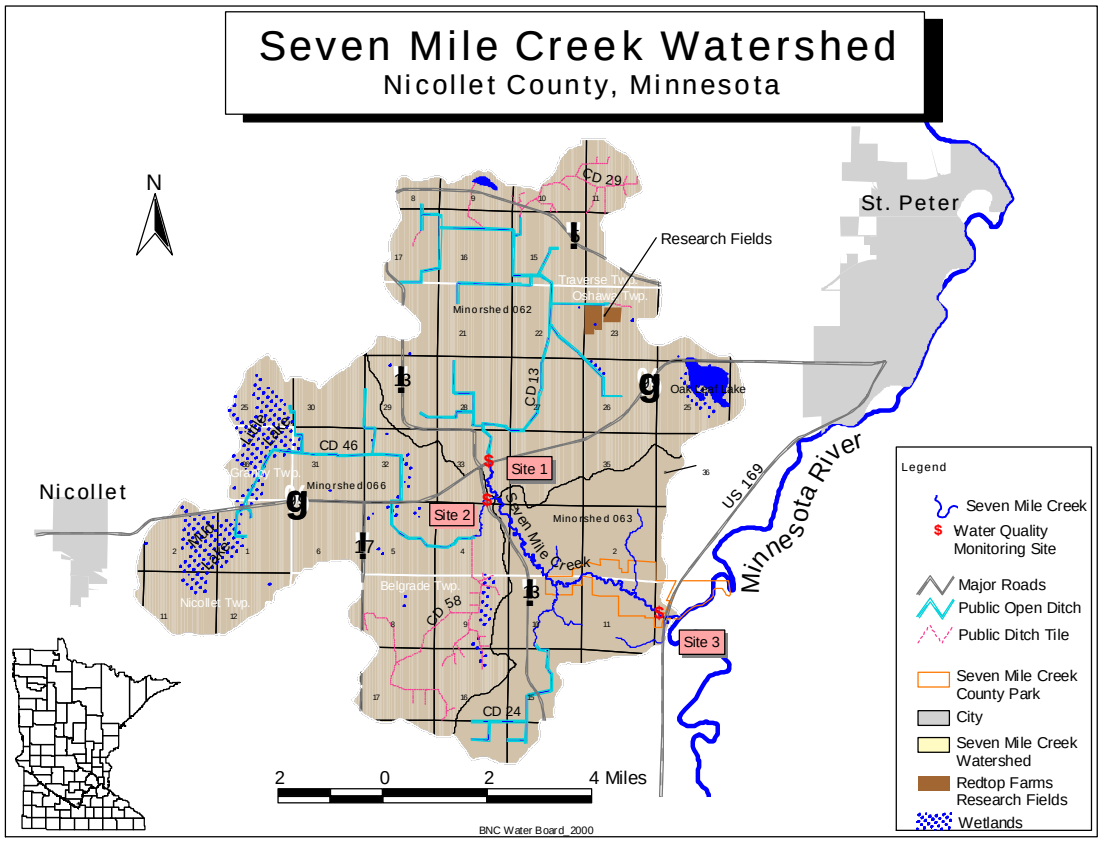
2002 Nutrient Management Assessment of Producers



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General information:
The Seven Mile Creek Watershed (SMCW)

The Seven Mile Creek Watershed (SMCW) project is a collaborative effort to help protect and enhance the water quality of Seven Mile Creek. Seven Mile Creek is Nicollet County's most visible natural resource with a 630-acre county park located at the mouth of the watershed. The park and designated trout stream is used by thousands of visitors every year. On going efforts in the late 1980's to help protect the drinking water for the city of St. Peter sparked local interest to investigate the water quality of unique streams like Seven Mile. The watershed project has turned into one of the most showcased and studied watersheds in the Middle Minnesota Major River Basin.

With that perspective, grants acquired from the Department of Natural Resources Environmental Partnerships and Minnesota Pollution Control Agency Resource Investigation programs were utilized to study the watershed in the mid- 1990's. Also, in the mid-1990's three monitoring stations were established and efforts to provide education about water quality protection began. A report summarizing the water quality of the watershed was printed in 2001(see at http://mrbdc.mnsu.edu/reports/midminn/sevenmile.html). According to the diagnostic study, fecal coliform bacteria, high nutrient loadings from phosphorus and nitrates, and extreme peak flows resulting in accelerated stream bank erosion were found to be the largest water quality impairments in the watershed. Soon after, watershed coalition efforts materialized into a Clean Water Partnership. The Clean Water Partnership[1] program for Minnesota was created in 1987 to address pollution associated with runoff from agricultural and urban areas. The program provides local governments with resources to protect and improve lakes, streams, and ground water.

Implementation of Conservation Practices to Protect and Enhance Water Quality

In 2002, work began to accelerate the voluntary adoption of Best Management Practices (BMPs). The three-year CWP project (2002-2005) focuses on accelerating conservation practices by providing additional technical and financial assistance to watershed landowners and producers. The project focuses on education, nutrient management, septic system upgrades, filter strips, wetlands, water storage, stream trout habitat creation, and stream bank erosion control using soil bioengineering techniques. Intensive water quality monitoring and watershed assessments have continued throughout the project.

Cooperators

The Seven Mile Creek Watershed Project is a mutual effort by watershed farmers, landowners, citizens, county, state, and federal groups. The coalition interested in improving this watershed includes traditional water resource agencies: Brown Nicollet Environmental Health, Soil and Water Conservation District (SWCD), Natural Resource Conservation District (NRCS), Environmental Services, Farm Service Agency (FSA), Minnesota Department of Agriculture (MDA), Minnesota Pollution Control Agency (MPCA), Minnesota Department of Natural Resources (MDNR) as well as an extraordinary roster, which includes two branches of the University of Minnesota (Soils/Agriculture & Public Health), the Center for Agricultural Partnerships, Blue Earth Consulting, agri-business retailers, United States Department of Agriculture (USDA) paired watershed study, and the McKnight Foundation. In addition, the watershed also has a 3,000-head Northern Plains Dairy operation which will begin operations in 2003, and Red Top Farm, southern Minnesota's long-running demonstration farm. Both are valued partners in the watershed protection project. At the time of this study, Brown-Nicollet-Cottonwood Water Quality Board is the project sponsor and coordinator; over 15 agencies, citizens groups, and private enterprises are involved in this watershed project.

[1] The Seven Mile Creek CWP formed in 2002.

This study focused on agricultural inputs (nutrients and pesticides) associated with the SMCW and summarizes the results of farm assessments conducted for the 2002 cropping season. A list of farmers/operators in the SMCW was obtained from the SMCW project and Nicollet SWCD and NRCS. Farm operations to be interviewed were chosen by the SMCW project with priority based on farmers with the most acres and highest number of livestock. Eighteen farmers participated and provided input data on 11,400 acres. This represents over 60% of the watershed-cultivated acres.

Introduction letters describing the project were mailed to the farmers in January of 2003. The letter's intent was to identify: 1) the overall project; 2) the purpose of the nutrient assessment; 3) why individual farmers were selected; and 4) what types of information and amount of time would be necessary to successfully complete the project.

The Minnesota Department of Agriculture (MDA) used a data-gathering tool and analysis system called the Farm Nutrient Management Assessment Program (FANMAP) to conduct the study. FANMAP was developed ten years ago to provide an understanding of current farm practices regarding agricultural inputs. This information is used to design effective water quality educational programs and provides baseline data to determine program effectiveness over time. In the past decade, more than 700 farmers throughout Minnesota have volunteered one to three hours of their time to share information about their farming operations. Previous FANMAP studies have been conducted as a result of funding from programs such as the Legislative Commission on Minnesota Resources, Clean Water Partnership, and USDA programs and supplemental funding from the fertilizer tonnage fee account at the MDA. Previous reports can be found on the MDA website at http://www.mda.state.mn.us/appd/ace/fanmap.htm.

Nutrient Information of the Selected Farms in the Seven Mile Creek Watershed

Inventory forms and database design were patterned after a previous successful project[2]. The following types of information were collected on a field-by-field basis for all inventoried acres within the SMCW through FANMAP interviews:

- Timing, rates and method of applications were collected for all nitrogen (N), phosphate (P_2O_5) and potassium (K_2O) inputs (fertilizers, manures and legumes);
- Pesticide information (product, rate, timing, etc);
- Soil and manure testing results if available;
- Tillage practices.

Livestock types, manure storage, application rates and application timing information was also recorded.

[2]Effective Nitrogen and Water Management for Water Quality Sensitive Regions of Minnesota, LCMR 1991-93

Nutrient inputs and yields were specific for the 2002 cropping season. Crop types and manure applications (starting in the fall of 2001) were also collected for the 2002 season for purposes of nitrogen crediting to crops grown during the 2002 season. 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. Information was gathered from the farmer or from the fertilizer dealer if the dealer kept the farmer's records.

Farm Size, Crop and Livestock Characteristics of the Selected Farms in the Seven Mile Creek Watershed

The eighteen farm interviews were conducted between February and July of 2003. A total of 11,000 acres of farmland was inventoried in the SMCW study for the 2002 crop season. Nicollet County Farm Service Agency farm and tract information for the cropping year 2002 indicated there were approximately 19,000 crop acres in the SMCW. Farm interviews covered approximately 60% of all agricultural acres in the SMCW. The SMCW cropland was dominated by a field corn/soybean rotation accounting for 93% of all acres. Figure 1 lists each type of crop grown and the corresponding percentage of acres.

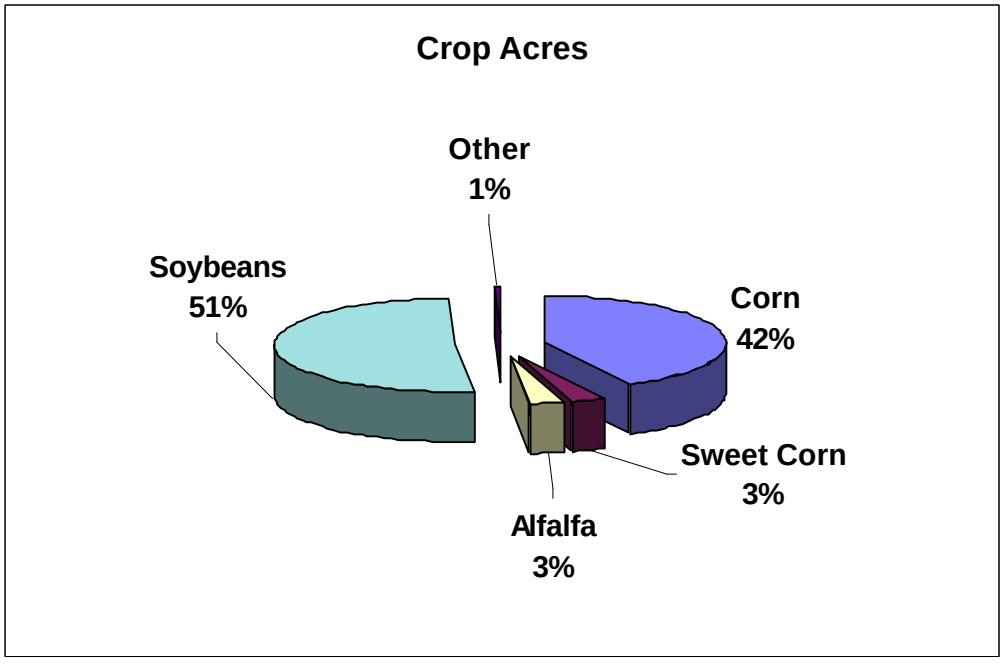


Figure 1. Crop types and corresponding percentages during the 2002 cropping season on 18 farms within the SMCW. Cropland totaled 11,414 acres.

Commercial Fertilizer Use Characteristics on Selected Farms: Seven Mile Creek Watershed

Commercial Nitrogen (N).

Field corn accounted for more than 92% (681,000) of the 743,000 pounds of commercial nitrogen (N) fertilizer applied on the 18 farms (Figure 2). Ninety-nine three (93%) of all field corn acres received commercial N fertilizer. All field corn acreage received either commercial N fertilizer or manure. Commercial N rates across all field corn acres averaged 141 lb/A. Total N inputs will be discussed later in the "Nutrient Balances and Economic Considerations" section of this report.

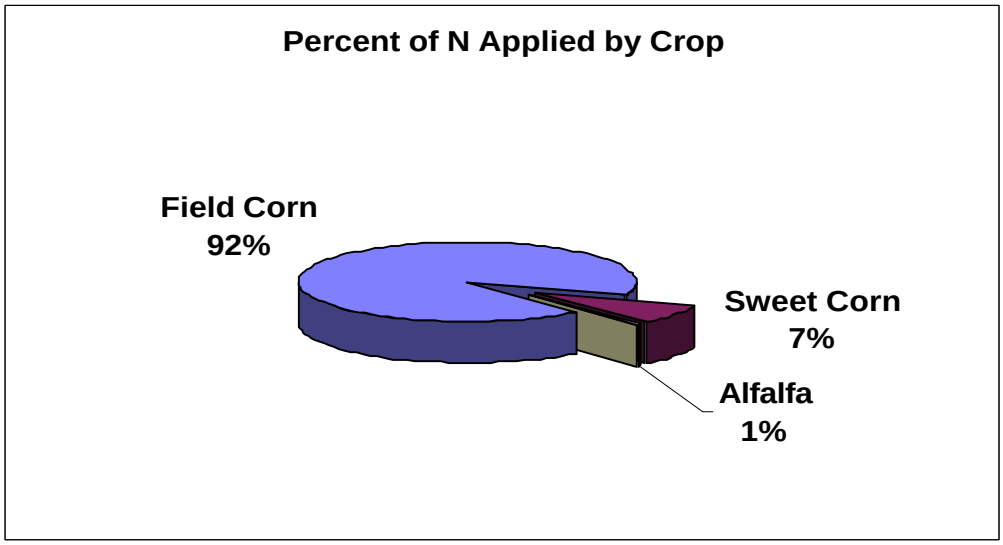
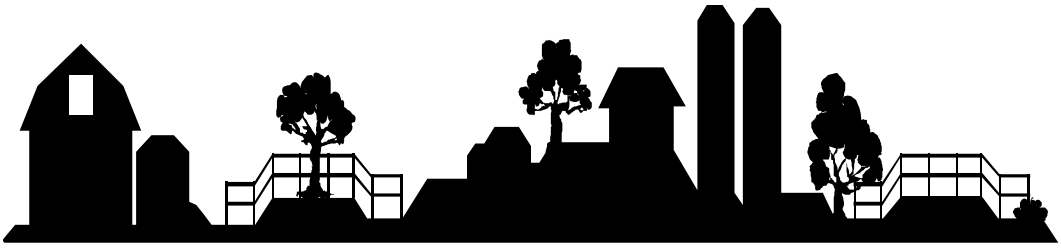


Figure 2. Commercial fertilizer N use by crop type. Commercial fertilizer N totaled 742,502 pounds.

Specific Best Management Practices for nitrogen use have been developed for south-central Minnesota[3]. Applications of nitrogen before spring planting of field corn are highly recommended in the SMCW. Eighty-one percent (81%) of the N applied to field corn was as a fall application (Figure 3).



[3] Best Management Practices for Nitrogen Use in South-Central Minnesota. M.A. Schmitt, G.W. Randall, University of Minnesota.

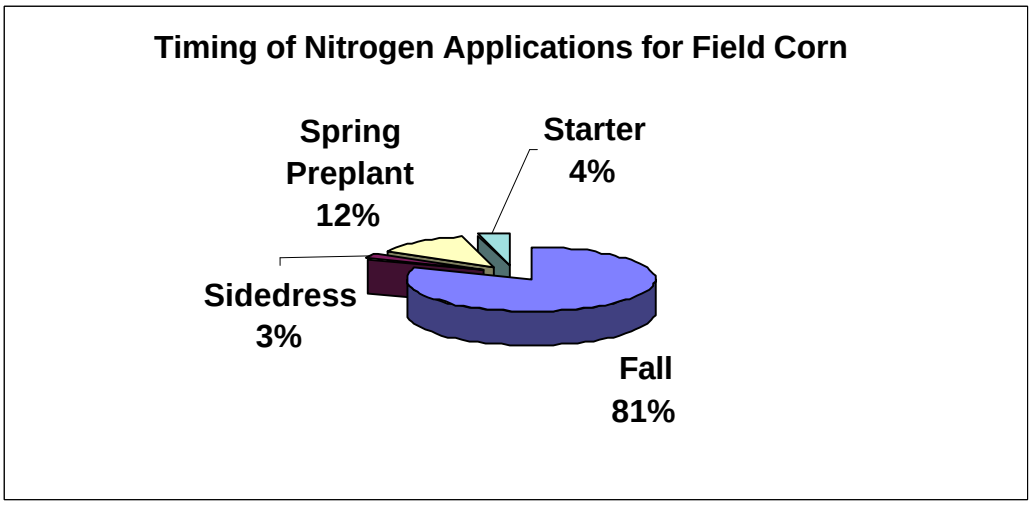


Figure 3. Timing of commercial N applications across all inventoried 4,819 **field corn** acres.

Anhydrous ammonia supplied 77% of all commercial N on field corn acres (Figure 4).

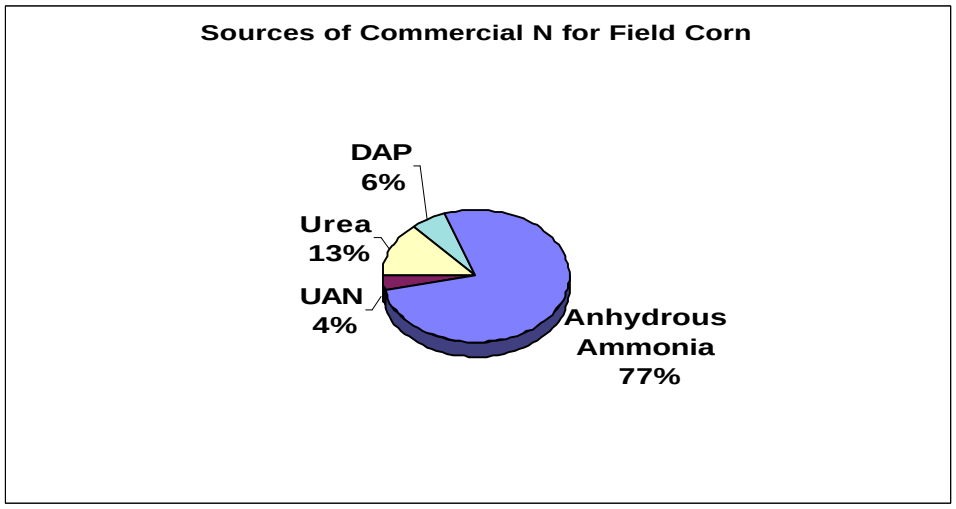


Figure 4. Sources of commercial N used on field corn acres.

Commercial N Applications on Field Corn

Ninety-three percent (93%) of the field corn received commercial nitrogen. Eighty-one percent (81%) of the N was fall-applied on corn acres. Fall applications of Urea or UAN solutions are not recommended. None of the growers were using fall-applied urea or UAN solutions. All applications of fall-applied N in the form of anhydrous ammonia were applied after November 1. Fall applications of anhydrous ammonia are not recommended until the soil temperature reaches a consistent 50°, which generally occurs approximately November 1. No farmers applied commercial N before November 1. Anhydrous ammonia was fall-applied on 75% of field corn acres (Table 1).

Urea was the only source of commercial N in spring preplant applications for field corn.

Table 1. Timing and Source of N on Field Corn Acres.

Timing	N Source	Acres	Pounds N
Fall	Anhydrous Ammonia	3,599	511,586
Fall	DAP	1,492	37,175
Spring Preplant	Urea	512	81,081
At Planting	UAN	2,685	25,450
At Planting	DAP	390	4,270
Sidedress	Anhydrous Ammonia	118	12,980
Sidedress	Urea	220	8,800
Totals	===	==	681,343

Commercial N Applications on Sweet Corn

Sweet corn, dominantly used for canning, was grown on 362 acres of the SMCW cropland. Average commercial N rate was 161 pounds per acre. Most of the commercial N was spring applied in the form of urea (Table 2).

Table 2. Timing and Source of N on Sweet Corn Acres.

Timing	N Source	Acres	Pounds N
Spring Preplant	Anhydrous Ammonia	42	5,250
Spring Preplant	Urea	320	43,300
At Planting	DAP	332	9,581
Totals	===	==	58,131

Commercial N Applications on Other Crops

A very small percentage (1%) of the commercial N was applied to alfalfa and was in the form of DAP. No N is recommended for soybeans and there were no applications of N on inventoried soybean acres.

Commercial Phosphorus.

Field corn accounted for more than 84% of the commercial phosphate fertilizer applied on the 18 farms (Figure 5). Seventy-seven (77%) of all field corn acres received commercial phosphate fertilizer. Average commercial fertilizer rate of phosphate (P_2O_5) across all field corn acres was 36 lb/A. Average commercial fertilizer rate of phosphate across all fields applied with commercial phosphate was 51 lb/A. Total phosphate inputs will be discussed later in the "Nutrient Balances and Economic Considerations" section of this report.

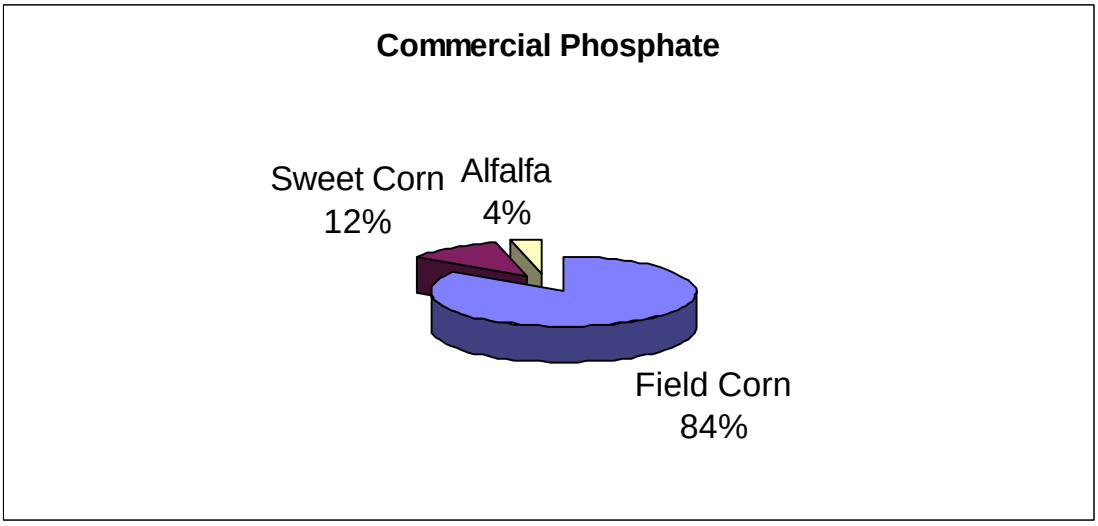


Figure 5. Destination of commercial phosphate used on field corn acres.

Fifty-four percent (54%) of the commercial P was fall applied on inventoried field corn acres. Figure 6 details the timing of commercial P on field corn acres.

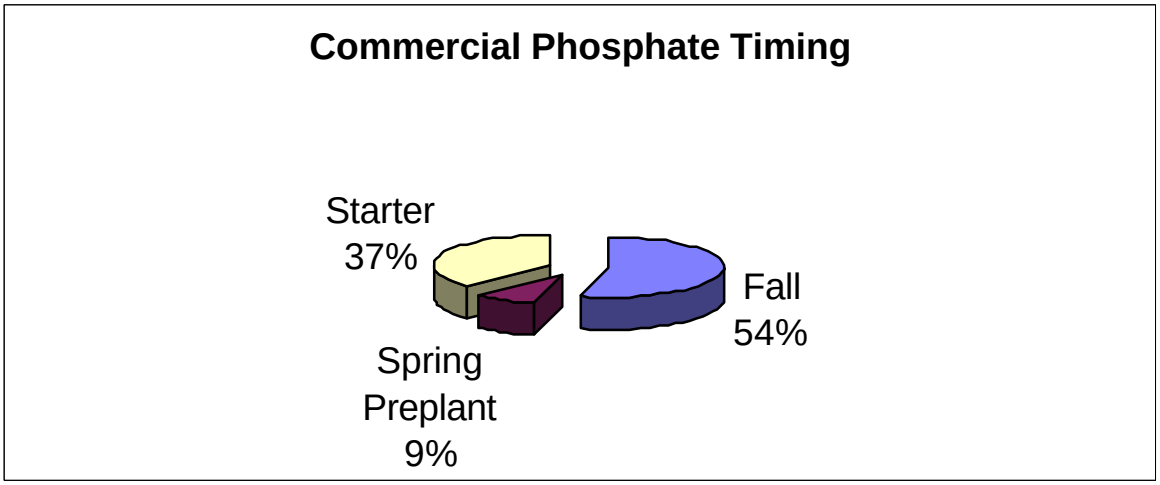


Figure 6. Timing of commercial phosphate applications across all **field corn** acres.

Thirty-one percent (31%) of the commercial phosphate was applied in liquid form as UAN solutions with the balance applied as DAP.

Livestock and Manure Characteristics of the Selected Farms:

Factors directly affecting crop nutrient availability from land-applied manure (including manure storage, types, manure amounts being generated, application methods, incorporation factors and rates) were also quantified to complete the "whole farm" nutrient balance. Livestock numbers in Table 3 represent the livestock inventory on hand from the fall of 2001 to the summer of 2002. Ws assumed that the livestock manure generated during this time period was applied at some point in time to the 2002 crops. Eight (8) of the 18 farmers interviewed had livestock in the SMCW.

Animal production on these farms consisted of dairy and hog operations. Table 3 details the variety of animals produced in the SMCW.

Table 3. 2002 Distribution of Livestock Across Inventoried Farms

Livestock Type	Livestock Number
Dairy Cows	131
Dairy Calves	118
Sows and Boars	1,543
Hog Finishers[4]	38,220
TOTALS	**40,012**

Manure systems consisted of liquid and solid manure systems. Ninety-seven percent (97%) of the manure, based on N content, was handled as a liquid with the balance handled as a solid. All liquid manure was injected and all solid manure was broadcast.

Hog manure accounted for over 75% of the nutrients applied though manure to inventoried acres. Table 4 further details the source of the nutrients, amounts of nutrients applied, and nutrients available after application losses. Approximately 2/3 of the hog finishers were raised in feedlots near the edge of the watershed. On these operations less than 25% of the manure was applied in the watershed with the balance applied outside of the watershed.

[4] Hog finishers are the number sold per year. All other categories are average on hand per year.

Table 4. Manure N and P spread on inventoried acres before and after application losses[5] for the 2002 crop season.

	Nitrogen		Phosphate		Potash	
Livestock Type	Nitrogen Applied	Nitrogen Available	Phosphate Applied	Phosphate Available	Potash Applied	Potash Available
Dairy	32,230	21,928	16,157	14,541	25,461	22,914
Hog	80,284	68,076	47,498	42,748	68,188	61,369
TOTALS	**112,514**	**90,004**	**63,655**	**57,289**	**93,649**	**84,283**

Manure was applied on 732 acres of corn and 20 acres of alfalfa. Of all inventoried acres, 7% received manure at an average rate of 119 pounds per acre of N. Manured corn acres received an average of 77 pounds of phosphate per acre through manure applications. Ninety-eight percent (98%) of the phosphate from manure was applied to corn.

Sixty-one percent (61%) of the first year available N was applied in the fall on inventoried acres in the SMCW (Figure 7).

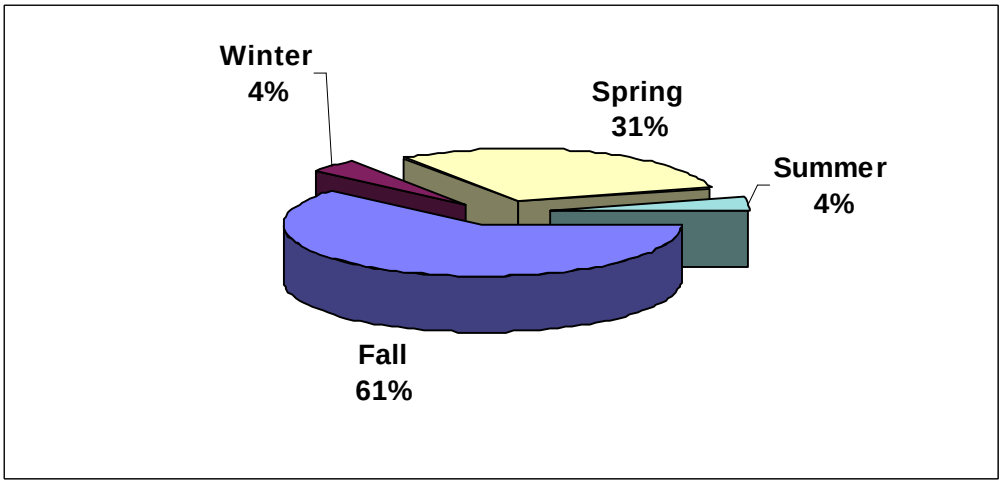


Figure 7. Timing[6] of first year available manure N on inventoried acres in the SMCW. Manured acres totaled 755 of which 20 acres were alfalfa and the balance corn.

[5] Application losses based on Livestock Waste Facilities Handbook.
[6] Timing based on pounds of N available to the 2002 crop.

Relative Importance of Nutrient Sources on the Selected Farms: Seven Mile Creek Watershed

It is important that producers recognize an take the appropriate credit for past legume crops. The UM recommendations for corn are reduced anywhere from 75-100 pounds per acre for alfalfa dependent on the alfalfa stand and 40 pound per acre or more for soybeans, dependent on yield. In this study alfalfa was the previous crop to corn on only 21 acres. Based on the stand density the first year alfalfa credit given was 75 pounds per acre. Soybeans, the most important source of legume N in this study, supplied 40 pounds of N per acre to all inventoried corn acres previously in soybeans in 2001.

Commercial fertilizers (72%), manures (10%), and legumes (18%) contributed a total of 936,000 lb of "first year available N" to all inventoried corn acres in 2002 (Figure 8).

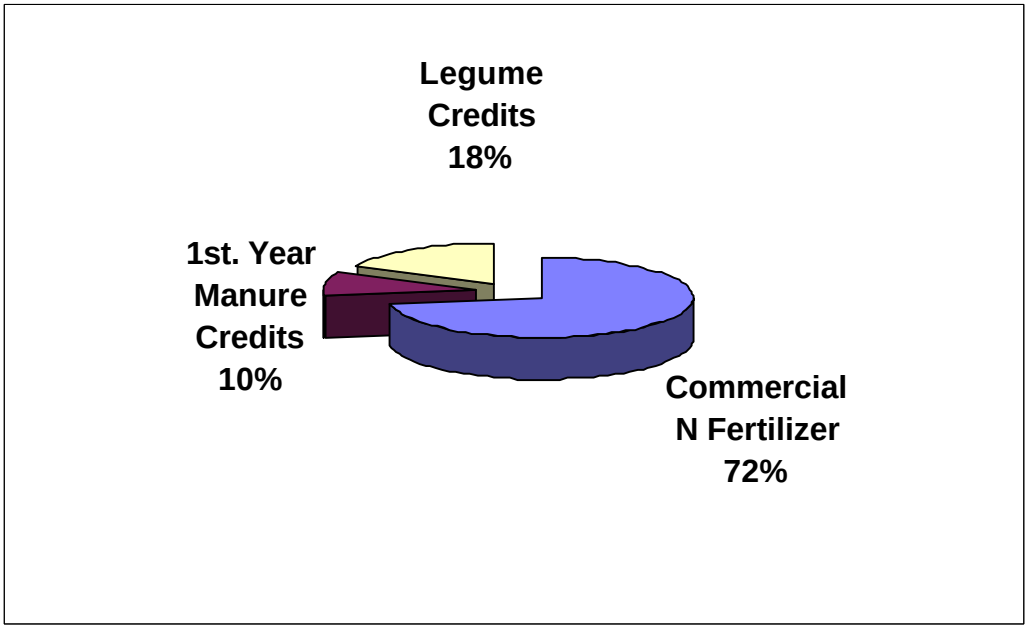


Figure 8. Relative N contributions from fertilizers, manures and legumes across all corn acres inventoried in 2002. Nitrogen inputs totaled 770,687 lb for all sources applied across all inventoried corn acres. Legume credits (165,655 pounds) are reflected in UM recommendations and are not considered an input.

Commercial P applications accounted for 75% of the total P applied for corn acres with the balance of P contributed from manure. A total of 263,000 pounds of P were applied on inventoried fields. Corn acres received 230,000 pounds with an additional 33,000 pounds of P applied to acres other than corn.

Nutrient Balances and Economic Considerations: Seven Mile Creek Watershed

Contributions of N from commercial fertilizer and manure to inventoried acres totaled 833,000 pounds. Field corn received most of the N with 93% (771,000 pounds of N) of the total N applied. Field corn yield goal across these farms averaged 171 Bu/A and were highly consistent with historic average yields of171 Bu/A for the past five years. It appears farmers are using realistic yield goals for field corn acres and it also appears that farmers have been growing excellent crops to reach their yield goals consistently in the past five years.

University of Minnesota recommendations are based on economic and environmental factors. Research at the Southern Minnesota Research & Outreach Center (Waseca) has shown that the recommendations are based on sound economic decisions and, in the long term, generally optimize profit.

University of Minnesota (UM) 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. This analysis compares actual amounts of N with the current recommendations. Based on soil surveys and actual soil tests in this survey, all soils in the SMCW are considered medium or high in organic matter.

Current UM N recommendations for field corn across all inventoried acres averaged 137 lb N/A. Actual amounts of N applied from fertilizer and manure averaged 160 lb N/A across all corn acres (figure 9). Factoring in all appropriate credits from fertilizer, legumes and manures, there was an over-application rate of 23 lb/N/A according to current UM recommendations.

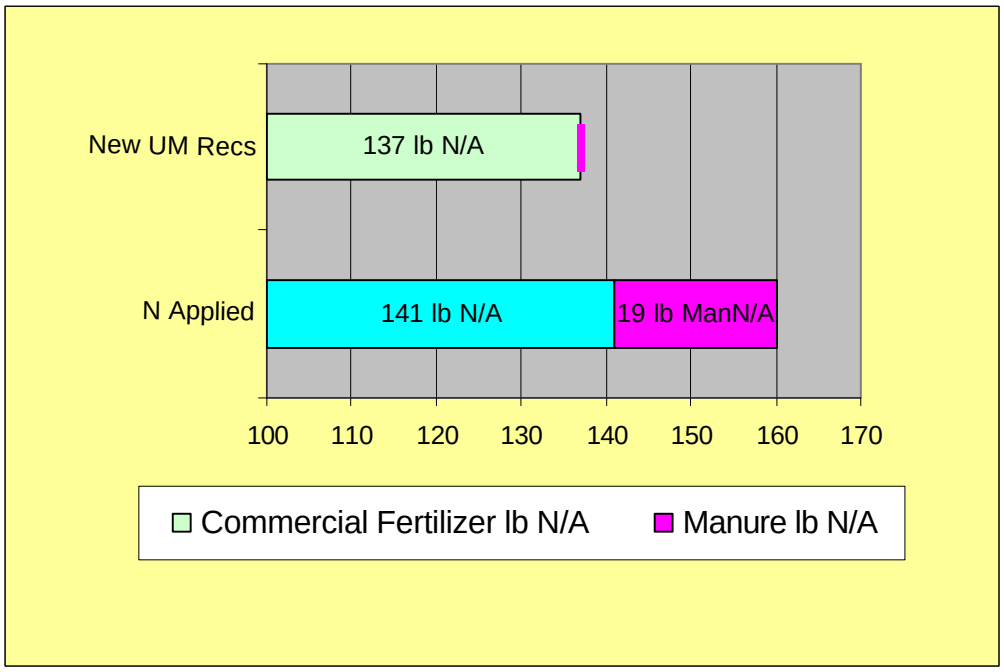


Figure 9. 2002 crop N requirements based on 2002 University of Minnesota nitrogen recommendations in comparison to actual N inputs (fertilizer and manure) for field corn acres in the inventoried area. Average N application was 160 lb N/A.

One major advantage 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. Factoring in legume N credits and manure N credits into the process on a field-by-field basis, the amounts in excess of UM recommendations are illustrated in Figure 10. The UM recommendations for nitrogen are "steps" that increases N rate in steps of 20 or 30 pounds as yield goals increases. University personnel consider applications of N within 30 pounds of the recommendations as following recommendations as they allow for individual management on an individual field basis and also cover the step function of UM recommendations.

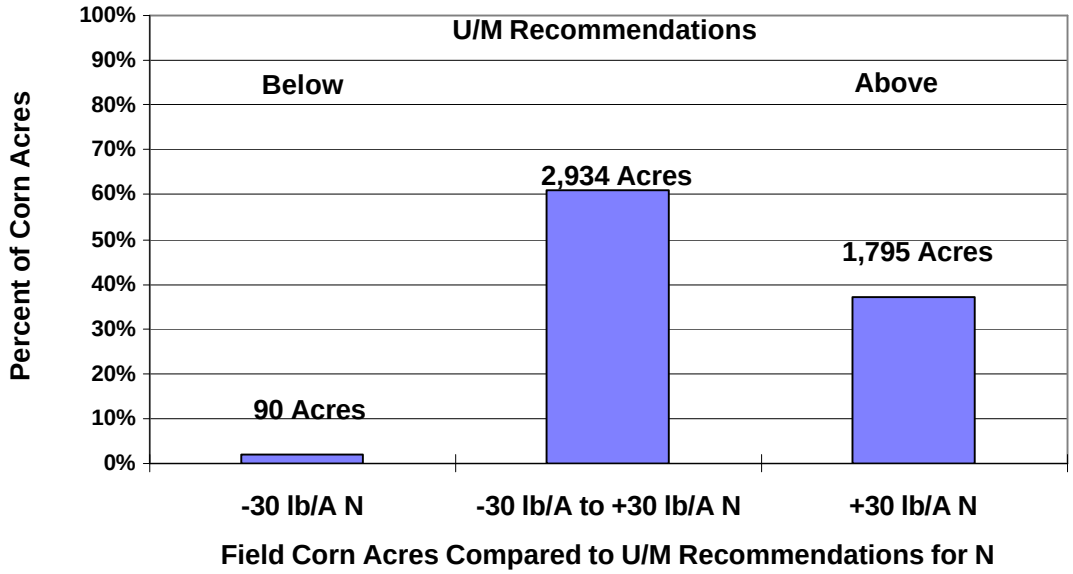


Figure 10. Percent of field corn acres that fall within plus and minus 30 pounds of the 2002 UM recommendations for N.

Thirty-seven percent (37%) of the field corn acres were classified in the excess category according to the UM recommendations. By applying the N according to strict UM recommendations (no over-application), N applied to corn acres would reduce N inputs by 109,807 lbs. Thirty-two percent (32%) of the manured acres were in the excess category.

Contributions of P from commercial fertilizer and manure to inventoried acres totaled 263,000 pounds. Field corn received most of the phosphate with 87% (230,000 pounds) of the total P applied.

Sixty percent (60%) of the acres inventoried had soil tests available at the time of the interview. Soil tests were from the previous three years. Soil tests were either Bray or Olsen and were converted to categories listed in Figure 11 of very low through very high. Figure 11 details the percentages of soil tests weighted by acres in each category and Figure 12 details the amounts of soil P tests across all acres.

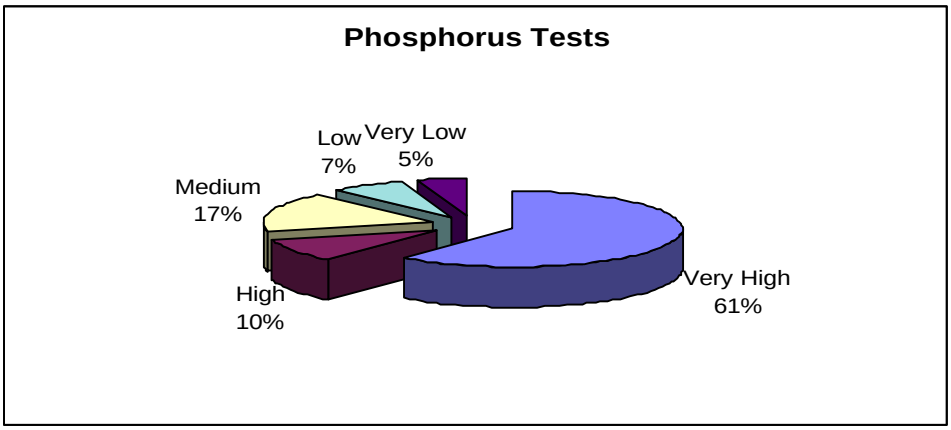


Figure 11. Percentage of acres in each soil testing P category across inventoried acres.

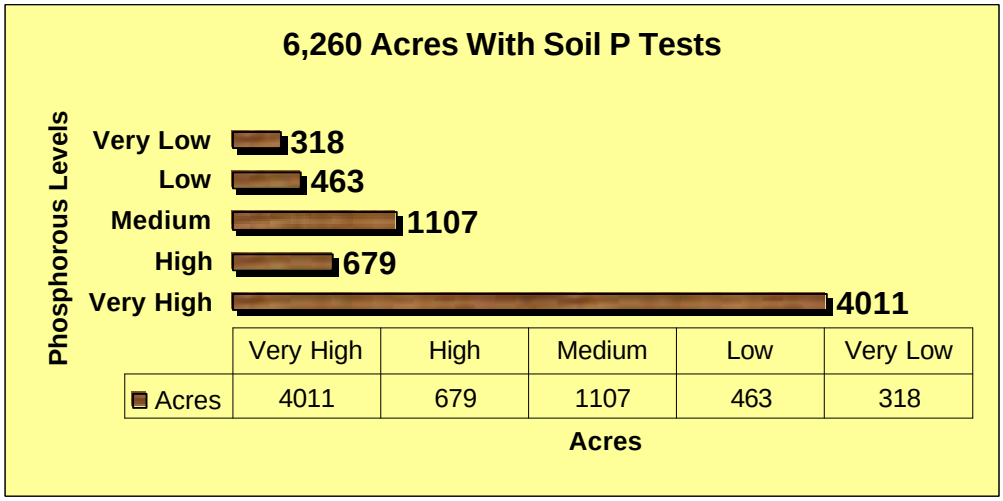


Figure 12. Soil tests across inventoried acres.

According to the Potash & Phosphate Institute[7], the percentage of soils testing medium or less for P within a state ranges from 15 to 86%. In Minnesota for the year 2001, 47% of the soil P tests were medium or below. On inventoried acres, 29% of the soil tests were medium or below. The UM recommendations for P vary widely by crop and by soil test, tillage, and placement. In addition the UM recognizes special considerations for applications of P[8]. Because of all of these factors, comparisons of actual amounts of P applied cannot be compared to UM recommendations as was done with N. However it does appear that rates for P could be reduced in many instances, especially when the P soil tests are in the high and very high ranges.

Phosphorus applications to inventoried field corn averaged 48 (36 lb/A from commercial P and 12 lb/A from manure applications). Crop removal of P can also be determined according to UM calculations. Corn grown on inventoried acres averaged 171 bushels per

[7] Nutrient Budgets in North America, P. E. Fixen, A. M. Johnston.
[8] Fertilizing corn in Minnesota, G. Rehm, J. Lamb, R. Eliason, M. Schmitt, G. Randall, University of Minnesota.

acre. Crop removal would be calculated at 60 lb/A per year for corn[9]. Soybeans grown on inventoried acres averaged 50 bushes per acre. Crop removal would be calculated at 45 lb/A per year for soybeans. Ninety-three percent (93%) of the acres were in a corn/soybean rotation. Over a two year rotation, 48 lb of phosphate would be applied and 105 lb phosphate would be removed. If this practice continues, the soil P tests would drop, on average, by 1 to 1.3 ppm P/yr[10]. Inventoried farmers could reduce phosphate applications in many cases but are still applying less than crop removal in this survey.

Tillage Practices:
Seven Mile Creek Watershed

Tillage practices were documented on all surveyed acres in the SMCW. All crop acres except established alfalfa were fall tilled and also spring tilled. Field corn acres were generally chiseled in the fall and field cultivated in the spring (Table 5).

Table 5. 2002 Tillage Practices Across Inventoried Field Corn Acres[11]

Type of Tillage	Corn Acres
Fall Chisel/Spring Field Cultivator	3,297
Fall Disk-ripper/Spring Field Cultivator	1,081
Fall Disk/Spring Disk or Field Cultivator	258
Fall Moldboard Plow/Spring Field Cultivator 2 Pass	58
Fall Disk or Chisel/Spring Field Cultivator 2 Pass	125
TOTAL	**4,819**

Soybean acres were generally chiseled in the fall and field cultivated in the spring (Table 6).

[9] Nutrient Removal by Major Minnesota Crops, G. Rehm, University of Minnesota.
[10] Soil Test P: How Fast Does it Change?, G. Randall, T Iragavarapu, University of Minnesota.
[11] Corn acres are acres planted to corn and those acres were generally soybean acres in the fall of 2001.

Table 6. 2002 Tillage Practices Across Inventoried Soybean Acres

Type of Tillage	Soybean Acres
Fall Disk-ripper/Spring Field Cultivator	4,984
Fall Moldboard Plow/Spring Field Cultivator 1 or 2 Pass	604
Fall Disk-ripper/Spring Field Cultivator 2 Pass	42
Fall Disk or Chisel/Spring Field Cultivator 2 Pass	37
Fall Chisel/Spring Field Cultivator	150
TOTAL	**5,817**

All 201 newly planted alfalfa acres were chiseled in the fall and field cultivated in the spring. Of the 362 acres of sweet corn, 332 acres were moldboard plowed in the fall and field cultivated in the spring. The other 30 acres were chiseled in the fall and field cultivated in the spring. No analysis was done on the "other" acres due to there being only 75 acres in this category.

Pesticide Applications: Seven Mile Creek Watershed

Pesticide use data was gathered on all inventoried crop acres. Pesticides were used on 99% of all inventoried crop acres (Table 7). Pesticide use in the SMCW included only herbicides and insecticides.

Table 7. Inventoried Crop Acreage and Percentage Treated With Pesticides.

Crop Grown	Total Acres	Pesticides	
		Acres Treated	Percent of Total Acres
Corn	4,819	4,819	100%
Sweet Corn	362	362	100%
Soybeans	5,817	5,817	100%
Alfalfa	341	194	57%
Other	75	70	93%
Total Acres	**11,414**	**11,262**	**99%**

Pesticide use on all acres consisted of 35 different formulas (different EPA numbers, or products). Table 8 describes the pesticide, product used and the corresponding Active Ingredients (AI) of each pesticide product used.

Table 8. Product Name and Description of Pesticide Use in SMCW.

Name Of Product	EPA Number	Herbicide Insecticide	Active Ingredients (AI)	AI in Product	AI Expressed as
Aatrex 4L	100-497	Herbicide	Atrazine	4.000	Pounds per Gallon
Aatrex 90	100-585	Herbicide	Atrazine	0.855	Percent By Weight
Accent	352-560	Herbicide	Nicosulfuron	0.750	Percent By Weight
Accent Gold	352-593	Herbicide	Clopyralid Flumetsulam Nicosulfuron Rimsulfuron	0.517 0.190 0.070 0.070	Percent By Weight
Atrazine 90 WDG	34704-622	Herbicide	Atrazine	0.900	Percent By Weight
Basagran	7969-45	Herbicide	Sodium Salt of Bentazon	4.000	Pounds Per Gallon
Boundary	100-958	Herbicide	S-Metolachlor Metribuzin	5.250 1.250	Pounds Per Gallon
Callisto	100-1131	Herbicide	Mesotrione	4.000	Pounds Per Gallon
Celebrity Plus	7969-137	Herbicide	Dicamba Diflufenzopyr Nicosulfuron	0.470 0.180 0.110	Percent By Weight
Clarity	7969-137	Herbicide	Dicamba Diglycolamine Salt	4.000	Pounds Per Gallon
Distinct	7969-150	Herbicide	Dicamba Dichloro O Anisic Acid	0.210 0.550	Percent By Weight
Doubleplay	10182-388	Herbicide	EPTC Acetochlor	5.600 1.400	Pounds Per Gallon
Dual II Magnum	100-818	Herbicide	S-Metolachlor	7.640	Pounds Per Gallon
Dual II Magnum SI	100-829	Herbicide	S-Metolachlor	6.300	Pounds Per Gallon
Extreme	241-405	Herbicide	Imazethapyr Glyphosate	0.170 2.000	Pounds Per Gallon
Flexstar	10182-418	Herbicide	Sodium Salt Of Fomesafen	0.221	Pounds Per Gallon
Frontier 6.0	7969-147	Herbicide	Dimethenamid	6.000	Pounds Per Gallon
Fusion	10182-343	Herbicide	Fluazifop-P-Butyl Fenoxaprop-p-ethyl	2.000 0.560	Pounds Per Gallon
Hornet	62719-253	Herbicide	Flumetsulam Clopyralid	0.231 0.630	Percent By Weight
Laddok S-12	7969-100	Herbicide	Bentazon Atrazine	2.500 2.500	Pounds Per Gallon
Liberty	45639-199	Herbicide	Glufosinate-Ammonium	1.670	Pounds Per Gallon
Lightning	241-377	Herbicide	Imazethapyr Imazapyr	0.525 0.175	Percent By Weight
Marksman	7969-136	Herbicide	Dicamba Potassium Salt Atrazine	0.134 0.222	Pounds Per Gallon
Northstar	100-923	Herbicide	Primisulfuron Sodium Salt of Dicamba	 0.075	Percent By Weight
Outlook	7969-156	Herbicide	Dimethenamid	6.000	Pounds Per Gallon
Pinnicle	352-525	Herbicide	Thifensulfuron Methyl	0.250	Percent By Weight
Poast	7969-58	Herbicide	Sethoxydim	1.500	Pounds Per Gallon
Pursuit	241-310	Herbicide	Imazethapyr	2.000	Pounds Per Gallon
Pursuit DG	241-350	Herbicide	Imazethapyr	0.700	Percent By Weight
Roundup Ultra Max	524-512	Herbicide	Glyphosate	4000	Pounds Per Gallon
Steadfast	352-608	Herbicide	Nicosulfuron Rimsulfuron	0.500 0.250	Percent By Weight
Surpass EC	10182-363	Herbicide	Acetochlor	6.400	Pounds Per Gallon
Touchdown	10182-449	Herbicide	Glyphosate	3.000	Pounds Per Gallon
Treflan HFP	62719-250	Herbicide	Trifluralin	4.000	Pounds Per Gallon
Warrior	10182-96	Insecticide	Lambda-Cyhalothrin	1.000	Pounds Per Gallon

There were a total of 22,276 pounds of active ingredients (AI) from all pesticides used on all crops. Herbicide AI totaled 22,271 pounds and insecticide AI totaled only 5 pounds. There were no fungicides applied on inventoried acres. All insecticide was applied on alfalfa acres. Field corn acres accounted for 52% of all pesticide AI use (Figure 13).

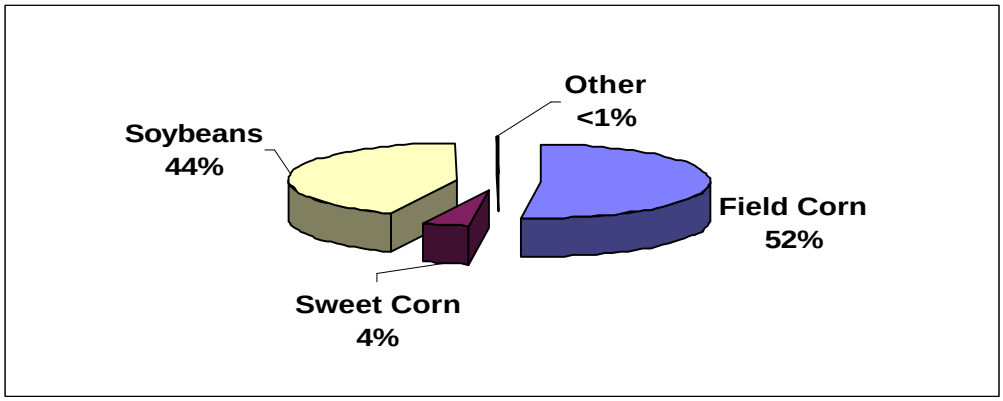


Figure 13. Application of pesticide AI's applied to inventoried acres by crop type.

Table 9 lists each AI, coverage and total pounds for the 27 different AI's applied to inventoried acres.

Table 9. Pesticide Use And Acres Treated by Active Ingredient.

Name Of Compound	Acres Treated	Total Pounds Applied
Acetochlor	1,721	2,123.70
Atrazine	2,664	1,685.16
Bentazon	370	236.81
Clopyralid	651	69.48
Dicamba	1,334	390.35
Dichloro O Anisic Acid	168	17.33
Diflufenzopyr	168	5.70
Dimethenamid	647	829.26
EPTC	1,223	4,271.75
Fenoxaprop-P-Ethyl	148	5.64
Fluazifop-P-Butyl	148	20.16
Flumetsulam	651	25.68
Fomesafen	433	101.76
Glufosinate-Ammonium	494	110.49
Glyphosate	5,346	6,525.28
Imazapyr	136	1.91
Imazethapyr	467	22.11
Lambda-Cyhalothrin	194	4.85
Mesotrione	2,100	196.88
S-Metolachlor	3,716	4,783.59
Metribuzin	2,059	528.52
Nicosulfuron	1,056	24.35
Primisulfuron	500	11.72
Rimsulfuron	358	6.95
Sethoxydim	137	25.69
Thifensulfuron Methyl	53	0.06
Trifluralin	394	250.72

Pesticide use on corn acres consisted of 17 separate herbicide AI's. Table 10 details each compound used and the number of acres covered by each compound.

Table 10. Pesticide Use on Corn Acres.

Name Of Active Ingredient	Acres Treated	Pounds Applied
Acetochlor	1,721	2,123.70
Atrazine	2,332	1,481.60
Clopyralid	651	69.48
Dicamba	1,334	390.35
Dichloro O Anisic Acid	168	17.33
Diflufenzopyr	168	5.70
Dimethenamid	617	799.73
EPTC	1,223	4,271.75
Flumetsulam	651	25.68
Glufosinate-Ammonium	494	110.49
Imazapyr	136	1.91
Imazethapyr	136	5.73
Mesotrione	2,100	196.88
S-Metolachlor	1,325	2,005.15
Nicosulfuron	1,056	24.35
Primisulfuron	500	11.72
Rimsulfuron	358	6.95

Figure 14 compares the top 7 active ingredients of pesticides used on field corn, based on acres.

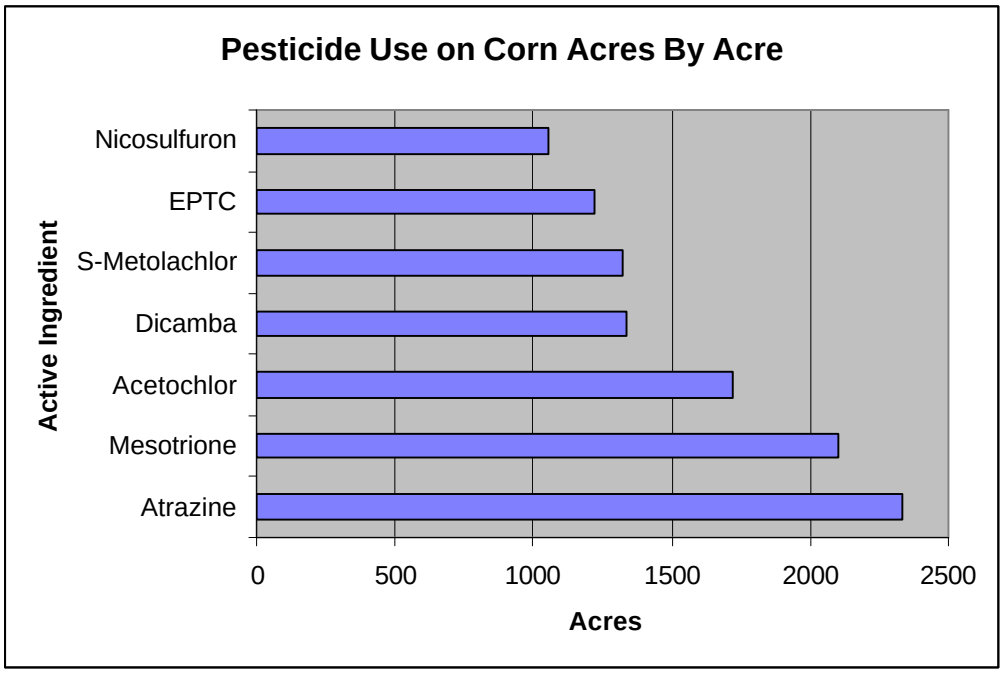


Figure 14. The top 7 active ingredients from herbicides applied to field corn acres, based on acres treated.

Figure 15 compares active ingredients of pesticides applied to field corn, based on pounds of active ingredients.

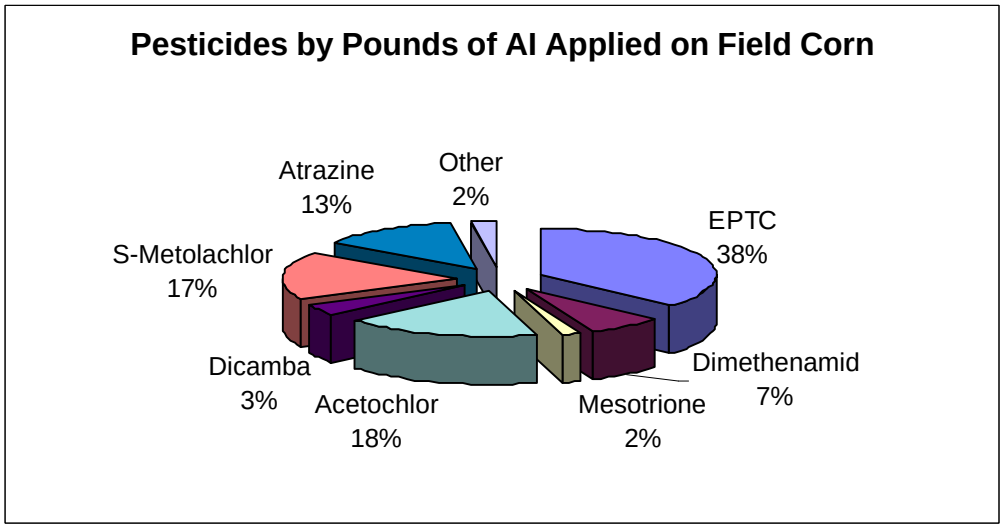


Figure 15. Percentage of pesticides applied to field corn by pounds of active ingredient applied.

Soybean acres received pesticide applications from 10 different compounds (Table 11).

Table 11. Pesticide Use on Soybean Acres.

Name Of Active Ingredient	Acres treated	Pounds Applied
Bentazon	38	33.25
Fenoxaprop-P-Ethyl	148	5.64
Fluazifop-P-Butyl	148	20.16
Fomesafen	433	101.76
Glyphosate	5,346	6,525.28
Imazethapyr	261	13.09
S-Metolachlor	2,059	2,219.77
Metribuzin	2,059	528.52
Thifensulfuron Methyl	53	0.06
Trifluralin	394	250.72

Pesticide applications to soybean acres were dominated by the herbicide glyphosate with over 90% of all inventoried soybean acres receiving at least one application (figure 16). Sixty-two percent (62%) of all soybean acres received two applications of glyphosate. No other AI was applied in multiple applications on inventoried soybean acres.

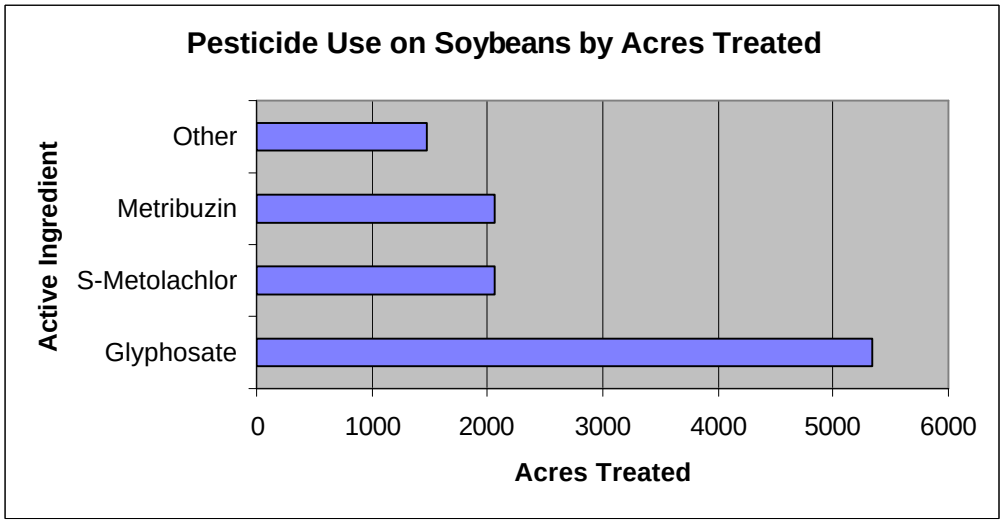


Figure 16. Percentage of pesticides applied to soybeans by acres treated.

Pesticide applications to soybean acres based on AI were also dominated by glyphosate applications (Figure 17).

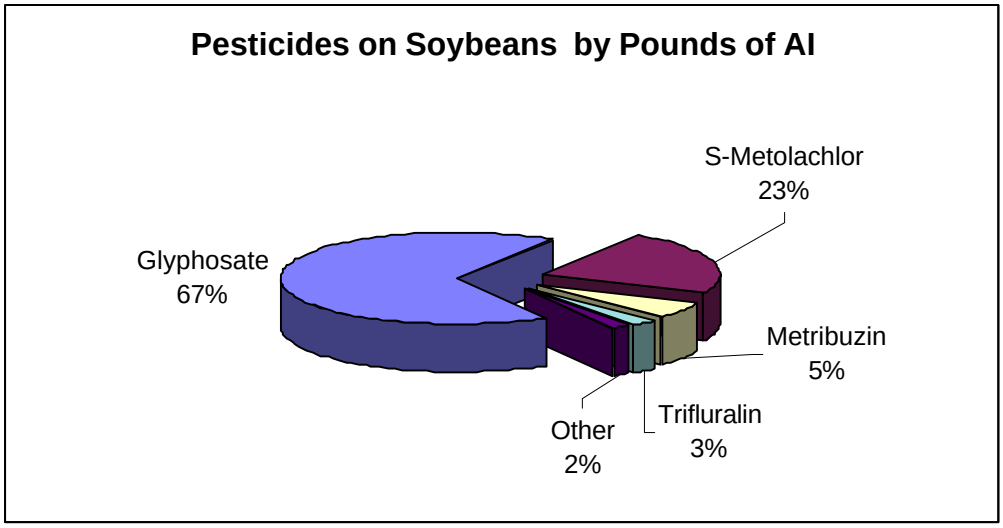


Figure 17. Percentage of pesticides applied to soybeans by pounds of AI applied.

Table 12 lists all pesticide applications to crops other than field corn or soybeans.

Table 12. Pesticide Use on Other Crop Acres.

Crop Type	Compound AI	Acres Covered	Pounds Applied
Sweet Corn	Atrazine	332	203.56
Sweet Corn	Bentazon	332	203.56
Sweet Corn	Dimethenamid	30	29.53
Sweet Corn	S-Metolachlor	332	558.68
Peas	Imazethapyr	70	3.28
Alfalfa	Lambda-Cyhalothrin	194	4.85
Alfalfa	Sethoxydim	137	25.69

Conclusions and Summary of the Current Nutrient, Tillage and Pesticide Management Practices for the Seven Mile Creek Watershed.

The Seven Mile Creek Watershed consists of fine-textured soils which are common in the south-central Minnesota region. Eighteen farmers, farming 11,000 acres in the SMCW, were interviewed by the Minnesota Department of Agriculture using the Farm Nutrient Management Assessment Program (FANMAP) tool. Total watershed area consists of 19,000 crop acres. Producers volunteered one to two hours of their time to share information about their farming operations. The overall purpose of the program was to develop a clear understanding of current farm practices regarding agricultural nutrients, tillage and pesticides, and, to use this knowledge for future water quality educational programs.

Approximately 60% of the crop acres within the SMCW were inventoried. Field corn and soybeans were the dominant crops with 93% of all acres planted to these crops. Forty-two percent (42%) of the crop acres were planted with field corn and 92% of the 700,000 pounds of commercial N was applied to those field corn acres. Eighty-one percent (81%) of all N applied was during fall applications. Anhydrous ammonia and urea accounted for 77% of N applied to field corn and for 93% of the fall applied N to field corn. Fifty-one percent (51%) of field corn acres applied with fall anhydrous ammonia used nitrogen inhibitors.

Field corn accounted for 84% of the commercial of the commercial P fertilizer applied to inventoried acres. Fall applications of commercial P accounted for 54% of the P applied, with starter and preplant applications accounting for the other 37% and 9% respectively.

Livestock in the SMCW was dominated by hog operations with the balance from dairy. Manure N (first year available) from hogs accounted for over 75% of manure N applied. All hog manure was in the liquid form and injected while all dairy manure was in the solid form and broadcast. Manure was applied on 732 acres of corn and 20 acres of alfalfa. Fall applications of manure accounted for 61% of the manure N applied.

Manure N accounted for 10% of all relative N contributions with legumes and commercial N accounting for 17% and 82%, respectively. Soybeans were the dominant source of legume N credits accounting for more than 99% of all legume N credits.

On average, inventoried farmers were over-applying N by 23 lb/A and 37% of the corn acres were over-applied by more than 30 lbs. On manured acres, 32% of the acres were over-applied for N by more than 30 lbs. In regard to phosphorus, 71% of the soil tests were in the high or very high range. Phosphorus applications account for slightly less than ½ of the P needed for crop removal. However, because a large percentage of the soil tests were in the high or very high range, there may be an opportunity for additional reductions on those fields.

Tillage practices were quite consistent across the inventoried farms with 68% of the acres planted to corn receiving fall chisel and spring field cultivator tillage and 86% of the acres planted to soybeans receiving fall disk-ripper and spring field cultivator tillage.

Pesticide use was prevalent in the SMCW, as 99% of all crop acres were treated with herbicides or insecticides. Pesticide use consisted of 35 different formulas or products. There were 27 separate active ingredients used in these pesticide applications, totaling 22,000 pounds of active ingredients. Field corn and soybeans accounted for 52% and 44% of all AI applied, respectively.

Atrazine and mesotrione were the two active ingredients most often used to treat field corn while EPTC and acetochlor were used at the highest volume, accounting for the 38% and 18% of all AI, respectively. Glyphosate was the most commonly used pesticide on soybeans accounting for 67% of all AI applied and over 90% of all soybean acres were treated.

Inventoried farmers in the SMCW appear to be a fairly homogeneous group with many of the practices consistent across the watershed. It also appears that tillage, pesticides and nutrients are closely tied together in this watershed. Therefore, any changes in one area may affect changes in the other two, thus some educational efforts would need to take into consideration the current “package” of practices that farmers are currently using.

Some very positive results were discovered through this study. There is strong evidence that producers are voluntarily adopting the educational materials and recommended N management strategies developed by the UM for the SMCW, especially in regard to manure crediting. However, overall reductions in N can still be achieved with little chance of economic loss in the long term. It is also evident that promotional activities need to continue and be specifically targeted to deliver the most recent advances in technology and revised N management and UM recommendations for the area.