

Getting a Hold on Input Costs

(economical rates of N & P, fuel prices, etc.)

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 Crop School – Staying Competitive
 January 20, 2009. Osage Community Building, Osage City



Historical and forecasted oil and diesel fuel prices



Historical and forecasted crude oil and farm diesel fuel average Mar-Oct prices...

Crude Oil and Off-road Diesel Fuel Prices

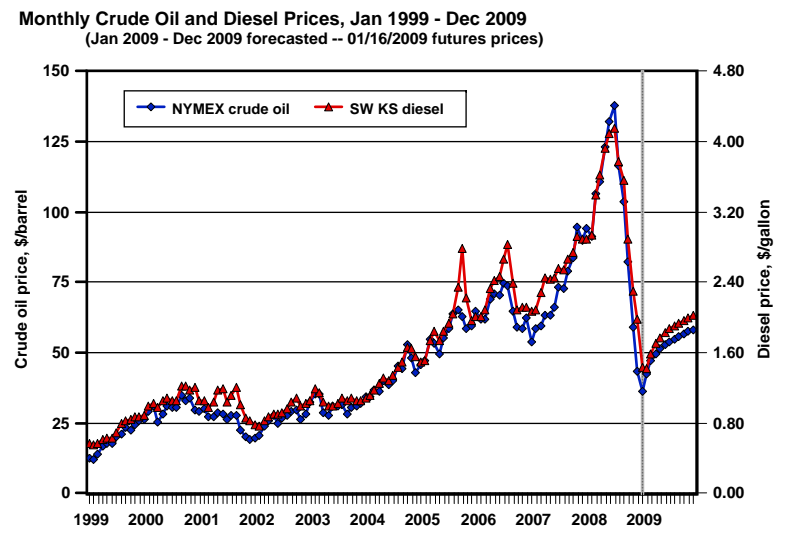
Year	Crude oil /1	Year-to-year change \$/barrel	percent	Diesel fuel /2	Year-to-year change \$/gal	percent
2004	\$41.84	\$11.31	37.0%	\$1.37	\$0.32	30.0%
2005	\$57.98	\$16.14	38.6%	\$2.04	\$0.67	48.5%
2006	\$68.07	\$10.09	17.4%	\$2.41	\$0.38	18.6%
2007	\$70.09	\$2.02	3.0%	\$2.52	\$0.11	4.4%
2008	\$114.19	\$44.10	62.9%	\$3.68	\$1.16	46.0%
2004-08 avg /3	\$70.44	\$43.54	161.9%	\$2.40	\$1.43	146.4%
2009 (F)	\$52.72	(\$61.48)	-53.8%	\$1.82	(\$1.86)	-50.5%
2009 less 04-08 avg	(\$17.72)	xxx	-25.2%	(\$0.58)	xxx	-24.2%

/1 Mar-Oct average of NYMEX futures

/2 Mar-Oct average for Southw est Kansas

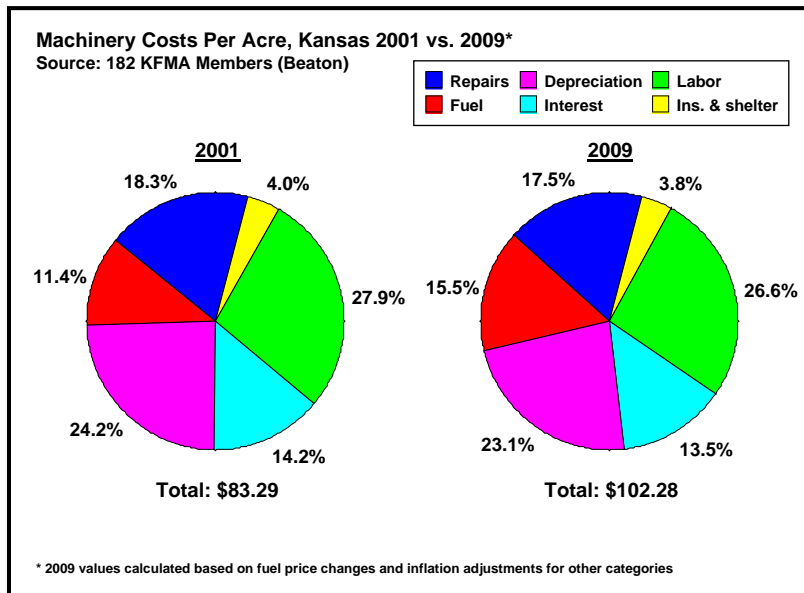
/3 Year-to-year and percent changes are calculated from the previous 5-year average (i.e., 1999-2003)

F = forecast based on 01/16/2009 futures prices



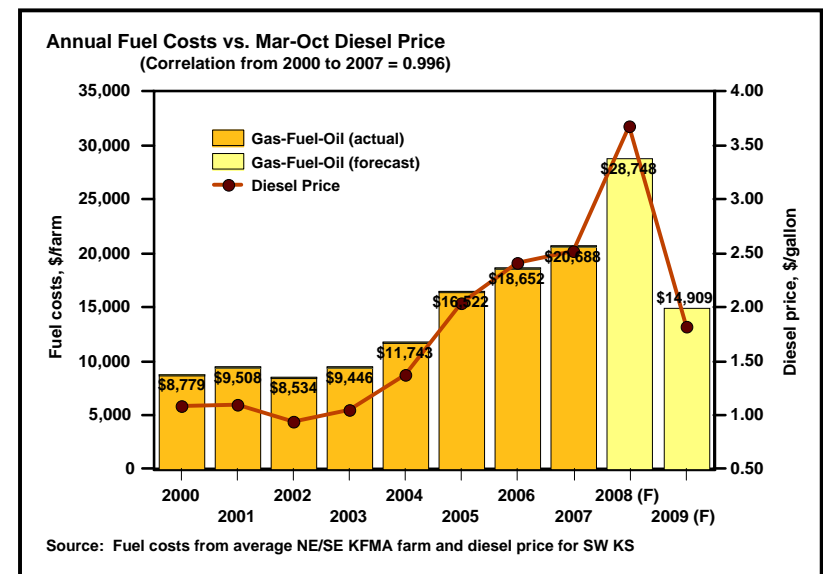
Historical relationship suggests that NYMEX crude oil market can be used to forecast diesel prices.

Impact of fuel prices on machinery costs...



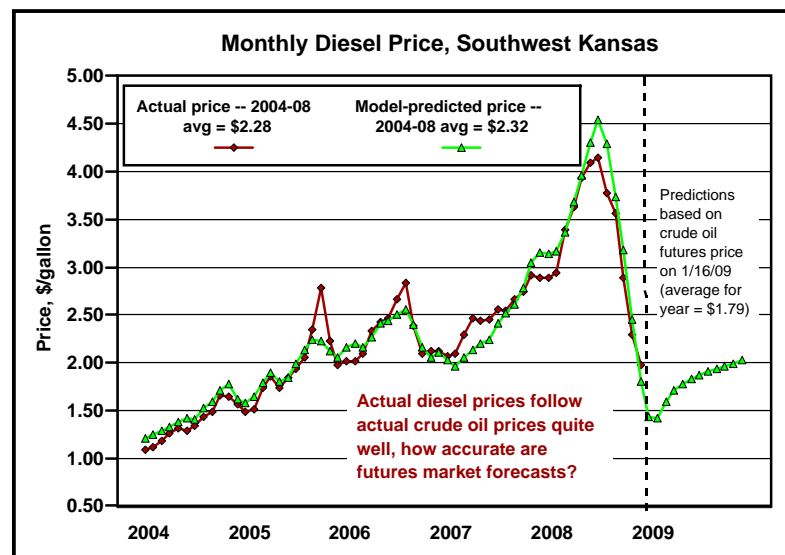
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Impact of fuel prices on farm-level costs...



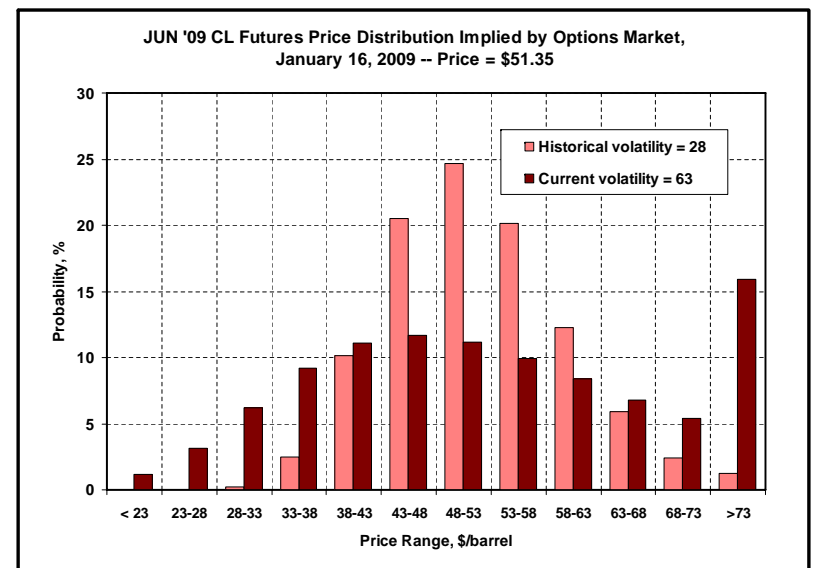
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But, how well can prices be predicted?



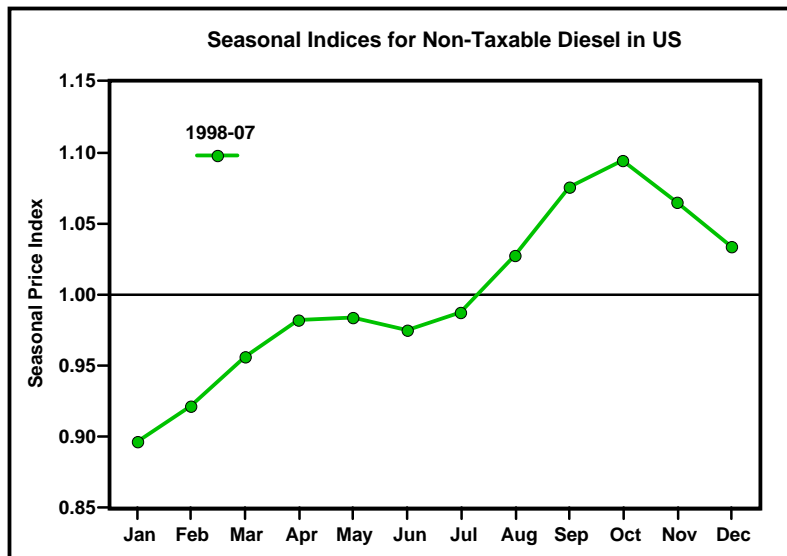
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Do we need to "lock in" current price forecasts?



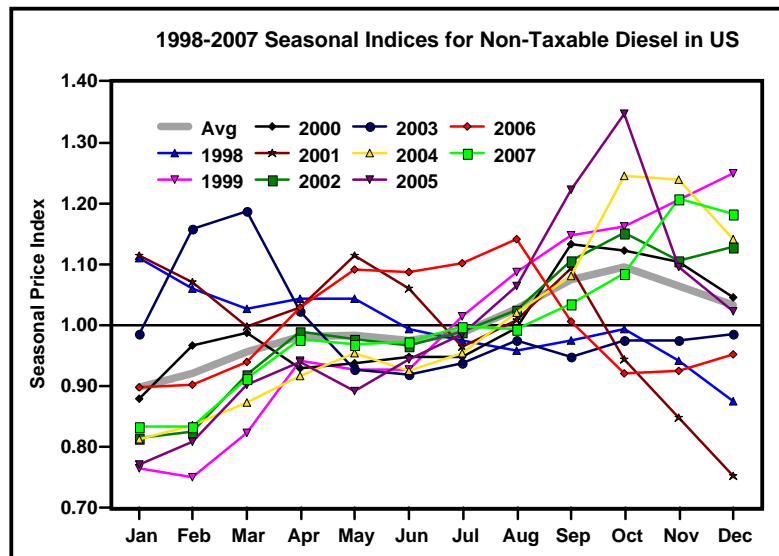
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Purchasing fuel based on seasonal patterns?



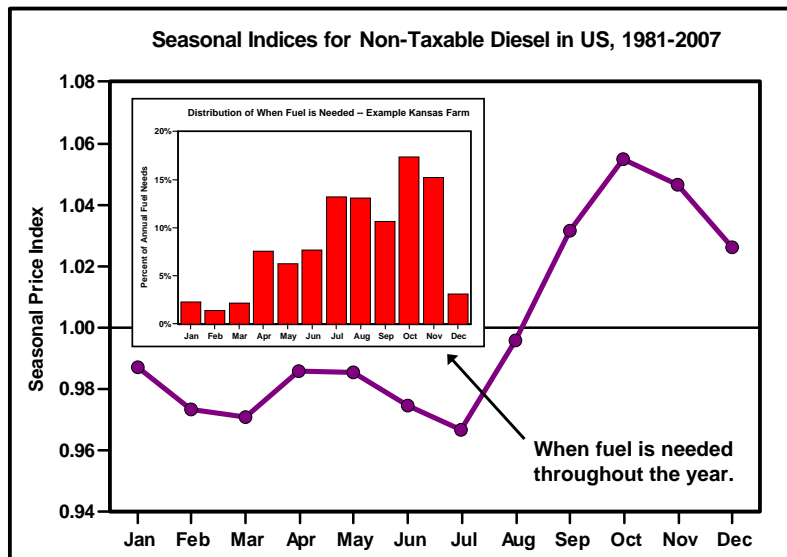
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Seasonal pattern is not particularly predictable...

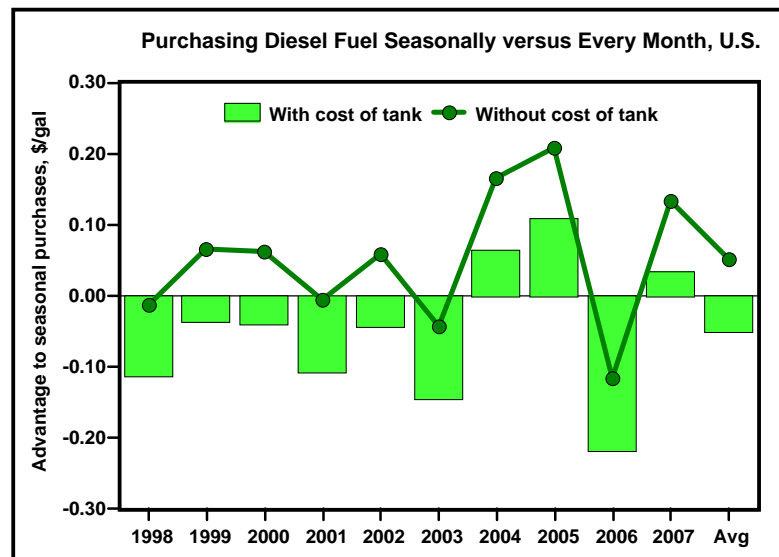


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Seasonal pattern used for analysis...



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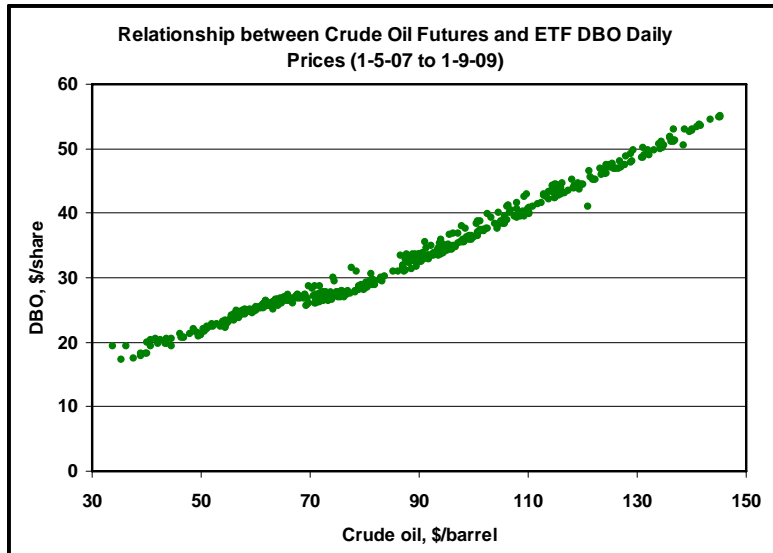
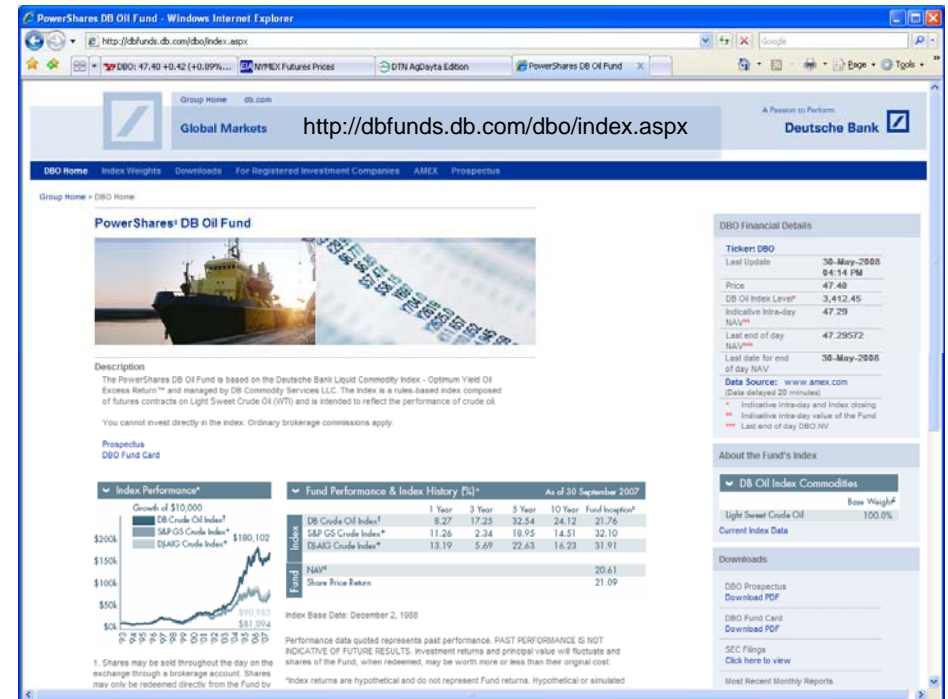
IF the only storage costs that existed were interest, then a strategy of buying in the months of Jan, Feb, Mar, Jun and Jul (based on 27-year seasonal pattern) would have resulted in a \$0.05/gallon advantage compared to buying as needed (i.e., every month). Purchasing fuel tanks turns gain into loss.

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Pre-purchasing / locking in fuel prices

- Buy now and take delivery (need to have storage)
- Forward contract for later delivery
 - Availability of this option?
 - Quantity requirements?
- Hedge fuel in NYMEX crude oil (or heating oil) futures market
 - Quantity – one crude oil contract (1,000 barrels) effectively hedges 30,000+ gallons of diesel
- Hedge using Exchange Traded Funds (ETF)

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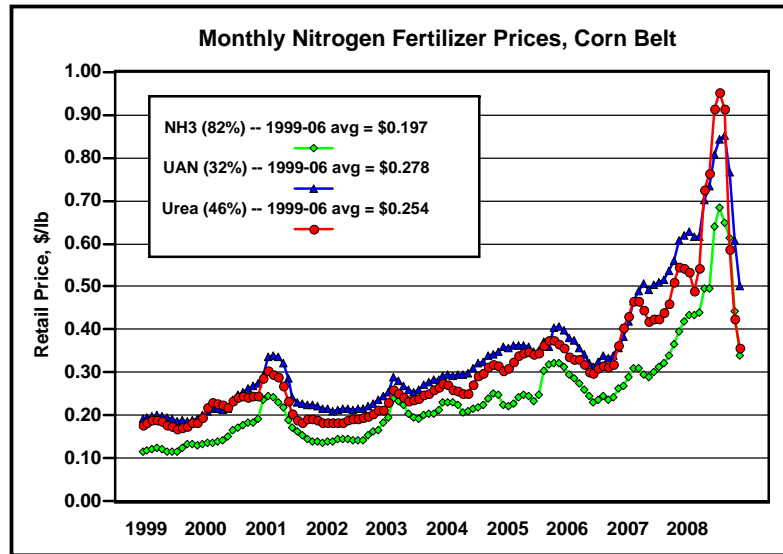
Relationship suggest you could reasonably hedge crude oil price (hence diesel fuel price) via buying DBO stock. One share of DBO stock would effectively hedge approximately 11.5-12.0 gallons of diesel (basis risk?).

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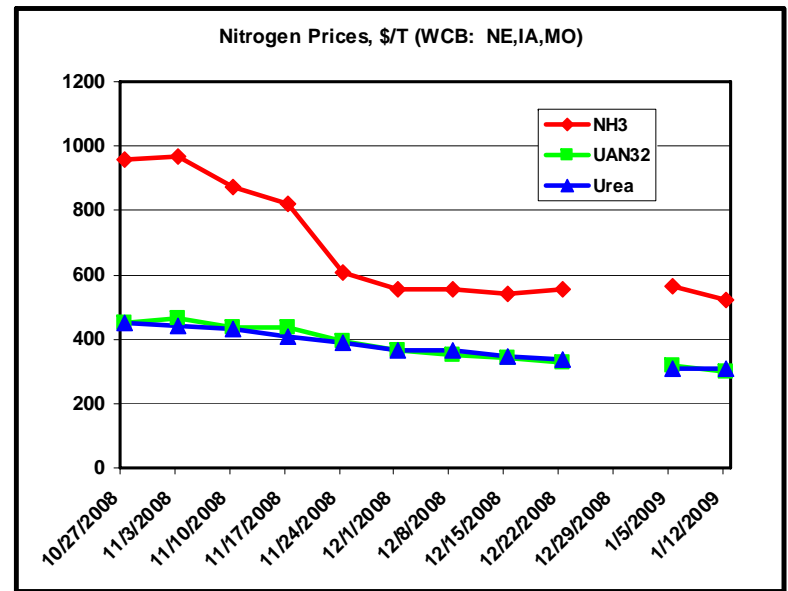
Fertilizer prices (should you be cutting back on fertilizer rates?)



N prices have fallen recently, but are still significantly above historical averages...

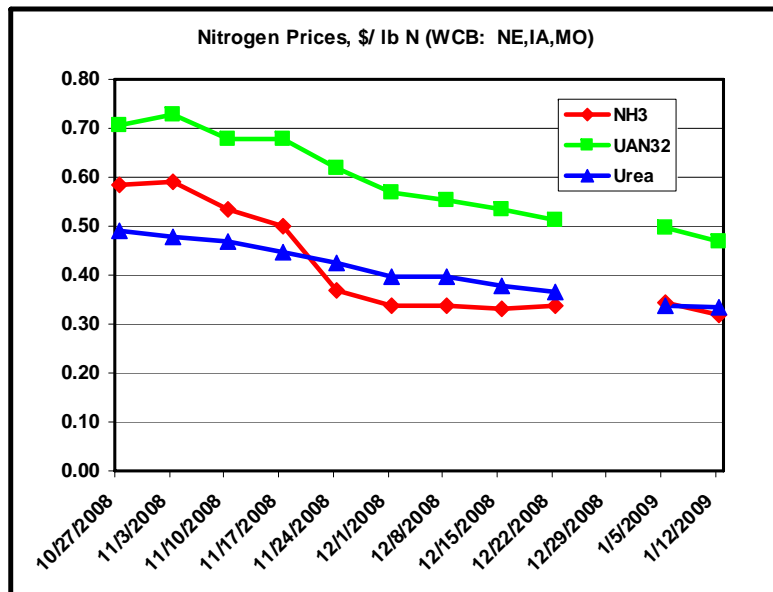


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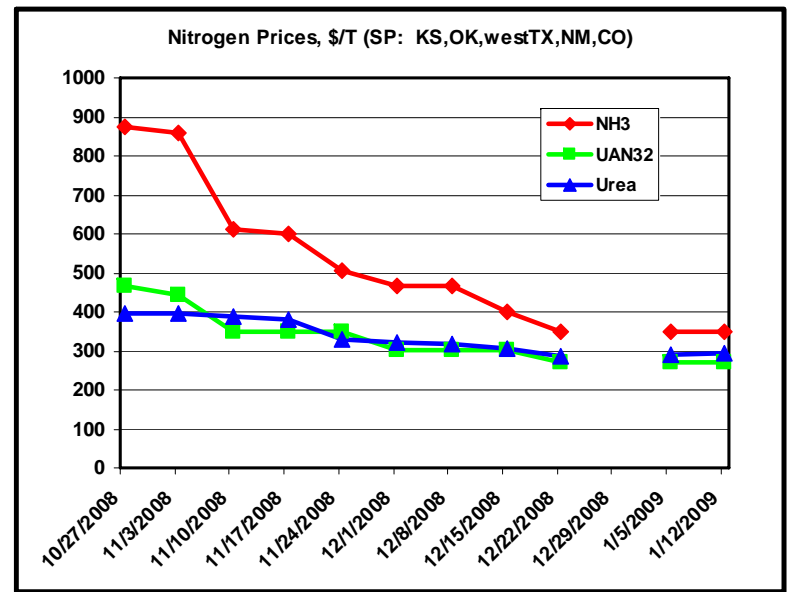
Prices continue to fall off their highs, especially NH3 (big drops in a short time span)

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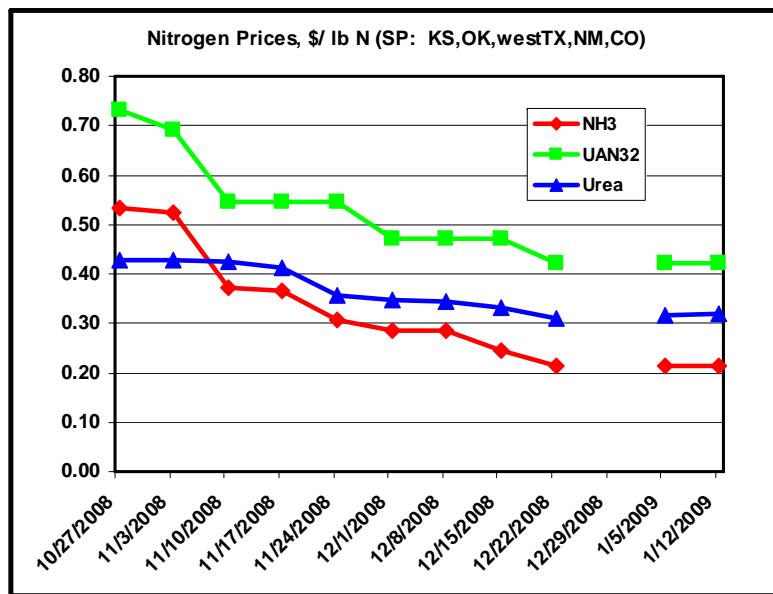
Big differences in prices of N products – how fast will the adjustment be?

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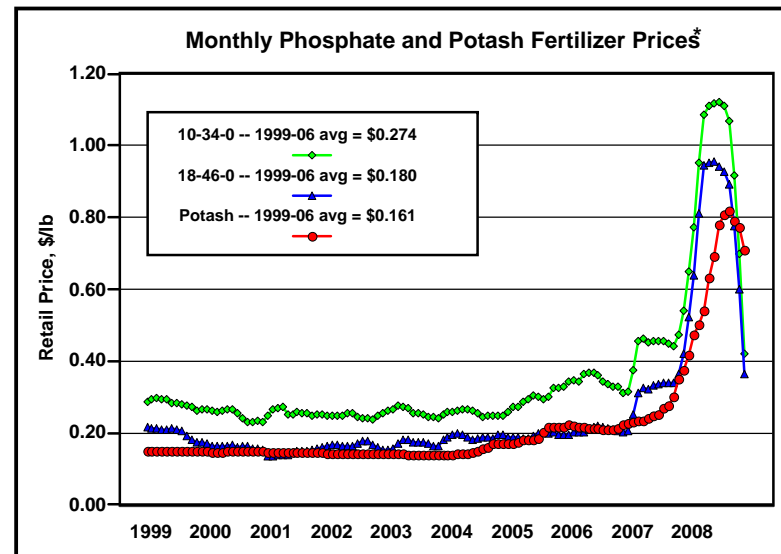
Prices continue to fall off their highs, especially NH3 (big drops in a short time span)

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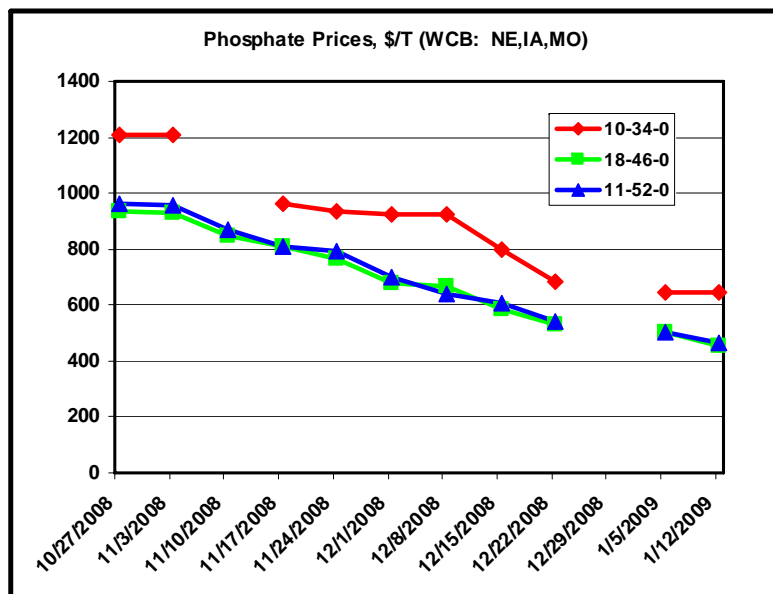


Big differences in prices of N products – how fast will the adjustment be?

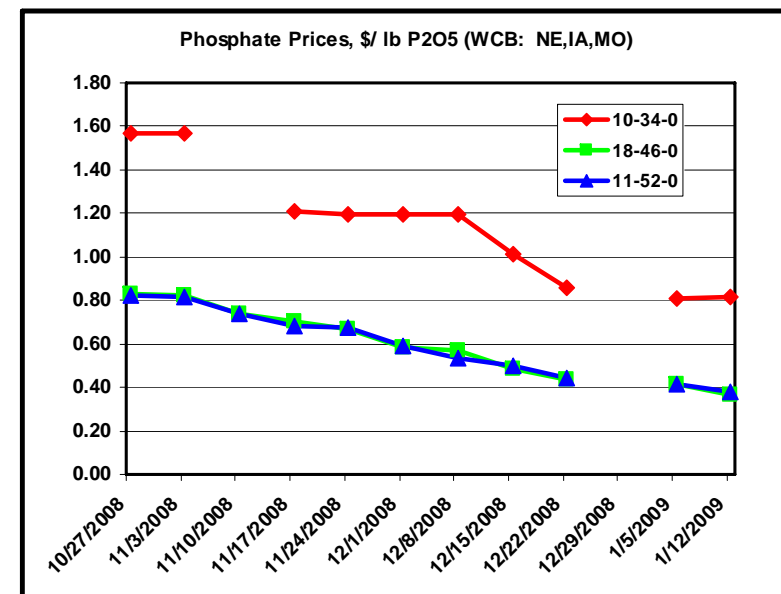
P and K prices have fallen recently, but are still significantly above historical averages...



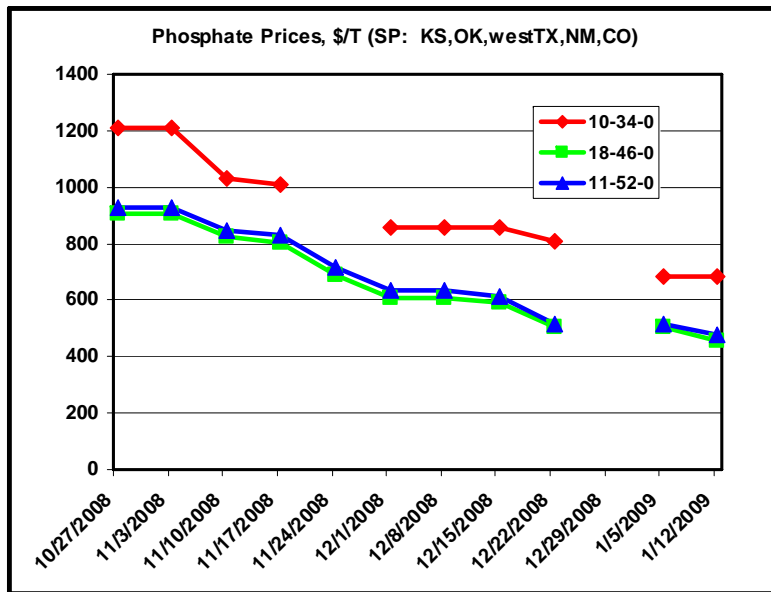
* Price of phosphate is based on blend price less value of N (average of NH3, UAN 32, and Urea prices)



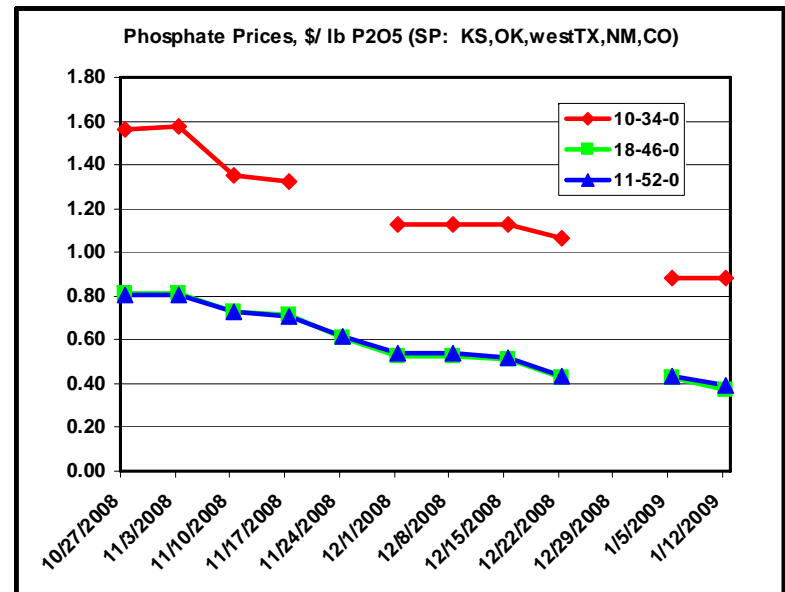
Big differences in prices of P products – how fast will the adjustment be?



Big differences in prices of P products – how fast will the adjustment be?



Prices continue to fall off their highs (big drops in a short time span)

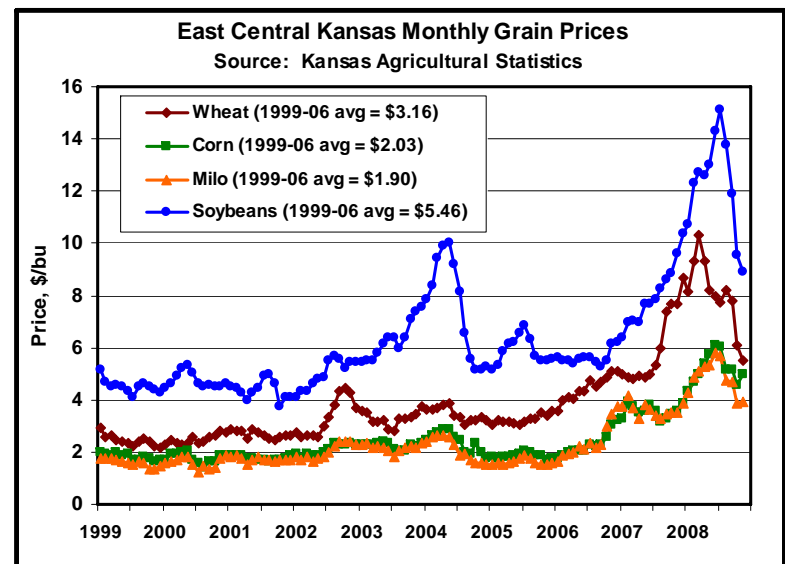


Big differences in prices of P products – how fast will the adjustment be?

What do these high prices imply for fertilizer rates?

... perhaps not a great deal if expected crop prices also are really high ... sort of what we've been preaching the last year and a half

Like fertilizer prices, crop prices have fallen recently, but they are still significantly above historical averages...



So, should we adjust fertilizer rates when fertilizer or crop prices change?

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KSU nitrogen recommendations ... no prices

Corn and grain sorghum

$N \text{ rec} = (\text{Yield Goal} \times 1.6) - (\% \text{SOM} \times 20) - \text{Profile N} - \text{Manure N} - \text{Other N Adjustments} + \text{Previous Crop Adjustments}$

Wheat

$N \text{ rec} = (\text{Yield Goal} \times 2.4) - (\% \text{SOM} \times 10) - \text{Profile N} - \text{Manure N} - \text{Other N Adjustments} + \text{Previous Crop Adjustments} + \text{Tillage Adjustments} + \text{Grazing Adjustments}$

Sunflowers

$N \text{ rec} = (\text{Yield Goal} \times 0.075) - (\% \text{SOM} \times 20) - \text{Profile N} - \text{Manure N} - \text{Other N Adjustments} + \text{Previous Crop Adjustments}$

Kastens, Dhuyvetter, Schlegel, & Dumler started working on this in late 2005 . . .

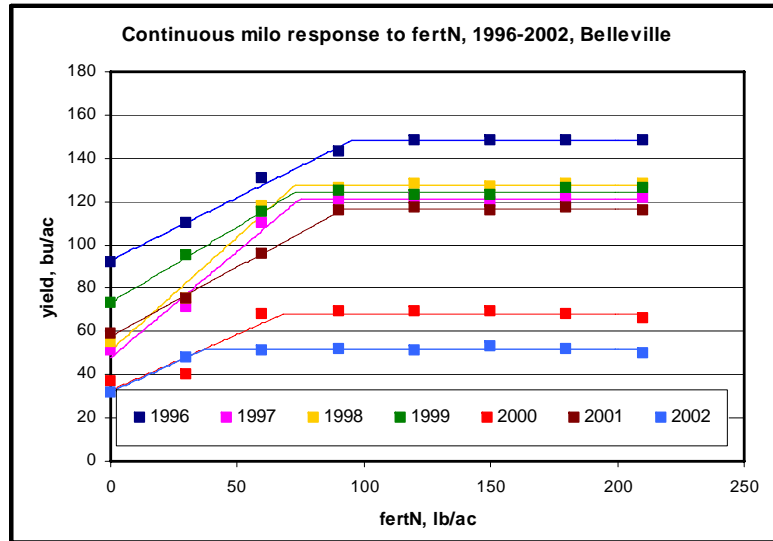
KSU nitrogen recommendations vs. N price

- Recommendations do not explicitly include prices
- Mathematical relationship between expected yield and nitrogen (i.e., production function) is needed in order to adjust recommendations for prices
- Similar issues pertain to P & K recommendations (i.e., no way to adjust them for prices)
- We assume KSU had in mind these prices:
 - Wheat \$3.22/bu
 - Corn \$2.35/bu
 - fertN \$0.21/lb N (fertP, used later, \$0.24/lb P2O5)

Nitrogen production function...

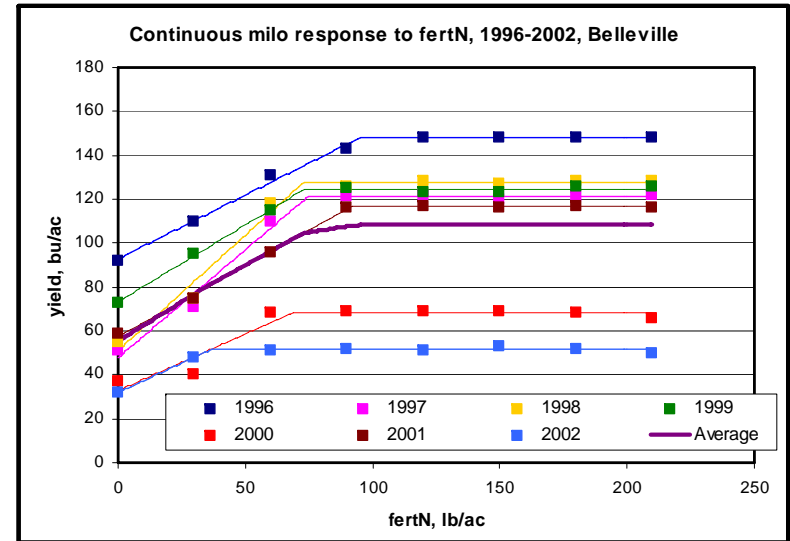
- In a limiting factor framework, it is generally believed that relationship between N and yield is linear for any given year and location (implies linear plateau production function)
- Linear plateau production function implies that optimal N will either be 0 or level where yield plateaus
- Average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

Yield response by year – linear plateau “fits” data quite well...

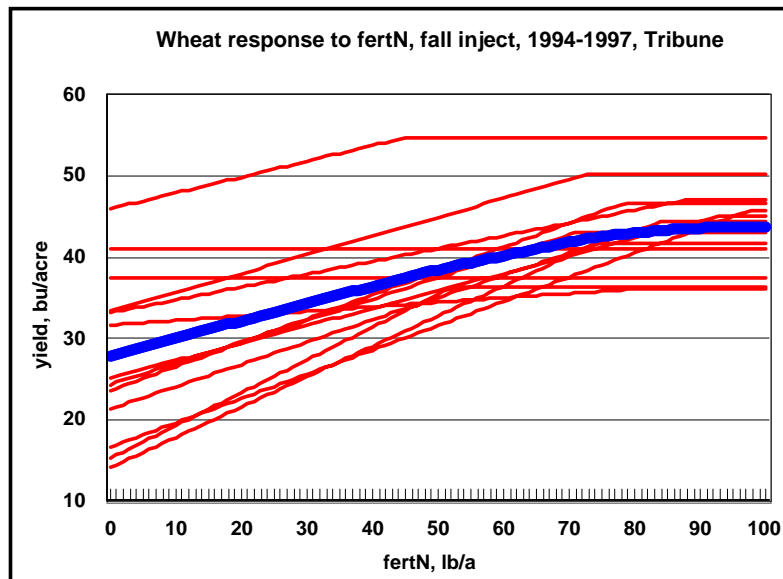


What would yield be for given fertN next year?

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

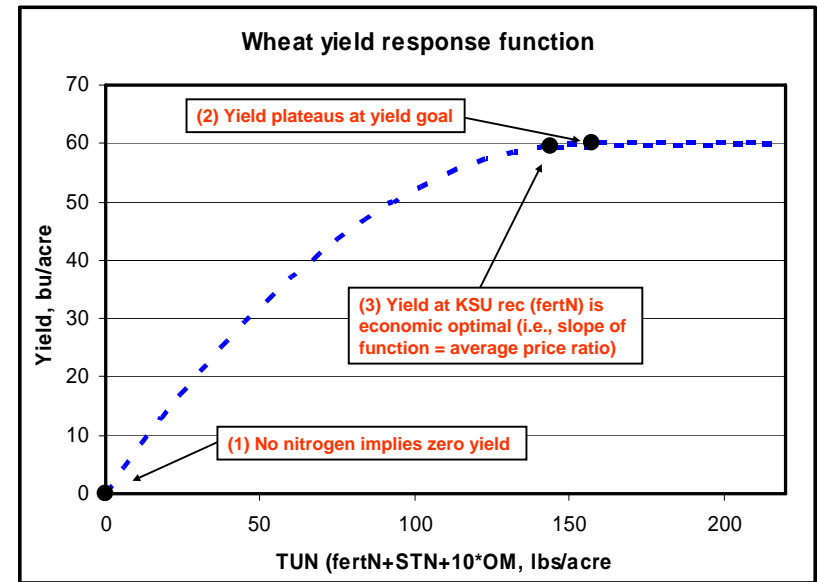
Functional form...

- Numerous functional forms could be used that would meet objectives. We considered:
 - Linear plateau, along with four different curvilinear forms
- Most non-linear models “look” very similar, but results (i.e., optimal N versus N price) do vary

Nitrogen production function...

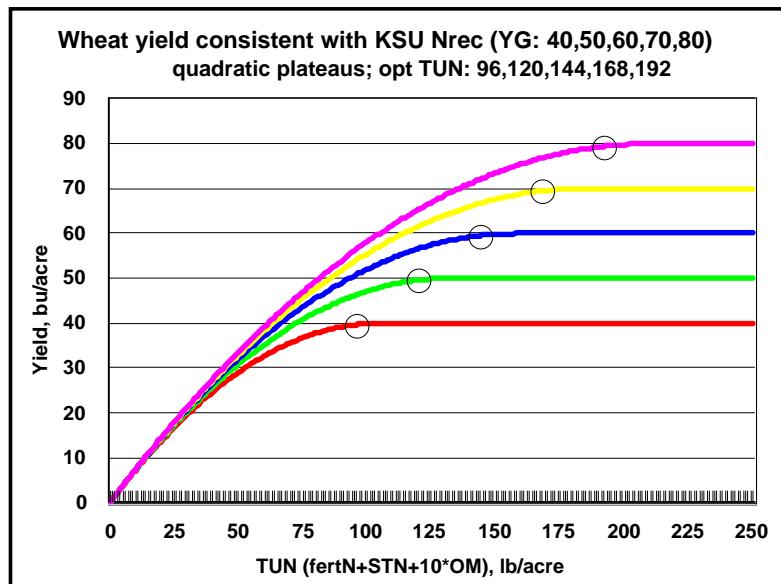
- Nice property of non-linear production function is that it implies diminishing marginal returns and thus prices matter
- Assumed functional form is quadratic plateau which allows diminishing returns – consistent with linear plateau in any given year
- Estimate model parameters such that
 - KSU Nrec 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...



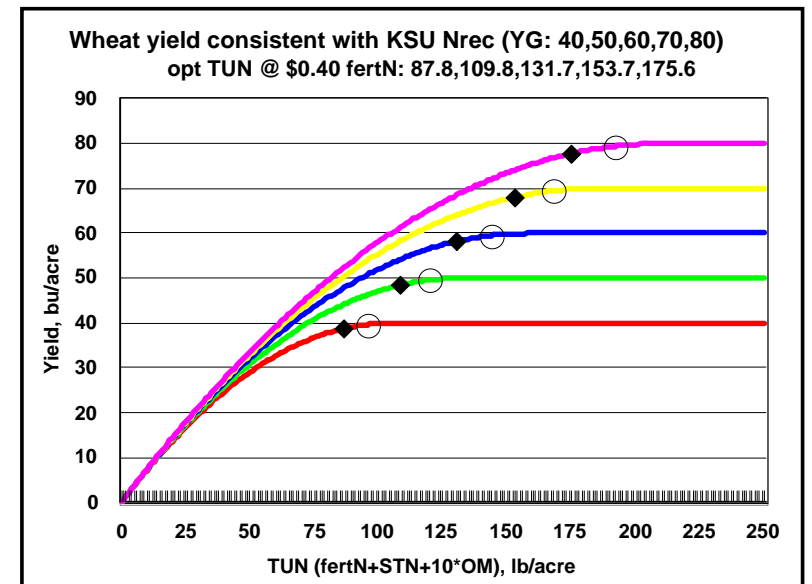
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Same optimal N (slope there = 0.21/3.22) but yields about 1% lower than plateau



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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...

- 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

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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 -- 11.30.08

INPUTS vs CALCULATED VALUES
In the *Budgets*, *Optimal Nsl*, *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).

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).

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

Crop/System	Wheat	Corn	Sorghum	Soybean	Sunflower	Alfalfa	DC Beans	Total	Per Acre	Per Acre
Planted acres of each crop	25.5	20.5	8.5	25.5	0.0	0.0	20	100.0		
Tillable acres per planted acre	1.00	1.00	1.00	1.00	0.00	1.00	0.00	80.0		
INCOME PER ACRE										
A. Yield per acre	45.4	110.2	84.9	34.9	1,165.2	3.6	20.0			
B. Price per unit	\$5.58	\$3.85	\$3.30	\$8.47	\$0.1583	\$110.00	\$8.47	\$28.441	\$284.41	\$355.51
C. Net government payments	\$11.39	\$11.39	\$11.39	\$11.39	\$0.00	\$11.39	\$0.00	911	9.11	11.39
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	\$264.67	\$435.14	\$291.18	\$306.65	\$184.44	\$406.20	\$169.40	\$29,352	\$293.52	\$366.90
COSTS PER ACRE										
1. Seed	\$14.40	\$40.56	\$14.22	\$34.91	\$20.02	\$12.60	\$40.00	\$3,010	\$30.10	\$37.62
2. Herbicide	3.42	35.41	20.50	9.48	19.47	5.21	19.90	1,627	16.27	20.34
3. Insecticide / fungicide	14.00	0.25	5.05	0.00	6.46	6.06	0.00	405	4.05	5.06
4. Fertilizer and lime	56.92	74.98	65.37	38.13	36.28	25.66	23.70	4,991	49.91	62.38
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	4.54	0.00	0.00	0	0.00	0.00
8. Miscellaneous	7.00	7.00	7.00	7.00	6.00	7.00	6.00	600	6.00	8.50
9. Machinery expense	79.95	117.79	92.89	90.45	56.39	134.59	53.57	6,621	66.21	107.76
10. Non-machinery labor	8.97	13.13	10.53	10.01	5.98	15.08	6.11	965	9.65	12.06
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	55.00	55.00	55.00	55.00	0.00	55.00	0.00	4,400	44.00	55.00
G. SUB TOTAL	\$239.66	\$344.12	\$270.57	\$244.98	\$155.14	\$261.59	\$149.28	\$24,698	\$246.98	\$308.72
13. Interest on 1/2 nonland costs	7.39	11.56	8.62	7.60	6.02	8.26	5.97	812	8.12	10.15
H. TOTAL COSTS	\$247.05	\$355.68	\$279.19	\$252.57	\$161.17	\$269.85	\$155.25	\$25,510	\$255.10	\$318.87
I. RETURNS OVER COSTS (F - H)	\$17.62	\$79.46	\$11.99	\$54.08	\$23.27	\$136.35	\$14.15	\$3,842	\$38.42	\$48.03
J. TOTAL COSTS/UNIT (H/A)	\$5.44	\$3.23	\$3.29	\$7.25	\$0.14	\$75.18	\$7.76			
K. RETURN TO ANNUAL COST (I+13)/G	10.43%	26.45%	7.62%	25.18%	18.88%	55.28%	13.48%		18.84%	18.84%
M. Breakeven price (w/ base crop)										
H. Breakeven yield (w/ base crop)	52.4	102.9	99.3	34.9	1,368.9	2.7	24.8			

Microsoft Excel - KSU_NPI_CropBudgets(OsageCo-Jan09).xls

TABLE 1. Production Inputs Used for Budgets

ITEM	Wheat	Corn	Sorghum	Soybean	Sunflower	Alfalfa	DC Beans	
Price scenarios to consider								Use (Y=1, N=0)
Low price scenario	\$4.50	\$3.00	\$2.60	\$6.75	\$0.1250	\$94.88	\$6.75	0
High price scenario	\$6.50	\$4.50	\$3.75	\$10.00	\$0.1658	\$119.67	\$10.00	0
2009 bids (1/16/09)--SEK & Burlington	\$5.58	\$3.85	\$3.30	\$8.47	\$0.1583	\$110.00	\$8.47	1
Yield goal (Y), bu/ac	46.5	112.0	87.0	35.0	1,200	3.6	20.0	
Enter 0 for dryland or 1 for irrigated	0	0	0	0	0	0	0	
Annual rainfall	36.00	36.00	36.00	36.00	36.00	36.00	na	
Soil test P (STP), ppm	12.00	12.00	12.00	12.00	12.00	12.00	na	
Organic matter (OM), %	2.00	2.00	2.00	2.00	2.00	2.00	na	
Soil test nitrogen (STN), lbs/ac	20.0	20.0	20.0	20.0	20.0	20.0	na	
Other N adjustments, lbs/ac	0.0	0.0	0.0	0.0	0.0	0.0	na	
KSU recommended nitrogen, lbs/ac	71.6	119.2	79.2	0.0	30.0	0.0		
Econ Optimum fertN, lbs/ac	51.9	95.9	55.4	0.0	11.7	0.0		
KSU recommended phosphate, lbs/ac	26.2	29.0	25.6	29.5	21.6	46.5		
Econ Optimum fertP, lbs/ac	13.0	16.8	12.1	24.2	9.3	40.4		
Econ Optimum Irrigation Amount, in	0.0	0.0	0.0	0.0	0.0	0.0		
Yield at optimal N, P, and I, bu/ac	43.7	107.6	81.7	34.5	1110.0	3.6	20.0	
Change in STP, ppm	-0.49	-1.04	-1.14	-0.19	-0.41			
Seeding rate (lbs, seeds, etc)	90	24	4.5	130	22	3	160	
Seed price, \$/unit	\$0.16	\$1.69	\$3.16	\$0.27	\$0.91	\$4.20	\$0.25	
Fertilizer:								\$/unit
Nitrogen (N)	64.8	119.8	69.3	0.0	14.7	0.0	0	\$0.535 /lb
Phosphate (P)	16.2	20.9	15.2	30.3	11.7	90.5	20.0	\$0.896 /lb
Potash (K)	30	30	40	30	30	0	20	\$0.690 /lb
Other	0	0	0	0	0	0	0	\$1,000 /ac
Lime	333	333	333	333	0	333	0	\$0.010 /lb
Herbicide								
Total herbicide	3.42	35.41	20.5	9.48	5.200	19.9		\$1.00 /ac
Bicep Lite II Magnum								\$11.28 /qt

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

Scenarios considered...

- Dry versus liquid N & P fertilizer prices
 - Dry: N = \$0.365 and P = \$0.495
 - Liquid: N = \$0.535 and P = \$0.896

- Three crop price scenarios

Price scenarios to consider	Wheat	Corn	Sorghum	Soybean
Low price scenario	\$4.50	\$3.00	\$2.60	\$6.75
High price scenario	\$6.50	\$4.50	\$3.75	\$10.00
2009 bids (1/16/09)--SEK & Burlington	\$5.58	\$3.85	\$3.30	\$8.47

- Fertilizer rates

- Economic optimal
- 75% of economic optimal (under fertilize)
- 125% of economic optimal (over fertilize)

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Crop yield at expected 2009 crop prices and various fertilizer scenarios...

Model-Estimated Yield vs Fertilizer Price and Rate (% of economic optimal)						
	Wheat	Corn	Milo	Soybean	DC Beans	Average
Acres	25.5	20.5	8.5	25.5	20.0	100.0
Dry N & P Prices (N=\$0.365 and P=\$0.495)						
A. Economic optimal rates						
	45.4	110.2	84.9	34.9		
B. 75% of economic optimal rates (under fertilize)						
	42.8	104.0	80.7	34.2		
C. 125% of economic optimal rates (over fertilize)						
	46.2	111.7	86.3	35.0		
Liquid N & P Prices (N=\$0.535 and P=\$0.896)						
D. Economic optimal rates						
	43.7	107.6	81.7	34.5		
E. 75% of economic optimal rates (under fertilize)						
	40.7	100.5	77.1	33.7		
F. 125% of economic optimal rates (over fertilize)						
	44.6	109.8	83.5	34.9	xxx	xxx

1) Economic optimal yields are 1-4% higher at lower priced fertilizer (dry).

2) Over-fertilizing results in yields about 1% higher than optimal rate yields.

3) Under-fertilizing results in yields about 5% lower than optimal rate yields.

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Return over costs at expected 2009 crop prices and various fertilizer scenarios...

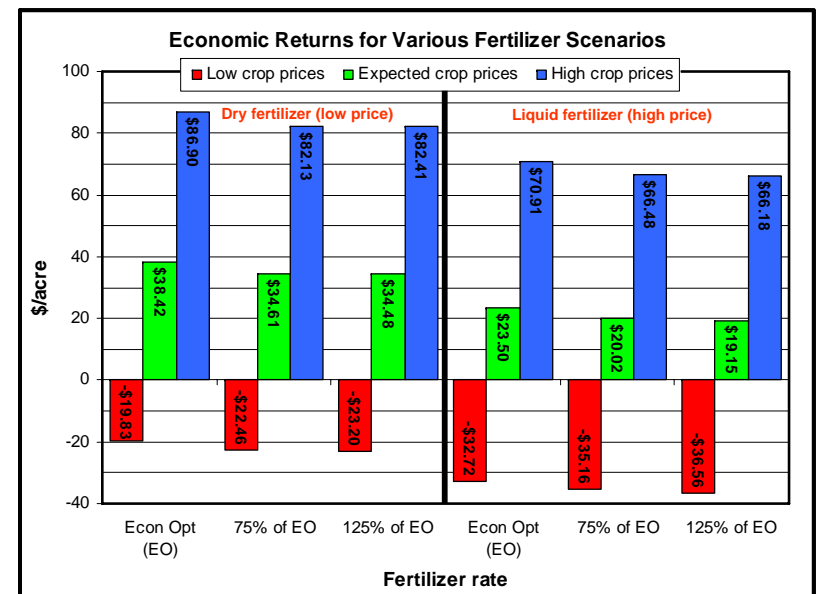
Return Over Costs vs Fertilizer Price and Rate (% of economic optimal)							
	Wheat	Corn	Milo	Soybean	DC Beans	Total	Average
Acres	25.5	20.5	8.5	25.5	20.0	100.0	
Dry N & P Prices (N=\$0.365 and P=\$0.495)							
A. Economic optimal rates							
	\$17.62	\$79.46	\$11.99	\$54.08		\$3,842	\$38.42
B. 75% of economic optimal rates (under fertilize)							
	\$12.53	\$71.03	\$8.73	\$52.07		\$3,461	\$34.61
C. 125% of economic optimal rates (over fertilize)							
	\$13.04	\$71.36	\$7.23	\$51.32		\$3,448	\$34.48
Liquid N & P Prices (N=\$0.535 and P=\$0.896)							
D. Economic optimal rates							
	\$1.66	\$54.53	-\$3.76	\$43.34		\$2,350	\$23.50
E. 75% of economic optimal rates (under fertilize)							
	-\$3.53	\$46.85	-\$6.65	\$42.03		\$2,002	\$20.02
F. 125% of economic optimal rates (over fertilize)							
	-\$3.53	\$44.68	-\$9.13	\$41.21		\$1,915	\$19.15

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Return over costs at expected 2009 crop prices and various fertilizer scenarios...

Return Over Costs vs Fertilizer Price and Rate (% of economic optimal)								
	Wheat	Corn	Milo	Soybean	DC Beans	Total	Average	
Acres	25.5	20.5	8.5	25.5	20.0	100.0		
Dry N & P Prices (N=\$0.365 and P=\$0.495)							KSU rates	
A. Economic optimal rates							\$36.75	
	\$17.62	\$79.46	\$11.99	\$54.08		\$3,842	\$38.42	
B. 75% of economic optimal rates (under fertilize)								
	\$12.53	\$71.03	\$8.73	\$52.07		\$3,461	\$34.61	
C. 125% of economic optimal rates (over fertilize)								
	\$13.04	\$71.36	\$7.23	\$51.32		\$3,448	\$34.48	
Liquid N & P Prices (N=\$0.535 and P=\$0.896)							KSU rates	
D.	1) Economic impact of over- or under-fertilizing is about the same at lower priced fertilizer (dry).					\$2,350	\$17.03	\$23.50
E.	2) At higher fertilizer prices (liquid), over-fertilizing starts becoming worse than under-fertilizing.					\$2,002	\$20.02	
F.	3) Fertilizer price (dry vs. liquid) has bigger impact on returns than deviations from the optimal rate.					\$1,915	\$19.15	

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Fertilizer prices and rates impact returns, but not near as much as commodity prices...

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Side issues with P

- Following MF-2586 N and Precs, depending upon crop and rotation, will end up over time at 11-14 ppm STP
- At crop prices and high fertilizer prices shown (esp P), would end up at much lower STP, perhaps 5-10 ppm
- Seems weird to end up that low but is it wrong?
 - Haven't seen such prices before

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Critical issues to think about

- Are MF-2586 rates really predicated on "other factors not limiting?"
- Can we fully compensate for low soil fertility with fertilizer?
- Might application methods and timing modify our results?
- What about using fertilizer P to compensate for low soil pH?

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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

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There may be bigger issues to consider

- We're seeing local fertilizer prices vary as much as 2x to 3x from location to location
- Liquid vs. dry – hire custom applicator?
- We expect continued drops in prices but perhaps a spike again next spring since little fertilizer got placed in the fall of 2008
- What about availability?
- Do I trust my provider's finances?

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The screenshot shows the AgManager.info website. The browser window title is "AgManager: providing agricultural economic information on crops, livestock, marketing and outlo". The address bar shows "http://www.agmanager.info/". The page has a green and white color scheme. On the left is a navigation menu with categories like "Agribusiness", "Crops", "Energy", "Farm Management", "Human Resources", "Income Tax & Law", "Livestock & Meat", "Policy (including 2008 Farm Bill)", "Ag Econ News", "Contributors", "Programs", "Sponsors", and "Upcoming Events". The main content area is titled "AgManager.info" and "Providing Information and Tools For The Competitive Business". It features a "Recent Updates" section with a list of articles and their authors. A large box with the word "Questions?" is overlaid on the bottom right of the page. The sidebar on the left includes a "Cattle Risk Management Library" section with a logo for CRMIL.