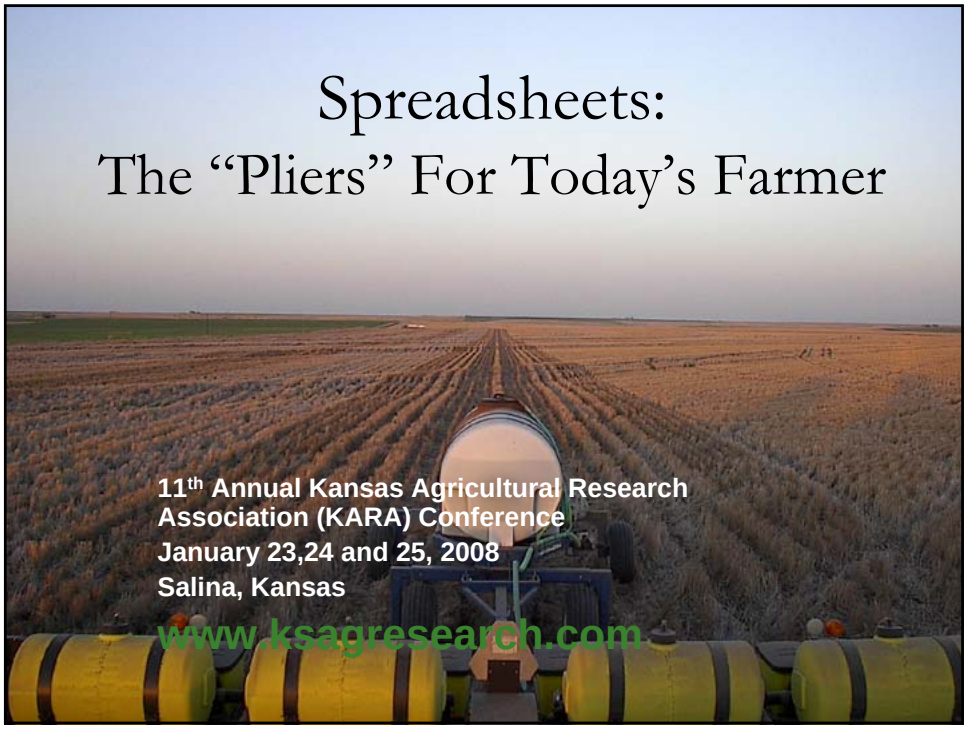


Overview

- In today's agricultural environment spreadsheets are becoming as common with farmers as the pliers and cell phones we all wear.
- This is for good reason as spreadsheets allow us to easily accomplish tasks that are simply overwhelming in a pen & paper world.
- From crop planning and data logging to advanced economic topics such as purchasing equipment and land, the spreadsheet is proving its worth on today's farm.

Overview

- Many fantastic spreadsheets (that do incredibly complicated tasks) have already been put together and are just sitting there ready for a farmer to fine tune them for their own applications.
- They sit at university, private sector and individual's websites and can often be found with simple web searches.
- Today, one of the spreadsheets we will look at is the KSU-GPSguidance.xls available from www.agmanager.info.

Planter –Section Control?

- We are going to evaluate adding sectional (or row) control to a planter for both seed and fertilizer products:
  - We are going to use information specific to our fields and operation.
  - Determine how much we can invest in this technology and what level we can afford to adopt.
  - Discuss the ability to accomplish the technology, given our determined investment and actual costs.

Planter Section Control – Assumptions

- Auto-trac is already being used for planting.
- We will be applying between 10-48 gpa of fertilizer.
- Minor assumptions will be shown as we move through the spreadsheets and naturally these can all be changed by the user.

Planter Section Control: Spreadsheet Evaluation of feasibility

- The KSU_GPSGuidance.xls was first downloaded.
  - Right-click “save to computer”.
  - Save-As a new file. Always keep a copy of the original.
- Field specific information was entered into the spreadsheet. In this example I entered the information (acres, maximum width and running distance of headlands) for about 40 different fields that we manage so that the results will be specific to “our” farm in Northwest Kansas.
- Most GIS software programs have the ability to get this kind of information from the “field borders”.

KSU_GPSGuidance.xls

Field shape and headland economics analysis

four stylized fields; assume farm north to south

Print information

	units	user-defined field userfield	square	equal sized isos R trian	equal sized equil triang	equal sized circle	odd1	odd2
Section A: Input and field characteristics section								
Size of field	acres	75	75	75	75	75	167.4	269.9
Size of field	square feet	3,267,000	3,267,000	3,267,000	3,267,000	3,267,000	7,291,944	11,756,844
Maximum width of field, perpendicular to direction of swaths (passes)	feet	2,000	1,807	1,807	2,379	2,040	3,960	3,910
Running distance of headlands to cover for field	feet	5,250	3,615	5,112	5,494	6,407	16,700	30,690
Number of swaths (passes) needed to cover headlands	count	2	2	2	2	2	2	2
Turnaround speed is this portion of field speed	percent	75%	75%	75%	75%	75%	75%	75%
Width of machine	feet	60	60	60	60	60	60	60
Typical swath overlap in percent of machine width (selected below)	percent	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%
Number of machine or boom sections to be controlled	count	12	12	12	12	12	12	12
Reaction distance (overlap) on manual shutoff of boom	feet	5	5	5	5	5	5	5
Effective width of equipment allowing for overlap	feet	57.9	57.9	57.9	57.9	57.9	57.9	57.9
Number of passes in field	count	34.54	31.22	31.22	41.08	35.23	68.39	67.54
Width of headland	feet	117.90	117.90	117.90	117.90	117.90	117.90	117.90
Area in headlands	acres	14.21	9.78	13.84	14.87	17.34	45.20	83.07
Area in field proper (i.e., non-headlands)	acres	60.79	65.22	61.16	60.13	57.66	122.20	186.83
Implied perimeter distance for each pass (i.e., the 2 ends)	feet	151.99	115.80	163.77	133.71	181.90	244.17	454.43
Avg length of a pass (distance before must turnaround)	feet	1324.01	1571.68	1474.01	1101.11	1231.45	1344.20	2081.29
Running distance of headland per acre	feet	70.00	48.20	68.16	73.25	85.43	99.76	113.71
Average angle of approach to headland in degrees (0-90)	degrees	49.63	90.00	45.00	60.00	39.54	28.31	14.76
Machine efficiency								
Excess area covered due to machine overlap	acres	2.46	2.54	2.46	2.45	2.40	5.24	8.26
Total area covered by machine	acres	91.67	87.32	91.30	92.31	94.74	217.84	361.22
Machine efficiency (acres in field / area covered)	percent	81.82%	85.89%	82.15%	81.24%	79.16%	76.85%	74.72%

ume farm north to south

equal sized equil triang	equal sized circle	odd1	odd2	Average	weighted Average	BearlyAnne 1	BearlyAnneSm 1	Bearlyhome 1
75	75	167.4	269.9	92.26	126.68	139.78	30.19	49.18
3,267,000	3,267,000	7,291,944	11,756,844			6,088,795	1,315,256	2,142,313
2,379	2,040	3,960	3,910			2584.57	1072.91	1303.48
5,494	6,407	16,700	30,690			11305.30	4613.90	5864.88
2	2	2	2			2	2	2
75%	75%	75%	75%			75%	75%	75%
60	60	60	60			60	60	60
3.50%	3.50%	3.50%	3.50%			3.50%	3.50%	3.50%
12	12	12	12			12	12	12
5	5	5	5			5	5	5
57.9	57.9	57.9	57.9			57.9	57.9	57.9
41.08	35.23	68.39	67.54			44.64	18.53	22.51
117.90	117.90	117.90	117.90			117.90	117.90	117.90
14.87	17.34	45.20	83.07			30.60	12.49	15.87
60.13	57.66	122.20	186.83			109.18	17.71	33.31
133.71	181.90	244.17	454.43			253.26	248.99	260.52
1101.11	1231.45	1344.20	2081.29			1840.11	718.86	1113.06
73.25	85.43	99.76	113.71	127.57	101.42	80.88	152.81	119.25
60.00	39.54	28.31	14.76	24.63	24.71	27.21	27.72	26.39
2.45	2.40	5.24	8.26	2.88	4.01	4.50	0.86	1.49
92.31	94.74	217.84	361.22	120.46	162.41	174.88	43.55	66.55
81.24%	79.16%	76.85%	74.72%	0.74	0.77	79.93%	69.34%	73.91%

Spreadsheet Setup & Modification

- As I wanted to make the spreadsheet specific to “our” operation I added a new sheet into the workbook.
- In this sheet I will setup my specific information as well as well use it to bring back the post-run results of interest.

	Assumptions	
	Custom Rate for notill planting	$12.50
	Acres of Corn	2000
	Acres of Milo	1000
	# headland passes	*2*
	Head turn efficiency	*75%*
	reaction overlap	*5*
	Sections to control	***12***
	Planter width	***60***
0	overlap at CustomR (w/ marker)	*5.50%*
1	overlap at CustomR (w/ AT)	*3.50%*
	Overlap to consider (max overlap)	*3.50%*
1	Input cost (seed only)	$26.24
0	input cost (fertilizer only)	$52.22
	Total Input Cost	$26.24
	Projected Field yield (bu/ac)	90
	Loss percentage due to overlap	25%
	Yield loss on overlap (bu/ac)	22.5
	Price of Corn	$4.50
	Price of Milo	$4.19
	Ac Weighted total loss/ac due to doubling planting	$98.89
	years Ammor	*5*
	Interest	*8.00%*

Input Cost Section	
Seed	
Per bag cost of Corn (avg)	*$150.00*
Seeds per bag Corn (avg)	*80,000*
Corn Planting Population (avg	*18500*
Per acre seed cost for Corn	*$34.69*
Per bag cost of Milo (avg)	*$140.00*
Seeds per bag Milo (avg)	750,000
Milo Planting Population (avg)	*50000*
Per acre seed cost for Milo	*$9.33*
Ac. Weighted total seed cost	**$26.24**
Fertilizer	
Price per lb of N	*$0.50*
Price per lb of P205	*$0.49*
lbs/ac of N Corn (avg)	*80*
lbs/ac of P205 Corn (avg)	*30*
lbs/ac of N Milo (avg)	*70*
lbs/ac of P205 Milo (avg)	*25*
Total cost N for Corn	$40.00
Total cost P205 for Corn	$14.70
Total cost N for Milo	$35.00
Total cost P205 for Milo	$12.25
Ac. Weighted total fert cost	**$52.22**

Working with the Modified Spreadsheet

- From my assumptions table, I then tied my values back into the KSU_GPSGuidance spreadsheet that way I could control everything from my spreadsheet.
- Next I brought back results that I was interested in back into my spreadsheet so that I wouldn't have to sift through Terry and Kevin's millions of numbers.

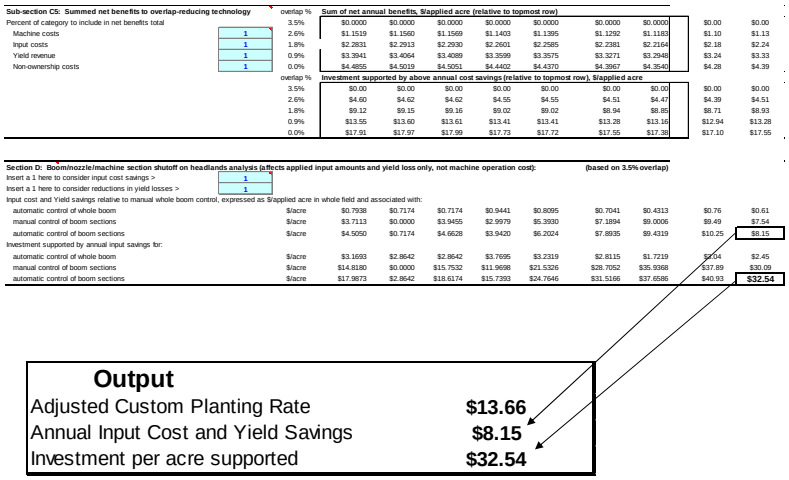
Output	
Adjusted Custom Planting Rate	**$13.66**
Annual Input Cost and Yield Savings	**$8.15**
Investment per acre supported	**$32.54**

Working with the Modified Spreadsheet

# headland passes	*2*
Head turn efficiency	*75%*
reaction overlap	*5*
Sections to control	*12*
Planter width	*60*

Section A: Input and field characteristics section

Size of field	acres	75
Size of field	square feet	3,267,000
Maximum width of field, perpendicular to direction of swaths (passes)	feet	2,000
Running distance of headlands to cover for field	feet	5,250
Number of swaths (passes) needed to cover headlands	count	2
Turnaround speed is this portion of field speed	percent	75%
Width of machine	feet	60
Typical swath overlap in percent of machine width (selected below)	percent	3.50%
Number of machine or boom sections to be controlled	count	12
Reaction distance (overlap) on manual shutoff of boom	feet	5



Sub-section C5: Summed net benefits to overlap-reducing technology		overlap %	Sum of net annual benefits, $/applied acre (relative to topmost row)								
Percent of category to include in net benefits total		3.5%	$0.0000	$0.0000	$0.0000	$0.0000	$0.0000	$0.0000	$0.0000	$0.00	$0.00
Machine costs	1	2.6%	$1.1519	$1.1560	$1.1569	$1.1403	$1.1395	$1.1292	$1.1183	$1.10	$1.13
Input costs	1	1.8%	$2.2831	$2.2913	$2.2930	$2.2601	$2.2585	$2.2381	$2.2164	$2.18	$2.24
Yield revenue	1	0.9%	$3.3941	$3.4064	$3.4089	$3.3599	$3.3575	$3.3271	$3.2948	$3.24	$3.33
Non-ownership costs	1	0.0%	$4.4855	$4.5019	$4.5051	$4.4402	$4.4370	$4.3967	$4.3540	$4.28	$4.39
		overlap %	Investment supported by above annual cost savings (relative to topmost row), $/applied acre								
		3.5%	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		2.6%	$4.60	$4.62	$4.62	$4.55	$4.55	$4.51	$4.47	$4.39	$4.51
		1.8%	$9.12	$9.15	$9.16	$9.02	$9.02	$8.94	$8.85	$8.71	$8.93
		0.9%	$13.55	$13.60	$13.61	$13.41	$13.41	$13.28	$13.16	$12.94	$13.28
		0.0%	$17.91	$17.97	$17.99	$17.73	$17.72	$17.55	$17.38	$17.10	$17.55

Section D: Boom/nozzle/machine section shutoff on headlands analysis (affects applied input amounts and yield loss only, not machine operation cost):								(based on 3.5% overlap)		
Insert a 1 here to consider input cost savings >	1									
Insert a 1 here to consider reductions in yield losses >	1									
Input cost and Yield savings relative to manual whole boom control, expressed as $/applied acre in whole field and associated with:										
automatic control of whole boom	$/acre	$0.7938	$0.7174	$0.7174	$0.9441	$0.8095	$0.7041	$0.4313	$0.76	$0.61
manual control of boom sections	$/acre	$3.7113	$0.0000	$3.9455	$2.9979	$5.3930	$7.1894	$9.0006	$9.49	$7.54
automatic control of boom sections	$/acre	$4.5050	$0.7174	$4.6628	$3.9420	$6.2024	$7.8935	$9.4319	$10.25	$8.15
Investment supported by annual input savings for:										
automatic control of whole boom	$/acre	$3.1693	$2.8642	$2.8642	$3.7695	$3.2319	$2.8115	$1.7219	$2.04	$2.45
manual control of boom sections	$/acre	$14.8180	$0.0000	$15.7532	$11.9698	$21.5326	$28.7052	$35.9368	$37.89	$30.09
automatic control of boom sections	$/acre	$17.9873	$2.8642	$18.6174	$15.7393	$24.7646	$31.5166	$37.6586	$40.93	$32.54

Output	
Adjusted Custom Planting Rate	**$13.66**
Annual Input Cost and Yield Savings	**$8.15**
Investment per acre supported	**$32.54**

Adjusted Custom Planting Rate came from the Analysis Page of the KSU_GPSGuidance spreadsheet

Building the Evaluation Tables

- Everything is setup
  - I entered my field specific information
  - I made my assumptions and created an external “sheet” that ties back into the main sheet
  - I am bringing back the critical results into my spreadsheet.
- By changing “my” input values, I can generate different results in my output table and then copy them into a separate table to be used for evaluation.

Planter Section Control -Seed

Only considering seed input costs and Yield loss

width (ft)	Description of type of control system	planting cost ($/ac)	inv. Support ($/ac)	Acres	Total Potential Investment ($)
40	*2 section manual control*	*$13.32*	*$10.94*	3000	**$32,820**
40	2 section automatic control	$13.32	$13.39	3000	$7,350
40	4 section automatic control	$13.32	$18.86	3000	$23,760
40	8 section automatic control	$13.32	$21.60	3000	$31,980
40	16 section automatic control	$13.32	$22.97	3000	$36,090
60	*2 section manual control*	*$13.66*	*$16.41*	3000	**$49,230**
60	2 section automatic control	$13.66	$18.86	3000	$7,350
60	4 section automatic control	$13.66	$27.07	3000	$31,980
60	6 section automatic control	$13.66	$29.81	3000	$40,200
60	8 section automatic control	$13.66	$31.17	3000	$44,280
60	12 section automatic control	$13.66	$32.54	3000	$48,390
60	24 section automatic control	$13.66	$33.91	3000	$52,500

Total Potential Investment dollars are all relative to 2 section manual control as we are already willing to do that and it does not cost anything extra.

Planter Section Control -Fertilizer

Only considering Fertilizer input costs

width (ft)	Description of type of control system	planting cost ($/ac)	inv. Support ($/ac)	Acres	Total Potential Investment ($)
40	*2 section manual control*	*$13.27*	$4.57	3000	**$13,710**
40	2 section automatic control	$13.27	$5.59	3000	$3,060
40	4 section automatic control	$13.27	$7.87	3000	$9,900
40	8 section automatic control	$13.27	$9.01	3000	$13,320
40	16 section automatic control	$13.27	$9.58	3000	$15,030
60	*2 section manual control*	*$13.61*	$6.85	3000	**$20,550**
60	2 section automatic control	$13.61	$7.87	3000	$3,060
60	4 section automatic control	$13.61	$11.30	3000	$13,350
60	6 section automatic control	$13.61	$12.44	3000	$16,770
60	8 section automatic control	$13.61	$13.01	3000	$18,480
60	12 section automatic control	$13.61	$13.58	3000	$20,190
60	24 section automatic control	$13.61	$14.15	3000	$21,900

Total Potential Investment dollars are all relative to 2 section manual control as we are already willing to do that and it does not cost anything extra.

Planter Section Control -Costs

Seed Equipment Cost Section
John Deere Planter

GS2 2600 Console	$5,200.00	1
Swath-Control Pro	$2,500.00	1
GS2 Rate Controller	$1,195.00	1
Tru-count (ea)	$354.16	24
Installation	$500.00	1
Extra stuff	$500.00	1
Total	**$18,394.84**	

Fertilizer Equipment Cost Section
Ag Leader Insight

Insight	$3,995.00	1
Direct Command	$2,700.00	1
Ball Valve Shutoff	$150.00	12
Installation	$500.00	1
Extra Stuff	$500.00	1
Total	**$9,495.00**	

Planter Section Control -Seed

Only considering seed input costs and Yield loss

width (ft)	Description of type of control system	planting cost ($/ac)	inv. Support ($/ac)	Acres	Total Potential Investment ($)	Total Cost ($)	Tot ACost w/o AT
40	*2 section manual control*	*$13.32*	*$10.94*	3000	**$32,820**		
40	2 section automatic control	$13.32	$13.39	3000	$7,350	$15,561.56	$10,361.56
40	4 section automatic control	$13.32	$18.86	3000	$23,760	$15,561.56	$10,361.56
40	8 section automatic control	$13.32	$21.60	3000	$31,980	$15,561.56	$10,361.56
40	16 section automatic control	$13.32	$22.97	3000	$36,090	$15,561.56	$10,361.56
60	*2 section manual control*	*$13.66*	*$16.41*	3000	**$49,230**		
60	2 section automatic control	$13.66	$18.86	3000	$7,350	$18,394.84	$13,194.84
60	4 section automatic control	$13.66	$27.07	3000	$31,980	$18,394.84	$13,194.84
60	6 section automatic control	$13.66	$29.81	3000	$40,200	$18,394.84	$13,194.84
60	8 section automatic control	$13.66	$31.17	3000	$44,280	$18,394.84	$13,194.84
60	12 section automatic control	$13.66	$32.54	3000	$48,390	$18,394.84	$13,194.84
60	24 section automatic control	$13.66	$33.91	3000	$52,500	$18,394.84	$13,194.84

Where Tot ACost = the total cost *minus* those components that would be required on the planter even in the absence of section shut-off equipment.

Planter Section Control -Fertilizer

Only considering Fertilizer input costs

width (ft)	Description of type of control system	planting cost ($/ac)	inv. Support ($/ac)	Acres	Total Potential Investment ($)	Total Cost ($)	Tot ACost w/o AT
40	*2 section manual control*	*$13.27*	$4.57	3000	**$13,710**		
40	2 section automatic control	$13.27	$5.59	3000	$3,060	$8,295.00	$4,300.00
40	4 section automatic control	$13.27	$7.87	3000	$9,900	$8,595.00	$4,600.00
40	8 section automatic control	$13.27	$9.01	3000	$13,320	$9,495.00	$5,500.00
40	16 section automatic control	$13.27	$9.58	3000	$15,030	$10,395.00	$6,400.00
60	*2 section manual control*	*$13.61*	$6.85	3000	**$20,550**		
60	2 section automatic control	$13.61	$7.87	3000	$3,060	$8,295.00	$4,300.00
60	4 section automatic control	$13.61	$11.30	3000	$13,350	$8,595.00	$4,600.00
60	6 section automatic control	$13.61	$12.44	3000	$16,770	$8,895.00	$4,900.00
60	8 section automatic control	$13.61	$13.01	3000	$18,480	$9,195.00	$5,200.00
60	12 section automatic control	$13.61	$13.58	3000	$20,190	$9,795.00	$5,800.00
60	24 section automatic control	$13.61	$14.15	3000	$21,900	$11,895.00	$7,900.00

Where Tot ACost = the total cost *minus* those components that would be required on the planter even in the absence of section shut-off equipment.

From the Evaluation

- There are BIG dollars at play!
- Manually controlling two-sections on a planter has huge per acre cost savings.

Annual value to manually control 2 planter sections

Planter	Ann. Sav. $/ac	Tot acres	Total Annual Value ($)
40' Planter	$2.74	3000	$8,220.00
60' Planter	$4.11	3000	$12,330.00

From the Evaluation

- In all configurations (except automatic control of only two sections) the investment in section shut-off technology clearly pays off for “our” fields under the assumptions laid out.
- It is quite clear that using section shut-off technologies becomes more significant as equipment size increases.
- In practice the “actual” investment dollars would be far larger for the 24-row planter as we would “expect” to put over 5000 acres on a planter that size as compared to the 3000 acres used in our example.

Can we do it? -Seed

- The Planter section control on the seed side is straight forward and very feasible today on up to 12 sections (row-pairs on a 24-row planter) with the limitation to going further being on the software side.
- As air clutches must be installed on all rows, regardless of actual section control size, then eventually full individual row shut-off will be realized; when the software guys get caught up with the farmers.

Can we do it? -Fertilizer

- The Fertilizer side is also limited to 12-sections due to software issues.
- The Fertilizer side poses some other issues that must be analyzed before a “section size” is determined. There are limitations on gpa/gpm requirements for both the pump and the nozzle side of things when one starts looking at section control.

Can we do it? -Fertilizer

- Consider the following example:
  - A 16-row planter is traveling at 5.5 mph and putting on 25 gpa of fertilizer which amounts to a total pumping requirement of 11.11 gpm which breaks down to 0.69 gpm per row.
  - Now we start shutting down sections until we have only 1 row left on. Essentially, we have created a situation where a 16-fold decrease in volume (11.11/0.69) must be realized in a few seconds. That would be like going from 160 gpa to 10 gpa in a “traditional” framework (whole toolbar). WOW!
  - It will be quite feasible to see pumps spinning at their lowest possible RPM while maintaining their highest pressures because pumps become “over-sized” as sections are shut down. More spreadsheet analysis will be necessary!


Questions, Comments, Suggestions.