Moving from Uniform to Variable Fertilizer Rates on Iowa Corn: Effects on Rates and Returns

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Working Paper 97-WP 182
October 1997

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Partial support for this research was provided by the Iowa Corn Promotion Board, the Iowa Soybean Promotion Board, and the Leopold Center for Sustainable Agriculture.

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Abstract

This paper estimates the potential value of switching from applying nitrogen fertilizer according to SRT to applying it according to VRT in 12 Iowa counties. Changes in yields, nitrogen use, and profits are estimated for individual fields and entire counties as farmers move from SRT to VRT. The county-level results indicate modest increases in returns over fertilizer costs, ranging from $7.43 per acre to $1.59 per acre. The county-level VRT production benefits are increases in yields ranging from 0.05 to 0.50 bushels per acre and reduction in production costs ranging from $1.19 to $6.83 per acre. The VRT environmental benefit for the entire study area is quite large, ranging from 77 to 172 tons of nitrogen. Increases in the price of corn and nitrogen cause the value of VRT to increase. Greater field variability from either the soil types within a field or from the best manner to treat the soil types also cause the value of VRT to increase.

MOVING FROM UNIFORM TO VARIABLE FERTILIZER RATES ON IOWA CORN: EFFECTS ON RATES AND RETURNS

Many studies show that crop yields vary within fields and that the degree of variability can be substantial [Robert et al., 1990; Carr et al., 1991; Miller et al., 1992; Vetsch et al., 1993; Wibawa et al., 1993; Wolkowski and Wollenhaupt, 1993]. Yield variability can be caused by a nonuniform distribution of soil properties, such as nutrient availability, soil moisture, landscape position, pest pressure, soil compaction, drainage, and rooting depth [Donahue, et al., 1983; Sawyer, 1994], or by a variable response to uniformly applied inputs.

The pervasiveness of spatial variability in yields suggests an opportunity for improving production efficiency by varying input applications within fields. Traditional input management techniques are to apply a single rate to an entire field (or group of fields). We refer to these traditional practices as single rate technologies (SRT). Significant research efforts are underway to develop the knowledge and equipment needed to allow farmers to move to variable rate technologies (VRT) [National Research Council, 1997].

When the response of yield to applied inputs varies across a field, then using an SRT will, in general, leave part of the field under-supplied with the input, while another portion is over-supplied. The under-supplied portion experiences a reduction in yield from the lack of necessary inputs. The over-supplied portion results in wasteful input use, increasing production costs and the risk of environmental contamination. Babcock (1992) showed that the profit-maximizing SRT application rate is where the marginal yield gain on the under-supplied portions of a field is just equal to the real cost of the input. Babcock showed that when the real cost of an input is inexpensive relative to its average productivity, then optimal SRT rates may result in most of a field being over-supplied. In this situation, moving to VRT, where each portion of a field receives an optimal amount of input, should lead to greater output with lower input levels.

Recent empirical findings indicate that moving from SRT to VRT to control nitrogen fertilizer rates should have significant effects on input usage and possibly yield levels. Spatial variations in soil moisture within a field result in variations in the marginal product of nitrogen fertilizer, which leads to optimal nitrogen application rates that vary across a field [Dai et al., 1993]. Also, other growing conditions between experimental sites alter optimal nitrogen fertilizer rates [Babcock and Blackmer, 1994], which suggests that optimal rates should vary within fields if site-specific growing conditions vary within fields. Increased growing condition variability tends to increase optimal SRT application rates as farmers over-apply nitrogen fertilizer to insure against the possibility of being caught short of fertilizer [Babcock, 1992; Babcock and Blackmer, 1992].

Excessive use of nitrogen by farmers is a major concern among agronomists, environmentalists, and the water industry [Nielsen and Lee, 1987; Office of Technology Assessment, 1984]. The environmental concern about the over-application of chemicals has grown over the years with the increasing evidence of groundwater contamination [Dao, 1992].

Small-scale experiments with VRT on specific fields indicate that potential exists for small yield increases with reduced input usage [Robert et al., 1990; Carr et al., 1991; Miller et al., 1992; Wibawa et al., 1993; Wolkowski and Wollenhaupt, 1993]. Individual fields are tested and monitored extensively over a number of years. The precision agriculture industry and the literature, however, lacks a method to use readily available data and decision rules to replicate the process of applying VRT. The output of such a model could assist local extension agents and the agricultural community in examining the private and environmental benefits from the widespread implementation of VRT.

This paper estimates the potential value of switching from applying nitrogen fertilizer according to SRT to applying it according to VRT in 12 Iowa counties. The economic and environmental impacts of moving from SRT to VRT depends heavily on the amount of inherent yield variability in fields [Hennessy et al., 1996]. An empirical contribution of this paper is that an estimate of potential yield variability across Iowa fields is estimated. Changes in yields, nitrogen use, and profits are estimated for individual fields and entire counties as farmers move from SRT to VRT. These estimates are based on a fertilizer decision model that is parameterized from the results of previous studies.

The Model

The overall relationship between corn yields and applied nitrogen is needed to calculate the value of VRT. A consensus on the appropriate functional form has not been reached. A substantial portion of the literature supports the existence of a plateau in the plant yield response to applied nitrogen [Ackello-Ogutu et al., 1985; Cerrato and Blackmer, 1990; Paris, 1992]. Others find the plateau conflicting with standard agronomic principles [Berck and Hefland, 1990; Frank et al., 1990; Sinclair and Park, 1993]. Studies that relate corn yields to nitrogen have used the quadratic [Babcock and Blackmer, 1994], the Mitscherlich [Babcock and Blackmer, 1994], cubic [Hennessy et al., 1996], and LRP production functions [Niven, 1994; Babcock and Blackmer, 1994; Babcock et al, 1996]. In this study the linear response plateau (LRP) relationship is used to represent the relationship between corn yield and applied nitrogen.

Each field is assumed to consist of n different types of soil. Each soil type is assumed to have an inherent maximum corn productivity level. Nitrogen is assumed to be the only input limiting corn productivity. All other necessary inputs are nonlimiting. For each soil type i, the maximum inherent yield (M_i) is produced by the optimal nitrogen application (Q_i). Nitrogen applications (N_i) greater than Q_i have no effect on the soil's productivity, but applications less than Q_i reduce the soil's corn yield by a constant per unit level (b). The dummy variable D_i is equal to one if $N_i < Q_i$ and equal to zero otherwise. Under these assumptions, the i^{th} soil type corn yield response to applied nitrogen is summarized by the LRP production function:

$$Y_i = M_i - D_i b(Q_i - N_i). \qquad (1)$$

With VRT, the farmer is assumed to know the exact location of the n soil types within a field. Let α_i denote the proportion of the field containing of the i^{th} soil type.

Furthermore, let P_N denote the price of nitrogen fertilizer and P_C the price of corn. The optimal per acre average yield (Y^{VRT}), nitrogen application (N^{VRT}), and profit (π^{VRT}) with VRT are:

$$Y^{VRT} = \sum_{i=1}^{n} \alpha_i M_i \,. \qquad (2)$$

$$N^{VRT} = \sum_{i=1}^{n} \alpha_i Q_i \,, \qquad (3)$$

$$\pi^{VRT} = P_C Y^{VRT} - P_N N^{VRT} = \sum_{i=1}^{n} \alpha_i (P_C M_i - P_N Q_i). \qquad (4)$$

With SRT, the farmer does not know the exact location of the n soil types within a field, but knows the spatial distribution of each soil type (the α_i's). The expected per acre profit on a field from SRT is given by:

$$E(\pi^{SRT}) = \sum_{i=1}^{n} \alpha_i [P_C(M_i - D_i b(Q_i - N^{SRT})) - P_N N^{SRT}], \qquad (5)$$

where N^{SRT} is the single rate of nitrogen fertilizer applied throughout the field.

The value, V, of moving to a variable rate technology on a field is the increase in profits when switching from SRT to VRT:

$$V = \pi^{VRT} - E(\pi^{SRT}) = \sum_{i=1}^{n} \alpha_i D_i (bP_C - P_N)(Q_i - N^{SRT}) + \sum_{i=1}^{n} \alpha_i (1 - D_i) P_N (N^{SRT} - Q_i). \quad (6)$$

With VRT, nitrogen fertilizer rates are varied according to soil type allowing optimal rates to be applied to each type of soil. The first term in equation (6) represents the change in profits from increased yields. The term $D_i(bP_C - P_N)$ represents the marginal profit from an additional unit of applied nitrogen when eliminating the under-application of nitrogen fertilizer and $(Q_i - N)$ is the amount of additional fertilizer applied to these soils. The second term in equation (6) represents the change in profits from eliminating the over-application of nitrogen fertilizer.

Equation (6) estimates the value of moving to VRT as the change in returns over fertilizer costs. It does not account for a number of costs associated with moving to VRT.

These include the cost of acquiring knowledge about the spatial distribution of soils within a field, any additional equipment costs including new fertilizer spreaders, computer hardware and software, global positioning systems, and any additional labor costs. There are two reasons why these costs are not accounted for here. First, some of the costs would be allocated to other precision farming endeavors, such as weed control, planting, and perhaps insect control. Thus, not all the costs would have to be covered by more efficient fertilizer decisions. Second, the actual increase in costs from moving to VRT are unknown. The precision farming industry is in its infancy. Equipment standards and practices have not been set. Hence, any current cost estimates are bound to overstate costs once the industry has matured.

The value of VRT depends on the type of SRT strategy used. If the SRT strategy is to farm to the best soil, so that $N^{SRT} = \max_i(Q_i)$ so that $D_i = 0$ for all i, then the total value of VRT becomes the cost saving from reduced fertilizer application, as corn yield and production are unaffected. In this case, VRT allows farmers to produce the same output with a smaller amount of fertilizer. Only the price of nitrogen fertilizer affects the value of VRT, not the price of corn. Increases (decreases) in the price of nitrogen fertilizer increases (decreases) the value of VRT.

If the SRT strategy is to find the nitrogen application rate that maximizes expected profit, then either farming to the best soil may be optimal or having $D_i = 0$ for some soil types and $D_i = 1$ for others. If some soil types are under-supplied and others over-supplied, then the value of VRT consists of yield increases as well as and input cost savings. The value of VRT increases as the prices of nitrogen fertilizer and corn increase, as demonstrated by equations (7) and (8). Equation (9) shows that as corn yields become more responsive to applied nitrogen, the value of VRT also increases.

$$\frac{\partial V}{\partial P_C} = \sum_{i=1}^{n} \alpha_i D_i b(Q_i - N^{SRT}) \geq 0, \tag{7}$$

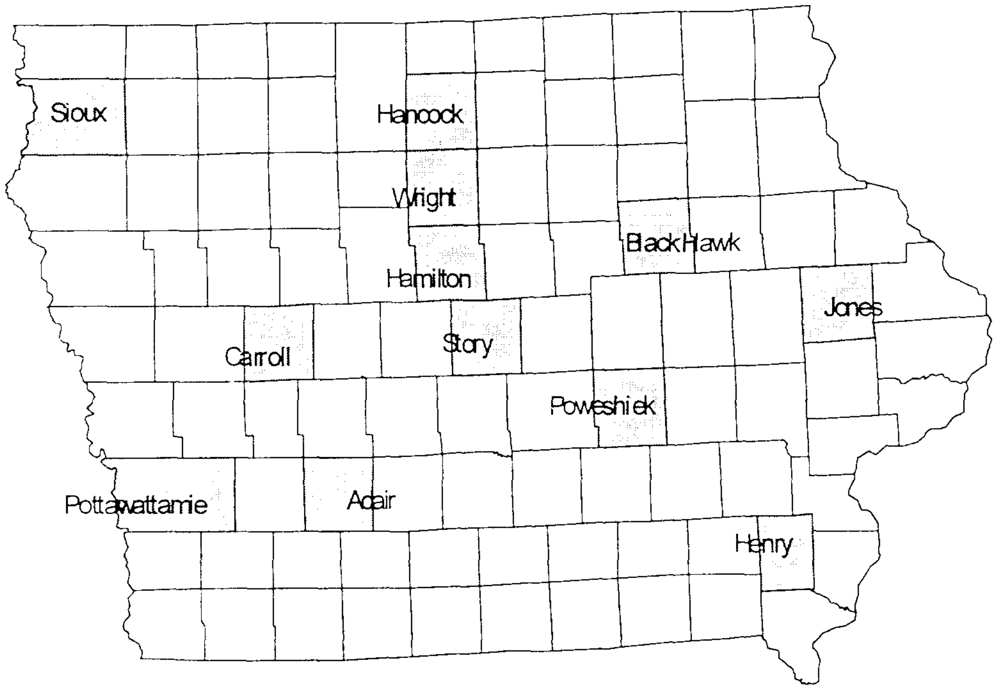
$$\frac{\partial V}{\partial P_N} = \sum_{i=1}^{n} \alpha_i [D_i(Q_i - N^{SRT}) + (1 - D_i)(N^{SRT} - Q_i)] \geq 0, \tag{8}$$

$$\frac{\partial V}{\partial b} = \sum_{i=1}^{n} \alpha_i D_i P_C (Q_i - N^{SRT}) \geq 0. \tag{9}$$

Empirical Results

Data on the distribution and productivity of soils on 20 randomly selected fields in 12 randomly selected Iowa counties were obtained from the Soil Survey section of the Iowa State University Department of Agronomy. Figure 1 shows the location of the counties. For each field, the spatial distribution of soil types (α_i) was estimated from digitized soil maps. Each soil type has an associated estimate of corn yield potential. The maximum yield in the LRP model (M_i from equation [1]) was set equal to this corn yield potential. The slope coefficient (b) of the LRP model was set equal to 0.56 which was the average LRP slope across many site-years in a previous study [Babcock and Blackmer, 1994]. The price per bushel of corn was set at $2.50 and the price per pound of nitrogen was set at $0.20.

Figure 1. Iowa Counties Selected for Analysis



How optimal nitrogen applications (the rate where the kink occurs in the LRP model) change with a soil's yield potential is not a straightforward relationship. Fertilizer recommendations from Iowa State University used to be based on the rule that $Q_i = 1.2M_i$. Babcock and Blackmer (1994) found evidence that supports a positive relationship between Q_i and M_i across sites, but the parameters of the relationship were sensitive to the assumed functional form of the site-specific production function. To show how the effects of moving to VRT are affected by the parameters, two sets of parameters are used in this study:

$$Q_i = 105.56 + 0.68M_i, \tag{11}$$

$$Q_i = -21.93 + 1.52M_i. \tag{12}$$

The two relationships are used to examine the changes in the value of VRT from altering the responsiveness of optimal nitrogen rates to maximum inherent yields. Equation (11) represents the situation where optimal nitrogen rates are relatively unresponsive to maximum yields, whereas equation (12) represents the more responsive case.

To estimate the effects of moving to VRT, we first must determine N^{SRT} for each field. This was accomplished by finding the application rate that maximized equation (5). At this optimal single application rate, portions of fields either receive too much fertilizer ($M_i < bN^{SRT}$), too little fertilizer ($M_i > bN^{SRT}$), or the optimal (in an ex post sense) amount ($M_i = bN^{SRT}$). Table 1 presents estimates of the acreage and proportion of acreage on the fields in each of the 12 counties that are over-supplied or under-supplied with fertilizer. The acreage that receives the optimal amount is the residual.

If farmers fertilize according to the optimal SRT rule, and if optimal fertilizer rates and soil type are linearly related, as specified in equations (11) and (12), then 66 percent of acreage would be over-supplied with fertilizer, 4 percent would be under-supplied, and 30 percent of the acreage on these fields would receive the correct amount of fertilizer. The optimal single rate of fertilizer will equal the optimal VRT application for an entire field only if the field has only one soil type. In this study, all fields exhibited some soil type variability. The optimal single rate will equal the VRT rate on a portion of a field if that portion is the predominant soil type that is relatively high yielding. This predominance of soils on fields is why 30 percent of the acreage would receive the correct amount of fertilizer under SRT.

Table 2 presents the per acre change in returns over fertilizer costs in each of the 12 Iowa counties when switching from SRT to VRT applications of nitrogen fertilizer. The Table 2 results assume that optimal nitrogen rates are relatively responsive to maximum yields (equation [11]). The largest increase in returns, $7.43 per acre, occurred in Adair County and the smallest increase in profit, $3.40 per acre, occurred in Henry County. Over the whole study area, switching to VRT would increase returns over fertilizer costs by $4.44 per acre.

Table 2 also presents the source of the increase in returns when switching to VRT. In the study area, the vast majority of the increase (86 percent) came from reducing excess fertilizer applications. Profit-maximization using SRT leads to excess applications because the payoff from reducing yield shortfalls in high-yielding portions of fields is greater than the cost savings from reducing rates on low-yielding portions. That is, when farmers cannot vary fertilizer rates across their fields, or they do not have information about the location of their best yielding soils, then they have an incentive to fertilize for the best soils on their fields. With VRT farmers possess information about the location of their soils and the ability to vary fertilizer rates. This knowledge and ability leads to lower production costs from reduced fertilizer applications without a yield loss. In Pottawattamie County, eliminating the over-application of nitrogen fertilizer contributed to 95 percent of the increase in profit. In Carroll County, the contribution is lowest, but still quite substantial at 70 percent.

The other source of increasing profits with VRT is eliminating the under-application of nitrogen fertilizer. Applying more nitrogen fertilizer where it is needed increases corn yield and farmer profit. In the study area, only 14 percent of the increase in profits are attributable to increasing yields. This modest contribution reflects the large amount of land that is over-supplied with nitrogen fertilizer rather than under supplied when using SRT. The increases in marginal returns from increasing fertilizer rates on under-supplied land is much higher than for reducing rates on over-supplied land. Adding a pound of nitrogen where it is needed generates $1.20 [(2.5*0.56)-0.2] additional returns per acre, whereas removing a pound of nitrogen where it is not needed generates only $0.20 per acre. Of course, this asymmetry in returns is why farmers have an incentive to over-apply nitrogen fertilizer under SRT.

Table 3 presents the environmental and production improvements when switching to VRT. As shown in Table 1, about 66 percent of acreage received excess fertilizer over the study area. The first column of Table 3 reports the amount of excess fertilizer applied on this acreage. This is fertilizer that is not needed by the crop and potentially lost to the environment. The second column reports the amount as a percentage of the level applied under VRT. Over the study region, the 66 percent of acreage that received too much fertilizer received, on average, 16.9 percent too much. This over-application ranged from a high of 31.8 percent in Adair County to a low of 12.1 percent in Carroll and Story Counties. The reductions in excess nitrogen applications presumably yields some public environmental benefit without any loss in farmer yields.

The VRT production benefits are higher yields and lower production costs. Increases in yields are quite small, since gains are possible on only 4 percent of the acreage. Over the entire study area, VRT increases yield by an average of 0.30 bushels per acre, which has a value of $0.75 per acre. This small yield increase occurs with a $3.69 per acre reduction in the cost of nitrogen fertilizer. With VRT, farmers are able to modestly increase production using a smaller amount of inputs and inflicting less damage on the surrounding environment.

The individual field estimates are presented in Appendixes A, B, and C. Appendix A contains the acres in each field that are over-supplied, under-supplied, and properly supplied with nitrogen when using the optimal SRT. Appendixes B and C contain estimates for the environmental and production benefits for each field when switching to VRT. Appendix B is for the case of highly responsive optimal nitrogen rates, while Appendix C is for the less responsive case.

Factors Affecting the Value of VRT

Factors that may affect the value of VRT are the responsiveness of optimal nitrogen rates to maximum yields, the variability of soil types within a field, and the overall productivity level of a field.

Responsiveness of Optimal Nitrogen Rates. The SRT acres that are either over-supplied or under-supplied with nitrogen fertilizer are unaffected by the responsiveness of optimal nitrogen rates to maximum inherent yields. The linearity of the relationships between yield and applied nitrogen and between maximum inherent yield and optimal nitrogen rate leaves the SRT acres improperly supplied unchanged.

Table 4 presents the increase in profit when switching to VRT when the response of optimal nitrogen application to maximum inherent yield is relatively unresponsive as given by equation [11]. As the responsiveness decreases, the increase in returns to moving to VRT becomes smaller for each county. The largest increase becomes $3.32 per acre in Adair County, while the smallest increase is $1.52 per acre in Henry County. For the study area, the increase is less than half the increase estimated under the more responsive relationship. The average increase falls from $4.44 per acre to $1.99 per acre. The source of the increase in returns from moving to VRT, however, remains at 86 percent due to the elimination of over-application and 14 percent due to the elimination of under-application of nitrogen.

As the responsiveness of optimal nitrogen rates to soil productivity declines, SRT applications continue to incorrectly apply nitrogen to the same acreage, but the magnitude of the over- and under-application becomes smaller. This reduction in the misapplication of nitrogen to a field is due to the reduced variability of optimal nitrogen rates. SRT applications of nitrogen fertilizer becomes closer to VRT applications. Of course, in the limit, as variability goes to zero, SRT rates converge to VRT rates.

Tables 3 and 5 provide additional evidence of this by showing that the VRT environmental and production improvements are smaller when the optimal nitrogen application rate is less responsive. In the study area, the amount of nitrogen fertilizer potentially leeching into underground water supplies declines from 16.9 percent of VRT application rates to 7.6 percent. VRT increase in corn yields also falls from 0.30 bushels per acre in the high response case to 0.13 bushels per acre in the low response case. Finally, the VRT reduction in nitrogen costs decreases from $3.69 per acre to $1.65 per acre. A lower optimal nitrogen rate response to maximum inherent yields causes the value of VRT as well as its environmental and production improvements to decline.

Field Variability and Productivity. To estimate the impact of yield variability within a field, the value of VRT on field (V) is regressed on the standard deviation of M_i for each field. Table 6 presents the results of the regression when the optimal nitrogen rate is relatively responsive and nonresponsive to soil productivity. Not surprisingly, the variability of soil productivity significantly affects V, a result that supports the theoretical models of the effects of variability on the value of VRT [Hennessy et al., 1996]. As the standard deviation of soil productivity (as measured by maximum inherent yield) increases by one bushel per acre, the value of VRT increases by $0.13 per acre in the low response case and $0.28 per acre in the high response case.

In the 12-county study area, fields with lower overall productivity on average possess greater yield variability. The correlation coefficient between yield variability and overall field productivity is equal to –0.54. These results indicate that the value of VRT on average will be greater for less productive fields than fields with higher productivity levels.

Conclusions

There is a growing need for research that estimates the potential value to farmers of acquiring and using improved information about spatial variability within their fields. This need comes from the precision agriculture industry, as it struggles to develop decision models that can turn technical advances in positioning equipment and data generation into value for farmers, and from farmers who are trying to estimate the potential value of investing in precision agriculture equipment. This study begins to fill this need by estimating the potential value of using information about the distribution of soil productivity within fields to guide nitrogen fertilizer rates.

The spatial distribution of soils on 20 randomly selected fields in each of 12 Iowa counties is used to estimate the degree of spatial variability that exists and how fertilizer rates and returns to fertilizer might be altered by moving to variable fertilizer rates. We demonstrate that following an optimal uniform rate on these 240 fields would result in 66 percent of acreage being over-supplied with nitrogen fertilizer. Only 4 percent of acreage would be under-supplied. Thus, matching fertilizer rates with a soil's productivity would reduce average nitrogen fertilizer rates and increase yields by a small amount, thereby increasing returns over fertilizer costs. Environmental benefits would accrue because less nitrogen would be available to contaminate water supplies.

The county-level results indicate modest increases in returns over fertilizer costs, ranging from $7.43 per acre to $1.59 per acre. The county-level VRT production benefits are increases in yields ranging from 0.05 to 0.50 bushels per acre and reduction in production costs ranging from $1.19 to $6.83 per acre. The modest increase in returns is due to farmers over-applying nitrogen when using SRT, thereby insuring themselves against yield losses. The profit margin for correcting over-supplied land is minimal, $0.20 per acre, while correcting under-supplied land is much larger, $1.20 per acre. The VRT environmental benefit for the entire study area is quite large, ranging from 77 to 172 tons of nitrogen.

Increases in the price of corn and nitrogen cause the value of VRT to increase. Greater field variability from either the soil types within a field (maximum inherent yields) or from the best manner to treat the soil types (optimal nitrogen applications) also cause the value of VRT to increase. Increasing the yield variability within a field one bushel per acre increases the value of VRT approximately $0.13 to $0.28 per acre. The lower productive fields in the study area were found to possess more yield variability than the higher productive fields. This indicates that the value of VRT will be greater on average for lower productive fields.

The increases in returns over fertilizer costs estimated here would likely not cover the total cost of moving to VRT. However, the analysis ignored other farming decisions that may be improved through the use of VRT for nitrogen applications. For example, knowing the soil types within a field may refine the decisions on the levels of phosphorous and potassium to add as well as improve seeding practices. In this manner, the multiproduct nature of VRT would be fully exploited, increasing its value.

Furthermore, the analysis assumed the farmer possessed either perfect information (VRT) or no information (SRT) about the location of soil types within a field. If the farmer obtains partial information, much of the VRT benefits might be realized at a significantly lower cost.

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Table 1. SRT acres over-supplied and under-supplied with nitrogen fertilizer in 12 Iowa counties

County	Total Acres	SRT Acres Over-Supplied	Percentage Over-Supplied	SRT Acres Under-Supplied	Percentage Under-Supplied
Adair	1,081	752	70	42	4
Black Hawk	987	567	58	27	3
Carroll	1,447	1,010	70	113	8
Henry	1,044	640	62	21	2
Hancock	1,800	1,144	64	83	5
Hamilton	1,909	1,257	66	113	6
Poweshiek	1,000	608	61	43	4
Pottawattamie	1,271	732	58	15	1
Sioux	2,024	1,470	73	115	6
Story	1,582	944	60	52	3
Jones	962	688	72	48	5
Wright	3,039	2,116	70	67	2
Total	18,146	11,929	66	738	4

Table 2. Increase in farmer returns over fertilizer costs using VRT in 12 Iowa counties when optimal nitrogen rates are less responsive to maximum yields

County	Returns over Fertilizer Cost	Percent Attributable to Eliminating SRT Over-Application of Nitrogen	Percent Attributable to Eliminating SRT Under-Application of Nitrogen
	($/acre)		
Adair	7.43	93	7
Black Hawk	3.42	93	7
Carroll	4.24	70	30
Henry	3.40	93	7
Hancock	4.52	86	14
Hamilton	3.89	73	27
Poweshiek	5.65	82	18
Pottawattamie	4.27	95	5
Sioux	3.78	86	14
Story	3.55	80	20
Jones	6.68	89	11
Wright	4.34	90	10
Total	4.44	86	14

Table 3. VRT environmental and production improvements in 12 Iowa counties when optimal nitrogen rates are highly responsive to maximum yields

County	VRT Reduction in Over Application of Nitrogen		VRT Increase in Corn Yield	VRT Decrease in Nitrogen Costs
	(lb.)	(%)	(bu./acre)	($/acre)
Adair	37,401	31.8	0.24	6.83
Black Hawk	15,661	14.6	0.12	3.13
Carroll	21,427	12.1	0.60	2.75
Henry	16,583	15.4	0.11	3.14
Hancock	34,851	18.3	0.30	3.76
Hamilton	26,988	12.1	0.50	2.65
Poweshiek	23,150	21.6	0.48	4.46
Pottawattamie	25,806	21.7	0.10	4.02
Sioux	32,913	15.1	0.25	3.16
Story	22,373	12.1	0.34	2.71
Jones	28,583	25.5	0.34	5.82
Wright	59,043	15.9	0.21	3.81
Total	344,778	16.9	0.30	3.69

Table 4. Increase in farmer profit using VRT in 12 Iowa counties ($/acre) when optimal nitrogen rates are less responsive to maximum yields

County	Returns over Fertilizer Cost	Percent Attributable to Eliminating SRT Over-Application of Nitrogen	Percent Attributable to Eliminating SRT Under-Application of Nitrogen
	($/acre)		
Adair	3.32	93	7
Black Hawk	1.53	93	7
Carroll	1.90	70	30
Henry	1.52	93	7
Hancock	2.02	86	14
Hamilton	1.74	73	27
Poweshiek	2.53	82	18
Pottawattamie	1.91	95	5
Sioux	1.69	86	14
Story	1.59	80	20
Jones	2.99	89	11
Wright	1.94	90	10
Total	1.99	86	14

Table 5. VRT environmental and production improvements in 12 Iowa counties when optimal nitrogen rates are less responsive to maximum yields

County	VRT Reduction in Over-Application of Nitrogen		VRT Increase in Corn Yield	VRT Decrease in Nitrogen Costs
	(lb.)	(%)	(bu./acre)	($/acre)
Adair	16,732	14.2	0.11	3.06
Black Hawk	7,006	6.5	0.05	1.40
Carroll	9,586	5.4	0.27	1.23
Henry	7,419	6.9	0.05	1.40
Hancock	15,591	8.2	0.14	1.68
Hamilton	12,073	5.4	0.22	1.19
Poweshiek	10,357	9.7	0.21	2.00
Pottawattamie	11,545	9.7	0.04	1.80
Sioux	14,724	6.7	0.11	1.42
Story	10,009	5.4	0.15	1.21
Jones	12,787	11.4	0.15	2.60
Wright	26,414	7.1	0.09	1.70
Total	154,243	7.6	0.13	1.65

Table 6. Regression results for the effect of yield variability within a field on the value of VRT

	Responsiveness of Optimal N Rates to Soil Productivity	
Variable	High Response	Low Response
Intercept	0.69*	0.31*
	(3.49)	(3.49)
Yield Variability	0.28*	0.13*
	(23.76)	(23.76)
R^2	0.69	0.69

Numbers in parentheses are t-ratios.

APPENDIX A

SRT Acres Over-supplied, Under-supplied and Properly Supplied with Nitrogen Fertilizer

Appendix A

County & Field	Total Acres	SRT Acres Over Supplied	SRT Acres Under Supplied	SRT Acres Properly Supplied	Percent Acres Over Supplied	Percent Acres Under Supplied	Percent Acres Properly Supplied
ADAIR753226	77.85	64.15	6.98	6.72	82%	9%	9%
ADAIR773321	24.16	16.22	0.00	7.94	67%	0%	33%
ADAIR743034	31.42	15.92	0.00	15.50	51%	0%	49%
ADAIR773323	39.96	29.41	1.88	8.68	74%	5%	22%
ADAIR743307	22.00	17.14	0.00	4.86	78%	0%	22%
ADAIR773131	86.97	60.61	0.00	26.36	70%	0%	30%
ADAIR743136A	50.97	29.41	4.84	16.73	58%	9%	33%
ADAIR743136	77.61	55.21	4.20	18.21	71%	5%	23%
ADAIR743118	66.66	44.37	6.34	15.95	67%	10%	24%
ADAIR763128	28.89	21.38	4.10	3.41	74%	14%	12%
ADAIR753328A	48.18	31.61	3.36	13.21	66%	7%	27%
ADAIR753328	104.14	87.25	0.00	16.89	84%	0%	16%
ADAIR773022	28.67	13.02	0.00	15.65	45%	0%	55%
ADAIR773022A	75.36	57.65	0.00	17.71	77%	0%	23%
ADAIR763034	33.72	27.76	0.00	5.96	82%	0%	18%
ADAIR773013	72.83	33.46	0.00	39.38	46%	0%	54%
ADAIR743017	44.84	24.15	0.00	20.69	54%	0%	46%
ADAIR763132	34.30	23.05	3.15	8.10	67%	9%	24%
ADAIR753020	78.50	55.77	0.00	22.73	71%	0%	29%
ADAIR753213	54.32	44.61	6.71	3.00	82%	12%	6%
BHAWK891123	106.99	61.28	0.00	45.70	57%	0%	43%
BHAWK881234	22.69	11.27	0.00	11.42	50%	0%	50%
BHAWK881330	55.61	48.48	0.00	7.13	87%	0%	13%
BHAWK901110	27.63	21.20	0.00	6.43	77%	0%	23%
BHAWK871114	30.51	23.51	1.49	5.51	77%	5%	18%
BHAWK871329	148.41	114.88	4.26	29.26	77%	3%	20%
BHAWK881125	30.04	7.14	0.00	22.90	24%	0%	76%
BHAWK881430	31.44	7.53	0.00	23.91	24%	0%	76%
BHAWK891102	33.41	11.10	0.00	22.30	33%	0%	67%
BHAWK871434	33.38	7.56	0.00	25.82	23%	0%	77%
BHAWK881217	32.01	2.60	0.81	28.60	8%	3%	89%
BHAWK891134	67.42	47.64	0.00	19.78	71%	0%	29%
BHAWK871334	59.42	31.74	4.88	22.80	53%	8%	38%
BHAWK871325	19.68	15.80	0.00	3.89	80%	0%	20%
BHAWK891409	75.66	45.36	5.54	24.76	60%	7%	33%
BHAWK891404	73.24	53.15	0.00	20.09	73%	0%	27%
BHAWK871223	17.93	7.25	2.32	8.36	40%	13%	47%
BHAWK901208	23.78	17.49	3.17	3.11	74%	13%	13%
BHAWK891109	64.57	21.03	4.25	39.29	33%	7%	61%
BHAWK901106	33.03	11.44	0.00	21.59	35%	0%	65%
CARROLL853508	19.81	11.04	2.79	5.98	56%	14%	30%
CARROLL 853520	118.40	89.82	0.00	28.58	76%	0%	24%
CARROLL823511	33.21	26.47	0.00	6.73	80%	0%	20%
CARROLL823315	115.45	91.77	6.91	16.77	79%	6%	15%
CARROLL843325	60.62	35.71	0.00	24.91	59%	0%	41%
CARROLL833331	165.17	140.60	13.21	11.35	85%	8%	7%
CARROLL833430	99.88	62.56	13.78	23.54	63%	14%	24%

Appendix A

County & Field	Total Acres	SRT Acres Over Supplied	SRT Acres Under Supplied	SRT Acres Properly Supplied	Percent Acres Over Supplied	Percent Acres Under Supplied	Percent Acres Properly Supplied
CARROLL853428	72.17	49.05	6.02	17.10	68%	8%	24%
CARROLL853510	36.20	20.75	0.58	14.87	57%	2%	41%
CARROLL853510A	64.94	54.25	0.00	10.69	84%	0%	16%
CARROLL843414	40.05	31.70	0.00	8.35	79%	0%	21%
CARROLL823430	123.93	91.27	4.37	28.29	74%	4%	23%
CARROLL843512	45.63	30.73	5.12	9.78	67%	11%	21%
CARROLL823534	54.46	38.76	0.00	15.69	71%	0%	29%
CARROLL823623	73.88	47.40	0.64	25.84	64%	1%	35%
CARROLL823324	58.57	0.00	3.28	55.29	0%	6%	94%
CARROLL823612	51.45	36.85	1.65	12.95	72%	3%	25%
CARROLL833303	129.83	110.00	17.93	1.90	85%	14%	1%
CARROLL833617	44.78	38.06	3.92	2.80	85%	9%	6%
CARROLL853321	38.51	3.42	32.85	2.24	9%	85%	6%
HENRY700712	35.41	27.60	1.05	6.76	78%	3%	19%
HENRY700701	71.97	61.42	0.00	10.55	85%	0%	15%
HENRY720508	82.10	55.03	0.00	27.07	67%	0%	33%
HENRY720615	40.59	26.91	0.00	13.67	66%	0%	34%
HENRY720614	61.94	46.46	0.00	15.48	75%	0%	25%
HENRY730731	81.95	65.37	0.00	16.58	80%	0%	20%
HENRY720605	37.61	23.73	5.05	8.82	63%	13%	23%
HENRY700513	36.38	13.16	0.00	23.21	36%	0%	64%
HENRY710736	19.77	10.15	0.00	9.62	51%	0%	49%
HENRY730501	41.01	19.93	3.69	17.40	49%	9%	42%
HENRY730720	46.34	32.03	0.00	14.31	69%	0%	31%
HENRY730717	51.02	18.05	3.35	29.61	35%	7%	58%
HENRY710718	31.10	22.40	0.10	8.60	72%	0%	28%
HENRY720703	62.52	23.75	0.00	38.77	38%	0%	62%
HENRY730702	47.24	39.19	0.00	8.04	83%	0%	17%
HENRY730708	59.38	14.60	0.00	44.78	25%	0%	75%
HENRY700514	47.88	24.97	0.00	22.91	52%	0%	48%
HENRY710623	77.93	47.42	0.00	30.51	61%	0%	39%
HENRY700527	30.17	16.39	0.00	13.78	54%	0%	46%
HENRY700624	81.71	51.52	7.96	22.23	63%	10%	27%
HANCOCK962521	182.44	126.31	7.93	48.21	69%	4%	26%
HANCOCK962323	176.35	101.16	13.79	61.41	57%	8%	35%
HANCOCK952403	52.66	52.44	0.00	0.22	100%	0%	0%
HANCOCK962633	28.81	21.42	0.00	7.39	74%	0%	26%
HANCOCK962423	115.26	76.48	15.94	22.83	66%	14%	20%
HANCOCK962524	104.82	88.76	14.63	1.43	85%	14%	1%
HANCOCK962524	35.10	26.75	0.41	7.94	76%	1%	23%
HANCOCK952612	155.55	129.21	0.00	26.34	83%	0%	17%
HANCOCK942520	82.04	62.67	0.00	19.37	76%	0%	24%
HANCOCK972433	52.34	41.84	0.00	10.50	80%	0%	20%
HANCOCK972426	74.52	51.40	1.57	21.55	69%	2%	29%
HANCOCK942402	53.99	34.15	6.58	13.27	63%	12%	25%
HANCOCK972530	54.44	44.72	0.00	9.72	82%	0%	18%
HANCOCK952630	124.14	14.99	0.31	108.85	12%	0%	88%

Appendix A

County & Field	Total Acres	SRT Acres Over Supplied	SRT Acres Under Supplied	SRT Acres Properly Supplied	Percent Acres Over Supplied	Percent Acres Under Supplied	Percent Acres Properly Supplied
HANCOCK952518	155.93	100.27	0.00	55.67	64%	0%	36%
HANCOCK942606	49.10	5.10	0.62	43.37	10%	1%	88%
HANCOCK952328	55.64	46.85	0.00	8.79	84%	0%	16%
HANCOCK972605	166.19	77.81	20.81	67.56	47%	13%	41%
HANCOCK942627	38.93	16.73	0.30	21.90	43%	1%	56%
HANCOCK942322	41.97	25.37	0.00	16.60	60%	0%	40%
HAMILTON882308	111.60	82.98	0.00	28.63	74%	0%	26%
HAMILTON892412	164.40	138.99	6.57	18.85	85%	4%	11%
HAMILTON892519	72.80	50.50	0.00	22.30	69%	0%	31%
HAMILTON862514	83.17	35.39	7.12	40.66	43%	9%	49%
HAMILTON872312	56.01	46.45	5.45	4.10	83%	10%	7%
HAMILTON882502	54.86	32.38	6.33	16.16	59%	12%	29%
HAMILTON862421	88.56	57.11	10.90	20.56	64%	12%	23%
HAMILTON872413	53.14	25.78	2.52	24.83	49%	5%	47%
HAMILTON872522	158.10	124.46	21.59	12.05	79%	14%	8%
HAMILTON882303	319.79	264.90	18.58	36.31	83%	6%	11%
HAMILTON872536	44.86	27.73	0.00	17.13	62%	0%	38%
HAMILTON892305	40.93	8.92	4.76	27.25	22%	12%	67%
HAMILTON862505	97.99	66.30	11.51	20.19	68%	12%	21%
HAMILTON862412	101.09	58.42	7.40	35.27	58%	7%	35%
HAMILTON882530	85.79	70.91	0.85	14.02	83%	1%	16%
HAMILTON862632	82.28	21.78	5.73	54.78	26%	7%	67%
HAMILTON862632A	80.93	47.65	2.61	30.66	59%	3%	38%
HAMILTON862629	87.80	54.43	0.00	33.37	62%	0%	38%
HAMILTON882627	85.49	13.50	0.81	71.17	16%	1%	83%
HAMILTON892616	39.33	28.20	0.00	11.13	72%	0%	28%
POWESHIE791529	33.81	17.47	0.00	16.34	52%	0%	48%
POWESHIE791532	35.32	25.35	3.81	6.16	72%	11%	17%
POWESHIE781629	89.93	65.39	2.33	22.21	73%	3%	25%
POWESHIE801409	25.63	11.43	2.81	11.39	45%	11%	44%
POWESHIE801404	38.70	26.25	1.16	11.29	68%	3%	29%
POWESHIE791318	149.56	57.40	12.31	79.85	38%	8%	53%
POWESHIE791318	87.48	53.91	11.11	22.46	62%	13%	26%
POWESHIE791509	40.19	16.92	0.39	22.88	42%	1%	57%
POWESHIE801532	93.16	71.82	0.00	21.35	77%	0%	23%
POWESHIE801430	62.76	35.87	7.71	19.18	57%	12%	31%
POWESHIE791525	51.00	38.25	0.00	12.75	75%	0%	25%
POWESHIE811310	36.03	23.94	1.46	10.63	66%	4%	30%
POWESHIE791608	38.43	14.32	0.00	24.11	37%	0%	63%
POWESHIE811620	43.01	32.27	0.00	10.74	75%	0%	25%
POWESHIE781618	42.25	30.48	0.00	11.77	72%	0%	28%
POWESHIE791308	9.86	4.66	0.00	5.20	47%	0%	53%
POWESHIE781509	48.10	30.70	0.00	17.40	64%	0%	36%
POWESHIE781419	21.95	14.55	0.00	7.41	66%	0%	34%
POWESHIE811509	36.26	27.02	0.00	9.24	75%	0%	25%
POWESHIE781436	16.49	10.20	0.00	6.29	62%	0%	38%
POTTAWAT764428	68.94	7.47	0.00	61.47	11%	0%	89%

Appendix A

County & Field	Total Acres	SRT Acres Over Supplied	SRT Acres Under Supplied	SRT Acres Properly Supplied	Percent Acres Over Supplied	Percent Acres Under Supplied	Percent Acres Properly Supplied
POTTAWAT754132	110.99	92.32	8.67	10.00	83%	8%	9%
POTTAWAT754107	37.90	24.88	0.00	13.02	66%	0%	34%
POTTAWAT744317	85.38	0.00	2.12	83.25	0%	2%	98%
POTTAWAT764326	62.74	42.42	0.00	20.32	68%	0%	32%
POTTAWAT744006	48.59	18.47	3.98	26.14	38%	8%	54%
POTTAWAT764324	66.79	47.19	0.00	19.60	71%	0%	29%
POTTAWAT764323	42.73	33.31	0.00	9.42	78%	0%	22%
POTTAWAT763912	39.73	32.04	0.00	7.69	81%	0%	19%
POTTAWAT773805	102.83	78.77	0.00	24.06	77%	0%	23%
POTTAWAT774010	65.30	40.35	0.00	24.95	62%	0%	38%
POTTAWAT763822	22.64	12.45	0.00	10.19	55%	0%	45%
POTTAWAT764335	40.29	15.49	0.00	24.80	38%	0%	62%
POTTAWAT764127	75.63	62.21	0.00	13.42	82%	0%	18%
POTTAWAT754322	14.28	10.78	0.00	3.51	75%	0%	25%
POTTAWAT743912	70.19	37.50	0.00	32.69	53%	0%	47%
POTTAWAT774110	38.68	19.76	0.00	18.92	51%	0%	49%
POTTAWAT774501	160.48	66.38	0.00	94.10	41%	0%	59%
POTTAWAT744130	81.72	60.65	0.00	21.07	74%	0%	26%
POTTAWAT774216	35.52	29.84	0.00	5.68	84%	0%	16%
SIOUX974510	124.73	104.53	6.44	13.77	84%	5%	11%
SIOUX944704	139.28	110.84	1.09	27.36	80%	1%	20%
SIOUX954416	43.26	22.99	0.00	20.27	53%	0%	47%
SIOUX964707	177.55	149.28	0.00	28.27	84%	0%	16%
SIOUX964425	42.34	34.39	1.37	6.58	81%	3%	16%
SIOUX974622	80.92	66.63	10.73	3.56	82%	13%	4%
SIOUX964629	40.58	32.87	4.56	3.15	81%	11%	8%
SIOUX944422	125.70	94.25	14.67	16.78	75%	12%	13%
SIOUX954627	21.24	17.02	1.57	2.65	80%	7%	12%
SIOUX944608	106.30	80.52	13.66	12.12	76%	13%	11%
SIOUX944409	63.89	49.37	8.31	6.21	77%	13%	10%
SIOUX944536	122.68	98.01	7.52	17.15	80%	6%	14%
SIOUX974721	34.77	29.06	0.00	5.71	84%	0%	16%
SIOUX954318	114.34	97.94	10.89	5.51	86%	10%	5%
SIOUX964723	40.48	8.74	3.23	28.51	22%	8%	70%
SIOUX964503	241.51	119.21	0.00	122.31	49%	0%	51%
SIOUX954714	105.47	68.63	0.21	36.63	65%	0%	35%
SIOUX974401	106.01	88.99	15.09	1.93	84%	14%	2%
SIOUX974517	147.52	119.49	12.71	15.33	81%	9%	10%
SIOUX944803	145.69	77.31	2.47	65.91	53%	2%	45%
STORY822404	66.68	24.73	7.90	34.04	37%	12%	51%
STORY240403	77.52	20.27	7.99	49.26	26%	10%	64%
STORY822407	81.35	40.80	8.50	32.04	50%	10%	39%
STORY822413	55.16	37.99	0.00	17.17	69%	0%	31%
STORY822211	42.61	0.48	3.84	38.29	1%	9%	90%
STORY822301	81.80	64.93	0.00	16.87	79%	0%	21%
STORY852335	150.80	109.16	8.45	33.19	72%	6%	22%
STORY852222	64.77	49.51	0.00	15.26	76%	0%	24%

Appendix A County & Field	Total Acres	SRT Acres Over Supplied	SRT Acres Under Supplied	SRT Acres Properly Supplied	Percent Acres Over Supplied	Percent Acres Under Supplied	Percent Acres Properly Supplied
STORY842218	84.55	70.09	0.00	14.46	83%	0%	17%
STORY852403	130.67	32.17	9.11	89.38	25%	7%	68%
STORY832301	108.22	78.12	0.00	30.10	72%	0%	28%
STORY822224	58.02	15.41	4.94	37.66	27%	9%	65%
STORY852122	45.92	24.14	0.00	21.78	53%	0%	47%
STORY832314	79.64	31.44	1.74	46.46	39%	2%	58%
STORY842110	94.43	79.79	0.00	14.63	85%	0%	15%
STORY832421	28.39	22.41	0.00	5.98	79%	0%	21%
STORY822425	46.60	19.79	0.00	26.82	42%	0%	58%
STORY842331	64.73	49.40	0.00	15.32	76%	0%	24%
STORY852105	68.39	46.04	0.00	22.35	67%	0%	33%
STORY832122	151.92	127.41	0.00	24.51	84%	0%	16%
JONES850207	35.67	13.80	3.75	18.12	39%	11%	51%
JONES840308	40.07	24.99	0.00	15.09	62%	0%	38%
JONES840305	47.63	38.62	8.32	0.70	81%	17%	1%
JONES840134	73.49	61.67	9.27	2.55	84%	13%	3%
JONES830235	37.37	29.56	0.00	7.81	79%	0%	21%
JONES830428	80.93	58.85	0.00	22.08	73%	0%	27%
JONES860229	41.27	33.81	4.66	2.80	82%	11%	7%
JONES860425	50.90	35.47	6.93	8.50	70%	14%	17%
JONES840226	31.16	22.64	0.25	8.27	73%	1%	27%
JONES830424	42.41	34.29	0.00	8.11	81%	0%	19%
JONES830424A	41.01	33.41	0.82	6.78	81%	2%	17%
JONES830310	40.43	32.70	4.25	3.48	81%	11%	9%
JONES850110	43.34	24.79	0.00	18.56	57%	0%	43%
JONES860135	67.40	55.35	0.32	11.73	82%	0%	17%
JONES830106	33.30	20.14	0.00	13.16	60%	0%	40%
JONES830135	71.65	59.41	4.31	7.93	83%	6%	11%
JONES830133	58.37	44.33	0.00	14.04	76%	0%	24%
JONES860313	39.67	5.57	0.00	34.10	14%	0%	86%
JONES860310	66.65	46.62	4.50	15.53	70%	7%	23%
JONES830401	18.82	11.85	0.45	6.52	63%	2%	35%
WRIGHT932301	219.90	166.30	0.00	53.60	76%	0%	24%
WRIGHT932620	36.10	28.50	0.00	7.60	79%	0%	21%
WRIGHT 932614	115.00	81.10	16.00	17.90	71%	14%	16%
WRIGHT932522	88.00	55.90	0.00	32.10	64%	0%	36%
WRIGHT932523	80.00	54.00	0.00	26.00	68%	0%	33%
WRIGHT932513	60.10	33.30	0.00	26.80	55%	0%	45%
WRIGHT932420	120.10	96.50	0.00	23.60	80%	0%	20%
WRIGHT932317	65.00	31.90	8.70	24.40	49%	13%	38%
WRIGHT932324	95.10	68.20	8.30	18.60	72%	9%	20%
WRIGHT932435	80.10	63.70	6.90	9.50	80%	9%	12%
WRIGHT922506	80.00	31.70	11.20	37.10	40%	14%	46%
WRIGHT922512	159.90	113.20	0.00	46.70	71%	0%	29%
WRIGHT922302	160.00	130.50	0.00	29.50	82%	0%	18%
WRIGHT922517	160.00	101.00	0.00	59.00	63%	0%	37%
WRIGHT922520	130.00	110.20	0.00	19.80	85%	0%	15%

Appendix A

County & Field	Total Acres	SRT Acres Over Supplied	SRT Acres Under Supplied	SRT Acres Properly Supplied	Percent Acres Over Supplied	Percent Acres Under Supplied	Percent Acres Properly Supplied
WRIGHT912618	40.00	29.40	0.00	10.60	74%	0%	27%
WRIGHT922415	80.00	62.10	0.70	17.20	78%	1%	22%
WRIGHT922423	112.10	85.00	0.00	27.10	76%	0%	24%
WRIGHT922313	157.10	121.40	0.00	35.70	77%	0%	23%
WRIGHT922331	77.90	58.10	0.00	19.80	75%	0%	25%
WRIGHT922326	80.10	57.40	0.00	22.70	72%	0%	28%
WRIGHT912611	80.00	58.20	0.00	21.80	73%	0%	27%
WRIGHT912506	95.00	51.40	0.00	43.60	54%	0%	46%
WRIGHT912411	53.10	43.00	0.00	10.10	81%	0%	19%
WRIGHT912632	80.00	0.20	11.00	68.80	0%	14%	86%
WRIGHT912532	57.00	25.20	0.00	31.80	44%	0%	56%
WRIGHT902314	216.90	174.50	2.20	40.20	80%	1%	19%
WRIGHT902527	80.00	66.40	0.00	13.60	83%	0%	17%
WRIGHT902426	80.00	50.10	0.00	29.90	63%	0%	37%
WRIGHT902335	100.10	67.20	2.20	30.70	67%	2%	31%
TOTAL	18,146.12	11,929.21	738.00	5,478.91	66%	4%	30%

APPENDIX B

Field Production and Environmental Benefits
The High Response Case

Appendix B

HIGH RESPONSE

County & Field	SRT Over Application of Nitrogen (lbs)	VRT Increase In Yield (bu/acre)	VRT Increase in Production ($)	VRT Increase in Revenue ($)	VRT Reduction in Costs ($)	VRT Increase in Profit ($)
ADAIR753226	3,120	0.40	31	78	613	691
ADAIR773321	904	0.00	0	0	181	181
ADAIR743034	642	0.00	0	0	128	128
ADAIR773323	310	0.29	12	29	58	87
ADAIR743307	793	0.00	0	0	159	159
ADAIR773131	6,193	0.00	0	0	1,239	1,239
ADAIR743136A	1,804	0.88	45	113	345	457
ADAIR743136	2,169	0.23	18	45	427	472
ADAIR743118	1,547	0.89	59	148	288	437
ADAIR763128	1,043	0.87	25	63	200	262
ADAIR753328A	1,676	0.52	25	63	326	389
ADAIR753328	4,628	0.00	0	0	926	926
ADAIR773022	215	0.00	0	0	43	43
ADAIR773022A	2,024	0.00	0	0	405	405
ADAIR763034	731	0.00	0	0	146	146
ADAIR773013	852	0.00	0	0	170	170
ADAIR743017	2,387	0.00	0	0	477	477
ADAIR763132	1,516	0.39	13	33	298	332
ADAIR753020	3,042	0.00	0	0	608	608
ADAIR753213	1,806	0.53	29	71	351	422
BHAWK891123	1,618	0.00	0	0	324	324
BHAWK881234	879	0.00	0	0	176	176
BHAWK881330	676	0.00	0	0	135	135
BHAWK901110	1,124	0.00	0	0	225	225
BHAWK871114	2,057	0.25	8	19	409	428
BHAWK871329	3,095	0.07	11	27	615	642
BHAWK881125	168	0.00	0	0	34	34
BHAWK881430	153	0.00	0	0	31	31
BHAWK891102	1,394	0.00	0	0	279	279
BHAWK871434	257	0.00	0	0	51	51
BHAWK881217	12	0.48	15	38	-3	35
BHAWK891134	923	0.00	0	0	185	185
BHAWK871334	654	0.49	29	73	120	193
BHAWK871325	314	0.00	0	0	63	63
BHAWK891409	735	0.06	5	12	145	157
BHAWK891404	506	0.00	0	0	101	101
BHAWK871223	210	1.32	24	59	34	93
BHAWK901208	364	0.48	11	29	69	97
BHAWK891109	416	0.17	11	27	79	106
BHAWK901106	108	0.00	0	0	22	22
CARROLL853508	92	1.32	26	65	9	74
CARROLL 853520	2,481	0.00	0	0	496	496
CARROLL823511	271	0.00	0	0	54	54
CARROLL823315	2,375	0.83	95	238	441	679
CARROLL843325	1,016	0.00	0	0	203	203

Appendix B

HIGH RESPONSE

County & Field	SRT Over Application of Nitrogen (lbs)	VRT Increase In Yield (bu/acre)	VRT Increase in Production ($)	VRT Increase in Revenue ($)	VRT Reduction in Costs ($)	VRT Increase in Profit ($)
CARROLL833331	2,269	0.68	112	281	414	695
CARROLL833430	967	0.23	23	59	185	244
CARROLL853428	1,011	0.78	56	141	182	323
CARROLL853510	180	0.15	5	14	34	48
CARROLL853510A	1,118	0.00	0	0	224	224
CARROLL843414	1,955	0.00	0	0	391	391
CARROLL823430	2,450	0.12	15	37	485	522
CARROLL843512	377	1.05	48	120	58	178
CARROLL823534	336	0.00	0	0	67	67
CARROLL823623	597	0.01	1	1	119	121
CARROLL823324	0	0.23	14	34	-5	29
CARROLL823612	310	0.11	6	14	60	74
CARROLL833303	2,691	0.82	107	267	500	767
CARROLL833617	654	0.22	10	25	127	152
CARROLL853321	276	8.97	345	864	-68	795
HENRY700712	1,419	0.33	12	29	280	309
HENRY700701	2,699	0.00	0	0	540	540
HENRY720508	251	0.00	0	0	50	50
HENRY720615	438	0.00	0	0	88	88
HENRY720614	656	0.00	0	0	131	131
HENRY730731	2,128	0.00	0	0	426	426
HENRY720605	578	0.87	33	81	104	185
HENRY700513	284	0.00	0	0	57	57
HENRY710736	245	0.00	0	0	49	49
HENRY730501	652	0.61	25	63	121	184
HENRY730720	112	0.00	0	0	22	22
HENRY730717	83	0.45	23	57	8	66
HENRY710718	781	0.07	2	5	155	161
HENRY720703	185	0.00	0	0	37	37
HENRY730702	2,946	0.00	0	0	589	589
HENRY730708	324	0.00	0	0	65	65
HENRY700514	367	0.00	0	0	73	73
HENRY710623	526	0.00	0	0	105	105
HENRY700527	425	0.00	0	0	85	85
HENRY700624	1,483	0.20	17	42	291	332
HANCOCK962521	4,576	0.18	32	81	904	985
HANCOCK962323	1,076	0.67	117	293	173	467
HANCOCK952403	1,782	0.00	0	0	356	356
HANCOCK962633	1,630	0.00	0	0	326	326
HANCOCK962423	1,985	0.24	27	68	387	455
HANCOCK962524	4,988	0.91	96	240	963	1,203
HANCOCK962524	549	0.10	3	9	109	117
HANCOCK952612	2,945	0.00	0	0	589	589
HANCOCK942520	1,617	0.00	0	0	323	323
HANCOCK972433	1,522	0.00	0	0	304	304

Appendix B

HIGH RESPONSE

County & Field	SRT Over Application of Nitrogen (lbs)	VRT Increase In Yield (bu/acre)	VRT Increase in Production ($)	VRT Increase in Revenue ($)	VRT Reduction in Costs ($)	VRT Increase in Profit ($)
HANCOCK972426	1,220	0.20	15	37	239	276
HANCOCK942402	1,698	1.28	69	173	315	488
HANCOCK972530	1,407	0.00	0	0	281	281
HANCOCK952630	366	0.03	4	11	72	82
HANCOCK952518	2,295	0.00	0	0	459	459
HANCOCK942606	178	0.06	3	8	35	42
HANCOCK952328	982	0.00	0	0	196	196
HANCOCK972605	2,975	1.06	176	439	532	972
HANCOCK942627	411	0.07	3	7	81	88
HANCOCK942322	648	0.00	0	0	130	130
HAMILTON882308	2,352	0.00	0	0	470	470
HAMILTON892412	1,850	0.36	59	147	349	496
HAMILTON892519	1,391	0.00	0	0	278	278
HAMILTON862514	1,055	0.80	67	167	187	354
HAMILTON872312	1,172	0.91	51	128	216	344
HAMILTON882502	549	0.79	43	108	94	202
HAMILTON862421	837	0.84	74	186	141	326
HAMILTON872413	296	0.44	24	59	51	110
HAMILTON872522	2,938	0.93	147	368	535	903
HAMILTON882303	6,416	0.54	174	435	1,221	1,656
HAMILTON872536	687	0.00	0	0	137	137
HAMILTON892305	249	1.59	65	163	26	189
HAMILTON862505	1,380	0.80	78	196	248	444
HAMILTON862412	1,133	0.68	69	173	202	375
HAMILTON882530	1,702	0.07	6	15	338	353
HAMILTON862632	205	0.65	54	134	22	156
HAMILTON862632A	547	0.30	24	61	101	162
HAMILTON862629	1,135	0.00	0	0	227	227
HAMILTON882627	364	0.14	12	29	69	98
HAMILTON892616	729	0.00	0	0	146	146
POWESHIE791529	264	0.00	0	0	53	53
POWESHIE791532	2,411	0.83	29	73	472	545
POWESHIE781629	1,851	0.18	16	40	365	404
POWESHIE801409	25	1.63	42	104	-10	94
POWESHIE801404	961	0.23	9	22	189	211
POWESHIE791318	872	1.31	195	488	105	593
POWESHIE791318	4,633	1.26	110	276	887	1,163
POWESHIE791509	489	0.02	1	2	97	100
POWESHIE801532	1,597	0.00	0	0	319	319
POWESHIE801430	3,790	0.94	59	148	737	885
POWESHIE791525	643	0.00	0	0	129	129
POWESHIE811310	296	0.45	16	40	53	94
POWESHIE791608	731	0.00	0	0	146	146
POWESHIE811620	1,681	0.00	0	0	336	336
POWESHIE781618	577	0.00	0	0	115	115

Appendix B

HIGH RESPONSE

County & Field	SRT Over Application of Nitrogen (lbs)	VRT Increase In Yield (bu/acre)	VRT Increase in Production ($)	VRT Increase in Revenue ($)	VRT Reduction in Costs ($)	VRT Increase in Profit ($)
POWESHIE791308	127	0.00	0	0	25	25
POWESHIE781509	1,128	0.00	0	0	226	226
POWESHIE781419	304	0.00	0	0	61	61
POWESHIE811509	467	0.00	0	0	93	93
POWESHIE781436	305	0.00	0	0	61	61
POTTAWAT764428	177	0.00	0	0	35	35
POTTAWAT754132	2,856	0.33	37	92	558	650
POTTAWAT754107	1,157	0.00	0	0	231	231
POTTAWAT744317	0	0.97	83	208	-30	178
POTTAWAT764326	2,902	0.00	0	0	580	580
POTTAWAT744006	464	0.07	3	8	92	100
POTTAWAT764324	2,036	0.00	0	0	407	407
POTTAWAT764323	1,546	0.00	0	0	309	309
POTTAWAT763912	634	0.00	0	0	127	127
POTTAWAT773805	1,795	0.00	0	0	359	359
POTTAWAT774010	678	0.00	0	0	136	136
POTTAWAT763822	208	0.00	0	0	42	42
POTTAWAT764335	769	0.00	0	0	154	154
POTTAWAT764127	1,850	0.00	0	0	370	370
POTTAWAT754322	686	0.00	0	0	137	137
POTTAWAT743912	1,067	0.00	0	0	213	213
POTTAWAT774110	897	0.00	0	0	179	179
POTTAWAT774501	2,881	0.00	0	0	576	576
POTTAWAT744130	1,672	0.00	0	0	334	334
POTTAWAT774216	1,532	0.00	0	0	306	306
SIOUX974510	1,797	0.13	16	41	354	395
SIOUX944704	1,459	0.01	1	2	291	294
SIOUX954416	505	0.00	0	0	101	101
SIOUX964707	8,858	0.00	0	0	1,772	1,772
SIOUX964425	356	0.14	6	15	69	84
SIOUX974622	4,176	0.34	27	69	825	894
SIOUX964629	300	0.50	20	51	53	103
SIOUX944422	1,494	0.62	78	195	271	466
SIOUX954627	130	0.50	11	27	22	49
SIOUX944608	877	0.67	71	178	150	328
SIOUX944409	369	0.89	57	141	54	195
SIOUX944536	1,636	0.16	19	48	320	368
SIOUX974721	477	0.00	0	0	95	95
SIOUX954318	1,020	0.56	65	161	181	342
SIOUX964723	501	0.80	33	81	89	170
SIOUX964503	1,599	0.00	0	0	320	320
SIOUX954714	522	0.02	2	5	104	109
SIOUX974401	1,263	0.58	61	153	231	384
SIOUX974517	1,889	0.22	32	81	366	447
SIOUX944803	3,684	0.01	2	5	736	741

Appendix B

HIGH RESPONSE

County & Field	SRT Over Application of Nitrogen (lbs)	VRT Increase In Yield (bu/acre)	VRT Increase in Production ($)	VRT Increase in Revenue ($)	VRT Reduction in Costs ($)	VRT Increase in Profit ($)
STORY822404	339	1.11	74	185	41	226
STORY240403	264	0.96	75	187	26	213
STORY822407	757	0.98	80	199	123	322
STORY822413	804	0.00	0	0	161	161
STORY822211	4	0.84	36	90	-12	78
STORY822301	1,214	0.00	0	0	243	243
STORY852335	3,853	0.52	79	198	742	940
STORY852222	1,224	0.00	0	0	245	245
STORY842218	1,178	0.00	0	0	236	236
STORY852403	962	0.95	124	310	148	458
STORY832301	1,936	0.00	0	0	387	387
STORY822224	448	0.80	46	116	73	189
STORY852122	853	0.00	0	0	171	171
STORY832314	610	0.20	16	41	116	157
STORY842110	1,502	0.00	0	0	300	300
STORY832421	393	0.00	0	0	79	79
STORY822425	573	0.00	0	0	115	115
STORY842331	958	0.00	0	0	192	192
STORY852105	867	0.00	0	0	173	173
STORY832122	3,635	0.00	0	0	727	727
JONES850207	593	1.29	46	115	102	217
JONES840308	387	0.00	0	0	77	77
JONES840305	871	1.05	50	125	156	281
JONES840134	4,656	0.97	71	178	906	1,083
JONES830235	698	0.00	0	0	140	140
JONES830428	924	0.00	0	0	185	185
JONES860229	3,507	1.31	54	135	682	817
JONES860425	174	1.16	59	147	14	161
JONES840226	687	0.06	2	5	137	141
JONES830424	804	0.00	0	0	161	161
JONES830424A	1,168	0.12	5	12	232	244
JONES830310	537	0.36	14	36	102	138
JONES850110	2,918	0.00	0	0	584	584
JONES860135	1,647	0.02	1	3	329	332
JONES830106	610	0.00	0	0	122	122
JONES830135	2,513	0.15	11	28	499	526
JONES830133	2,082	0.00	0	0	416	416
JONES860313	379	0.00	0	0	76	76
JONES860310	3,251	0.23	15	38	645	683
JONES830401	180	0.10	2	5	35	40
WRIGHT932301	5,166	0.00	0	0	1,033	1,033
WRIGHT932620	553	0.00	0	0	111	111
WRIGHT 932614	740	1.30	150	375	94	469
WRIGHT932522	1,205	0.00	0	0	241	241
WRIGHT932523	1,291	0.00	0	0	258	258

Appendix B

HIGH RESPONSE

County & Field	SRT Over Application of Nitrogen (lbs)	VRT Increase In Yield (bu/acre)	VRT Increase in Production ($)	VRT Increase in Revenue ($)	VRT Reduction in Costs ($)	VRT Increase in Profit ($)
WRIGHT932513	804	0.00	0	0	161	161
WRIGHT932420	2,607	0.00	0	0	521	521
WRIGHT932317	312	1.25	81	204	33	237
WRIGHT932324	1,968	0.82	78	194	366	560
WRIGHT932435	1,003	0.37	29	73	190	264
WRIGHT922506	760	1.99	159	398	95	493
WRIGHT922512	3,121	0.00	0	0	624	624
WRIGHT922302	3,512	0.00	0	0	702	702
WRIGHT922517	2,131	0.00	0	0	426	426
WRIGHT922520	3,892	0.00	0	0	778	778
WRIGHT912618	643	0.00	0	0	129	129
WRIGHT922415	2,333	0.08	7	16	464	481
WRIGHT922423	1,928	0.00	0	0	386	386
WRIGHT922313	2,769	0.00	0	0	554	554
WRIGHT922331	1,473	0.00	0	0	295	295
WRIGHT922326	1,482	0.00	0	0	296	296
WRIGHT912611	1,550	0.00	0	0	310	310
WRIGHT912506	1,228	0.00	0	0	246	246
WRIGHT912411	1,129	0.00	0	0	226	226
WRIGHT912632	9	1.29	103	257	-35	223
WRIGHT912532	1,053	0.00	0	0	211	211
WRIGHT902314	9,777	0.07	15	37	1,950	1,988
WRIGHT902527	2,347	0.00	0	0	469	469
WRIGHT902426	1,344	0.00	0	0	269	269
WRIGHT902335	915	0.21	21	51	176	227
TOTAL	344,778	0.30	5,445	13,612	67,011	80,623

APPENDIX C

Field Production and Environmental Benefits
The Low Response Case

Appendix C

LOW RESPONSE

County & Field	SRT Over Application of Nitrogen (lbs)	VRT Increase In Yield (bu/acre)	VRT Increase in Production ($)	VRT Increase in Revenue ($)	VRT Reduction in Costs ($)	VRT Increase in Profit ($)
ADAIR753226	1,396	0.18	14	35	274	309
ADAIR773321	404	0.00	0	0	81	81
ADAIR743034	287	0.00	0	0	57	57
ADAIR773323	139	0.13	5	13	26	39
ADAIR743307	355	0.00	0	0	71	71
ADAIR773131	2,770	0.00	0	0	554	554
ADAIR743136A	807	0.40	20	50	154	205
ADAIR743136	970	0.10	8	20	191	211
ADAIR743118	692	0.40	27	66	129	195
ADAIR763128	467	0.39	11	28	89	117
ADAIR753328A	750	0.23	11	28	146	174
ADAIR753328	2,071	0.00	0	0	414	414
ADAIR773022	96	0.00	0	0	19	19
ADAIR773022A	906	0.00	0	0	181	181
ADAIR763034	327	0.00	0	0	65	65
ADAIR773013	381	0.00	0	0	76	76
ADAIR743017	1,068	0.00	0	0	214	214
ADAIR763132	678	0.17	6	15	133	148
ADAIR753020	1,361	0.00	0	0	272	272
ADAIR753213	808	0.24	13	32	157	189
BHAWK891123	724	0.00	0	0	145	145
BHAWK881234	393	0.00	0	0	79	79
BHAWK881330	302	0.00	0	0	60	60
BHAWK901110	503	0.00	0	0	101	101
BHAWK871114	920	0.11	3	8	183	191
BHAWK871329	1,385	0.03	5	12	275	287
BHAWK881125	75	0.00	0	0	15	15
BHAWK881430	68	0.00	0	0	14	14
BHAWK891102	624	0.00	0	0	125	125
BHAWK871434	115	0.00	0	0	23	23
BHAWK881217	5	0.21	7	17	-1	16
BHAWK891134	413	0.00	0	0	83	83
BHAWK871334	293	0.22	13	33	54	86
BHAWK871325	140	0.00	0	0	28	28
BHAWK891409	329	0.03	2	5	65	70
BHAWK891404	226	0.00	0	0	45	45
BHAWK871223	94	0.59	11	27	15	42
BHAWK901208	163	0.22	5	13	31	44
BHAWK891109	186	0.08	5	12	35	48
BHAWK901106	48	0.00	0	0	10	10
CARROLL853508	41	0.59	12	29	4	33
CARROLL 853520	1,110	0.00	0	0	222	222
CARROLL823511	121	0.00	0	0	24	24
CARROLL823315	1,062	0.37	43	107	197	304
CARROLL843325	455	0.00	0	0	91	91

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County & Field	SRT Over Application of Nitrogen (lbs)	VRT Increase In Yield (bu/acre)	VRT Increase in Production ($)	VRT Increase in Revenue ($)	VRT Reduction in Costs ($)	VRT Increase in Profit ($)
CARROLL833331	1,015	0.30	50	126	185	311
CARROLL833430	433	0.11	10	26	83	109
CARROLL853428	452	0.35	25	63	81	144
CARROLL853510	80	0.07	2	6	15	21
CARROLL853510A	500	0.00	0	0	100	100
CARROLL843414	875	0.00	0	0	175	175
CARROLL823430	1,096	0.05	7	17	217	233
CARROLL843512	169	0.47	21	54	26	80
CARROLL823534	150	0.00	0	0	30	30
CARROLL823623	267	0.00	0	1	53	54
CARROLL823324	0	0.10	6	15	-2	13
CARROLL823612	139	0.05	3	6	27	33
CARROLL833303	1,204	0.37	48	119	224	343
CARROLL833617	293	0.10	4	11	57	68
CARROLL853321	123	4.01	155	386	-31	356
HENRY700712	635	0.15	5	13	125	138
HENRY700701	1,207	0.00	0	0	241	241
HENRY720508	112	0.00	0	0	22	22
HENRY720615	196	0.00	0	0	39	39
HENRY720614	293	0.00	0	0	59	59
HENRY730731	952	0.00	0	0	190	190
HENRY720605	258	0.39	15	36	46	83
HENRY700513	127	0.00	0	0	25	25
HENRY710736	110	0.00	0	0	22	22
HENRY730501	292	0.27	11	28	54	82
HENRY730720	50	0.00	0	0	10	10
HENRY730717	37	0.20	10	26	4	29
HENRY710718	349	0.03	1	2	70	72
HENRY720703	83	0.00	0	0	17	17
HENRY730702	1,318	0.00	0	0	264	264
HENRY730708	145	0.00	0	0	29	29
HENRY700514	164	0.00	0	0	33	33
HENRY710623	235	0.00	0	0	47	47
HENRY700527	190	0.00	0	0	38	38
HENRY700624	664	0.09	7	19	130	149
HANCOCK962521	2,047	0.08	14	36	404	440
HANCOCK962323	481	0.30	53	131	78	209
HANCOCK952403	797	0.00	0	0	159	159
HANCOCK962633	729	0.00	0	0	146	146
HANCOCK962423	888	0.11	12	30	173	204
HANCOCK962524	2,231	0.41	43	107	431	538
HANCOCK962524	246	0.04	2	4	49	52
HANCOCK952612	1,318	0.00	0	0	264	264
HANCOCK942520	724	0.00	0	0	145	145
HANCOCK972433	681	0.00	0	0	136	136

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County & Field	SRT Over Application of Nitrogen (lbs)	VRT Increase In Yield (bu/acre)	VRT Increase in Production ($)	VRT Increase in Revenue ($)	VRT Reduction in Costs ($)	VRT Increase in Profit ($)
HANCOCK972426	546	0.09	7	16	107	123
HANCOCK942402	760	0.57	31	77	141	218
HANCOCK972530	629	0.00	0	0	126	126
HANCOCK952630	164	0.02	2	5	32	37
HANCOCK952518	1,027	0.00	0	0	205	205
HANCOCK942606	80	0.03	1	4	15	19
HANCOCK952328	440	0.00	0	0	88	88
HANCOCK972605	1,331	0.47	79	197	238	435
HANCOCK942627	184	0.03	1	3	36	40
HANCOCK942322	290	0.00	0	0	58	58
HAMILTON882308	1,052	0.00	0	0	210	210
HAMILTON892412	828	0.16	26	66	156	222
HAMILTON892519	622	0.00	0	0	124	124
HAMILTON862514	472	0.36	30	75	84	158
HAMILTON872312	524	0.41	23	57	97	154
HAMILTON882502	245	0.35	19	48	42	90
HAMILTON862421	375	0.37	33	83	63	146
HAMILTON872413	132	0.20	11	26	23	49
HAMILTON872522	1,314	0.42	66	164	239	404
HAMILTON882303	2,870	0.24	78	195	546	741
HAMILTON872536	307	0.00	0	0	61	61
HAMILTON892305	111	0.71	29	73	12	85
HAMILTON862505	617	0.36	35	88	111	199
HAMILTON862412	507	0.31	31	77	90	168
HAMILTON882530	761	0.03	3	7	151	158
HAMILTON862632	92	0.29	24	60	10	70
HAMILTON862632A	245	0.13	11	27	45	72
HAMILTON862629	508	0.00	0	0	102	102
HAMILTON882627	163	0.06	5	13	31	44
HAMILTON892616	326	0.00	0	0	65	65
POWESHIE791529	118	0.00	0	0	24	24
POWESHIE791532	1,078	0.37	13	33	211	244
POWESHIE781629	828	0.08	7	18	163	181
POWESHIE801409	11	0.73	19	47	-4	42
POWESHIE801404	430	0.10	4	10	85	94
POWESHIE791318	390	0.58	87	218	47	265
POWESHIE791318	2,073	0.56	49	124	397	520
POWESHIE791509	219	0.01	0	1	44	45
POWESHIE801532	714	0.00	0	0	143	143
POWESHIE801430	1,696	0.42	26	66	330	396
POWESHIE791525	288	0.00	0	0	58	58
POWESHIE811310	132	0.20	7	18	24	42
POWESHIE791608	327	0.00	0	0	65	65
POWESHIE811620	752	0.00	0	0	150	150
POWESHIE781618	258	0.00	0	0	52	52

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County & Field	SRT Over Application of Nitrogen (lbs)	VRT Increase In Yield (bu/acre)	VRT Increase in Production ($)	VRT Increase in Revenue ($)	VRT Reduction in Costs ($)	VRT Increase in Profit ($)
POWESHIE791308	57	0.00	0	0	11	11
POWESHIE781509	505	0.00	0	0	101	101
POWESHIE781419	136	0.00	0	0	27	27
POWESHIE811509	209	0.00	0	0	42	42
POWESHIE781436	136	0.00	0	0	27	27
POTTAWAT764428	79	0.00	0	0	16	16
POTTAWAT754132	1,278	0.15	17	41	250	291
POTTAWAT754107	518	0.00	0	0	104	104
POTTAWAT744317	0	0.44	37	93	-13	80
POTTAWAT764326	1,298	0.00	0	0	260	260
POTTAWAT744006	208	0.03	2	4	41	45
POTTAWAT764324	911	0.00	0	0	182	182
POTTAWAT764323	692	0.00	0	0	138	138
POTTAWAT763912	284	0.00	0	0	57	57
POTTAWAT773805	803	0.00	0	0	161	161
POTTAWAT774010	303	0.00	0	0	61	61
POTTAWAT763822	93	0.00	0	0	19	19
POTTAWAT764335	344	0.00	0	0	69	69
POTTAWAT764127	828	0.00	0	0	166	166
POTTAWAT754322	307	0.00	0	0	61	61
POTTAWAT743912	477	0.00	0	0	95	95
POTTAWAT774110	401	0.00	0	0	80	80
POTTAWAT774501	1,289	0.00	0	0	258	258
POTTAWAT744130	748	0.00	0	0	150	150
POTTAWAT774216	685	0.00	0	0	137	137
SIOUX974510	804	0.06	7	18	158	177
SIOUX944704	653	0.00	0	1	130	131
SIOUX954416	226	0.00	0	0	45	45
SIOUX964707	3,963	0.00	0	0	793	793
SIOUX964425	159	0.06	3	7	31	37
SIOUX974622	1,868	0.15	12	31	369	400
SIOUX964629	134	0.22	9	23	24	46
SIOUX944422	669	0.28	35	87	121	209
SIOUX954627	58	0.23	5	12	10	22
SIOUX944608	392	0.30	32	80	67	147
SIOUX944409	165	0.40	25	63	24	87
SIOUX944536	732	0.07	9	21	143	165
SIOUX974721	213	0.00	0	0	43	43
SIOUX954318	456	0.25	29	72	81	153
SIOUX964723	224	0.36	15	36	40	76
SIOUX964503	715	0.00	0	0	143	143
SIOUX954714	233	0.01	1	2	46	49
SIOUX974401	565	0.26	27	69	103	172
SIOUX974517	845	0.10	15	36	164	200
SIOUX944803	1,648	0.01	1	2	329	332

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County & Field	SRT Over Application of Nitrogen (lbs)	VRT Increase In Yield (bu/acre)	VRT Increase in Production ($)	VRT Increase in Revenue ($)	VRT Reduction in Costs ($)	VRT Increase in Profit ($)
STORY822404	152	0.50	33	83	18	101
STORY240403	118	0.43	33	84	12	95
STORY822407	339	0.44	36	89	55	144
STORY822413	360	0.00	0	0	72	72
STORY822211	2	0.38	16	40	-5	35
STORY822301	543	0.00	0	0	109	109
STORY852335	1,724	0.23	35	88	332	421
STORY852222	547	0.00	0	0	109	109
STORY842218	527	0.00	0	0	105	105
STORY852403	430	0.42	56	139	66	205
STORY832301	866	0.00	0	0	173	173
STORY822224	201	0.36	21	52	33	84
STORY852122	382	0.00	0	0	76	76
STORY832314	273	0.09	7	18	52	70
STORY842110	672	0.00	0	0	134	134
STORY832421	176	0.00	0	0	35	35
STORY822425	256	0.00	0	0	51	51
STORY842331	429	0.00	0	0	86	86
STORY852105	388	0.00	0	0	78	78
STORY832122	1,626	0.00	0	0	325	325
JONES850207	265	0.58	21	51	46	97
JONES840308	173	0.00	0	0	35	35
JONES840305	390	0.47	22	56	70	126
JONES840134	2,083	0.43	32	79	405	485
JONES830235	312	0.00	0	0	62	62
JONES830428	414	0.00	0	0	83	83
JONES860229	1,569	0.59	24	61	305	366
JONES860425	78	0.52	26	66	6	72
JONES840226	307	0.03	1	2	61	63
JONES830424	360	0.00	0	0	72	72
JONES830424A	522	0.05	2	5	104	109
JONES830310	240	0.16	6	16	46	62
JONES850110	1,305	0.00	0	0	261	261
JONES860135	737	0.01	0	1	147	148
JONES830106	273	0.00	0	0	55	55
JONES830135	1,124	0.07	5	12	223	235
JONES830133	931	0.00	0	0	186	186
JONES860313	169	0.00	0	0	34	34
JONES860310	1,455	0.10	7	17	288	306
JONES830401	81	0.05	1	2	16	18
WRIGHT932301	2,311	0.00	0	0	462	462
WRIGHT932620	247	0.00	0	0	49	49
WRIGHT 932614	331	0.58	67	168	42	210
WRIGHT932522	539	0.00	0	0	108	108
WRIGHT932523	578	0.00	0	0	116	116

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County & Field	SRT Over Application of Nitrogen (lbs)	VRT Increase In Yield (bu/acre)	VRT Increase in Production ($)	VRT Increase in Revenue ($)	VRT Reduction in Costs ($)	VRT Increase in Profit ($)
WRIGHT932513	360	0.00	0	0	72	72
WRIGHT932420	1,166	0.00	0	0	233	233
WRIGHT932317	140	0.56	36	91	15	106
WRIGHT932324	880	0.37	35	87	164	251
WRIGHT932435	449	0.16	13	33	85	118
WRIGHT922506	340	0.89	71	178	43	221
WRIGHT922512	1,396	0.00	0	0	279	279
WRIGHT922302	1,571	0.00	0	0	314	314
WRIGHT922517	953	0.00	0	0	191	191
WRIGHT922520	1,741	0.00	0	0	348	348
WRIGHT912618	287	0.00	0	0	57	57
WRIGHT922415	1,044	0.04	3	7	208	215
WRIGHT922423	863	0.00	0	0	173	173
WRIGHT922313	1,239	0.00	0	0	248	248
WRIGHT922331	659	0.00	0	0	132	132
WRIGHT922326	663	0.00	0	0	133	133
WRIGHT912611	693	0.00	0	0	139	139
WRIGHT912506	549	0.00	0	0	110	110
WRIGHT912411	505	0.00	0	0	101	101
WRIGHT912632	4	0.58	46	115	-16	100
WRIGHT912532	471	0.00	0	0	94	94
WRIGHT902314	4,374	0.03	7	17	872	889
WRIGHT902527	1,050	0.00	0	0	210	210
WRIGHT902426	601	0.00	0	0	120	120
WRIGHT902335	409	0.09	9	23	79	102
TOTAL	154,243	0.13	2,436	6,089	29,979	36,068