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MANITOBA AGRONOMISTS CONFERENCE 2010

Crop profitability –
Where should we focus our management efforts?

Kevin C. Dhuyvetter, PhD
Extension Ag Economist
Kansas State University
Manhattan, KS 66506
785-532-3527 -- kcd@ksu.edu

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

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A Common Belief?

"… to make 10¢ more through higher production, you may have to spend 5¢ to 8¢. Marketing has little to no cost."

– Farmer, Top Producer, April/May 2003

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A Common Belief?

"Four key areas do affect profitability results. A fifth area is less important but can still add to your bottom line." … "The last area that separates those who make good returns from others is reducing input costs. It pales in comparison to the opportunity in 'chasing the top four rabbits,' however."

First four are marketing, equipment cost management, inventory management, and agronomic management.

– Farm mgmt consultant, SoybeanDigest.com, Nov 2002

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A Common Belief?

"Having a good marketer is better these days than having a good crop consultant. That is critical because the opportunities for a higher price are there. On average, if you took all the ways people could make money last year they could have made $3 a bushel for their corn."

– Ag lender, High Plains Journal, August 27, 2001

A Common Belief?

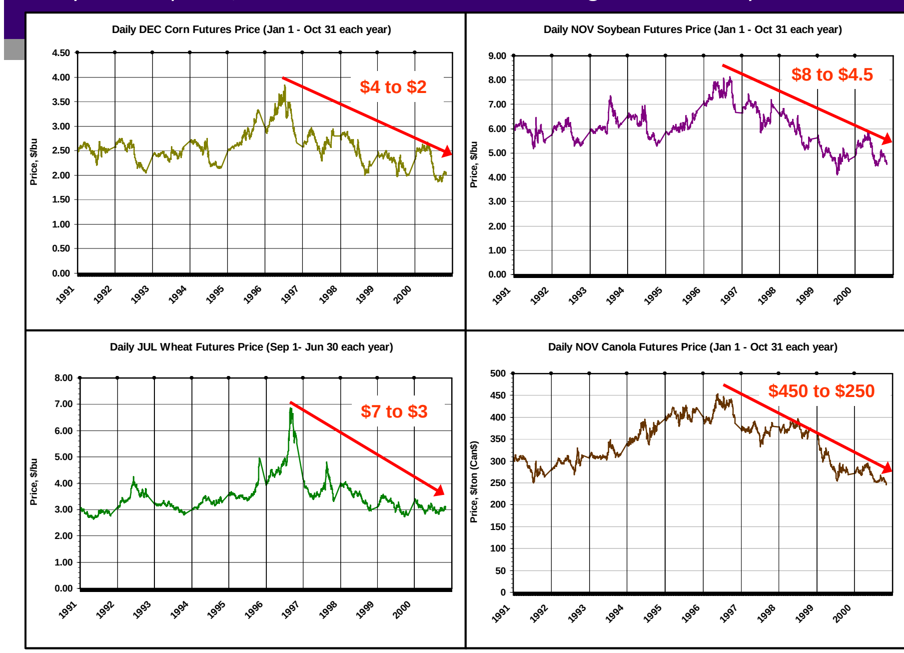
"Marketing is as important, or more important, than the (natural) gas price increase. Low crop prices, compounded by poor marketing in some cases, is hurting us. Most growers can raise their crops within five to 10 percent of the yield of anybody else in the county. However, too many of them take 30 percent less than their neighbors because they do not market their crop as well as they should."

– **Crop consultant, <u>Crop Decisions</u>, January 2001**

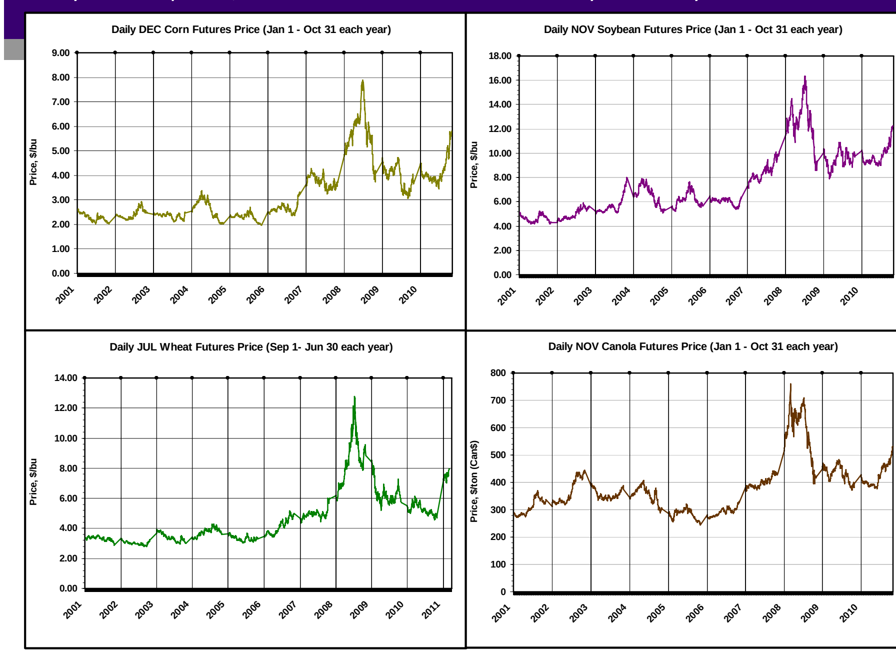
Grain marketing …

- **Seems like a "no-brainer" -- do a good job of marketing and you will be successful.**
- **Is this really what makes farms successful?**
- **What do the data suggest; i.e., is there evidence to support that being successful at marketing is that easy and that important?**

Daily futures prices, 1991-2000 – Market was trending down for 4-5 years…



Daily futures prices, 2001-2010 – Much more volatility in last 4 years!



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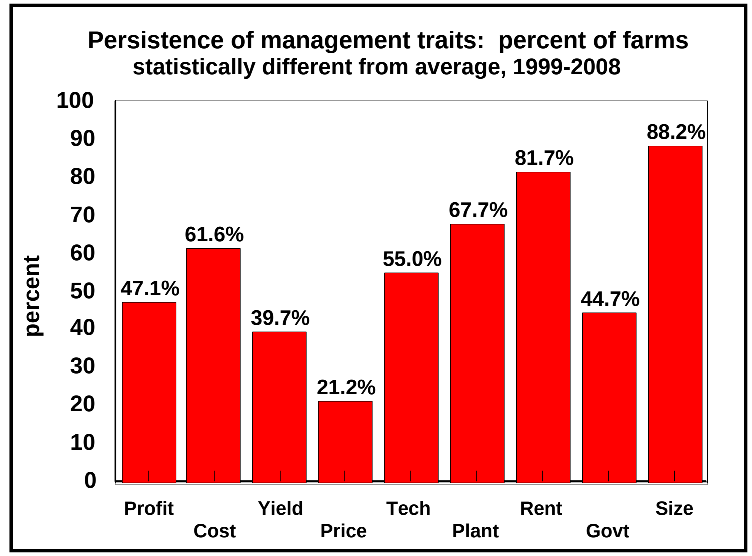
Persistence --

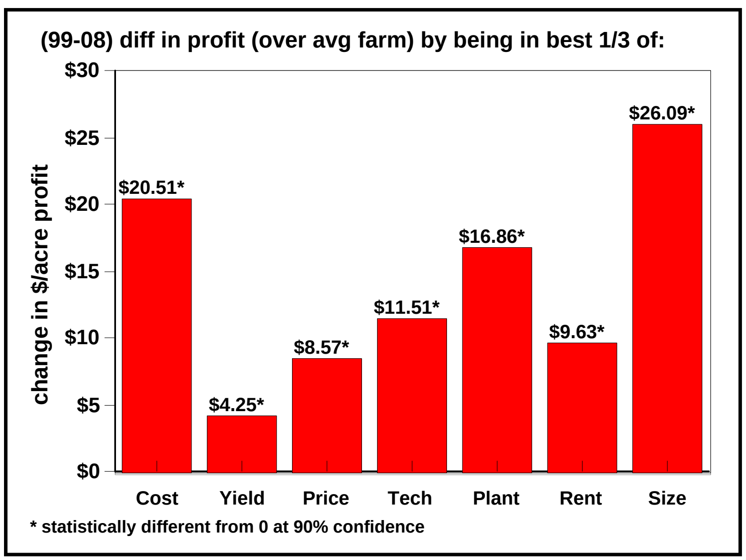
Something is said to be persistent if it is consistently different (better or worse) than average. Thus, the less persistent something is, the more random it is.

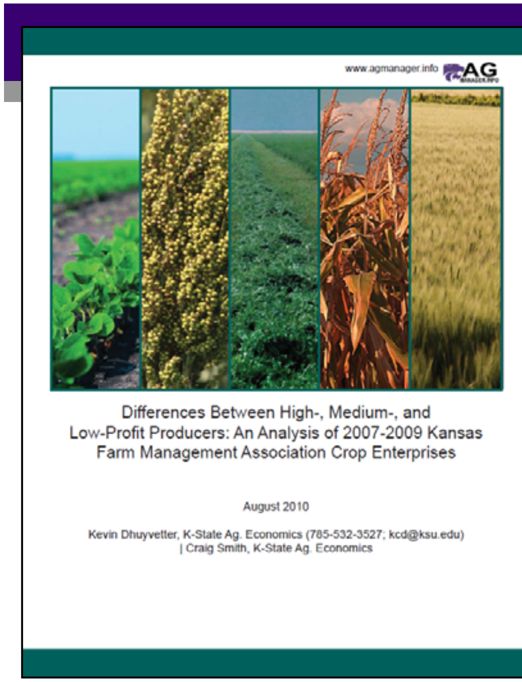
What does this mean in terms of where we should spend our management efforts?

Persistence of management traits…



Factors impacting profitability differences…





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

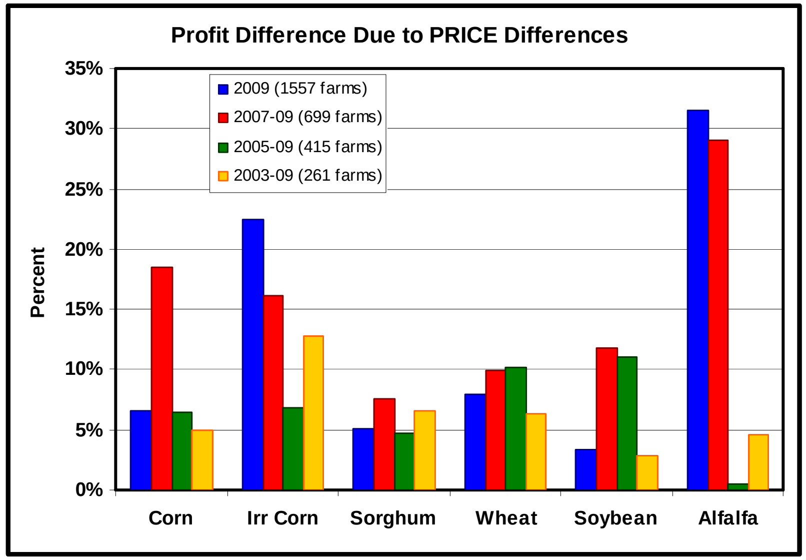
*** In this study, income plays a larger part in explaining profit differences than earlier analyses have found, which is attributed to the years analyzed (i.e., 2007-09).**

DIFFERENCE between the High 1/3 and Low 1/3 farms ranked on return to management
Kansas Farm Management Association Enterprise Analysis, State Averages 2007-09

	Corn	Irr Corn	Sorghum	Wheat	Soybean	Alfalfa
Number of farms	115	50	128	221	139	46
INCOME ($/acre)						
Yield per acre, bu	17.8	16.6	23.2	7.6	7.8	1.2
Price per unit	$0.25	$0.28	$0.12	$0.29	$0.40	$13.12
Crop income	$97.17	$51.95	$72.78	$45.16	$91.51	$167.91
Government payment	-0.04	-5.09	-1.64	1.10	-0.20	-1.61
Gross income	$97.64	$45.16	$68.63	$50.69	$94.12	$166.63
COSTS ($/acre)[1]						
Seed	-$3.83	-$27.93	-$2.53	-$2.14	-$2.30	$1.42
Fertilizer	-7.42	-26.14	-3.81	-15.32	-0.92	2.67
Herbicide-insecticide	-6.10	-17.85	-7.77	-3.42	-2.67	-3.10
Crop insurance	0.72	-15.37	0.24	0.04	0.64	-0.40
Machinery	-19.70	-22.91	-27.75	-30.52	-32.71	-17.79
Other	-5.41	-49.21	-8.76	-11.06	-10.23	-5.83
Land	3.11	-36.25	-3.49	-7.41	6.15	11.26
Interest	-4.46	-16.16	-4.11	-4.75	-5.02	-4.36
Total Cost	-$43.08	-$211.82	-$57.97	-$74.59	-$47.06	-$16.12
Net Return to Management	$140.72	$256.98	$126.60	$125.28	$141.18	$182.75
Enterprise acres	184	-99	201	606	150	-28
Operator percentage	4.2%	-7.3%	-0.6%	-1.6%	3.0%	6.5%
Yield effect	37.9%	19.9%	48.1%	34.3%	45.7%	49.3%
Price effect	18.5%	16.2%	7.5%	9.9%	11.8%	29.0%
Operator % effect	13.0%	-18.5%	-1.4%	-3.8%	9.1%	12.9%
Cost effect	30.6%	82.4%	45.8%	59.5%	33.3%	8.8%

[1] Based on the operator's share of production, and thus includes only production expenses paid by the operator.

Price effect decreases with additional years…

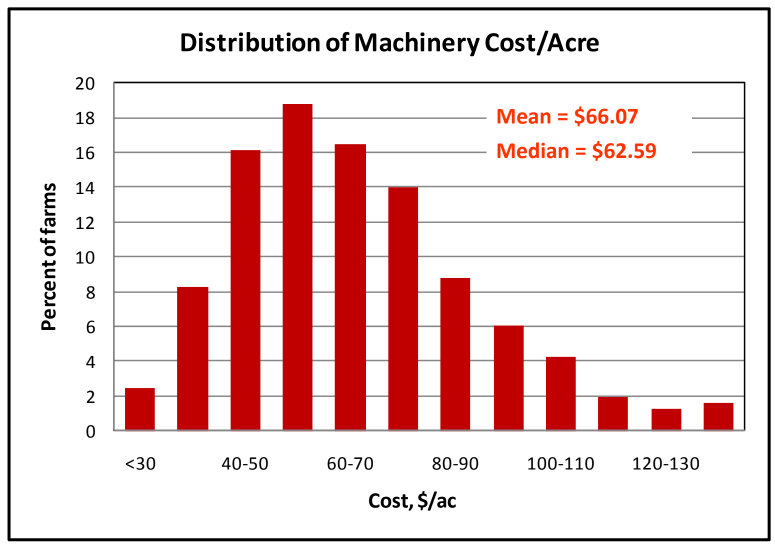


Key drivers of profitability differences among producers…

- Costs
- Technology adoption
- Farm size

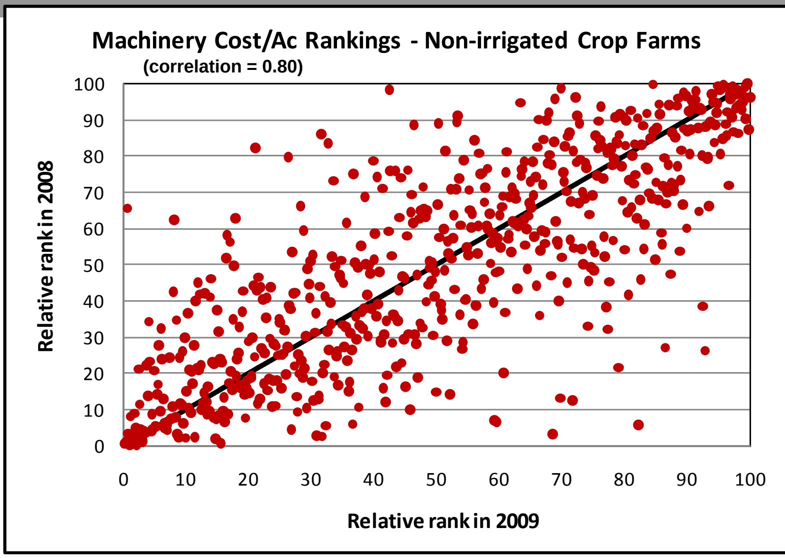
Machinery investment and costs are directly related to these three factors…

Variability in machinery cost 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)

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

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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)

See "Machinery Costs – The impact of field size, shape, and distance" (presentation at 2010 KSU Risk & Profit Conference available at www.agmanager.info/Faculty/dhuyvetter/presentations/)

Machinery decision-tools available…

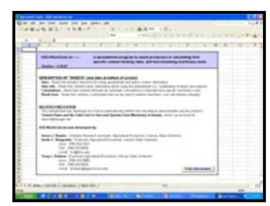
www.agmanager.info

OwnCombine.xls

KSU-GPSguidance.xls

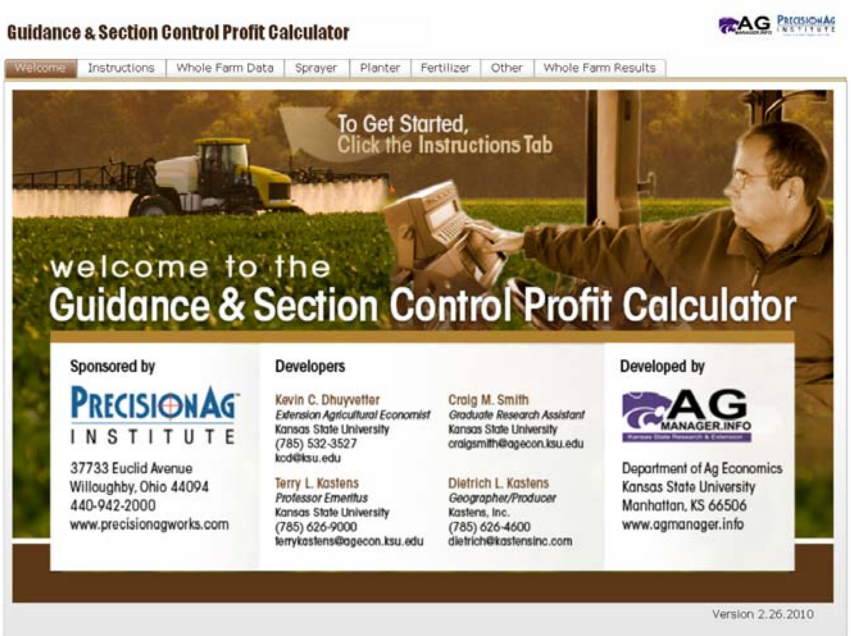
OwnBaler.xls

OwnSprayer.xls



KSU-MachCost.xls

OwnTractor.xls



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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

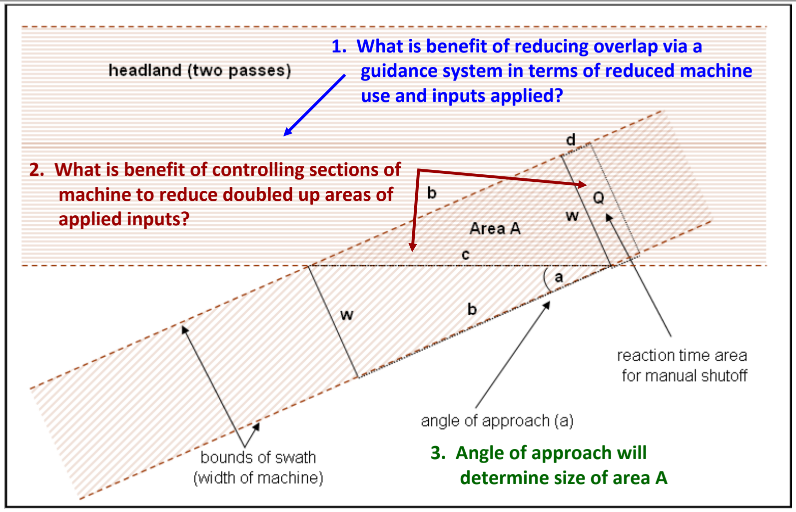
General machinery overlap issues

- **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

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.

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

Impact of Acres Covered on Economics of Guidance System[1]			
Annual acres	Investment supported[2]	Return on investment[2,3]	Payback years[3]
14,000	$32,744	54.3%	1.7
12,000	$28,066	43.0%	2.0
10,000	$23,389	31.2%	2.4
8,000	$18,711	18.7%	3.1
6,000	$14,033	5.1%	4.3
4,000	$9,355	-10.4%	7.2
2,000	$4,678	-30.2%	24.6

[1] Machine and input cost savings reducing overlap from 7.0% to 1.75%
[2] Based on four-year ammortization
[3] Given $15,000 investment

Impact of Acres Covered on Economics of Section Control[1]			
Annual acres	Investment supported[2]	Return on investment[2,3]	Payback years[3]
14,000	$52,554	154.9%	0.7
12,000	$45,046	131.2%	0.8
10,000	$37,539	107.2%	1.0
8,000	$30,031	82.5%	1.2
6,000	$22,523	56.7%	1.6
4,000	$15,015	28.9%	2.5
2,000	$7,508	-3.8%	5.7

[1] Automatic control of 5 boom sections, input cost savings (guidance exists)
[2] Based on four-year ammortization
[3] Given $10,000 investment

As with most all technologies, the returns to investing in guidance systems and section controls are 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]					
Annual	Average cost of input, $/application acre				
acres	$4.00	$8.00	$12.00	$16.00	$20.00
14,000	11.4%	33.9%	54.3%	73.5%	92.0%
12,000	4.5%	24.8%	43.0%	60.0%	76.3%
10,000	-2.9%	15.2%	31.2%	46.0%	60.1%
8,000	-10.9%	4.9%	18.7%	31.3%	43.3%
6,000	-19.9%	-6.5%	5.1%	15.5%	25.3%
4,000	-30.5%	-19.6%	-10.4%	-2.3%	5.3%
2,000	-44.6%	-36.7%	-30.2%	-24.5%	-19.4%

[1] Machine and input cost savings reducing overlap from 7.0% to 1.75%
Based on four-year ammortization
Given $15,000 investment

Impact of Acres Covered and Input Cost on Section Control ROI[1]					
Annual	Average cost of input, $/application acre				
acres	$4.00	$8.00	$12.00	$16.00	$20.00
14,000	38.5%	99.0%	154.9%	209.2%	262.9%
12,000	28.9%	82.5%	131.2%	178.3%	224.6%
10,000	18.8%	65.5%	107.2%	147.1%	186.1%
8,000	8.0%	47.8%	82.5%	115.3%	147.1%
6,000	-3.8%	28.9%	56.7%	82.5%	107.2%
4,000	-17.5%	8.0%	28.9%	47.8%	65.5%
2,000	-35.1%	-17.5%	-3.8%	8.0%	18.8%

[1] Automatic control of 5 boom sections, input cost savings (guidance exists)
Based on four-year ammortization
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).

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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%

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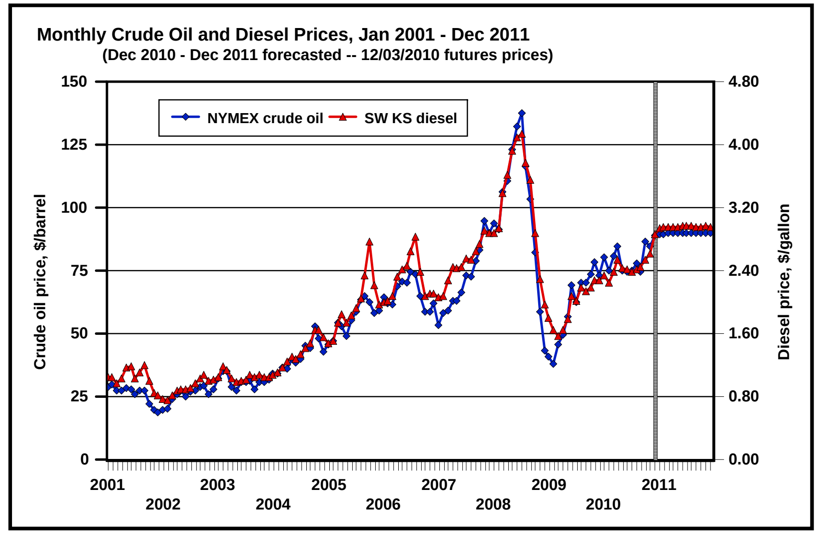

Historical relationship suggests that NYMEX crude oil futures market can be used to forecast diesel prices.

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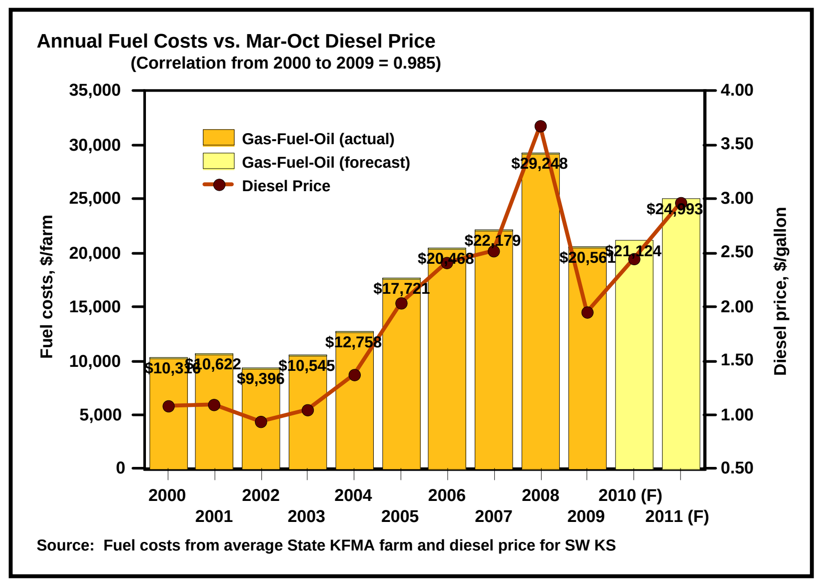
Historical and forecasted average Mar-Oct prices…

Crude Oil and Off-road Diesel Fuel Prices

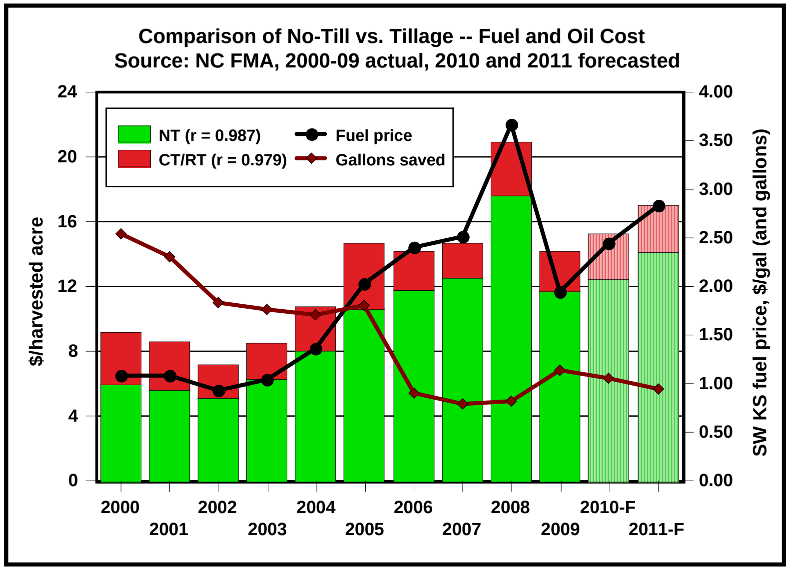
Year	Crude oil /1	Year-to-year change $/barrel	Year-to-year change percent	Diesel fuel /2	Year-to-year change $/gal	Year-to-year change percent
2006	$68.07	$10.09	17.4%	$2.41	$0.38	18.6%
2007	$70.09	$2.02	3.0%	$2.52	$0.11	4.4%
2008	$114.19	$44.10	62.9%	$3.68	$1.16	46.0%
2009	$62.49	($51.71)	-45.3%	$1.96	($1.72)	-46.8%
2010	$78.90	$16.41	26.3%	$2.45	$0.49	25.2%
2006-2010 avg /3	$78.75	$41.87	113.5%	$2.60	$1.30	100.5%
2011 (F)	$90.10	$11.19	14.2%	$2.97	$0.52	21.2%
2011 (F) - 2006-2010 avg		$11.35	14.4%		$0.37	14.0%

/1 Mar-Oct average of NYMEX futures
/2 Mar-Oct average for Southwest Kansas
/3 Year-to-year changes are calculated from the previous 5-year average (i.e., 2001-2005)
F = forecast based on 12/03/2010 futures prices

Impact of fuel prices on farm-level costs…

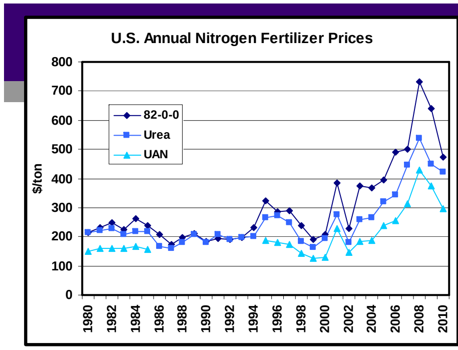


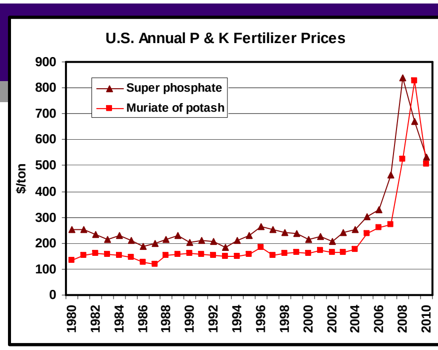
Impact of fuel prices on costs versus tillage method…

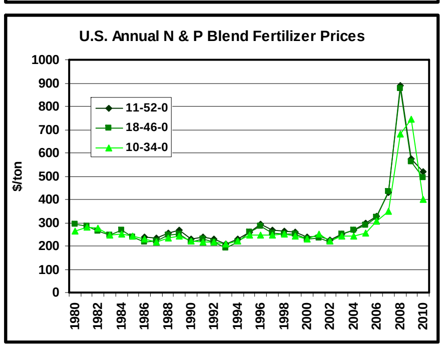


Fertilizer prices

(should you be cutting back on fertilizer rates?)





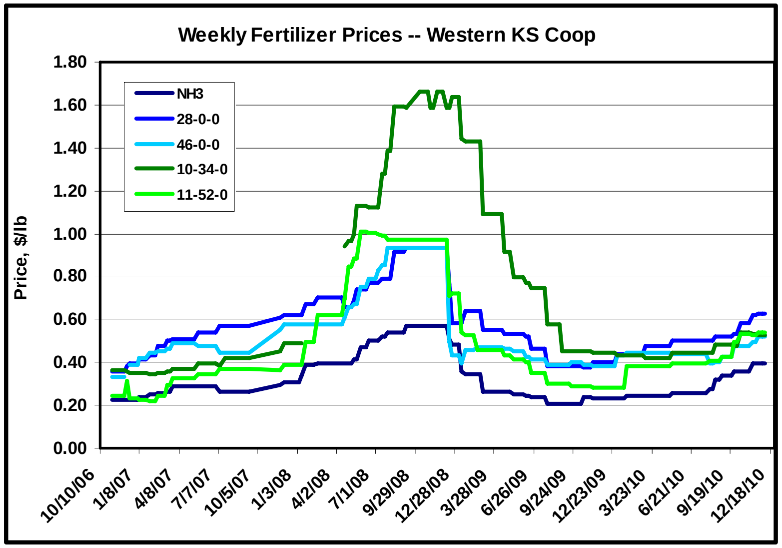


We went 20-25 years with relatively stable fertilizer prices in the U.S. It appears those days likely are over…

Situation…

- **Price volatility of crops and fertilizers have been at unprecedented levels in recent years (similar for irrigation pumping costs)**
- **Prices of all fertilizer nutrients increased (and then decreased) significantly in recent years, but the magnitude of changes varied considerably by nutrient and product**
- **Increased volatility has led to many questions from producers regarding recommended fertilizer rates (i.e., do optimal levels change?)**

Fertilizer prices are on the rise again…



Problem…

- **Many fertilizer recommendations for a specific nutrient do not explicitly account for prices of the crop or the nutrient**
- **Very few (any?) of the fertilizer recommendations for one nutrient (e.g., N) explicitly account for costs of other nutrients/inputs (e.g., P)**
- **Subjective understanding of the issue allows recommendations to be modified with regard to direction, but quantifying magnitude is difficult…**

Response to problem…

- **Started with KSU fertilizer recommendations for N and P (MF-2586) and developed production functions that could incorporate prices**
- **Key assumptions behind analysis**
  - **KSU recommendations are economic optimal at long run prices (1993-2002 – 10-yr avg prior to publication)**
    - **Wheat = $3.22/bu; Corn =$2.35/bu;**
    - **N = $0.2094/lb; P = $0.2445/lb**
  - **Recommended rates for one nutrient (e.g., N) assume other management factors are non-limiting (implies that yield responds independently to various inputs)**
  - **Expected P-response can be represented using a quadratic plateau (similar to N-response, which was tested)**

Initial efforts beginning in late 2005 (Kastens, Dhuyvetter, Schlegel, & Dumler) were based entirely on nitrogen

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A little background info

Soil Test Interpretations and Fertilizer Recommendations

K-STATE Kansas State University — Department of Agronomy — MF-2586 — Nutrient Management

KSU nitrogen recommendations … no prices

Corn and grain sorghum

N rec = (Yield Goal x 1.6) – (%SOM x 20) – Profile N – Manure N – Other N Adjustments + Previous Crop Adjustments

Wheat

Each lb/a of N equates to 0.42 bu/ac

N rec = (Yield Goal x 2.4) – (%SOM x 10) – Profile N – Manure N – Other N Adjustments + Previous Crop Adjustments + Tillage Adjustments + Grazing Adjustments

Sunflowers

N rec = (Yield Goal x 0.075) – (%SOM x 20) – Profile N – Manure N – Other N Adjustments + Previous Crop Adjustments

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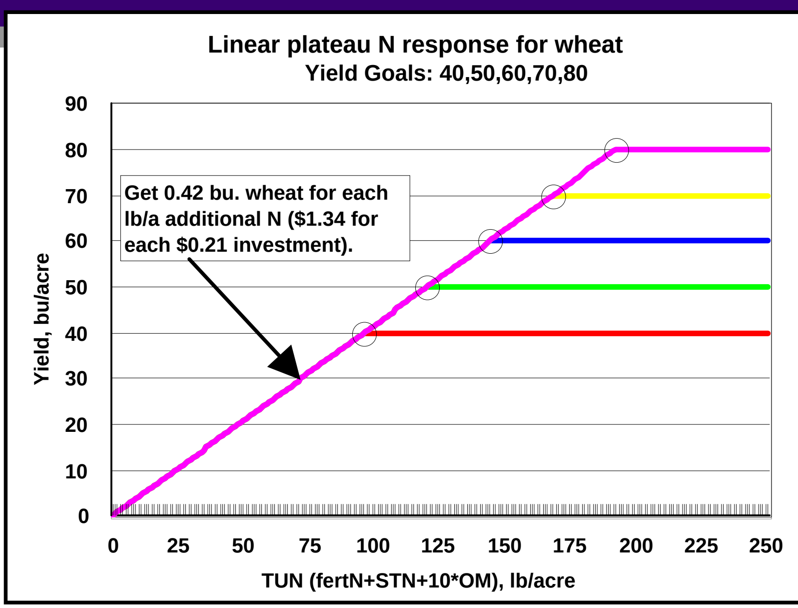
Nitrogen production function…

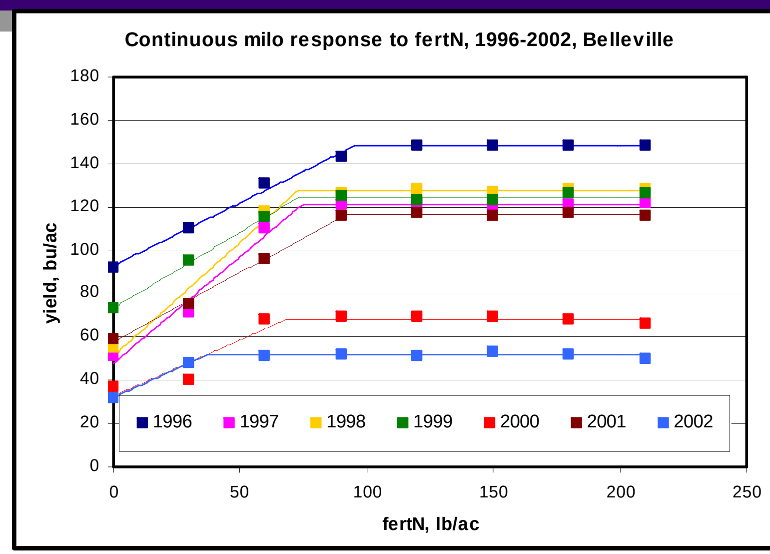
- In a limiting factor framework, it is generally believed that relationship between N and yield is linear for any given year and location (implies linear plateau production function)
- Linear plateau production function implies that optimal N will either be 0 or level where yield plateaus
- Average of multiple linear plateau production functions can be non-linear and this represents expectations of future N:yield relationship

Functions could and likely should have 0-intercept if response is to total N



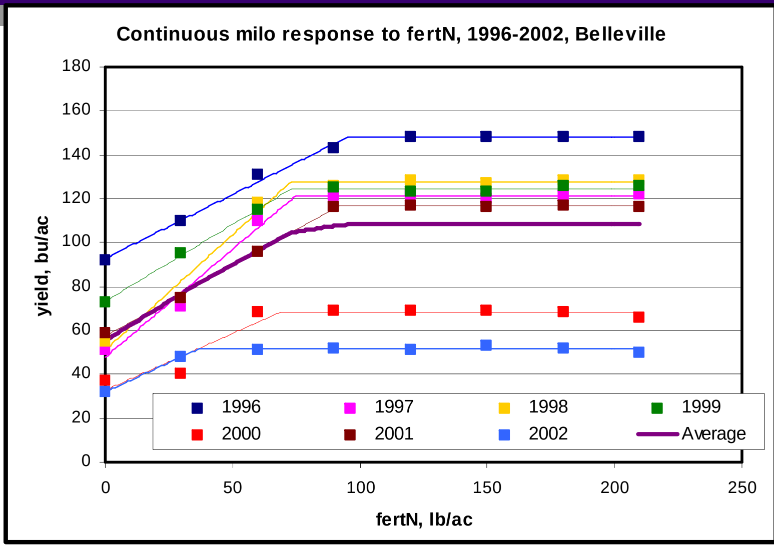
If wheat = $3.20/bu, N price won't matter until fertN = $1.34/lb, then optimal is 0 lb/acre

Yield response by year – linear plateau "fits" data quite well…

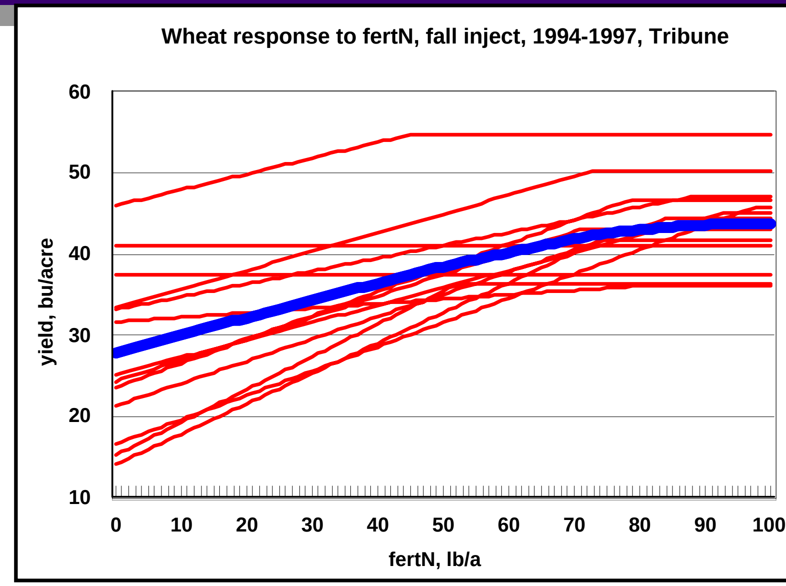


What would yield be for given fertN next year?

Average of linear plateaus can become non-linear…



Average of linear plateaus can become non-linear…



Blue line is NOT based on a mathematical function

Functional form…

- **Numerous functional forms could be used that would meet objectives. We considered:**
  - **Linear plateau, along with four different curvilinear forms**
- **Based on nitrogen fertilizer research studies from north central and western Kansas on wheat, corn, and milo, quadratic plateau model fit data better than alternatives most often**
- **Most non-linear models "look" very similar, but results (i.e., optimal N versus N price) do vary**

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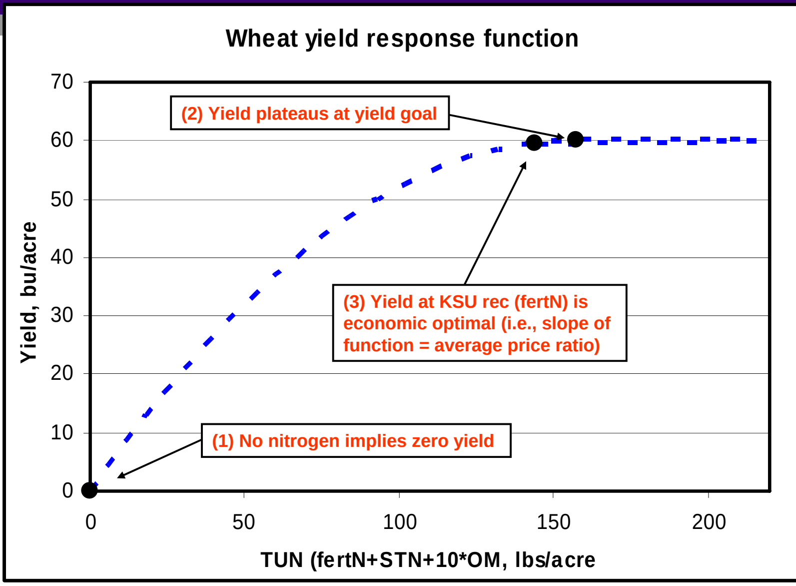
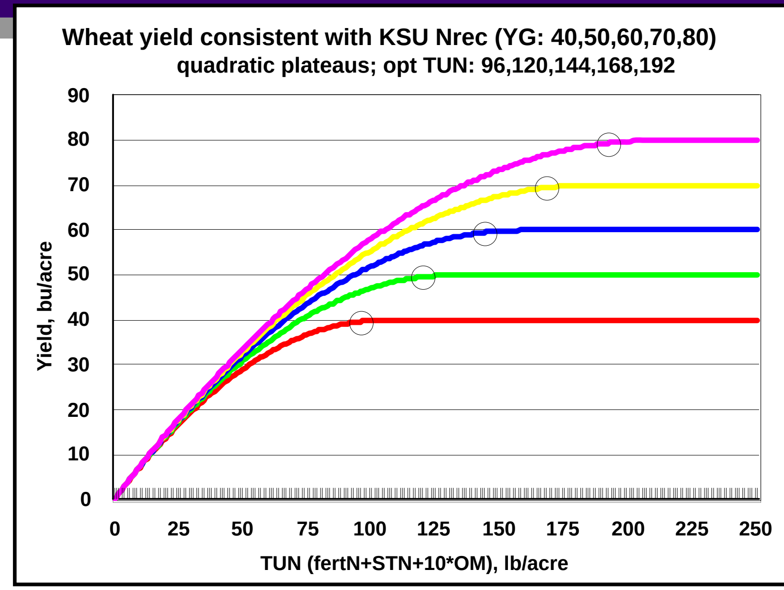
Nitrogen production function…

- **Nice property of non-linear production function is that it implies diminishing marginal returns and thus prices matter**
- **Assumed functional form is quadratic plateau which allows diminishing returns – consistent with linear plateau in any given year**
- **Estimate model parameters such that**
  - **KSU Nrec is economic optimum at historical average prices**
  - **Yield plateau is equal to yield goal**
  - **Intercept goes through origin (i.e., 0 N equates to 0 yield)**

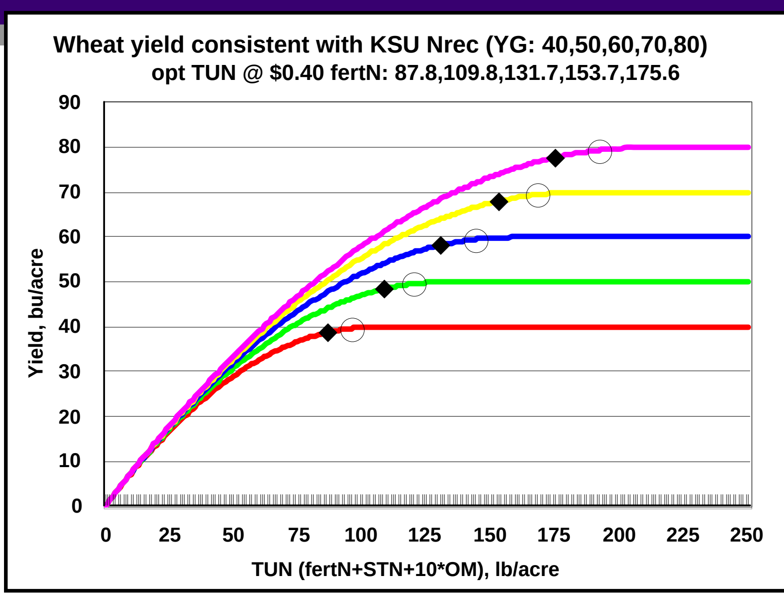
Defined points that allowed quadratic-plateau function to be defined…



Same optimal N (slope = 0.21/3.22) but yields about 1% lower than plateau



Slope at diamonds is 0.40/3.22



With more expensive N, you make more money by applying less

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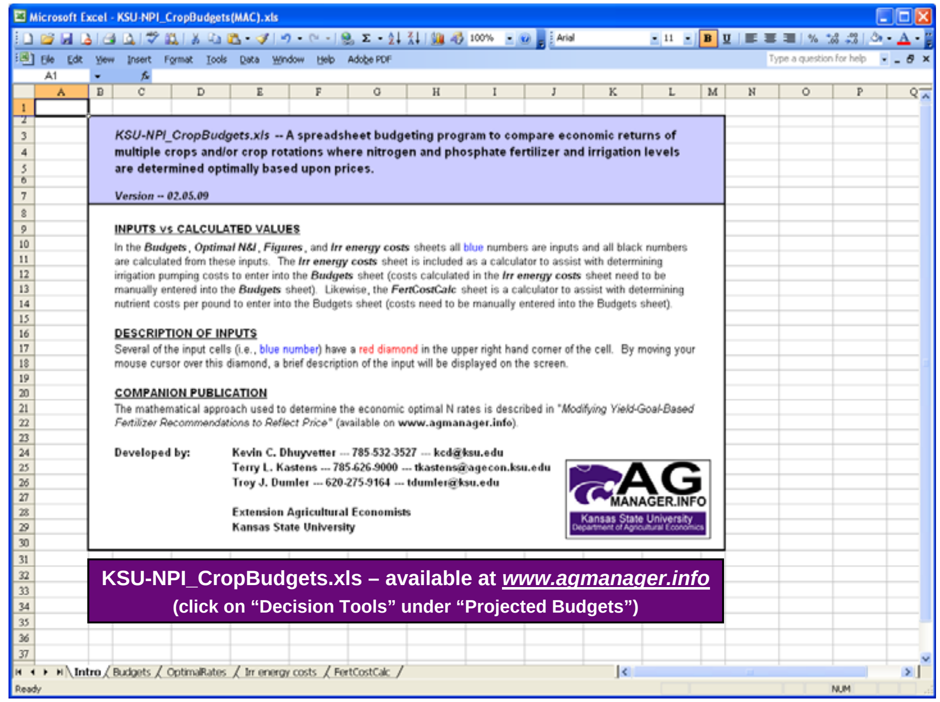
Operationalizing production function…

- We believe we got to the point of "if you believe KSU's fertilizer recommendations you have to believe our price-dependent profit-maximizing rates"
- Everything was embedded in an Excel spreadsheet so that users could determine optimal fertilizer N rates based on fertilizer N prices and crop prices
- We could use the spreadsheet to recommend some "typical" percentage cutbacks on fertilizer – dealers had been requesting such info throughout 2005

Late summer early Fall 2008…

- Very high fertilizer prices and not just N
- Falling crop prices
- Producers asking about price-based adjustments again, especially related to high P prices ($1.20/lb P2O5??)

- And so we adjust the decision spreadsheet again… …this time incorporating P
  - Use MF-2586 sufficiency P recs



Microsoft Excel - KSU-NPI_CropBudgets(MAC).xls

KSU-NPI_CropBudgets.xls -- A spreadsheet budgeting program to compare economic returns of multiple crops and/or crop rotations where nitrogen and phosphate fertilizer and irrigation levels are determined optimally based upon prices.

Version -- 02.05.09

INPUTS vs CALCULATED VALUES

In the ***Budgets***, ***Optimal N&I***, ***Figures***, and ***Irr energy costs*** sheets all blue numbers are inputs and all black numbers are calculated from these inputs. The ***Irr energy costs*** sheet is included as a calculator to assist with determining irrigation pumping costs to enter into the ***Budgets*** sheet (costs calculated in the ***Irr energy costs*** sheet need to be manually entered into the ***Budgets*** sheet). Likewise, the ***FertCostCalc*** sheet is a calculator to assist with determining nutrient costs per pound to enter into the Budgets sheet (costs need to be manually entered into the Budgets sheet).

DESCRIPTION OF INPUTS

Several of the input cells (i.e., blue number) have a red diamond in the upper right hand corner of the cell. By moving your mouse cursor over this diamond, a brief description of the input will be displayed on the screen.

COMPANION PUBLICATION

The mathematical approach used to determine the economic optimal N rates is described in "*Modifying Yield-Goal-Based Fertilizer Recommendations to Reflect Price*" (available on www.agmanager.info).

Developed by: Kevin C. Dhuyvetter -- 785-532-3527 -- kcd@ksu.edu
Terry L. Kastens -- 785-626-9000 -- tkastens@agecon.ksu.edu
Troy J. Dumler -- 620-275-9164 -- tdumler@ksu.edu

Extension Agricultural Economists
Kansas State University

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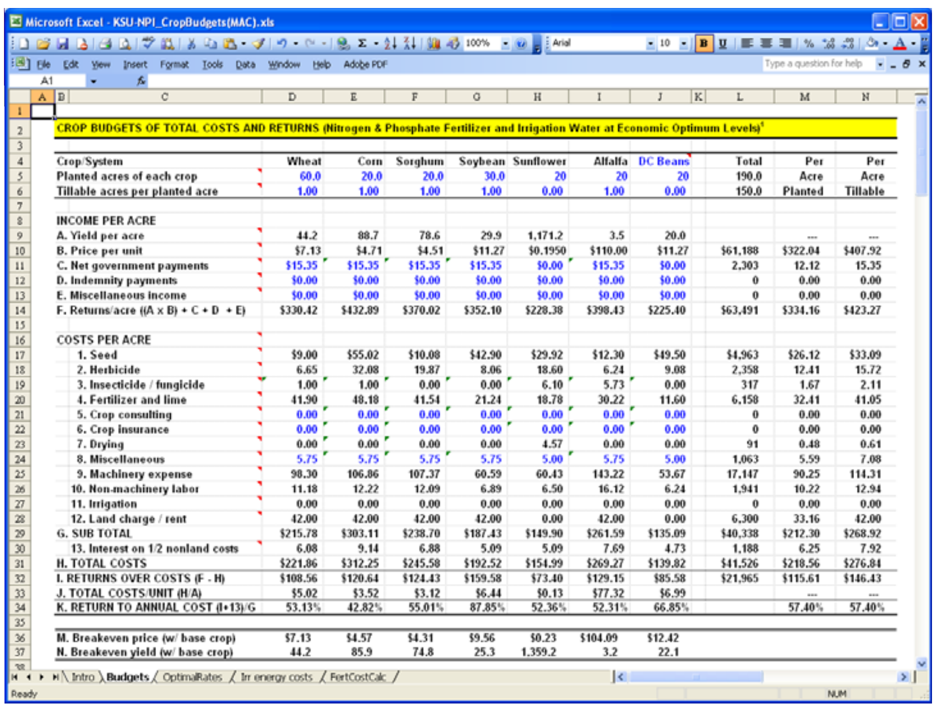
Intro / Budgets / OptimalRates / Irr energy costs / FertCostCalc

KSU-NPI_CropBudgets.xls – available at www.agmanager.info
(click on "Decision Tools" under "Projected Budgets")



Microsoft Excel - KSU-NPI_CropBudgets(MAC).xls

CROP BUDGETS OF TOTAL COSTS AND RETURNS (Nitrogen & Phosphate Fertilizer and Irrigation Water at Economic Optimum Levels)[1]

Crop/System	Wheat	Corn	Sorghum	Soybean	Sunflower	Alfalfa	DC Beans	Total	Per	Per
Planted acres of each crop	60.0	20.0	20.0	30.0	20	20	20	190.0	Acre	Acre
Tillable acres per planted acre	1.00	1.00	1.00	1.00	0.00	1.00	0.00	150.0	Planted	Tillable
INCOME PER ACRE										
A. Yield per acre	44.2	88.7	78.6	29.9	1,171.2	3.5	20.0		---	---
B. Price per unit	$7.13	$4.71	$4.51	$11.27	$0.1950	$110.00	$11.27	$61,188	$322.04	$407.92
C. Net government payments	$15.35	$15.35	$15.35	$15.35	$0.00	$15.35	$0.00	2,303	12.12	15.35
D. Indemnity payments	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0	0.00	0.00
E. Miscellaneous income	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0	0.00	0.00
F. Returns/acre ((A x B) + C + D + E)	$330.42	$432.89	$370.02	$352.10	$228.38	$398.43	$225.40	$63,491	$334.16	$423.27
COSTS PER ACRE										
1. Seed	$9.00	$55.02	$10.08	$42.90	$29.92	$12.30	$49.50	$4,963	$26.12	$33.09
2. Herbicide	6.65	32.08	19.87	8.06	18.60	6.24	9.08	2,358	12.41	15.72
3. Insecticide / fungicide	1.00	1.00	0.00	0.00	6.10	5.73	0.00	317	1.67	2.11
4. Fertilizer and lime	41.90	48.18	41.54	21.24	18.78	30.22	11.60	6,158	32.41	41.05
5. Crop consulting	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00
6. Crop insurance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00
7. Drying	0.00	0.00	0.00	0.00	4.57	0.00	0.00	91	0.48	0.61
8. Miscellaneous	5.75	5.75	5.75	5.75	5.00	5.75	5.00	1,063	5.59	7.08
9. Machinery expense	98.30	106.86	107.37	60.59	60.43	143.22	53.67	17,147	90.25	114.31
10. Non-machinery labor	11.18	12.22	12.09	6.89	6.50	16.12	6.24	1,941	10.22	12.94
11. Irrigation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00
12. Land charge / rent	42.00	42.00	42.00	42.00	0.00	42.00	0.00	6,300	33.16	42.00
G. SUB TOTAL	$215.78	$303.11	$238.70	$187.43	$149.90	$261.59	$135.09	$40,338	$212.30	$268.92
13. Interest on 1/2 nonland costs	6.08	9.14	6.88	5.09	5.09	7.69	4.73	1,188	6.25	7.92
H. TOTAL COSTS	$221.86	$312.25	$245.58	$192.52	$154.99	$269.27	$139.82	$41,526	$218.56	$276.84
I. RETURNS OVER COSTS (F - H)	$108.56	$120.64	$124.43	$159.58	$73.40	$129.15	$85.58	$21,965	$115.61	$146.43
J. TOTAL COSTS/UNIT (H/A)	$5.02	$3.52	$3.12	$6.44	$0.13	$77.32	$6.99		---	---
K. RETURN TO ANNUAL COST (I+13)/G	53.13%	42.82%	55.01%	87.85%	52.36%	52.31%	66.85%		57.40%	57.40%
M. Breakeven price (w/ base crop)	$7.13	$4.57	$4.31	$9.56	$0.23	$104.09	$12.42			
N. Breakeven yield (w/ base crop)	44.2	85.9	74.8	25.3	1,359.2	3.2	22.1			

Intro / Budgets / OptimalRates / Irr energy costs / FertCostCalc

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At current fertilizer (NH3 for N) and crop prices, N rates are ~8% lower than official KSU rec and P rates are ~20% lower.

TABLE 1. Production Inputs Used for Budgets — 5:54 PM 12/07/10

ITEM	Wheat	Corn	Sorghum	Soybean	Sunflower	
Price scenarios to consider						Use (Y=1, N=0)
Low prices	$4.50	$3.00	$2.80	$7.50	$0.1250	0
5-year average prices	$6.10	$4.01	$3.76	$9.89	$0.1700	0
2011 bids (Newton -- 12/4/10)	$7.13	$4.71	$4.51	$11.27	$0.1950	1
Yield goal (YG), bu/ac	45.0	90.0	80.0	30.0	1,200	
Enter 0 for dryland or 1 for irrigated	0	0	0	0	0	
Soil test P (STP), ppm	12.00	12.00	12.00	12.00	12.00	
Organic matter (OM), %	2.00	2.00	2.00	2.00	2.00	
Soil test nitrogen (STN), lbs/ac	20.0	20.0	20.0	20.0	20.0	
Other N adjustments, lbs/ac	0.0	0.0	0.0	0.0	0.0	
KSU recommended nitrogen, lbs/ac	68.0	84.0	68.0	0.0	30.0	
Econ Optimum fertN, lbs/ac	62.2	76.9	62.6	0.0	23.5	
KSU recommended phosphate, lbs/ac	26.0	27.2	25.1	28.5	21.6	
Econ Optimum fertP, lbs/ac	20.7	21.4	19.8	28.0	16.2	
Econ Optimum Irrigation Amount, in	0.0	0.0	0.0	0.0	0.0	
Yield at optimal N, P, and I, bu/ac	44.2	88.7	78.6	29.9	1171.2	
Change in STP, ppm	-0.08	-0.44	-0.65	0.23	-0.08	
Fertilizer:						$/unit
Nitrogen (N)	62.2	76.9	62.6	0.0	23.5	$0.400 /lb
Phosphate (P)	20.7	21.4	19.8	28.0	16.2	$0.580 /lb

User enters yield goal, crop and fertilizer prices, and soil properties – optimal N and P rates are calculated.

Blue values represent user-entered inputs (all other values are calculated).

At current fertilizer (UAN for N) and crop prices, N rates are ~14% lower than official KSU rec and P rates are ~30% lower.

TABLE 1. Production Inputs Used for Budgets — 5:55 PM 12/07/10

ITEM	Wheat	Corn	Sorghum	Soybean	Sunflower	Use (Y=1, N=0)
Price scenarios to consider						
Low prices	$4.50	$3.00	$2.80	$7.50	$0.1250	0
5-year average prices	$6.10	$4.01	$3.76	$9.89	$0.1700	0
2011 bids (Newton -- 12/4/10)	$7.13	$4.71	$4.51	$11.27	$0.1950	1
Yield goal (YG), bu/ac	45.0	90.0	80.0	30.0	1,200	
Enter 0 for dryland or 1 for irrigated	0	0	0	0	0	
Soil test P (STP), ppm	12.00	12.00	12.00	12.00	12.00	
Organic matter (OM), %	2.00	2.00	2.00	2.00	2.00	
Soil test nitrogen (STN), lbs/ac	20.0	20.0	20.0	20.0	20.0	
Other N adjustments, lbs/ac	0.0	0.0	0.0	0.0	0.0	
KSU recommended nitrogen, lbs/ac	68.0	84.0	68.0	0.0	30.0	
Econ Optimum fertN, lbs/ac	58.7	72.9	58.2	0.0	20.3	
KSU recommended phosphate, lbs/ac	26.0	27.2	25.1	28.5	21.6	
Econ Optimum fertP, lbs/ac	18.6	19.6	17.8	28.0	14.3	
Econ Optimum Irrigation Amount, in	0.0	0.0	0.0	0.0	0.0	
Yield at optimal N, P, and I, bu/ac	43.8	88.0	77.9	29.9	1158.0	
Change in STP, ppm	-0.18	-0.53	-0.74	0.23	-0.17	
Fertilizer:						$/unit
Nitrogen (N)	58.7	72.9	58.2	0.0	20.3	$0.550 /lb
Phosphate (P)	18.6	19.6	17.8	28.0	14.3	$0.580 /lb

User enters yield goal, crop and fertilizer prices, and soil properties – optimal N and P rates are calculated.

Blue values represent user-entered inputs (all other values are calculated).

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At current fertilizer (UAN for N) and "low" crop prices, N rates are ~30% lower than official KSU rec and P rates are ~50% lower.

TABLE 1. Production Inputs Used for Budgets — 5:56 PM 12/07/10

ITEM	Wheat	Corn	Sorghum	Soybean	Sunflower	Use (Y=1, N=0)
Price scenarios to consider						
Low prices	$4.50	$3.00	$2.80	$7.50	$0.1250	1
5-year average prices	$6.10	$4.01	$3.76	$9.89	$0.1700	0
2011 bids (Newton -- 12/4/10)	$7.13	$4.71	$4.51	$11.27	$0.1950	0
Yield goal (YG), bu/ac	45.0	90.0	80.0	30.0	1,200	
Enter 0 for dryland or 1 for irrigated	0	0	0	0	0	
Soil test P (STP), ppm	12.00	12.00	12.00	12.00	12.00	
Organic matter (OM), %	2.00	2.00	2.00	2.00	2.00	
Soil test nitrogen (STN), lbs/ac	20.0	20.0	20.0	20.0	20.0	
Other N adjustments, lbs/ac	0.0	0.0	0.0	0.0	0.0	
KSU recommended nitrogen, lbs/ac	68.0	84.0	68.0	0.0	30.0	
Econ Optimum fertN, lbs/ac	47.5	59.5	44.5	0.0	10.0	
KSU recommended phosphate, lbs/ac	26.0	27.2	25.1	28.5	21.6	
Econ Optimum fertP, lbs/ac	12.1	13.5	11.3	25.6	8.3	
Econ Optimum Irrigation Amount, in	0.0	0.0	0.0	0.0	0.0	
Yield at optimal N, P, and I, bu/ac	42.0	85.1	74.6	29.7	1098.0	
Change in STP, ppm	-0.49	-0.81	-1.03	0.10	-0.45	
Fertilizer:						$/unit
Nitrogen (N)	47.5	59.5	44.5	0.0	10.0	$0.550 /lb
Phosphate (P)	12.1	13.5	11.3	25.6	8.3	$0.580 /lb

User enters yield goal, crop and fertilizer prices, and soil properties – optimal N and P rates are calculated.

Blue values represent user-entered inputs (all other values are calculated).

Summary of fertilizer economics…

- In order to determine how to adjust fertilizer rates in response to prices, a mathematical relationship between nutrient and yield is needed
- A quadratic-plateau function can be "backed out" of KSU N and P recs
- Quadratic-plateau function allows diminishing returns, but is also consistent with linear plateau within any site-year
- If multiple inputs are considered simultaneously, economic optimal rates are lower than when other inputs are ignored (or have zero cost)

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So, what should one do?

- Use the spreadsheet! If your intuition causes you to question the results:
  - Average the results with some other method
  - Use the adjustment factors in the spreadsheet
  - Question your intuition
- Likely, no one would ignore prices forever, i.e., regardless of their levels

Summary…

- **Tremendous variability in profitability across producers**
- **Prices impacts returns, but we have little evidence indicating they can be managed consistently**
- **Over time, differences in profitability are driven principally by cost and yield differences**
- **High profit farms are low-cost operators, but they do not cut costs at the expense of yields**
- **Machinery is a major determinant of cost differences, hence profit differences, and current technologies offer tremendous opportunity to lower costs**