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Progress on private and public economic incentives for improving NUE on the farm and impediments to their adoption

SSSA Nitrogen Use Efficiency Conference
Kansas City, MO

Some key constraints in knowing what to do:

Understanding people and institutions

Understanding biological, biophysical, hydrological and other environmental responses

There are also trade-offs for everything we might consider.

Different approaches we might take for improving NUE:

1. Information & outreach
2. Financial incentives
3. Australian Bush Tender
4. Input tax
5. Compliance
6. Comprehensive regulation

Modified from Nitrogen in Agricultural Systems, Economic Research Service, USDA, Economic Research Report, Number 127

Information and outreach

- Private action taken if valued or if profitable
- Not necessarily targeted to worst acres
- Information can be targeted
- Most flexible for farmers—motivation and action

Financial incentives

Action depends on level of subsidy

May or may not be targeted

Usually practice-based (vs. performance)

High costs to taxpayers

Australian Bush Tender

- Joint choice between government and farmer
- Can be targeted to area and problem
- Government and farmer manage own flexibility
- Lower cost than financial incentives

Input tax

High tax based on high value in use

Can cover all acres where N used

Only deals with amount of Fertilizer N

Flexible adjustment

How to handle revenue?

Conservation Compliance

- Depends upon program payments level
- Limited by payments geography
- Currently erosion is main target
- Flexibility depends on provisions
- Enforcement difficult and costs are a consideration

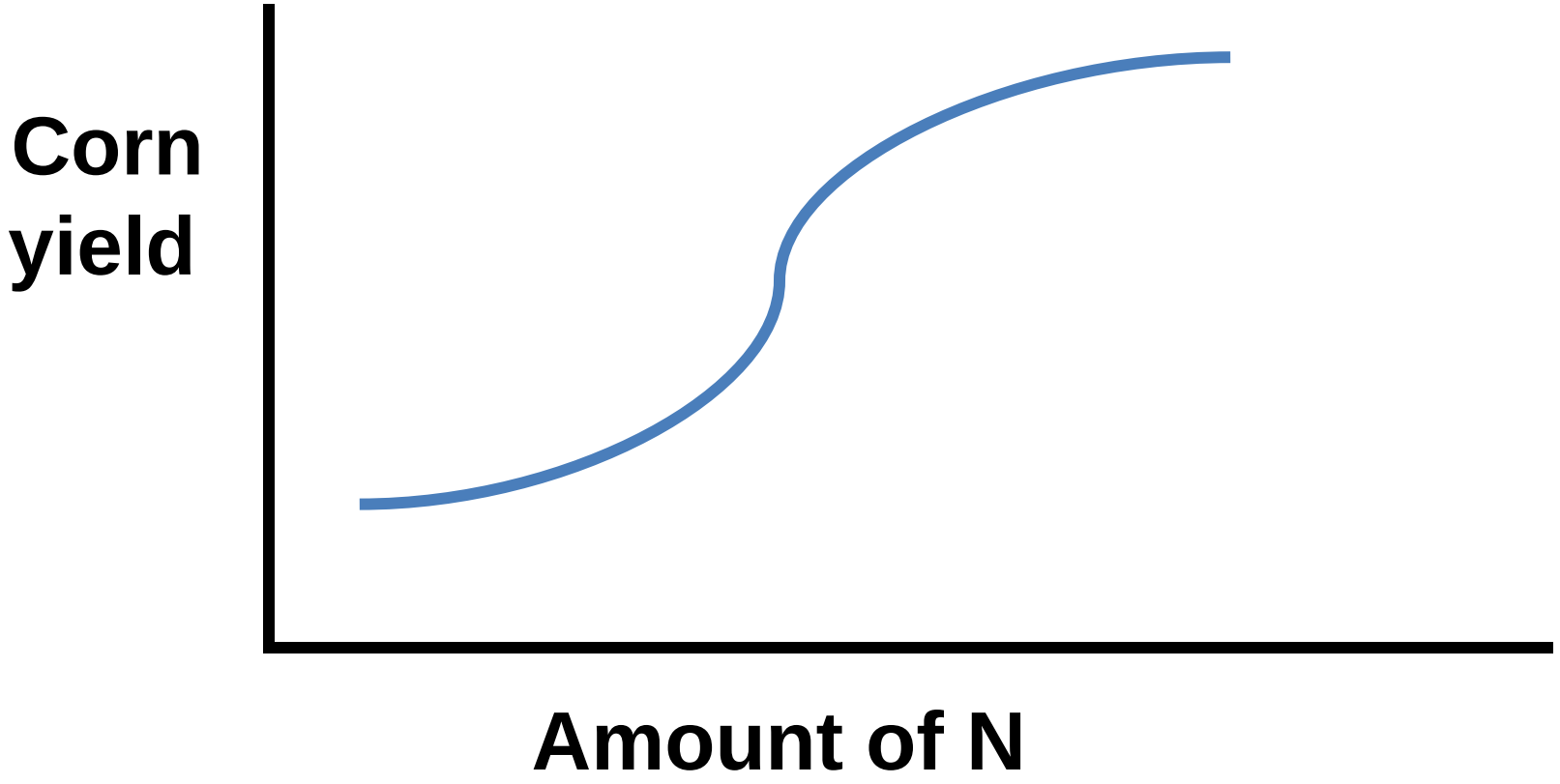
Comprehensive regulation European style

- Strongest incentive
- Coverage can be directed as desired
- Can target all aspects of N management
- Limited flexibility
- Enforcement costs are a consideration

Dealing with Nitrogen's high value in use

If 0.8 pound of N can add one bushel to corn yield, then $0.40 can return $6.50 (N @ $0.50 per pound and corn @ $6.50)

The return depends upon where one is on the production function!



Does a high price of N necessarily reduce application?

Not necessarily!

Determining factor is the Nitrogen/ Corn Price Ratio

Historical N/Corn Price Ratios

		N$/lb.	Corn$/bu.	N/Corn Price Ratio
	Example	0.50	6.50	.077
Year				
1970		0.046	1.33	.035
1975		0.16	2.54	.063
1980		0.14	3.11	.045
1985		0.155	2.23	.070
1990		0.12	2.28	.053
1995		0.20	3.24	.062
2000		0.138	1.85	.075
2001		0.243	1.97	.123
2005		0.25	2.00	.125
2010		0.304	5.18	.059

How did price drive farm decision makers in 2005?

Farmer Actions in:	2001	2005	2010
(N/Corn PR)	(.123)	(.125)	(.057)
Reduced N rate	11%	24%	14%
How much?	21%	17%	28%
More careful N management	8%	21%	.16%

Chart information from Nitrogen Management on U.S. Corn Acres, 2001-10 Economic Research Service, USDA, Economic Brief Number 20, November 2012.

Factors in farm N decisions

Opportunity cost (time and money)

Marginal analysis

Risk

Excess N is an externality

Opportunity cost

Alternative opportunities for current expenses and capital expenditure (Highest return with lowest risk)

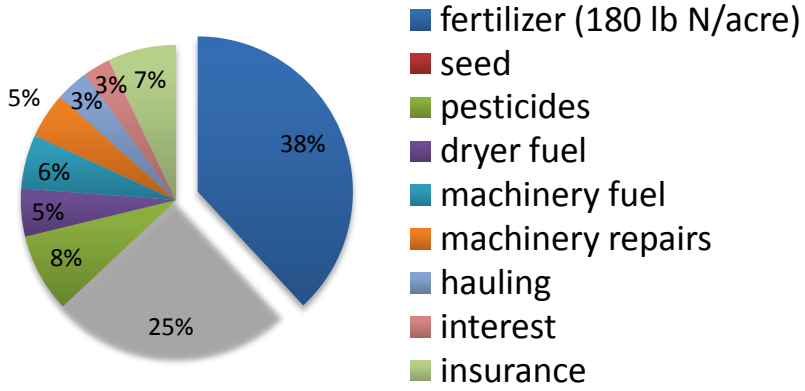
Scarcity of management time

Marginal analysis

Savings or profits from modifying N use and management

Why does nitrogen fertilizer application timing matter?

Estimated shares of variable costs per acre for rotation corn in 2013



	Cont. Corn	Rot. Corn
Expected yield per acre[2]	153	163
Harvest price[3]	$5.80	$5.80
Market revenue	$887	$945
Less variable costs[4]		
Fertilizer[5]	$195	$176
Seed[6]	115	115
Pesticides[7]	38	38
Dryer fuel[8]	29	23
Machinery fuel @ $3.45	26	26
Machinery repairs[9]	22	22
Hauling[10]	15	16
Interest[11]	14	13
Insurance/misc.[12]	32	33
Total variable cost	$486	$462
Contribution margin[13] (Revenue - variable costs) per acre	$401	$483

From Ben Gramig, Purdue University.

Recommended Agronomic N rates from *Tri-State Fertilizer Recommendations*

(Vitosh, et al., 1995)

Previous crop	Pre-plant Nitrogen Application (lbs N/acre) Expected Corn yield (bushels/acre)			Sidedress Nitrogen Application (lbs N/ acre) 10% less than Pre-plant N rate		
	100	140	180+	100	140	180+
Corn	110	160	220	99	144	198
Soybeans	80	130	190	72	117	171
Annual legume cover crop	80	130	190	72	117	171

Estimated Cost of Fertilizer by Application Timing and Crop Rotation

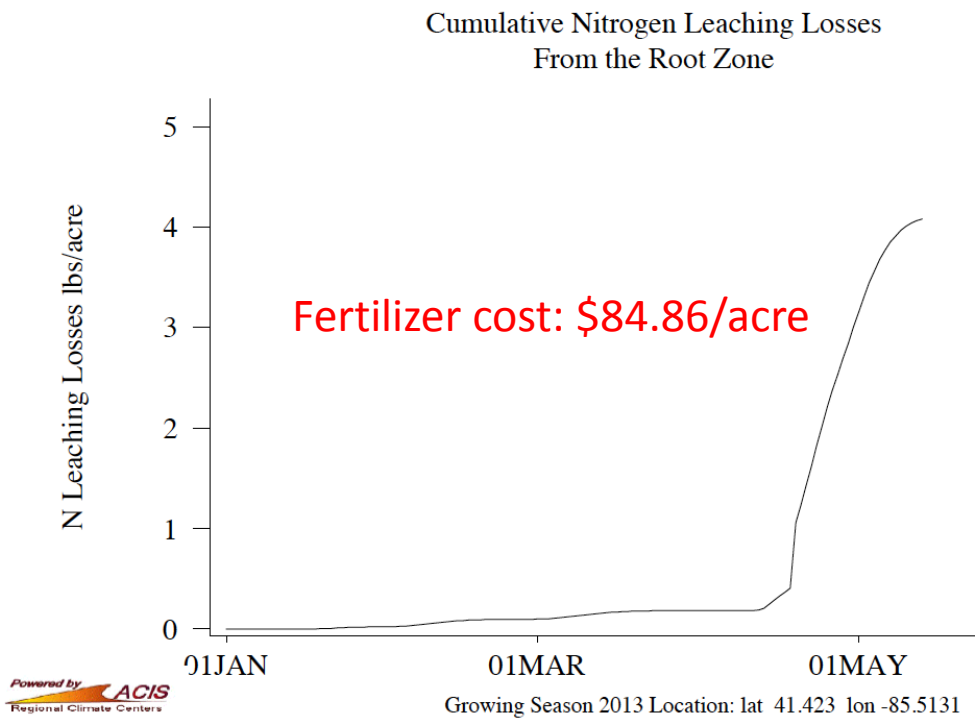
State average corn yields, 2010 (USDA, NASS)

Indiana	157 bushels/acre
Michigan	150 bushels/acre

	Indiana				Michigan			
Previous crop	Pre-Plant Application (lbs/acre)	Fertilizer Cost ($/acre)	Sidedress Application (lbs/acre)	Fertilizer Cost ($/acre)	Pre-Plant Application (lbs/acre)	Fertilizer Cost ($/acre)	Sidedress Application (lbs/acre)	Fertilizer Cost ($/acre)
Corn	157	$ 104.98	141	$ 94.48	147	$ 98.60	132	$ 88.74
Soybeans	127	$ 84.86	111	$ 74.36	117	$ 78.48	102	$ 68.62
Annual legume cover crop	97	$ 64.74	81	$ 54.24	87	$ 58.35	72	$ 48.49

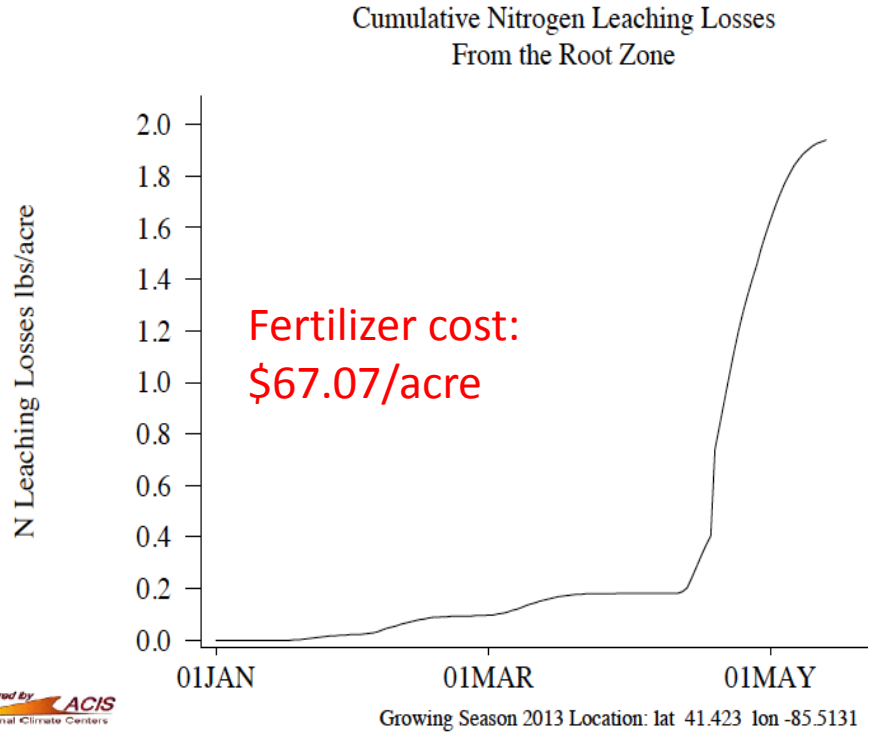
Compare N Losses: Leaching from Root Zone

Pre-plant application (127 lbs. N/acre)



Fertilizer cost: $84.86/acre

Side-dress application (100 lbs. N/acre)



Fertilizer cost: $67.07/acre

Why aren’t all farmers doing this already?

- More intensive management required for greatest benefit
- Risk of field access
- Specialized equipment for high clearance

“One cannot bring about change unless one knows why people are doing what they are doing today”.

Bruce McKenzie

What about risk?

Think in terms of field working days as a complicating factor.

Take a split application in Missouri but factor in available working days to get the job done.

1500 Acres

A split application of 100 lbs. of N followed by 50 lbs. This split application allows a reduction of 30 lbs. of N for a given yield.

30 lbs. x $0.50 x 1500 = $22,500 potential savings

But, not possible on all acres for all years.

1 year in 10 only 535 acres could be side-dressed.
Yield loss on acres not side-dressed = 25 bu./acre.

At $6.50 corn this loss is $156,800.

1 year in 30 there is no opportunity for side-dressing.

“Recipe Farming” may have higher input volumes and costs, but

- Lower perceived risk
- Less management time per acre
- Accommodates industrial-style organization

Some take aways on the economics of improving NUE

Individual pure market-driven incentives may not move us much from where we are today.

Institutional change can drive market-based incentives (and technology) to reduce externalities.

A widely-held perception of the need for change will be required to drive institutional change and individual action.

There is no silver bullet.

Our Earth