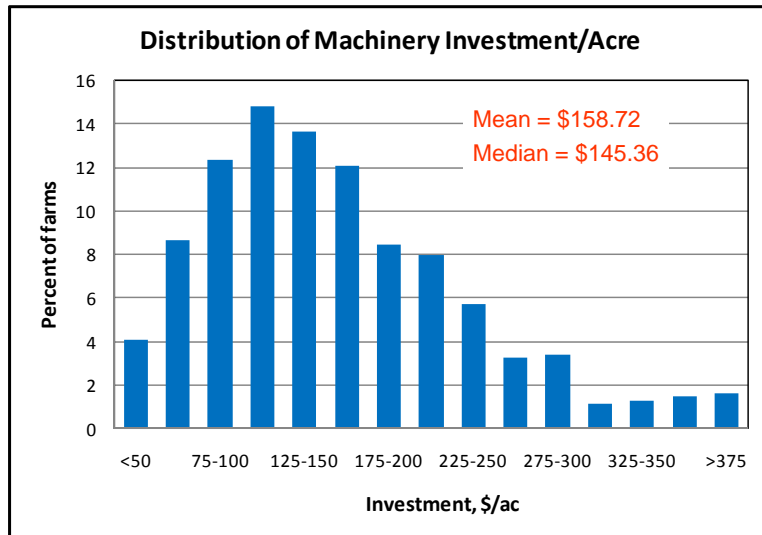
Source: KFMA non-irrigated crop farms having continuous data from 2005-2009 (minimum of 160 acres and machinery cost/acre > \$10/ac; costs do not include labor – total of 614 farms)

It is important to use assets efficiently



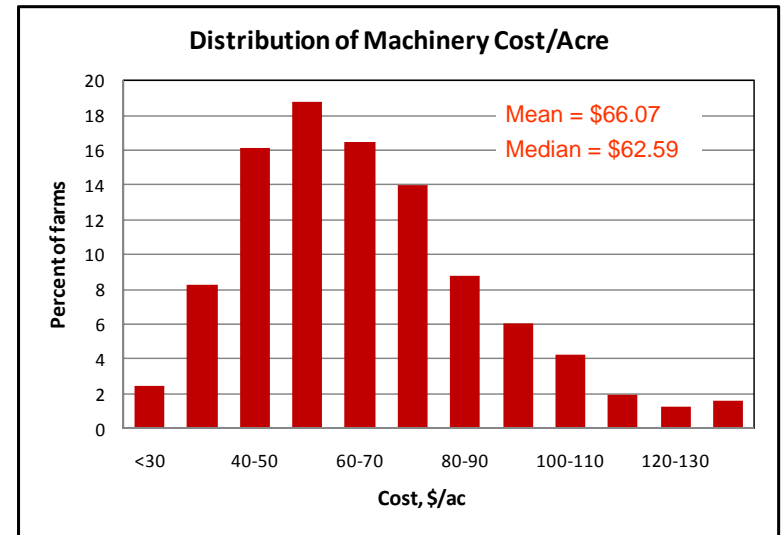
Source: KFMA non-irrigated crop farms having continuous data from 2005-2009 (minimum of 160 acres and machinery cost/acre > \$10/ac; costs do not include labor – total of 614 farms)

Machinery investment varies across producers...



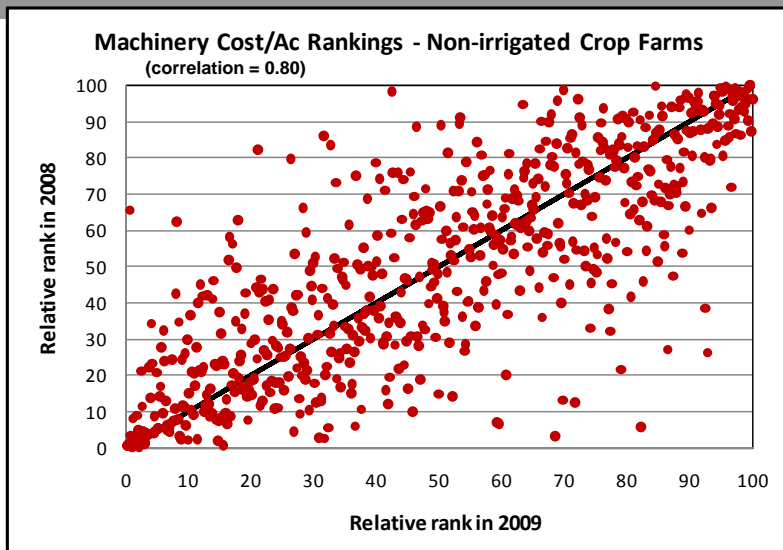
Source: KFMA non-irrigated crop farms having continuous data from 2005-2009 (minimum of 160 acres and machinery cost/acre > \$10/ac; costs do not include labor – total of 614 farms)

Hence, machinery cost varies across producers...



Source: KFMA non-irrigated crop farms having continuous data from 2005-2009 (minimum of 160 acres and machinery cost/acre > \$10/ac; costs do not include labor – total of 614 farms)

Machinery costs per acre are fairly persistent...



Source: KFMA non-irrigated crop farms having continuous data from 2005-2009 (minimum of 160 acres and machinery cost/acre > \$10/ac – total of 614 farms)

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Differences Between High-, Medium-, and Low-Profit Producers: An Analysis of 2006-2008 Kansas Farm Management Association Crop Enterprises

The following slides are an update of this study (results have not been written up yet, but will be shortly).

Study examining profitability differences between crop producers for different enterprises. Costs are quite important in explaining differences and machinery costs represent a relatively large portion of costs.*

Paper is available on www.agmanager.info

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How important are farm machinery costs for KS farmers?

Kansas Farm Management Association Crop Enterprises Analysis

State Averages, 2007-2009

	Corn	Irr Corn	Sorghum	Wheat	Soybean	Alfalfa
Number of Farms	115	50	128	221	139	46
Average Acres	409	568	364	725	297	73
Costs, \$ per Acre						
Seed	\$42.44	\$61.97	\$13.45	\$12.65	\$35.53	\$12.01
Fertilizer	61.63	93.02	44.99	44.96	9.02	12.39
Herb-Ins	30.94	47.44	33.92	11.11	24.01	11.36
Crop Ins	16.66	24.65	11.50	11.28	13.01	0.15
Machinery	97.49	126.23	83.73	86.92	92.22	120.18
Other	25.39	106.55	22.22	23.00	24.71	29.47
Land	60.65	95.40	38.10	34.41	55.69	61.27
Interest	24.80	39.99	17.44	17.26	18.99	20.81
Total Cost	\$360.00	\$595.26	\$265.36	\$241.59	\$273.16	\$267.64
Machinery, %	27.1%	21.2%	31.6%	36.0%	33.8%	44.9%

High profit farms have lower machinery costs...

Kansas Farm Management Association Crop Enterprises Analysis

State Averages, 2007-2009

	Corn	Irr Corn	Sorghum	Wheat	Soybean	Alfalfa
Number of Farms	115	50	128	221	139	46
Average Acres						
High profit farms	506	568	473	1002	358	79
Mid profit farms	400	464	348	777	324	108
Low profit farms	322	667	271	396	208	107
Machinery Costs, \$/acre						
High profit farms	\$90.29	\$118.35	\$70.77	\$75.48	\$77.90	\$109.44
Mid profit farms	\$92.33	\$118.64	\$81.88	\$79.18	\$88.24	\$123.63
Low profit farms	\$109.99	\$141.26	\$98.52	\$106.00	\$110.61	\$127.23
High less low, \$	-\$19.70	-\$22.91	-\$27.75	-\$30.52	-\$32.71	-\$17.79
High less low, %	-17.9%	-16.2%	-28.2%	-28.8%	-29.6%	-14.0%

High profit farms have lower machinery costs...

Kansas Farm Management Association Crop Enterprises Analysis

State Averages, 2007-2009

	Corn	Irr Corn	Sorghum	Wheat	Soybean	Alfalfa
Number of Farms	115	50	128	221	139	46
Average Acres	409	568	364	725	297	73
Differences in Machinery Costs, \$/acre (high profit vs. low profit)						
Repairs	-\$4.84	-\$9.57	-\$4.02	-\$7.43	-\$7.02	-\$7.48
Machine Hire	-3.93	2.11	-5.03	-3.41	-5.35	3.29
Fuel and Oil	-2.44	4.18	-2.96	-2.94	-2.97	-4.41
Depreciation	-3.55	-6.34	-1.87	-2.02	-6.74	-2.58
Labor	-4.94	-13.28	-13.87	-14.71	-10.64	-6.61
Total	-\$19.70	-\$22.91	-\$27.75	-\$30.52	-\$32.71	-\$17.79

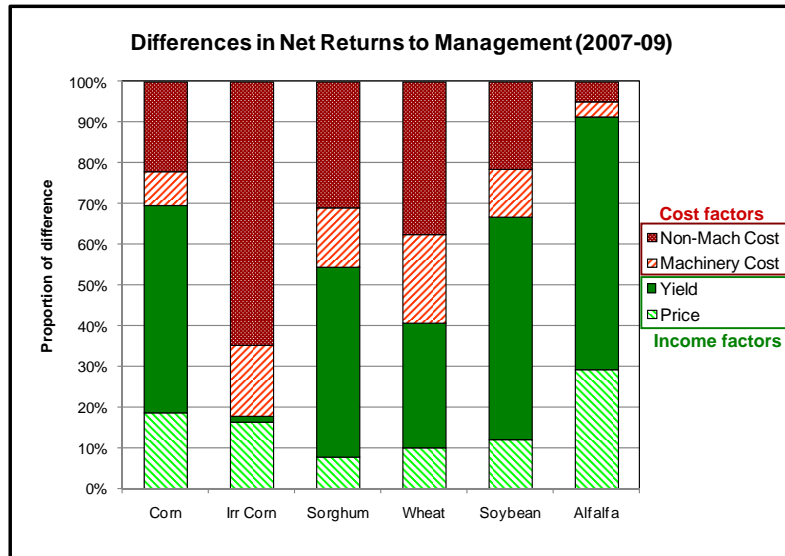
Machinery cost differences help explain profitability differences across farms (but clearly other factors also matter)

Kansas Farm Management Association Crop Enterprises Analysis

State Averages, 2007-2009

	Corn	Irr Corn	Sorghum	Wheat	Soybean	Alfalfa
Number of Farms	115	50	128	221	139	46
Differences between high profit farms and low profit farms in ...						
Net returns	\$140.72	\$256.98	\$126.60	\$125.28	\$141.18	\$182.75
Machinery costs	-\$19.70	-\$22.91	-\$27.75	-\$30.52	-\$32.71	-\$17.79
Total costs	-\$43.08	-\$211.82	-\$57.97	-\$74.59	-\$47.06	-\$16.12
Cost/net returns	30.6%	82.4%	45.8%	59.5%	33.3%	8.8%
Mach/total costs	45.7%	10.8%	47.9%	40.9%	69.5%	110.4%
Mach/net returns	14.0%	8.9%	21.9%	24.4%	23.2%	9.7%

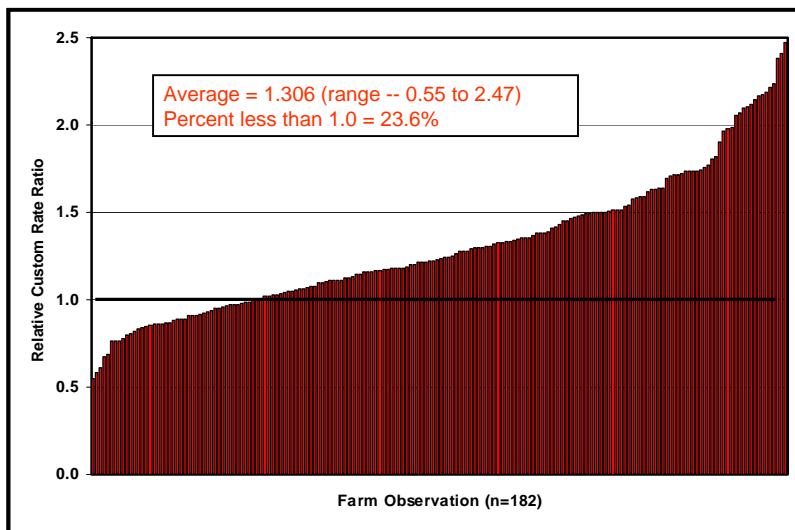
Machinery costs and prices similar magnitudes...



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

Producers actual machinery costs vs. custom rates...



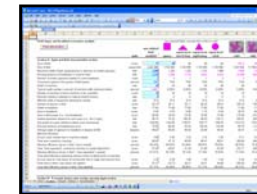
Source: Aaron Beaton thesis (2003 – actual farm-level data for 2001)

Other machinery decision-tools available...

www.agmanager.info



OwnCombine.xls



KSU-GPSguidance.xls



OwnBaler.xls



OwnSprayer.xls



KSU-MachCost.xls



OwnTractor.xls

Key drivers of profitability differences among producers...

- Costs
- Technology adoption
- Farm size

Adopting new machinery technologies is an important way that farm managers lower their machinery costs to distinguish themselves from others for the purpose of increasing profit (but this should only be done if it is profitable)

Welcome | 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

<p>Sponsored by</p> <p>PRECISIONAG INSTITUTE</p> <p>37733 Euclid Avenue Willoughby, Ohio 44094 440-942-2000 www.precisionagworks.com</p>	<p>Developers</p> <p>Kevin C. Dhuyvetter Extension Agricultural Economist Kansas State University (785) 532-3527 kod@ksu.edu</p> <p>Terry L. Kastens Professor Emeritus Kansas State University (785) 626-9000 terrykastens@agecon.ksu.edu</p>	<p>Developed by</p> <p>Craig M. Smith Graduate Research Assistant Kansas State University craigsmith@agecon.ksu.edu</p> <p>Dietrich L. Kastens Geographer/Producer Kastens, Inc. (785) 626-4600 dietrich@kastensinc.com</p>	<p>Developed by</p> <p>AG MANAGER.INFO</p> <p>Department of Ag Economics Kansas State University Manhattan, KS 66506 www.agmanager.info</p>
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- Precision agriculture means different things to different people
- Can't make blanket statements that it "pays" or "doesn't pay"
- One aspect of precision agriculture is related to machinery technology
 - Guidance systems
 - Section controllers
- Issues
 - Machinery overlap
 - Field headlands
 - Large (wide) machinery

General machinery overlap issues

- Extra machine operation
 - Increases machinery costs since overlap areas are covered more than once, so more acres have to be farmed than which are in the field
- May affect applied input usage
 - Increases crop input cost since overlap areas are covered more than once and thus get more seed, fertilizer, herbicide, etc.
- These are cost issues

Field 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

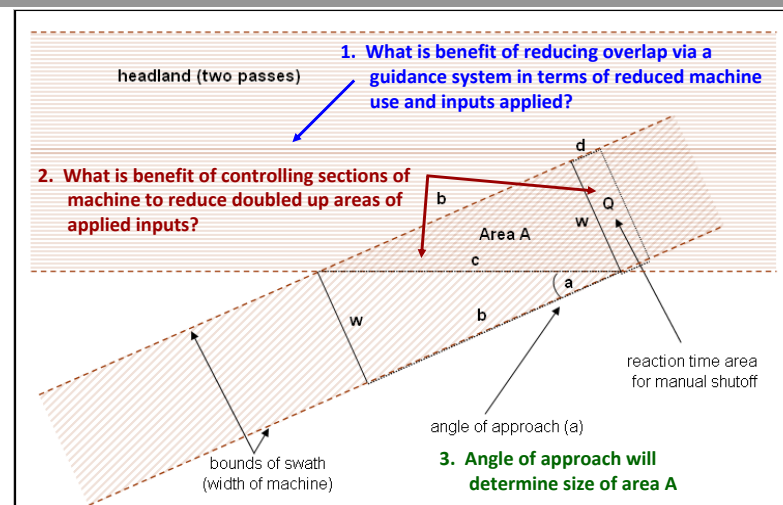
Large (wide) machine issues

- Need large turnaround area, increasing headland size
- Can we make the larger machines behave as though they were smaller, at least in terms of the portion of a headland affected by input doubling-up?
 - boom or section shut-offs
- What are the economics of this technology?

Guidance & Section Control Economics

- All situations are quite site- and machine-specific
 - Hard to make general rules of thumb across operations
 - Requires individual-situation analysis
 - So, along with the PrecisionAg Institute we developed a decision tool to aid in such decisions
 - **Guidance & Section Control Profit Calculator**
 - Web Dashboard
 - Excel spreadsheet

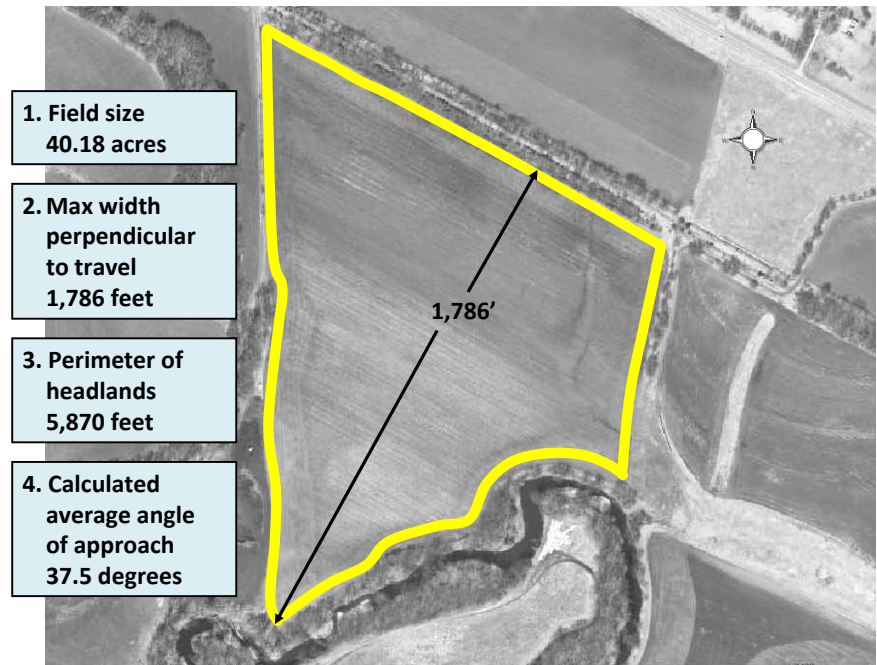
Overlap and headlands geometry



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.



Let's look at the Calculator...



Stylized field shapes (farm left to right)



Square; hit ends at 90 degree angles, 5,280 feet of headlands in 160 acre field



Isosceles right triangle; hit ends at 60 degree angles, 7,467 feet of headlands in 160 acre field



Equilateral triangle; hit ends at 45 degree angles, 8,024 feet of headlands in 160 acre field



Circle; hit ends at angles varying from 0 to 90 degrees (avg. 40 degrees) 9,359 feet of headlands in 160 acre field



Kansas State
UNIVERSITY

Department of Agricultural Economics

Back to the Calculator ...

90-ft sprayer example -- results based on machine and input cost savings

Impact of Acres Covered on Economics of Guidance System ¹				Impact of Acres Covered on Economics of Section Control ¹			
Annual acres	Investment supported ²	Return on investment ^{2,3}	Payback years ³	Annual acres	Investment supported ²	Return on investment ^{2,3}	Payback years ³
14,000	\$32,744	54.3%	1.7	14,000	\$52,554	154.9%	0.7
12,000	\$28,066	43.0%	2.0	12,000	\$45,046	131.2%	0.8
10,000	\$23,389	31.2%	2.4	10,000	\$37,539	107.2%	1.0
8,000	\$18,711	18.7%	3.1	8,000	\$30,031	82.5%	1.2
6,000	\$14,033	5.1%	4.3	6,000	\$22,523	56.7%	1.6
4,000	\$9,355	-10.4%	7.2	4,000	\$15,015	28.9%	2.5
2,000	\$4,678	-30.2%	24.6	2,000	\$7,508	-3.8%	5.7

¹ Machine and input cost savings reducing overlap from 7.0% to 1.75%

² Based on four-year amortization

³ Given \$15,000 investment

¹ Automatic control of 5 boom sections, input cost savings (guidance exists)

² Based on four-year amortization

³ Given \$10,000 investment

As with most all technologies, the returns to investing in guidance systems and section controls is not scale neutral...

Given the assumptions for this example, the returns to investing in section controls are much higher than guidance systems (but you need the guidance system to realize these benefits)

90-ft sprayer example -- results based on machine and input cost savings

Impact of Acres Covered and Input Cost on Guidance System ROI ¹						Impact of Acres Covered and Input Cost on Section Control ROI ¹					
Annual acres	Average cost of input, \$/application acre					Annual acres	Average cost of input, \$/application acre				
	\$4.00	\$8.00	\$12.00	\$16.00	\$20.00		\$4.00	\$8.00	\$12.00	\$16.00	\$20.00
14,000	11.4%	33.9%	54.3%	73.5%	92.0%	14,000	38.5%	99.0%	154.9%	209.2%	262.9%
12,000	4.5%	24.8%	43.0%	60.0%	76.3%	12,000	28.9%	82.5%	131.2%	178.3%	224.6%
10,000	-2.9%	15.2%	31.2%	46.0%	60.1%	10,000	18.8%	65.5%	107.2%	147.1%	186.1%
8,000	-10.9%	4.9%	18.7%	31.3%	43.3%	8,000	8.0%	47.8%	82.5%	115.3%	147.1%
6,000	-19.9%	-6.5%	5.1%	15.5%	25.3%	6,000	-3.8%	28.9%	56.7%	82.5%	107.2%
4,000	-30.5%	-19.6%	-10.4%	-2.3%	5.3%	4,000	-17.5%	8.0%	28.9%	47.8%	65.5%
2,000	-44.6%	-36.7%	-30.2%	-24.5%	-19.4%	2,000	-35.1%	-17.5%	-3.8%	8.0%	18.8%

¹ Machine and input cost savings reducing overlap from 7.0% to 1.75%

Based on four-year amortization

Given \$15,000 investment

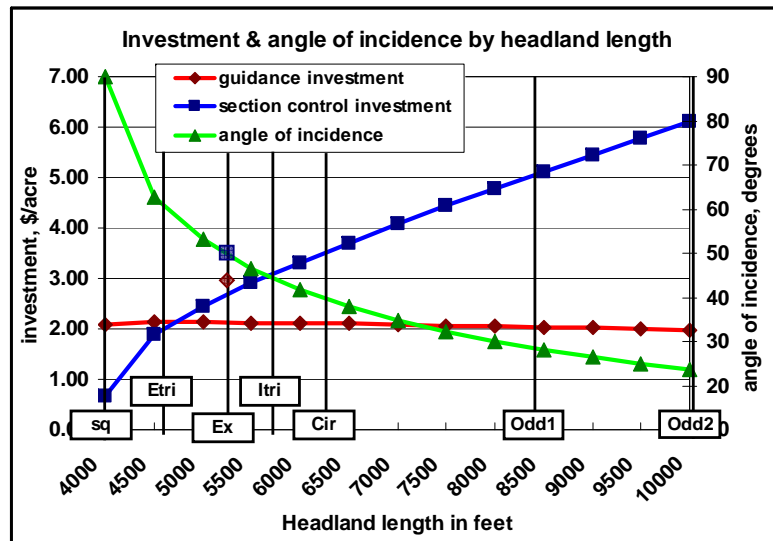
¹ Automatic control of 5 boom sections, input cost savings (guidance exists)

Based on four-year amortization

Given \$10,000 investment

... but, as input costs increase, these technologies will pay for smaller operations as well (additionally, investment required likely will fall over time).

As a reminder,
results for section control depend heavily on field shape ...



Many things to consider for an analysis

- Base machine operation cost or custom rate
- Machine size
- Which machines, which operations?
- Machines share investment components?
- Accuracy of GPS wish to consider
- Crop input cost
- Field size
- Field shape
- Farm/operation size (mostly a fixed cost investment)
- How do you value personal comfort?

- Video and written tutorials available online at www.AgManager.info
- Excel Spreadsheet version allows a little more customization and flexibility in analysis

Questions ???

Kevin C. Dhuyvetter
kcd@ksu.edu
(785) 532-3527

Craig M. Smith
craigsmith@agecon.ksu.edu
(785) 477-0464

Terry L. Kastens
terrykastens@agecon.ksu.edu
(785) 626-9000

Dietrich L. Kastens
dietrich@kastensinc.com
(785) 626-4600