

Economics of GPS Guidance

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Agricultural Technology Field Day

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General Issues

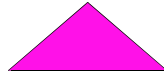
- **Overlap**
 - Extra machine operation (cost)
 - May affect applied input usage (cost)
 - May affect crop yields (revenue)
- **Cost**
 - Custom rates for machine operation cost
 - Amortize investment over time
 - Scale: number of acres per year
- **Field size and shape: headlands**
 - Portion of field
 - Machine slow down
 - Doubling up of applied inputs

Situations are unique – hard to make rules of thumb across farms

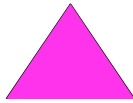
Various field shapes of interest (farm left to right)



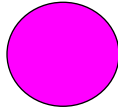
Square; hit ends at 90 degree angles
5,280 feet of headlands in 160 acre field



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

Kastens fields likely average hitting headlands at around 43 degrees

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				stylized fields (farm N-S)>>>					
Field shape and headland economics									
				Kastens typical	equal sized square	equal sized isos R trian	equal sized equil triang	equal sized circle	
Acres in field				75	75	75	75	75	
Width of machine in feet				90	90	90	90	90	
Average swath overlap in percent of machine width (foam or marker)				8%	8%	8%	8%	8%	
Effective width of equipment in feet allowing for overlap				82.8	82.8	82.8	82.8	82.8	
Implied running distance of headlands to cover in feet				5250	3615	5112	5494	6407	
Running feet of headland per acre				70	48	68	73	85	
Number of swaths (passes) needed to cover headlands				1	1	1	1	1	
Turnaround speed this percent of field speed				75%	75%	75%	75%	75%	
Acres in headlands				10.85	7.47	10.56	11.35	13.24	
Excess acres covered due to machine overlap (in-field, not headlands)				6.52	6.52	6.52	6.52	6.52	
Machine operations: covered acres/actual acres (incl. overlap&headlands)				1.2316	1.1865	1.2278	1.2383	1.2635	
"Acres of headlands" equivalent with speed adjustment				14.46	9.96	14.08	15.13	17.65	
Machine operations: covered acres/actual acres with speed adjustment				1.2798	1.2197	1.2747	1.2887	1.3223	
Cost of machine operation at various overlaps, \$/acre				8%	\$4.72	\$4.50	\$4.70	\$4.75	\$4.88
Put custom rate at appropriate benchmark				6%	\$4.64	\$4.41	\$4.62	\$4.67	\$4.79
Includes turnaround slow down in analysis				4%	\$4.55	\$4.33	\$4.54	\$4.59	\$4.71
				2%	\$4.48	\$4.25	\$4.46	\$4.51	\$4.63
				0%	\$4.40	\$4.18	\$4.38	\$4.43	\$4.56
\$/acre advantage going from 8% to 4% overlap (A)					\$0.1671	\$0.1671	\$0.1671	\$0.1671	\$0.1671
\$/acre advantage going from 4% to 0% overlap (B)					\$0.1537	\$0.1537	\$0.1537	\$0.1537	\$0.1537
	interest rate	no years							
Investment supported, \$/acre	8.00%	10	A		\$1.12	\$1.12	\$1.12	\$1.12	\$1.12
Investment supported, \$/acre	8.00%	10	B		\$1.03	\$1.03	\$1.03	\$1.03	\$1.03

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amortization factors				
years	interest rates>			
	6.00%	7.00%	8.00%	9.00%
1	1.0600	1.0700	1.0800	1.0900
2	0.5454	0.5531	0.5608	0.5685
3	0.3741	0.3811	0.3880	0.3951
4	0.2886	0.2952	0.3019	0.3087
5	0.2374	0.2439	0.2505	0.2571
6	0.2034	0.2098	0.2163	0.2229
7	0.1791	0.1856	0.1921	0.1987
8	0.1610	0.1675	0.1740	0.1807
9	0.1470	0.1535	0.1601	0.1668
10	0.1359	0.1424	0.1490	0.1558

payment factor>	int/[1-(1+int)^(-N)]			
interest rate>	8.00%			
number of years>	10			
investment>	\$13,000			
annual payment>	\$1,937.38			
acres used on annually>	15000			
annual cost per acre>	\$0.1292			

At 12,600 acres would be an annual cost of \$0.154. Kastens farm uses 3.11 applications for each acre of crop (WCF rotation); so would breakeven at around 4,000 acres of crops annually (on basis of only machinery operations savings)

Field shape and headland economics		stylized fields (farm N-S)>>>				
		Kastens typical	equal sized square	equal sized isos R trian	equal sized equil triang	equal sized circle
Acres in field		75	75	75	75	75
Width of machine in feet		90	90	90	90	90
Average swath overlap in percent of machine width (foam or marker)		8%	8%	8%	8%	8%
Effective width of equipment in feet allowing for overlap		82.8	82.8	82.8	82.8	82.8
Implied running distance of headlands to cover in feet		5250	3615	5112	5494	6407
Running feet of headland per acre		70	48	68	73	85
Number of swaths (passes) needed to cover headlands		1	1	1	1	1
Turnaround speed this percent of field speed		75%	75%	75%	75%	75%
Acres in headlands		10.85	7.47	10.56	11.35	13.24
Excess acres covered due to machine overlap (in-field, not headlands)		6.52	6.52	6.52	6.52	6.52
Machine operations: covered acres/actual acres (incl. overlap&headlands)		1.2316	1.1865	1.2278	1.2383	1.2635
Acres of headlands equivalent with speed adjustment		14.46	9.96	14.08	15.13	17.65
Machine operations: covered acres/actual acres with speed adjustment		1.2798	1.2197	1.2747	1.2887	1.3223
Cost of machine operation at various overlaps, \$/acre	8%	\$4.72	\$4.50	\$4.70	\$4.75	\$4.88
Put custom rate at appropriate benchmark	6%	\$4.64	\$4.41	\$4.62	\$4.67	\$4.79
Includes turnaround slow down n in analysis	4%	\$4.55	\$4.33	\$4.54	\$4.59	\$4.71
	2%	\$4.48	\$4.25	\$4.46	\$4.51	\$4.63
	0%	\$4.40	\$4.18	\$4.38	\$4.43	\$4.56
\$/acre advantage going from 8% to 4% overlap (A)		\$0.1671	\$0.1671	\$0.1671	\$0.1671	\$0.1671
\$/acre advantage going from 4% to 0% overlap (B)		\$0.1537	\$0.1537	\$0.1537	\$0.1537	\$0.1537
Investment supported, \$/acre	interest rate	no years				
	8.00%	10	A	\$1.12	\$1.12	\$1.12
	8.00%	10	B	\$1.03	\$1.03	\$1.03
Cost of input (fertilizer, herbicide, etc.) per acre		\$7.75	\$7.75	\$7.75	\$7.75	\$7.75
Guidance benefit if consider in-field (not headland) overlap as affecting input usage						
\$/acre advantage going from 8% to 4% overlap (A)		\$0.3510	\$0.3510	\$0.3510	\$0.3510	\$0.3510
\$/acre advantage going from 4% to 0% overlap (B)		\$0.3229	\$0.3229	\$0.3229	\$0.3229	\$0.3229
Investment supported, \$/acre	interest rate	no years				
	8.00%	10	A	\$2.36	\$2.36	\$2.36
	8.00%	10	B	\$2.17	\$2.17	\$2.17

Benefits of reduced overlap in terms of herbicide savings. Now, autosteer will pay off in about 2 years if 15K acres/year

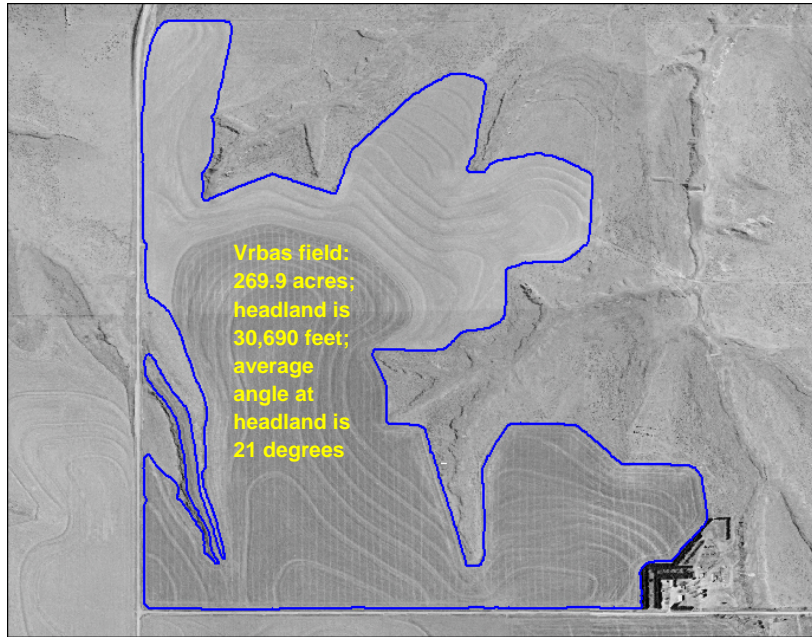
stylized fields (farm N-S)>>>

Field shape and headland economics		Kastens typical	equal sized square	equal sized isos R trian	equal sized equil trian	equal sized circle
Acres in field		75	75	75	75	75
Width of machine in feet		90	90	90	90	90
Average swath overlap in percent of machine width (foam or marker)		8%	8%	8%	8%	8%
Effective width of equipment in feet allowing for overlap		82.8	82.8	82.8	82.8	82.8
Implied running distance of headlands to cover in feet		5250	3615	5112	5494	6407
Running feet of headland per acre		70	48	68	73	85
Number of swaths (passes) needed to cover headlands		1	1	1	1	1
Turnaround speed this percent of field speed		75%	75%	75%	75%	75%
Acres in headlands		10.85	7.47	10.56	11.35	13.24
Excess acres covered due to machine overlap (in-field, not headlands)		6.52	6.52	6.52	6.52	6.52
Machine operations: covered acres/actual acres (incl. overlap&headlands)		1.2316	1.1865	1.2278	1.2383	1.2635
"Acres of headlands" equivalent w ith speed adjustment		14.46	9.96	14.08	15.13	17.65
Machine operations: covered acres/actual acres w ith speed adjustment		1.2798	1.2197	1.2747	1.2887	1.3223
Cost of machine operation at various overlaps, \$/acre		8% \$4.72	\$4.50	\$4.70	\$4.75	\$4.88
Put custom rate at appropriate benchmark		6% \$4.64	\$4.41	\$4.62	\$4.67	\$4.79
Includes turnaround slow down in analysis		4% \$4.55	\$4.33	\$4.54	\$4.59	\$4.71
		2% \$4.48	\$4.25	\$4.46	\$4.51	\$4.63
		0% \$4.40	\$4.18	\$4.38	\$4.43	\$4.56
\$/acre advantage going from 8% to 4% overlap (A)		\$0.1671	\$0.1671	\$0.1671	\$0.1671	\$0.1671
\$/acre advantage going from 4% to 0% overlap (B)		\$0.1537	\$0.1537	\$0.1537	\$0.1537	\$0.1537
Investment supported, \$/acre	interest rate no years					
	8.00% 10 A	\$1.12	\$1.12	\$1.12	\$1.12	\$1.12
	8.00% 10 B	\$1.03	\$1.03	\$1.03	\$1.03	\$1.03
If want to consider impact on applied inputs						
Cost of input (fertilizer, herbicide, etc.) per acre		\$7.75	\$7.75	\$7.75	\$7.75	\$7.75
Boom/nozzle shutoff on headlands analysis (affects applied input amounts):						
Normal turnaround application rate as % of field rate (manual shutoff)		36%	17%	36%	30%	38%
Considered turnaround application rate as % of field rate (auto shutoff)		9%	6%	9%	8%	10%
Reduction in overall acres sprayed due to boom shutoff		3.89%	1.11%	3.73%	3.33%	4.92%
Input savings on headlands assigned to whole field, \$/acre		\$0.30	\$0.09	\$0.29	\$0.26	\$0.38
Investment supported, \$/acre	8.00% 10	\$2.02	\$0.58	\$1.94	\$1.73	\$2.56

**Auto-boom
shutoff:
\$10,000
investment
will pay off
in just over
2 years on
15,000
acres of
fields like
the typical
Kastens
field**



Much less efficient than squares, triangles, circles, or typical Kastens field



Extremely inefficient field

Field shape and headland economics		stylized fields (farm N-S)>>>					Ranch field	Vrbas field	
		Kastens typical	equal sized square	equal sized isos R trian	equal sized equi triang	equal sized circle			
Acres in field		75	75	75	75	75	167.4	269.9	
Width of machine in feet		90	90	90	90	90	90	90	
Average swath overlap in percent of machine width (foam or marker)		8%	8%	8%	8%	8%	8%	8%	
Effective width of equipment in feet allowing for overlap		82.8	82.8	82.8	82.8	82.8	82.8	82.8	
Implied running distance of headlands to cover in feet		5250	3615	5112	5494	6407	16700	30690	
Running feet of headland per acre		70	48	68	73	85	100	114	
Number of swaths (passes) needed to cover headlands		1	1	1	1	1	1	1	
Turnaround speed this percent of field speed		75%	75%	75%	75%	75%	75%	75%	
Acres in headlands		10.85	7.47	10.56	11.35	13.24	34.50	63.41	
Excess acres covered due to machine overlap (in-field, not headlands)		6.52	6.52	6.52	6.52	6.52	14.56	23.47	
Machine operations: covered acres/actual acres (incl. overlap&headlands)		1.2316	1.1865	1.2278	1.2383	1.2635	1.2931	1.3219	
Acres of headlands equivalent with speed adjustment		14.46	9.96	14.08	15.13	17.65	46.01	84.55	
Machine operations: covered acres/actual acres with speed adjustment		1.2798	1.2197	1.2747	1.2887	1.3223	1.3618	1.4002	
Cost of machine operation at various overlaps, \$/acre		8%	\$4.72	\$4.50	\$4.70	\$4.75	\$4.88	\$5.02	\$5.17
Put custom rate at appropriate benchmark		6%	\$4.64	\$4.41	\$4.62	\$4.67	\$4.79	\$4.94	\$5.08
Includes turnaround slow down in analysis		4%	\$4.55	\$4.33	\$4.54	\$4.59	\$4.71	\$4.86	\$5.00
		2%	\$4.48	\$4.25	\$4.46	\$4.51	\$4.63	\$4.78	\$4.92
		0%	\$4.40	\$4.18	\$4.38	\$4.43	\$4.56	\$4.70	\$4.84
\$/acre advantage going from 8% to 4% overlap (A)			\$0.1671	\$0.1671	\$0.1671	\$0.1671	\$0.1671	\$0.1671	\$0.1671
\$/acre advantage going from 4% to 0% overlap (B)			\$0.1537	\$0.1537	\$0.1537	\$0.1537	\$0.1537	\$0.1537	\$0.1537
Investment supported, \$/acre	interest rate	no years							
	8.00%	10	A	\$1.12	\$1.12	\$1.12	\$1.12	\$1.12	\$1.12
	8.00%	10	B	\$1.03	\$1.03	\$1.03	\$1.03	\$1.03	\$1.03

GPS guidance not more beneficial on weird fields on the basis of only machinery operation costs – but big difference in farming efficiency (but is it the technology associated with PA that allows such calculations?)

Field shape and headland economics		stylized fields (farm N-S)>>>					Ranch field	Vrbas field
		Kastens typical	equal sized square	equal sized isos R trian	equal sized equil triang	equal sized circle		
Acres in field		75	75	75	75	75	167.4	269.9
Width of machine in feet		90	90	90	90	90	90	90
Average swath overlap in percent of machine width (foam or marker)		8%	8%	8%	8%	8%	8%	8%
Effective width of equipment in feet allowing for overlap		82.8	82.8	82.8	82.8	82.8	82.8	82.8
Implied running distance of headlands to cover in feet		5250	3615	5112	5494	6407	16700	30690
Running feet of headland per acre		70	48	68	73	85	100	114
Number of swaths (passes) needed to cover headlands		1	1	1	1	1	1	1
Turnaround speed this percent of field speed		75%	75%	75%	75%	75%	75%	75%
Acres in headlands		10.85	7.47	10.56	11.35	13.24	34.50	63.41
Excess acres covered due to machine overlap (in-field, not headlands)		6.52	6.52	6.52	6.52	6.52	14.56	23.47
Machine operations: covered acres/actual acres (incl. overlap&headlands)		1.2316	1.1865	1.2278	1.2383	1.2635	1.2931	1.3219
"Acres of headlands" equivalent with speed adjustment		14.46	9.96	14.08	15.13	17.65	46.01	84.55
Machine operations: covered acres/actual acres with speed adjustment overlap		1.2798	1.2197	1.2747	1.2887	1.3223	1.3618	1.4002
Cost of machine operation at various overlaps, \$/acre	8%	\$4.72	\$4.50	\$4.70	\$4.75	\$4.88	\$5.02	\$5.17
Put custom rate at appropriate benchmark	6%	\$4.64	\$4.41	\$4.62	\$4.67	\$4.79	\$4.94	\$5.08
Includes turnaround slow down in analysis	4%	\$4.55	\$4.33	\$4.54	\$4.59	\$4.71	\$4.86	\$5.00
	2%	\$4.48	\$4.25	\$4.46	\$4.51	\$4.63	\$4.78	\$4.92
	0%	\$4.40	\$4.18	\$4.38	\$4.43	\$4.56	\$4.70	\$4.84
\$/acre advantage going from 8% to 4% overlap (A)		\$0.1671	\$0.1671	\$0.1671	\$0.1671	\$0.1671	\$0.1671	\$0.1671
\$/acre advantage going from 4% to 0% overlap (B)		\$0.1537	\$0.1537	\$0.1537	\$0.1537	\$0.1537	\$0.1537	\$0.1537
Investment supported, \$/acre	8.00% 10 A	\$1.12	\$1.12	\$1.12	\$1.12	\$1.12	\$1.12	\$1.12
Investment supported, \$/acre	8.00% 10 B	\$1.03	\$1.03	\$1.03	\$1.03	\$1.03	\$1.03	\$1.03
If want to consider impact on applied inputs								
Cost of input (fertilizer, herbicide, etc.) per acre		\$7.75	\$7.75	\$7.75	\$7.75	\$7.75	\$7.75	\$7.75
Boom/nozzle shutoff on headlands analysis (affects applied input amounts):								
Normal turnaround application rate as % of field rate (manual shutoff)		36%	17%	36%	30%	38%	41%	42%
Considered turnaround application rate as % of field rate (auto shutoff)		9%	6%	9%	8%	10%	10%	11%
Reduction in overall acres sprayed due to boom shutoff		3.89%	1.11%	3.73%	3.33%	4.92%	6.24%	7.38%
Input savings on headlands assigned to whole field, \$/acre		\$0.30	\$0.09	\$0.29	\$0.26	\$0.38	\$0.48	\$0.57
Investment supported, \$/acre	8.00% 10	\$2.02	\$0.58	\$1.94	\$1.73	\$2.56	\$3.24	\$3.84

But boom shutoff really pays on weird fields

Field shape and headland economics		stylized fields (farm N-S)>>>					Ranch field	Vrbas field
		Kastens typical	equal sized square	equal sized isos R trian	equal sized equil triang	equal sized circle		
Acres in field		75	75	75	75	75	167.4	269.9
Width of machine in feet		40	40	40	40	40	40	40
Average swath overlap in percent of machine width (foam or marker)		8%	8%	8%	8%	8%	8%	8%
Effective width of equipment in feet allowing for overlap		36.8	36.8	36.8	36.8	36.8	36.8	36.8
Implied running distance of headlands to cover in feet		5250	3615	5112	5494	6407	16700	30690
Running feet of headland per acre		70	48	68	73	85	100	114
Number of swaths (passes) needed to cover headlands		2	2	2	2	2	2	2
Turnaround speed this percent of field speed		75%	75%	75%	75%	75%	75%	75%
Acres in headlands		9.26	6.37	9.01	9.69	11.30	29.44	54.11
Excess acres covered due to machine overlap (in-field, not headlands)		6.52	6.52	6.52	6.52	6.52	14.56	23.47
Machine operations: covered acres/actual acres (incl. overlap&headlands)		1.2104	1.1719	1.2071	1.2161	1.2376	1.2628	1.2874
"Acres of headlands" equivalent with speed adjustment		12.34	8.50	12.02	12.91	15.06	39.26	72.15
Machine operations: covered acres/actual acres with speed adjustment overlap		1.2515	1.2003	1.2472	1.2591	1.2878	1.3215	1.3543
Cost of machine operation at various overlaps, \$/acre	8%	\$7.56	\$7.25	\$7.53	\$7.61	\$7.78	\$7.98	\$8.18
Put custom rate at appropriate benchmark	6%	\$7.42	\$7.11	\$7.39	\$7.47	\$7.64	\$7.84	\$8.04
Includes turnaround slow down in analysis	4%	\$7.29	\$6.98	\$7.26	\$7.33	\$7.51	\$7.71	\$7.91
	2%	\$7.16	\$6.85	\$7.13	\$7.20	\$7.38	\$7.58	\$7.78
	0%	\$7.03	\$6.72	\$7.01	\$7.08	\$7.25	\$7.46	\$7.65
\$/acre advantage going from 8% to 4% overlap (A)		\$0.2736	\$0.2736	\$0.2736	\$0.2736	\$0.2736	\$0.2736	\$0.2736
\$/acre advantage going from 4% to 0% overlap (B)		\$0.2517	\$0.2517	\$0.2517	\$0.2517	\$0.2517	\$0.2517	\$0.2517
Investment supported, \$/acre	8.00% 10 A	\$1.84	\$1.84	\$1.84	\$1.84	\$1.84	\$1.84	\$1.84
Investment supported, \$/acre	8.00% 10 B	\$1.69	\$1.69	\$1.69	\$1.69	\$1.69	\$1.69	\$1.69
If want to consider impact on applied inputs								
Cost of input (fertilizer, herbicide, etc.) per acre		\$35.00	\$35.00	\$35.00	\$35.00	\$35.00	\$35.00	\$35.00
Guidance benefit if consider in-field (not headland) overlap as affecting input usage								
\$/acre advantage going from 8% to 4% overlap (A)		\$1.5851	\$1.5851	\$1.5851	\$1.5851	\$1.5851	\$1.5851	\$1.5851
\$/acre advantage going from 4% to 0% overlap (B)		\$1.4583	\$1.4583	\$1.4583	\$1.4583	\$1.4583	\$1.4583	\$1.4583
Investment supported, \$/acre	8.00% 10 A	\$10.64	\$10.64	\$10.64	\$10.64	\$10.64	\$10.64	\$10.64
Investment supported, \$/acre	8.00% 10 B	\$9.79	\$9.79	\$9.79	\$9.79	\$9.79	\$9.79	\$9.79

Autosteer on tractor fertilizing with 40-foot DMI rig. On 2000 acres per year would payoff in 5 years if considered fertilizer savings

		stylized fields (farm N-S)>>>						
Field shape and headland economics		Kastens typical	equal sized square	equal sized isos R trian	equal sized equal trian	equal sized circle	Ranch field	Vrbas field
Acres in field		75	75	75	75	75	167.4	269.9
Width of machine in feet		40	40	40	40	40	40	40
Average swath overlap in percent of machine width (foam or marker)		8%	8%	8%	8%	8%	8%	8%
Effective width of equipment in feet allowing for overlap		36.8	36.8	36.8	36.8	36.8	36.8	36.8
Implied running distance of headlands to cover in feet		\$239	\$315	\$112	\$494	\$407	1670	3069
Running feet of headland per acre		70	48	68	73	85	100	114
Number of swaths (passes) needed to cover headlands		2	2	2	2	2	2	2
Turnaround speed this percent of field speed		75%	75%	75%	75%	75%	75%	75%
Acres in headlands		9.26	6.37	9.01	9.69	11.30	29.44	54.11
Excess acres covered due to machine overlap (in-field, not headlands)		6.52	6.52	6.52	6.52	6.52	14.56	23.47
Machine operations: covered acres/actual acres (incl. overlap&headlands)		1,2104	1,1719	1,2071	1,2161	1,2376	1,2628	1,2874
*Acres of headlands' equivalent with speed adjustment		12.34	8.50	12.02	12.91	15.06	39.26	72.15
Machine operations: covered acres/actual acres w/ith speed adjustment		1,2515	1,2003	1,2472	1,2591	1,2878	1,3215	1,3543
Cost of machine operation at various overlaps, \$/acre	8%	\$13.03	\$12.50	\$12.99	\$13.11	\$13.41	\$13.76	\$14.10
Put custom rate at appropriate benchmark	6%	\$12.79	\$12.26	\$12.75	\$12.87	\$13.17	\$13.52	\$13.86
Includes turnaround slow down in analysis	4%	\$12.56	\$12.03	\$12.52	\$12.64	\$12.94	\$13.29	\$13.63
	2%	\$12.34	\$11.81	\$12.30	\$12.42	\$12.72	\$13.07	\$13.41
	0%	\$12.13	\$11.59	\$12.08	\$12.21	\$12.51	\$12.86	\$13.20
\$/acre advantage going from 8% to 4% overlap (A)		\$0.4717	\$0.4717	\$0.4717	\$0.4717	\$0.4717	\$0.4717	\$0.4717
\$/acre advantage going from 4% to 0% overlap (B)		\$0.4339	\$0.4339	\$0.4339	\$0.4339	\$0.4339	\$0.4339	\$0.4339
interest rate	no years							
Investment supported, \$/acre	8.00%	10	A	\$3.16	\$3.16	\$3.16	\$3.16	\$3.16
Investment supported, \$/acre	8.00%	10	B	\$2.91	\$2.91	\$2.91	\$2.91	\$2.91
If want to consider impact on applied inputs								
Cost of input (fertilizer, herbicide, etc.) per acre		\$22.50	\$22.50	\$22.50	\$22.50	\$22.50	\$22.50	\$22.50
Guidance benefit if consider in-field (not headland) overlap as affecting input usage								
\$/acre advantage going from 8% to 4% overlap (A)		\$1.0190	\$1.0190	\$1.0190	\$1.0190	\$1.0190	\$1.0190	\$1.0190
\$/acre advantage going from 4% to 0% overlap (B)		\$0.9375	\$0.9375	\$0.9375	\$0.9375	\$0.9375	\$0.9375	\$0.9375
interest rate	no years							
Investment supported, \$/acre	8.00%	10	A	\$6.84	\$6.84	\$6.84	\$6.84	\$6.84
Investment supported, \$/acre	8.00%	10	B	\$6.29	\$6.29	\$6.29	\$6.29	\$6.29
Boom/nozzle shutoff on headlands analysis (affects applied input amounts):								
Normal turnaround application rate as % of field rate (manual shutoff)		9%	8%	9%	8%	10%	10%	11%
Considered turnaround application rate as % of field rate (auto shutoff)		0%	0%	0%	0%	0%	0%	0%
Reduction in overall acres sprayed due to boom shutoff		1.11%	0.71%	1.06%	0.97%	1.40%	1.76%	2.08%
Input savings on headlands assigned to whole field, \$/acre		\$0.25	\$0.16	\$0.24	\$0.22	\$0.31	\$0.40	\$0.47
Investment supported, \$/acre	8.00%	10		\$1.67	\$1.07	\$1.61	\$1.46	\$2.11

Corn planting analysis: might row shutoffs support a \$1-\$2/acre investment?

Additional thoughts

- **Guidance: how much to spend**
 - Farm size
 - Machinery operation only, or include inputs
 - Unmeasured benefits
 - Enhanced crop yields
 - reduced operator fatigue
- **Technology adoption helps one put a number to other management facets**
 - Was it GPS guidance that motivated or allowed us to assess the costs of field size & shape?
- **Do your homework if in doubt!**

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