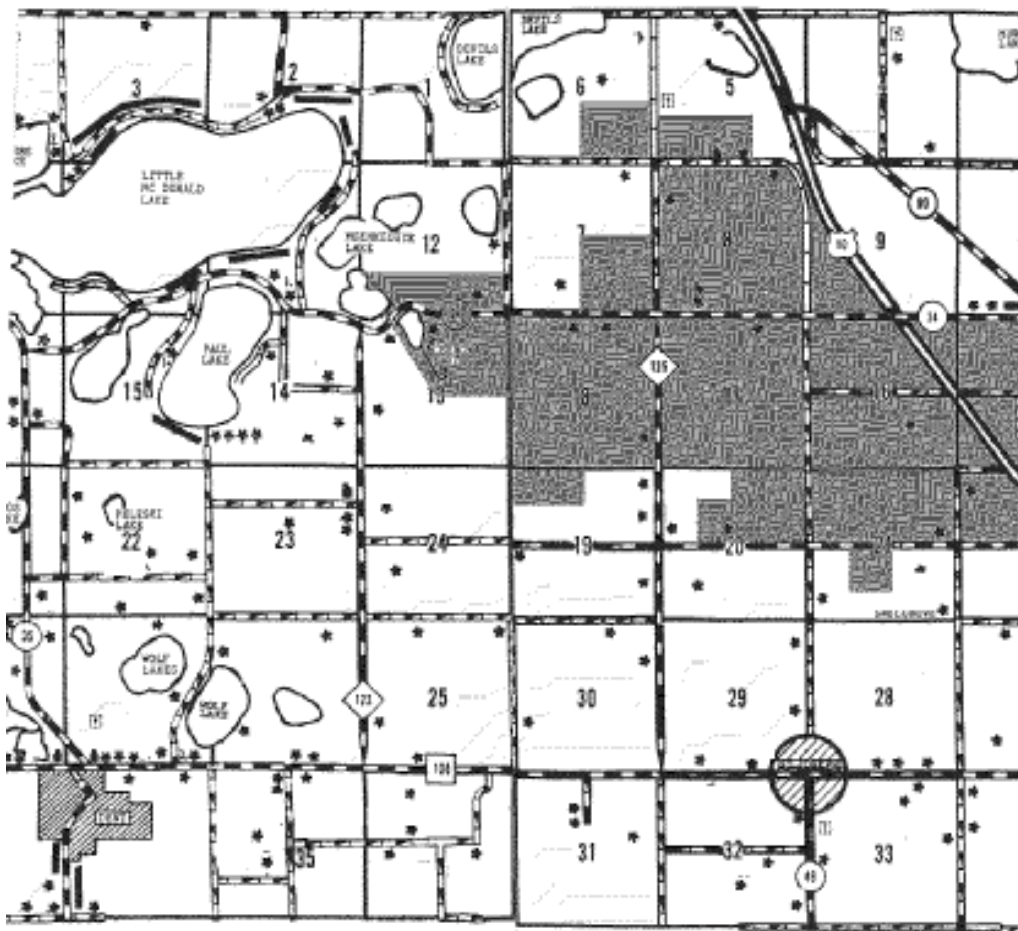


# Survey of Farmers within the Perham Wellhead Protection Area.



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## **General information: Farmers in the Perham Wellhead Protection Area.**

Water quality in the Perham Wellhead protection area is a concern to the citizens of Perham and the surrounding area. Perham water supply is obtained from four wells ranging in depth from 90 feet to 125 feet. The wellhead protection area is the area where the wells for Perham could be affected by contamination from surface activities. This study focuses on the farming aspect of the wellhead protection area.

A list of farmers in the Perham wellhead protection area was obtained from the Ottertail Farm Service Agency. The county extension agent, Perham wellhead protection committee, Natural Resources Conservation Service (NRCS) and the Soil and Water Conservation District (SWCD) were contacted to inform them of the specifics of the project and overall goals. Introduction letters signed by the Commissioner of Agriculture were mailed out to the farmers in December of 1998. The letter's intent was to identify: the overall project; the purpose of the nutrient assessment; why they were selected; and what types of information and amount of their time would be necessary to successfully complete the project. Letters were sent to 27 farmers and a total of 17 farmers were interviewed. Approximately 70% of the farmland in the Perham wellhead protection area was included in the survey.

The Minnesota Department of Agriculture has developed the Farm Nutrient Management Assessment Program (FANMAP) to get a thorough understanding of current farm practices regarding agricultural inputs. This information will be used to design effective water quality educational programs and serve as baseline data to determine program effectiveness over time. In the past six years, over 500 farmers have volunteered two to four hours of their time to share information about their farming operations. This previous information was collected as a result of funding through the Legislative Commission on Minnesota Resources or from Clean Water Partnership Programs.



## **Nutrient Information of the Selected Farms in Perham Wellhead Protection Area**

Inventory forms and database design were patterned after a previous successful project<sup>1</sup>. Timing, rates, and method of applications were collected for all nitrogen (N), phosphate (P<sub>2</sub>O<sub>5</sub>), and potassium (K<sub>2</sub>O) inputs (fertilizers, manures, and legumes) on **a field-by-field basis for all acres within the watershed**. Soil and manure testing results were also collected if available. Nutrient inputs, and yields, were specific for the 1998 cropping season. Crop types and manure applications (starting in the fall of 1997) were also collected from the 1997 season for purposes of 1998 nitrogen crediting. Long term yield data generally reflected the past three to five years. Livestock census and other specifics for the entire farm (i.e. types of manure storage systems, total farm sizes) were also recorded.

### **Farm Size, Crop and Livestock Characteristics of the Selected Farms in Perham Wellhead Protection Area**

Seventeen farmers were interviewed in January through March of 1997. Some of the "farmers" were actually a combination of farmers such as a father and son who farmed together. Only four farming operations applied any manure to crop acres.

A total of 2,471 acres of farmland were inventoried in the Perham Wellhead Protection Area. Farm interviews covered approximately 70% of all agricultural acres in the watershed. Livestock appears to play a limited role in the Perham Wellhead Protection Area for the 1998 growing season. Four operations broadcast manure on a total of 295 acres. The manure broadcast was not incorporated immediately after application. Approximately 10,000 lbs of nitrogen (N) was applied through broadcast and was available as first year manure N credits. The manure was spread on a variety of crops including 165 acres of corn, 15 acres of alfalfa and 75 acres of potatoes.

Table 1 lists each type of crop and the number of acres of the crop surveyed in the Perham Wellhead Protection Area. Irrigation is prevalent as 1,222 acres, or 50%, of the acres surveyed were irrigated.

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<sup>1</sup>Effective Nitrogen and Water Management for Water Quality Sensitive Regions of Minnesota, LCMR 1991-93

**Table 1. Crop Type and Acres in the Perham Wellhead Protection Area.**

<b>Crop</b>	<b>Total Acres</b>	<b>Irrigated Acres</b>	<b>Non-irrigated Acres</b>
Corn	426	199	227
Edible Beans	328	308	20
Alfalfa	549	140	409
Small Grain	83	30	53
Potato	545	545	0
CRP	386	0	386
Other	154	0	154
<b>Total Acres</b>	<b>2,471</b>	<b>1,222</b>	<b>1,249</b>

**Commercial Fertilizer Use Characteristics on Selected Farms:  
Perham Wellhead Protection Area:**

Field corn accounted for 19% of the total N commercial fertilizer use. All corn acreage received commercial N fertilizer (Table 2). Average fertilizer N rate on corn acres with commercial fertilizer was 96 lb./A. This rate is calculated as the means across all commercially N fertilized corn acres regardless of past manure or legume N credits. Total N inputs will be discussed later in the "Nitrogen Balances and Economic Considerations" section.

**Table 2. Distribution Of Commercial Nitrogen Applications  
On Cropland - 1998.**

<b>Crop</b>	<b>Acres Receiving N Fertilizer</b>	<b>Total N Applied</b>	<b>Average Rate of N on Fertilized Acres</b>
Corn	426	40,887	96
Edible Beans	328	40,952	125
Potatoes	545	131,258	241
Small Grains	45	2,700	60
<b>TOTALS</b>	<b>1,344</b>	<b>215,797</b>	<b>-----</b>

Irrigated acres accounted for 207,000 pounds of N or 96% of all N used. Fifty percent of crop acres were irrigated. Seventy percent of the corn acres were irrigated. Average rate

of N on irrigated corn acres was 115 pounds per acre. Average rate of N on non-irrigated corn acres was 51 pounds per acre.

Timing of N fertilizer applications is an important consideration in maximizing fertilizer use efficiency and minimizing environmental effects. Spring preplant applications of nitrogen in the form of anhydrous ammonia or urea are recommended for Central Minnesota and irrigated soils<sup>2</sup>. There was no fall application of N for any of the crops. Approximately 20% of commercial nitrogen fertilizer was applied as a spring preplant or at planting on all crop acres (Figure 1). It appears that timing of N applications to all crops are in agreement with UM recommendations.

**Timing of N Fertilizer Applications Across All Crops**

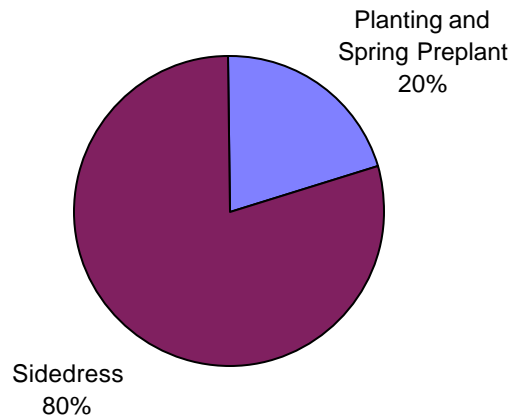


Figure 1. Timing of N fertilizer applications across all crop acres. There was no fall application of N.

Potatoes accounted for over 60% of all N applied (Figure 2)..

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<sup>2</sup> M.A. Schmitt and G.W. Randall 1993. Best Management Practices for Nitrogen Use in Central MN. AG-FO-6127-B.

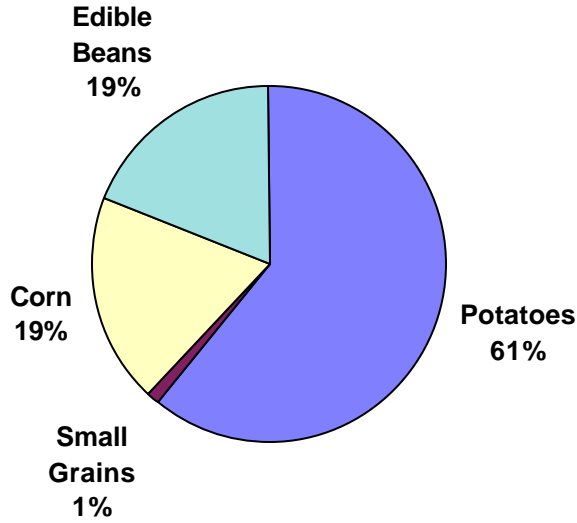


Figure 2. Distribution of N across all crop acres fertilized with N. Table 3 details the timing of each specific crop fertilized with N.

<b>Table 3. Timing of N Fertilizer Applications on All Crop Acres.</b>			
<b>Crop</b>	<b>Growth Stage</b>	<b>Total N Applied</b>	<b>Percentage of Total N for Each Crop</b>
Corn	Spring Plant/Preplant	13,727	34%
	Sidedress	27,160	66%
<b>Totals</b>	-----	<b>40,887</b>	<b>100%</b>
Beans	Spring Plant/Preplant	11,772	29%
	Sidedress	29,180	71%
<b>Totals</b>	-----	<b>40,952</b>	<b>100%</b>
Potatoes	Spring Plant/Preplant	15,765	12%
	Sidedress	115,493	88%
<b>Totals</b>	-----	<b>131,258</b>	<b>100%</b>
Small Grains	Spring Plant/Preplant	2,700	100%
	Sidedress	0	0%
<b>Totals</b>	-----	<b>2,700</b>	<b>100%</b>
<b>TOTALS</b>		<b>215,797</b>	-----

Anhydrous ammonia was not a source of N in the Perham Wellhead Protection Area. Liquid N, or UAN solutions supplied 37% of the total amount of commercial N applied to all crops (Figure 3).

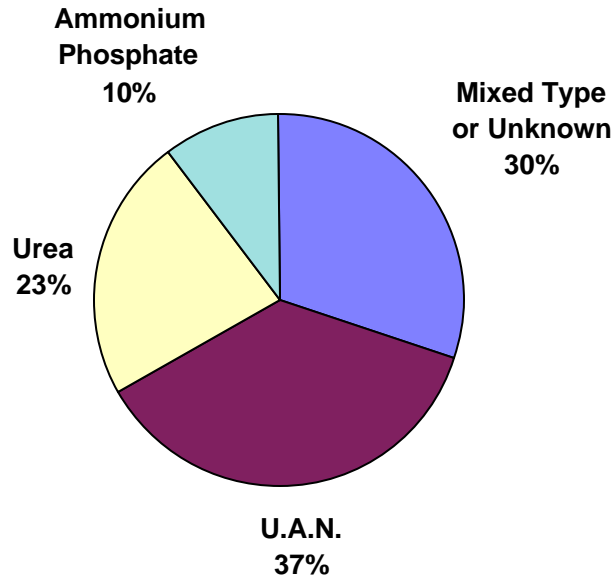


Figure 3. Sources of N used on all crops.

### **Relative Importance of N Sources on the Selected Farms: Perham Wellhead Protection Area:**

University of Minnesota recommendations for nitrogen provide N credits from legumes. Alfalfa was assumed to have 2-3 plants per square foot when tilled for the following corn crop. First year alfalfa provided a 75 lb./A credit, and second year alfalfa provided a 50 lb./A credit. Edible beans supply a 20 lb./A N credit, but only when corn follows the bean crop<sup>3</sup>. The general crop rotation for non-irrigated acres is corn -small grain - alfalfa. The general crop rotation for irrigated acres is corn - edible beans - potatoes. In the Perham survey, alfalfa was by far the most important source of legume N, supplying approximately 95% of all legume N.

Commercial fertilizer (94%), manure (4%), and legume (2%) contributed a total of 231,000 pounds of "first year available N" to all acres (Figure 4). Proper crediting for these sources is critical in maintaining economic and environmental balances.

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<sup>3</sup> According to the UM edible bean credits should not be used for the following potato crop.

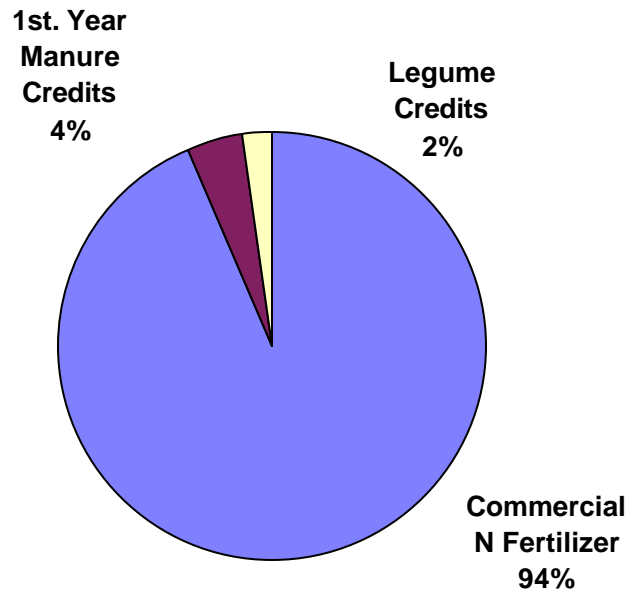


Figure 4. Relative N contributions from fertilizers, manures and legumes across all corn acres. N inputs totaled 231,000 for all sources.



## Nitrogen Balances and Economic Considerations: Perham Wellhead Protection Area

Contributions of N to corn totaled 46,000 pounds. Irrigated corn received 38,000 lbs. of N and non-irrigated corn received 8,000 lbs. of N. The irrigated corn yield goal across all farms averaged 138 bushels/A. Historic yields averaged 138 bushels/A. The non-irrigated corn yield goal averaged 81 bushels/A. Historic yields averaged 75 bushel/A. Yield goals for both irrigated and non-irrigated corn was equal to or slightly greater than historic yields. University of Minnesota N recommendations (based on yield goal, crop history, and soil organic matter level) were compared to actual amounts of fertilizer and manure applied to each field. Approximately 780 acres had soil tests with soil organic matter data and 98% of those acres were in the low range (<3%).

University of Minnesota(UM) N recommendations for irrigated corn averaged 137 lb./N/A (Figure 5). Actual amounts of N applied from fertilizer and manure averaged 129 lb./A across all irrigated corn acres. Factoring in all appropriate credits from fertilizer, legumes and manures, there was an under-application rate of 8 lb./N/A. University of Minnesota(UM) N recommendations for non-irrigated corn averaged 48 lb./N/A (Figure 6). Actual amounts of N applied from fertilizer and manure averaged 62 lb./A respectively across all non-irrigated corn acres. Factoring in all appropriate credits from fertilizer, legumes and manures, there was an over-application rate of 14 lb./N/A.

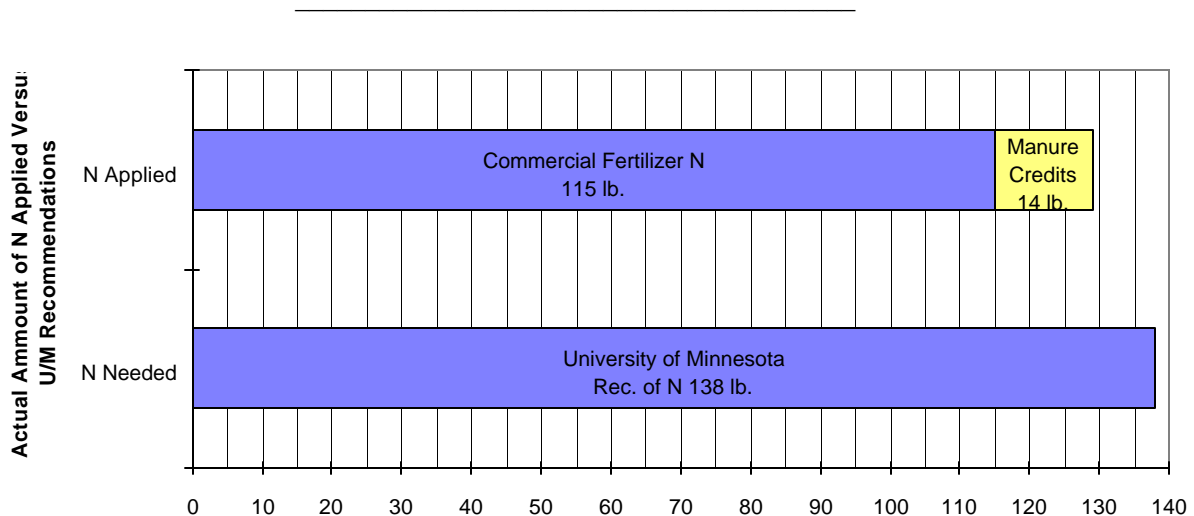


Figure 5. Crop N requirements based on University of MN recommendations in comparison to actual N inputs (fertilizer, and manure) across all irrigated corn acres. Total corn area in this analysis was 299 acres.

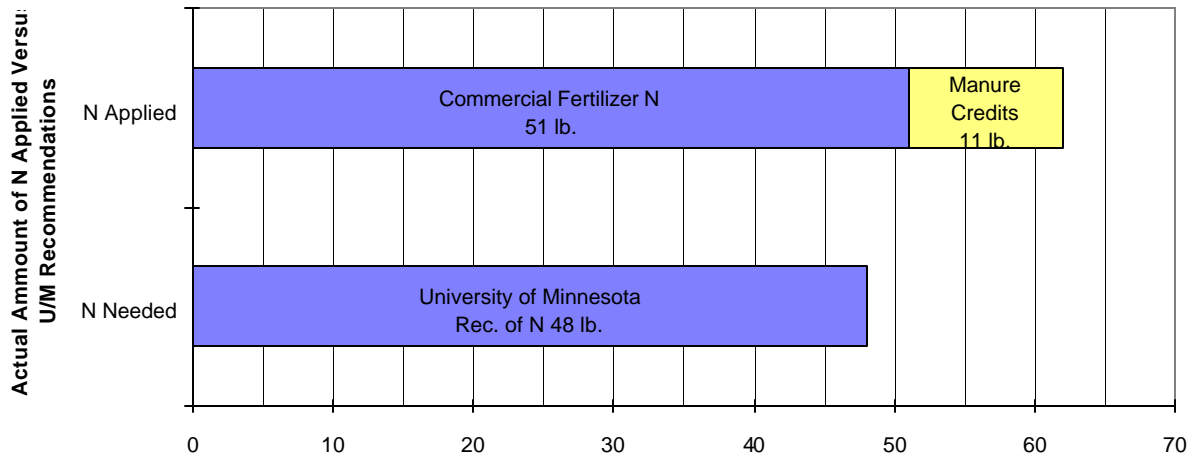


Figure 6. Crop N requirements based on University of MN recommendations in comparison to actual N inputs (fertilizer, and manure) across all non-irrigated corn acres. Total corn area in this analysis was 127 acres.

Factoring in legume N credits and manure N inputs into the process on a field-by-field basis, the amounts in excess of 1998 UM recommendations are illustrated in Figure 7. One of the huge advantages of the technique developed through the nutrient assessment process is the ability to examine in great detail the nutrient balances and make some inferences on where the biggest gains in water quality can be obtained through focused educational programs.

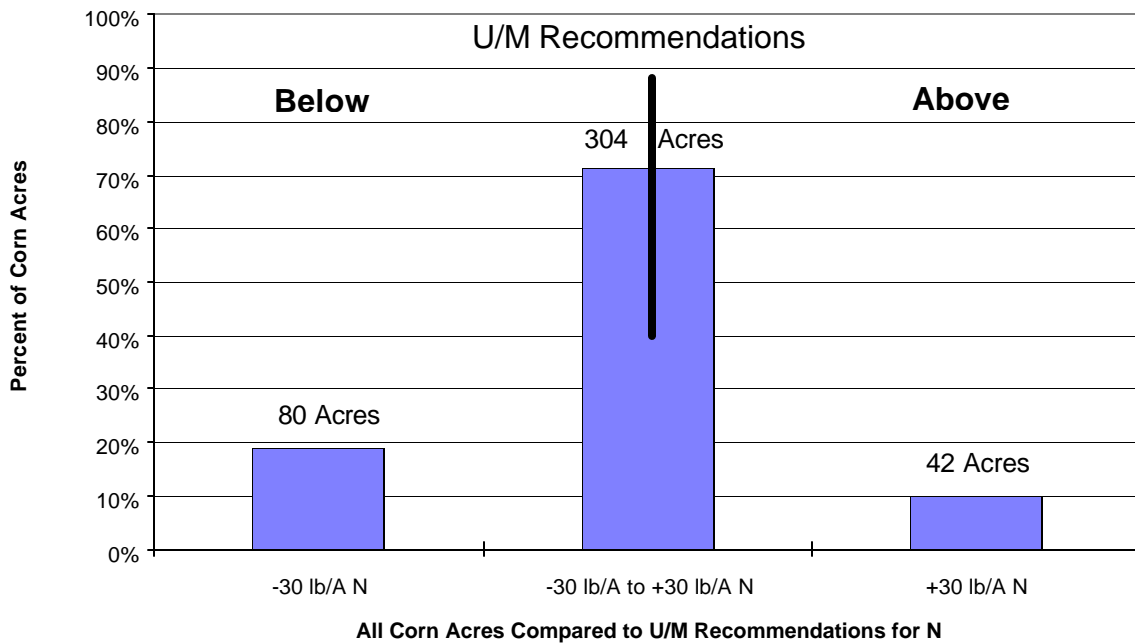


Figure 7. Corn acres that fall within plus and minus 30 pounds of the UM recommendations for N.

Ten percent (10%) of the corn acres were classified in the excess category and 19% of the acres were in the below UM category. By adjusting both of these categories to within 30 lbs of the UM recommendations would actually increase the amount of N on corn acres in the Perham Wellhead Protection Area by 1,000 lbs. It appears farmers are very close to UM recommendations for N in regard to corn.

Contributions of N to edible beans totaled 41,000 pounds. All bean acres were irrigated except for 20 acres of non-irrigated beans. The edible bean yield goal across all farms averaged 2000 pounds/A. Historic yield averaged 1668 pounds/A. Yield goals for edible beans were 20% greater than historic yields. University of Minnesota N recommendations (based on yield goal, crop history, and soil organic matter level) were compared to actual amounts of fertilizer and manure applied to each field. There was no manure applied to edible beans. University of Minnesota(UM) N recommendations<sup>4</sup> for edible beans averaged 120 lb./N/A (Figure 8). This recommendation is based on yield goal, not actual or historic yields. Actual amounts of N applied from fertilizer (no manure was applied to edible beans) averaged 125 lb./A respectively across all edible acres. There was an over-application rate of 5 lb./N/A.

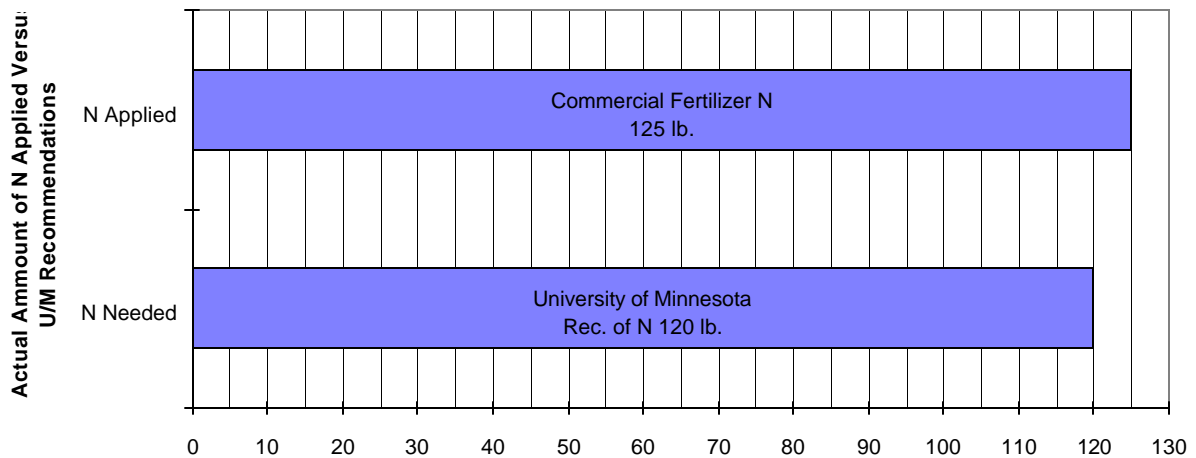


Figure 8. Crop N requirements based on University of MN recommendations in comparison to actual N inputs across all edible bean acres. Total edible beans area in this analysis was 328 acres.

<sup>4</sup> New recommendations for edible beans are in the process of revision. New recommendations are from George Rehms, University of Minnesota.

UM recommendations are based on yield goal, not actual yields. All edible beans were within 30 pounds of N of the UM.

Contributions of N to potatoes totaled 135,000 pounds. All potato acres were irrigated. The potato yield goal across all farms averaged 450 hundred weight/A. Historic yield averaged 408 hundred weight/A. Yield goals for potatoes were 10% greater than historic yields. University of Minnesota N recommendations (based on yield goal, crop history, and soil organic matter level) were compared to actual amounts of fertilizer and manure applied to each field. There was limited manure applied to 74 acres of potatoes. University of Minnesota N recommendations for potatoes averaged 225 lb./N/A (Figure 9). This recommendation is based on yield goal, not actual or historic yields. Actual amounts of N applied from fertilizer and manure averaged 248 lb./A across all potato acres. There was an over-application rate of 23 lb./N/A. Use of petiole analysis, after properly timed N applications, could increase the amount of recommended N on potatoes.

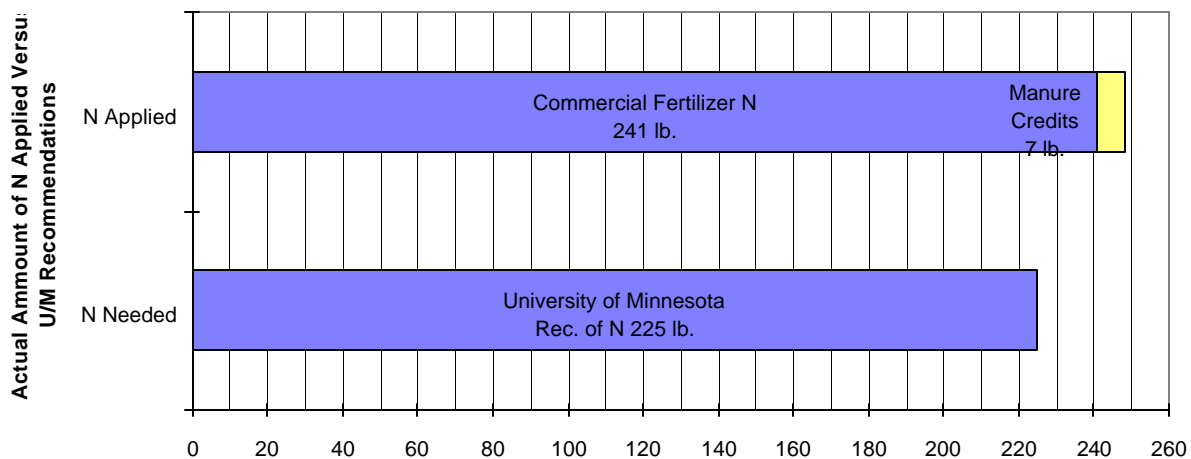


Figure 9. Crop N requirements based on University of MN recommendations in comparison to actual N inputs across all potato acres. Total potato area in this analysis was 545 acres.



## **Conclusions and Summary of the Current Nutrient Management Practices for the Perham Wellhead Protection Area.**

Seventeen farms, covering 2,500 acres, participated in the Farm Nutrient Management Assessment Program (FANMAP) with staff from the Minnesota Department of Agriculture. Producers volunteered two to four hours of their time to share information about their farming operation. The overall purpose of the program was to develop a clear understanding of current farm practices regarding agricultural nutrients and utilize this knowledge for future water quality educational programs.

Over 215,000 pounds of commercial N was applied to the crops for the 1998 growing year. Sixty-one percent of the commercial N was applied to potato acres. Anhydrous ammonia was not a source of N and no fall application of N occurred.

Manure (first year available) accounted for 4% of the N while legumes and commercial N accounted for 2% and 94%, respectively. Alfalfa was the dominate source of legume N credits. Producers appeared to be very close to the UM recommendations for N on all crops. Timing of N appears to follow UM recommendations as well as the source of N.

There were some very positive findings from this study. There is strong evidence that producers are voluntarily adopting the educational materials and strategies developed by the UM. It is also evident that promotional activities need to continue and be specifically targeted to deliver the most recent technology and recommendations.