Nitrogen Experiments

This year 16 side-by-side comparisons of nitrogen fertilizer rates were conducted by PFI cooperators. The results are shown in Table 1. In each trial, the "high rate" was chosen by the cooperator to be more-or-less the customary rate of N fertilizer for that farm. The "low rate" was determined using the late spring soil nitrate test that is being adapted and developed at Iowa State University. With this test, the farmer samples the soil to a depth of 12" when the corn is 6-12" tall. A kit allows the results to be derived right on the farm, avoiding the delay involved with sending a sample to a distant lab. The day after taking the sample, the farmer can be back in the field sidedressing the crop.

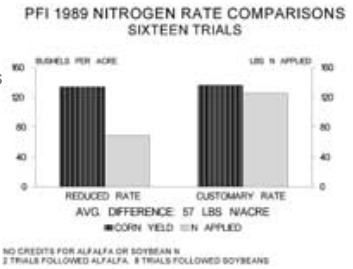

Figure 2. Crop yields from PFI nitrogen rate trials
No credits for alfalfa or soybean N
2 trials followed alfalfa. 8 trials followed soybeans

The nitrate test proved especially useful in 1989 because of the unusually dry winter and spring and the poor weather in 1988. There was a good deal of nitrogen carryover, especially in second-year corn. The test provided a way to put numbers to this "windfall" N. Cooperator Tom Frantzen says that the test saved him several thousand dollars in 1989. Some other cooperators found from the test that they required fairly high amounts of nitrogen.

The table shows corn yields in bushels per acre, and nitrogen rates in pounds per acre. Also included is the leaf tissue nitrogen content, in percent, at silking. Under most conditions, a leaf nitrogen content of at least 3% indicates that this nutrient is not limiting crop growth.

The columns under "low" and "high" frame a rough rate recommendation "window." The low recommendation equals the addition of 7 lbs of N for each part per million below the test kit standard, which is around 21 ppm. The high rate recommendation is based on adding 15 lbs N for each ppm below the standard. At this point, researchers do not know the best recommendation - the window just shows where the "ballpark" is, and only for research purposes, at that. The "actual" column in the table show the amount of N actually sidedressed.

A star indicates that the difference in yields between the high- and low-N corn was statistically significant at the 95% confidence level. As the table shows, the low rate of nitrogen was associated with lower yields in two trials, which are starred. The "N.S." in the other rows stands for "not significant." Both rate reductions occurred in "borderline" cases, where the minimum "recommendation" was somewhat above the actual rate sidedressed.

The "Low Rate $ Benefit" column shows the returns from using the lower of the two rates of nitrogen. Numbers within () are costs, or negative payoffs. In most trials, the greater return was from the low-N strips. Where there was no significant difference in yield, the Low Rate $ Benefit equals the difference in production costs. Where a significant yield difference was found, the Low Rate $ also factors in the value of the crop, using a corn price of $2.20/bu.

The last column indicates the energy savings from using the reduced rates of nitrogen, expressed in gallons of diesel fuel per acre. Synthetic nitrogen fertilizer is a major energy input in crop farming. If farmers across Iowa are able to reduce nitrogen rates, they will not only benefit their pocket books and the groundwater, they will also lessen the energy dependence of agriculture.

Table 1

NITROGEN RATE TRIALS

		LOW RATE TRT			HIGH RATE TRT			RECOMMENDED				DIFFERENCE			
COOPERATOR	PREVIOUS CROP	YIELD	N RATE	LEAF N	YIELD	N RATE	LEAF N	LOW	HIGH	ACTUAL		YIELD	YLD SIGN.	LOW RATE $ BENEFIT	GAL DIESEL EQUIVALENT
BAUER	ALFALFA	135.9	0	3.37	135.9	41	3.53	0	0	0		-0.1	N.S.	$7.30	6.3
BRODERS	SET-ASIDE ALFAFA	151.9	28	3.08	152	62	2.99	0	0	0		0.1	N.S.	$6.05	5.2
BUMGARNER	SOYBEANS	112.3	71	3.02	118.9	155	3.09	49	105	71		6.6	N.S.	$7.81	10.5
GRAAF	SOYBEANS	144.2	130	3.47	149	180	3.32	14	30	100		4.8	N.S.	$8.90	7.7
MADSEN	SOYBEANS	194.1	46	3.00	196.5	102	3.13			0		2.4	N.S.	$10.02	8.7
STONECYPHER	SOYBEANS	93.7	32	3.17	96.4	94	3.54	0	0	0		2.6	N.S.	$10.96	9.5
THOMPSON	SOYBEANS	140.2	130	3.37	142	190	3.24	42	90	0		1.8	N.S.	$10.68	9.3
WILSON	SOYBEANS	120.9	58	2.77	121.3	98	2.81	5	11	50		0.4	N.S.	$3.72	5.0
HAGENSICK	CORN	116.1	65	3.09	111.8	130	3.11	49	105	56		-4.3	N.S.	$6.05	8.1
HANKS	CORN	91	113	3.51	89.9	187	3.52	58	124	60		-1.0	N.S.	$13.17	11.4
HOULIHAN	CORN	129	67	3.36	130	132	3.43	0	0	0		1.0	N.S.	$11.57	10.0
SCHMADEKE	CORN	156.7	99	3.32	158.6	155	3.36	60	128	56		1.9	N.S.	$5.21	7.0
TREIMER	CORN	133.4	110	3.16	127.5	170	3.04	70	150	110		-5.9	N.S.	$10.68	9.3
TREIMER	CORN	135	50	3.24	132.8	110	3.24	28	60	50		-2.2	N.S.	$10.68	9.3
AVERAGE		132.4		3.21	133		3.24	29	62	40		0.58		$8.77	7.8
BAUER	SOYBEANS	146.4	36	3.24	155.4	78	3.18	9	19	0		9.0	*	($12.33)	6.5
SCHMADEKE	SOYBEANS	149.8	67	3.18	163.9	128	3.36	77	165	61		14.1	*	($25.37)	7.6
OVERALL AVG	.	134.4	69	3.21	136.4	126	3.24	30.7	66	38.4		2.0		$5.32	8.2

NITROGEN RATE TRIALS