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Injecting N Cuts Application Rate in Half?

Could be, say University of Tennessee researchers who set up models comparing broadcasting with injecting UAN in no-till corn.

Summary: *Results of this research show a reduction of 46 percent in the amount of N required from injected compared to broadcast UAN to achieve a no-till corn yield of 90 bu/A under average weather conditions. A 90-bu/A yield is not chosen as a target yield to which farmers aspire, but rather is representative of average corn yields in Tennessee. Although the cost of application is over two times higher for injection than broadcast, a lower cost of N is more than offsetting, resulting in a reduction in total cost of N fertilization by 39 percent. Furthermore, total production costs (less costs of land, management, and risk) of producing a 90-bushel yield through injection are nine percent lower than those for broadcast. Greatest differences in break-even prices between the two application methods occurred under poor weather conditions.*

The objective of this study was to evaluate the economic tradeoffs between injection and broadcast methods of applying N to no-till corn.

Data were obtained from a three-year experiment that began in 1983 and ended in 1985. Location of the study was the Milan Experiment Station in Milan, Tennessee. Soil was Memphis silt loam. No-till corn followed a wheat cover crop, and N was applied after planting. Weather conditions in 1983 were poor, while in 1984 precipitation was excellent and well timed. In 1985, weather conditions were about average. These data are still applicable in defining cost-efficient N application methods because the same application methods are currently being used, and state average corn yields have not changed appreciably since 1984.

The University of Tennessee Agricultural Extension Service prints row-crop budgets annually. These budgets include no-till corn production inputs and machinery complements specified for a 90 bu/A yield. This 90-bu/A yield was not chosen as a target yield to which farmers aspire. Rather it was chosen because it is representative of what typical corn land produced in an average weather year in Gibson County, Tennessee (1985 average yield, 96 bu/A), and in the state as a whole (1984-93 average yield, 92 bu/A).

Table 1. Cost comparisons between broadcasting and injecting UAN at rates expected to achieve a 90-bu/A no-till corn yield at Milan, TN, 1985, Roberts, et al.

Method	N	N Price	Variable cost of N	Application cost of N	Total Cost of N[1]
	lbs/A	$/lb	$/A	$/A	$/A
Broadcast	133.2	0.229	30.50	1.34	31.84
Inject	71.5	0.229	16.37	3.07	19.44

[1] Variable cost of N, plus cost of applying N. Does not include interest on operating capital.

Table 2. Differences in costs and break-even prices to achieve a 90-bu/A no-till corn yield at Milan, TN, by broadcasting or injecting UAN, Roberts, et al., University of Tennessee.

Method	Estimated yield	Cost of production	Break-even price	Difference in break-even prices
	bu/A	$/A	$/bu	$/bu
1983:				
Broadcast	50.0	148.60	2.97	0.72
Inject	60.2	135.65	2.25	--
1984:				
Broadcast	112.8	148.60	1.32	0.07
Inject	108.9	135.65	1.25	--
1985:				
Broadcast	90.0	148.60	1.65	0.14
Inject	90.0	135.65	1.51	--

[1] Includes interest on operating capital not included in Table 1.

Forty-six percent less N

Quadratic yield response functions were estimated by regression using 1983, 1984, and 1985 field data. Assuming a grower fertilizes for an average weather year, the 1985 yield response functions (field yields were 95 bu/A) were chosen to represent conditions necessary to achieve the 90-bushel yield given in the no-till corn budget. The resulting response functions for 1985 (average weather) are given in Figure 1, which shows the amounts of N that would be required to achieve a corn yield of 90 bu/A for each application method. Note by the curves how injecting UAN, compared to broadcasting, would require significantly less lbs/A of N.

Table 1 lists the amounts of N that would be needed to produce yields of 90 bushels using the 1985 function, the price of UAN, and costs of N as well as its application. To achieve a 90-bu/A yield for average weather conditions (1985) would require 133 lbs/A of N from broadcast UAN and 72 lbs/A of N from injected UAN. These findings suggest substantial N reductions can be achieved through injection rather than broadcast. In fertilizing for average weather conditions to achieve a 90-bu/A yield, injecting UAN would require 46 percent less N than broadcasting UAN.

Total cost lower

Injected UAN has a variable N cost lower than broadcast in Table 1 because of a lower N application rate. The cost of injecting N is higher because more time is required to fertilizer an acre. Both labor and machinery

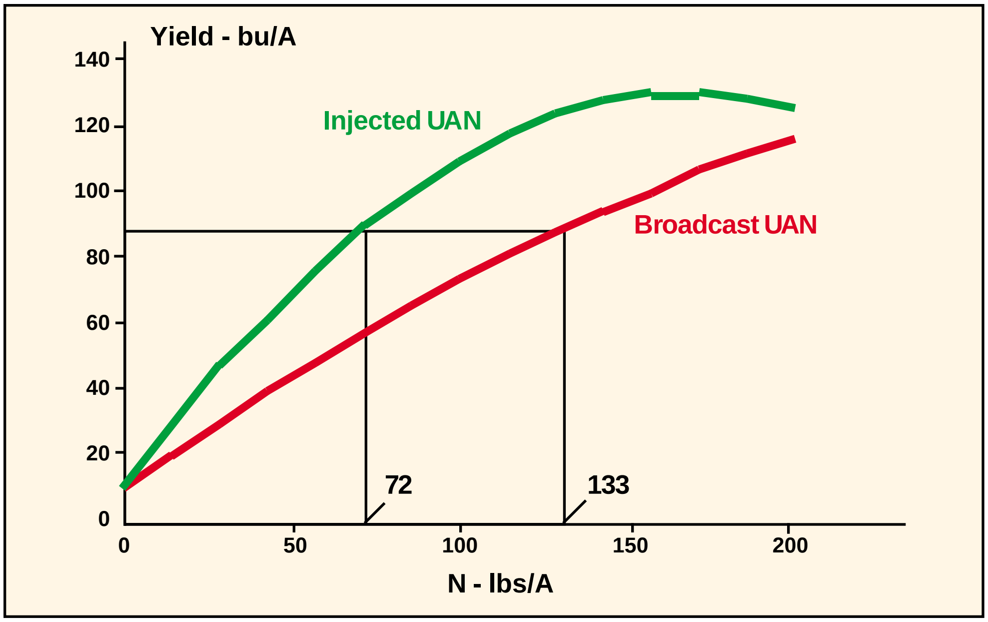

Figure 1. Estimated yield response functions for UAN applied to no-till corn, comparing broadcast and injection responses, Milan, TN, Roberts, et al., University of Tennessee, 1985.

costs increase as field time increases, making UAN injection more expensive. Nevertheless, when the cost of N and the cost of application are combined, injection still has a total cost advantage because higher application costs are greatly offset by lower N costs when compared to broadcasting. As can be seen in the table, injected UAN has a $12.40/A total cost advantage over broadcast UAN.

Table 2 lists estimated yields per acre, total production costs per acre, and break-even prices per bushel for N application methods, using the 1983, 1984, and 1985 yield response functions. Total production costs include all costs except those for land, management, and risk. Differences in total production cost emanate from differences in method of application.

Break-even lower, too

Break-even prices to land, management, and risk are calculated by dividing the yield level into total cost of production (Table 2). Note that the highest break-even price difference between broadcast and injection of UAN occurs in the year 1983, being $0.72/bu. As already noted, poor weather account for this skewing.

With yields higher in 1984 and 1985, because of more favorable weather, break-even prices in Table 2 decline notably. So do break-even price differences between broadcast and injection application methods. Note in Table 2 that the break-even price for injected UAN is $0.07 below broadcast UAN in 1984 and $0.14 below in 1985. These results reflect the increased efficiency of broadcast UAN, relative to injection, under good and average weather conditions (1984 and 1985) as opposed to poor weather conditions (1983). Thus, risk associated with broadcasting is greatest in poor weather years.

Assuming, as we have, a Tennessee no-till corn grower fertilizes for average weather conditions to achieve a yield of 90 bu/A, results show (for 1985 conditions in Table 2) a more favorable return for injected UAN versus broadcast. Using the marketing year average corn price in Tennessee for 1984 through 1993, we'll see how this would work out. Given a price of $2.36/bu, injected UAN would return $0.85/bu ($2.36 - $1.51) while broadcast UAN would return only $0.71/bu. On a per acre basis, with a 90-bu/A yield, injected UAN would return $76.75 (90 bu/A times $2.36/bu, less $135.65/A total costs) to land, management, and risk, while broadcast UAN would return only $63.80. That amounts to a difference of $12.95/A!

Differences in break-even prices between application methods are greatest for the poor weather conditions of 1983, as the table so clearly shows, suggesting greatly reduced efficiency of broadcast UAN. For the good and average weather conditions of 1984 and 1985, greater relative efficiency of broadcast UAN is reflected in smaller differences in break-even prices. Thus, risk associated with broadcasting compared to injected UAN is greatly increased in poor weather years.

Based on our yield response functions, no-till corn growers should inject rather than broadcast UAN. Risks of negative returns in poor weather years will be reduced, and profits will be enhanced in years with average or better than average weather.

Methodology

Production costs found in the 90-bushel, no-till corn budget were adjusted for the N application methods. Adjustments to budgets were for the amounts and price of UAN, and for machinery and labor required for application.

Application costs were estimated to include fuel, repairs, machinery depreciation and interest, interest on operating capital, and labor associated with application.

A 100-horsepower tractor was assumed for both application methods. Tractor time required to pull the fertilizer spreader was assumed to be 0.07 hours/A for broadcast UAN. For injected UAN, tractor hours/A to pull the injector tanks were assumed to be 0.16. For both broadcast and injected UAN, labor hours for application were set at 1.35 times tractor hours. This extra labor was assumed to cover the time associated with preparation and cleanup.

Charges for spreader or tank rental were assumed to be included in the price of fertilizer. A common practice in Tennessee is for the fertilizer distributor to supply application equipment at no extra cost to the growers.

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