2013 Phosphorus Reduction Report

Yahara Pride Farms - Board of Directors

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During 2013 the Yahara Pride Farms board of directors developed and implemented a number of agricultural conservation programs designed to reduce the loss of phosphorus within the Yahara Watershed. There were four major incentive programs offered within the watershed in 2013 including:

1. Farm Certification Program,
2. Cover Crop Assistance,
3. Vertical Manure Injection, and
4. Strip tillage.

Each of these programs have unique benefits both from a phosphorus reduction standpoint as well as educational and confidence/trust building within the watershed. This report provides an update on the number of acres and farms involved in these programs as well as an estimate of the number of pounds of phosphorus prevented from entering the Madison lakes.

A. Strip Tillage:

Strip-tillage is a conservation system that uses a minimum tillage. It combines the soil drying and warming benefits of conventional tillage with the soil-protecting advantages of no-till by disturbing only the portion of the soil that is to contain the seed row (similar to zone tillage). Each row that has been strip-tilled is usually about eight to ten inches wide. The system still allows for some soil water contact that could cause erosion, however, the amount of erosion on a strip-tilled field would be light compared to the amount of erosion on an intensively tilled field. Compared to intensive tillage, strip tillage saves considerable time and money. Strip-till conserves more soil moisture compared to intensive tillage systems. However, compared to no-till, strip-till may in some cases reduce soil moisture and increase the potential for soil loss. Strip-till is performed with a special piece of equipment and the Yahara Pride Farms strip till program allowed farmers to rent a strip till machine to determine if this farming system fit with their overall farming goals and management.

As indicated in the table on the following page, there were three farms who tried the strip-tillage machine. On two of these farms we had the SNAP field data and were able to run comparisons for phosphorus loss based on the typical farming system and the strip-tillage system. As demonstrated in the table, there are times when switching to strip-tillage increases phosphorus loss and times where it reduces phosphorus loss. Eleven fields were strip-tilled in 2013. Of the 11 fields, we had SNAP estimates for 7 fields and used the average phosphorus change on the other 4 fields. Of the 7 fields with data, 2 had increases in phosphorus loss (0.2 and 0.1 lbs/acre) and 5 had reductions (0.7, 2.7, 2.0, 2.6 & 2.4 lbs/acre). **When the data from the7 fields were combined we had an average phosphorus reduction of 1.4 lbs/acre.** This average was then used on the remaining 5 fields to calculate an estimated phosphorus reduction for all fields adopting the strip-tillage system.

Yahara Pride Farms 2013-2014 Strip Tillage

Calucalations based on 2013 SNAP where possible

Previous Practice				Strip Tillage				Annual	3 Yr Rotational	Average
Rot. PI	Ann PI	Part	Sol	Rot. PI	Ann PI	Part	Sol	Lbs Phosphorus reduced	Lbs Phosphorus reduced	Annual / Acre
								18.9	56.7	1.4
3	0	0.3	0.1	3	0	0.4	0.1	-3.0	-8.9	-0.1
2	3	2.1	0.4	1	2	1.1	0.7	23.8	71.4	0.7
2	6	5.7	0.0	2	3	3.0	0.0	15.8	47.4	2.7
2	5	4.5	0.2	1	3	2.4	0.3	21.6	64.8	2.0
2	6	5.4	0.1	2	3	2.8	0.1	13.8	41.3	2.6
1	1	0.1	0.5	1	1	0.2	0.6	-1.9	-5.7	-0.2
										1.3
2	4	3.4	0.6	1	2	1	0.6	37.2	111.6	2.4
								20.4	61.3	1.4
								14.0	42.0	1.4
								9.8	29.4	1.4
								170.5	511	1.4

Strip tillage offers some great estimated reductions in phosphorus loss, when used in fields that were going to be fall or spring chiseled (with and without disking).
However, if fields were going to be no-tilled, then in all cases the estimated phosphorus loss increased. Would fit well on farms using manure that must be incorporated.

Estimated rotational phosphorus reduction from strip tillage = 511.0lbs

Comparing the 11 fields (156 acres) in the program offers great insight into when and where phosphorus reductions because of the adoption of strip-tillage have the greatest potential to occur. The two fields in the program that saw increases in phosphorus loss were slated for no-till corn following this year's crop. Switching from no-till to strip-till increases the potential for particulate loss while having minimal impact on soluble losses. In fact, a comparison of all 11 fields in the table shows that soluble losses remained the same on 4 fields and increased (from 0.1 - 0.3) on the three remaining fields. However, there is a potential that with high surface manure applications, strip-tillage could reduce soluble losses, but there were no fields within this dataset to test this theory. The greatest reduction in loss occurs with particulate (soil particle bound) phosphorus. The range in reductions of particulate phosphorus was from 1.0 - 2.7 lbs/acre. Therefore, strip-tillage offers significant potential to reduce losses of particulate bound phosphorus when adopted by farming systems using intensive tillage (chiseled - either spring or fall with or without disking) or on farms surface applying manure without incorporation.

Based on the field data collected during the 2013 seasons, the strip-tillage demonstration program reduced phosphorus loss by 170.5 pounds this year. The average reduction in phosphorus was calculated to be 1.4 lbs/acre, and efforts should be directed on farms/fields with high potential for soil loss (based on slope and tillage). On a typical dairy farm within the Yahara Watershed with a 8 year crop rotation (1 year new seeding, 4 years hay, 1 corn silage & 2 corn grain); phosphorus loss could be reduced about 2 - 2.5 lbs/year during the corn years for farms using tillage systems.

This year's phosphorus reduction = 170.5 lbs
Rotational phosphorus reduction (3 years corn) = 511 lbs

B. <u>Vertical Manure Injection:</u>

Manure in the Yahara Watershed is either incorporated into the soil using a number of different tillage implements (chisel plow, disk, or field cultivator) or it is applied to the soil's surface and not incorporated. Surface applications of manure have been shown to increase nitrogen and phosphorus runoff to rivers and streams, while injection/incorporation places manure below the surface where it doesn't interact with runoff water during storms. For many livestock operations in the Yahara, manure incorporation is a standard practice. Traditional incorporation methods move a great deal of soil and increase the potential for soil erosion. Field evaluations conducted by the Yahara Pride Certification Program during the spring of 2013 identified reducing soil erosion as a high priority. Since much of the tillage was conducted to incorporate manure, a system of incorporating manure with minimal soil disturbance needs to be implemented in the watershed. Minimum disturbance equipment also works well with no-till planting farming systems and allows farmers to experiment with new methods of preserving nitrogen and phosphorus to save on fertilizer costs. In addition to

the economic benefits, improved manure utilization benefits the environment by ensuring efficient nutrient use and improving soil and water quality.

Vertical manure injection is a relatively new farming system that incorporates manure into the soil with minimal soil disturbance. This system uses a single large fluted coulter to cut crop residue and open a channel in the soil surface for manure placement. Significantly less soil disturbance occurs with this process than with either chisel or chisel/disk incorporation. To encourage farmers to try this new incorporation system, the Yahara Pride Farmers Board worked with VTI of Washington Iowa and a local equipment dealer to outfit a manure tanker with the VTI injection system. This equipment and a tractor was made available to farmers within the watershed.

Estimates for reductions in phosphorus loss were conducted using crop rotation, tillage practices and manure application data provided by farmers in the watershed. The table on the following page is a summary of the SNAP data collected from this operations and contains the information for all of the cooperating farms. Eleven farmers worked with the vertical manure incorporation equipment on approximately 321 acres. Over 3,000,000 gallons of liquid manure was applied with this equipment in the fall of 2013. There was significant interest in using this equipment and having it available earlier in the year would have probably greatly increase the number of acres.

As seen in the table, Yahara Pride was able to obtain SNAP data on 14 of the 20 fields where manure was injected. There are two additional fields where manure was applied but we do not have either the acreage or cropping information at this time. Since vertical manure injection is not programmed into SNAP, comparisons between chisel plowing; chisel/disking; no-till; strip-till and vertical tillage were conducted to develop estimates for particulate and soluble phosphorus loss. In all cases, vertical manure injection reduced phosphorus loss compared to the current management system.

This was the only practice conducted by Yahara Pride Farms where implementation of a new practice reduce the potential for phosphorus loss on every field. The greatest potential for reducing losses occurs in intensive tillage farming systems with high rates of manure applied. These system can use either fall or spring chisel/disk systems. As seen in the first field in the table, this farm conducts spring chisel/disk incorporation and changing from this incorporation method to vertical manure injection reduces particulate loss from 10.5 lbs/acre to 3.0. It had minimal impact on soluble loss because the manure was incorporated into the soil. **Estimated annual phosphorus loss was reduced by 0.1 - 7.6 lbs/acre by this farming system, with an average reduction of 2.9 lbs per acre.**

Yahara Pride Farms 2013-2014 Verticle Manure Injection

Calculations based on 2013 SNAP where possible

Previous Practice				Verticle Manure Injection				Annual	3 Yr Rotational	Average
Rot. Pl	Ann Pl	Part	Sol	Rot. Pl	Ann Pl	Part	Soul	Lbs Phosphorus reduced	Lbs Phosphorus reduced	Annual / Acre
5	11	10.5	0.5	4	3	3.0	0.4	168.0	503.9	7.6
2	1	0.8	0.7	2	1	0.7	0.6	4.0	11.9	0.2
1	2	0.9	1	1	1	0.6	0.3	24.8	74.4	1.0
2	3	2.7	0.2	2	2	2.1	0.1	6.7	20.2	0.7
2	3	2.3	0.3	1	2	1.9	0.2	8.8	26.3	0.5
1	2	1.1	0.4	1	1	0.6	0.2	8.3	25.0	0.7
								52.6	157.7	0.6
2	1	0.4	0.6	2	1	0.2	0.6	4.7	14.1	0.2
1	1	1.1	0.4	1	1	0.9	0.0	1.4	4.3	0.6
1	1	0.8	0.4	1	1	0.6	0.0	3.8	11.5	0.6
1	1	0.2	0.5	1	0	0.2	0.1	4.7	14.2	0.4
3	1	0.9	0.3	3	1	0.9	0.2	0.9	2.6	0.1
1	1	0.6	0.6	1	1	0.5	0.2	4.0	12.0	0.5
2	2	1.2	0.8	2	2	1.1	0.5	1.2	3.5	0.4
4	3	1.6	1.2	4	3	1.6	0.9	0.8	2.5	0.3
								21.6	64.7	0.4
								115.1	345.4	2.9
								78.3	234.9	2.9
								34.8	104.4	2.9
								96.0	288.0	2.9
								43.5	130.5	2.9
										2.9
								63.8	191.4	2.9
										2.9
								673.62	1,675.47	2.9

Phosphorus reductions from vertical manure injection ranged from **0.4 - 7.6 lbs/acre** and averaged **2.9 lbs/acre** (calculations based on 2013 SNAP 2).

321 acres injected = estimated rotational phosphorus reduction of **674 - 1,676 lbs saved.**

Based on the field data collected during the 2013 seasons, the vertical manure injection demonstration program reduced phosphorus loss by 674 pounds this year. The average reduction in phosphorus was calculated to be 2.9 lbs/acre, and efforts should be directed on farms/fields with high potential for soil loss (based on slope and tillage). On a typical dairy farm within the Yahara Watershed with a 8 year crop rotation (1 year new seeding, 4 years hay, 1 corn silage & 2 corn grain); phosphorus loss could be reduced about 3 lbs/year during the corn years for farms using tillage systems.

This year's phosphorus reduction = 674 lbs
Rotational phosphorus reduction (3 years corn) = 1,676 lbs

C. Cover Crop Assistance Program:

Cover crops are grasses, legumes, small grains or other crops grown between regular grain crop production periods for the purpose of protecting and improving the soil. The most common cover crops are fall-seeded cereals, such as rye or wheat, and fall-seeded annual ryegrass. Late summer-seeded spring oats are sometimes used, even though they winterkill. One of the two major reasons for growing winter cover crops is to reduce soil erosion. In the Yahara Watershed a significant amount of the tillable acres has sufficient slope to be at risk for erosion if not adequately protected. Eroding soil particles not only fill in wetlands and streams, but they also carry particulate bound phosphorus to surface water.

Based on the data collected by the Yahara Pride Farms during the spring of 2013, cover crops need to be targeted to specific fields and farming systems. Cover crops have a high potential to reduce phosphorus loss on fields being harvested as corn silage with manure incorporated in the late summer or fall. Research has shown that fields with winter cover incorporated in the spring have 55 percent less water runoff and 50 percent less soil loss annually than do fields with no winter cover. More recent studies show soil losses from corn or soy- beans no-tilled into a vigorous growth of rye or wheat to be 90-95 percent less than soil losses from corn and soybeans conventionally tilled.

The Yahara Pride Farms began working with cover crops as a demonstration program in 2012. The program got a fair amount of publicity and recognition and other farmers within the watershed became interested in cooperating because of the ease of getting into the program. **In 2013, the program worked with 20 farmers on 80 different fields.** While not all the fields in the watershed planted into cover crops can be attributed to the Yahara Pride Farms program, it is clear that cover crops are becoming a recognized and accepted practice in the watershed. There are still a number of important considerations that need to be evaluated and addressed in regards to cover crops in this region of the state. Some of these include the crops planted, the timing of planting, targeting fields

that have the greatest potential for nutrient and sediment loss and targeting farming systems that have the greatest potential for nutrient and sediment loss.

Information collected by Yahara Pride Farms on the potential environmental benefits of the cover crop program is contained on the following three pages. A review of the data indicates that there were 43 fields with SNAP information so that calculations could be made. In addition, there were another 32 fields where phosphorus reductions were calculated using the average of the group. There were also 3 fields with no information on size or SNAP data so calculations could not be made. As can be seen in the data, there were 12 fields/farms where the estimated phosphorus loss increased due to the planting of cover crops. The occurred most often on fields that were planted using no-tillage and manure information was lacking. It is interesting to note that of the 8 farms with SNAP data, 3 of them saw at least 1 field where planting a cover crop increased the potential for phosphorus loss. Of these three farms that saw increases in P loss:

- one farm saw an increase in 5 of 6 fields;
- one farm saw an increase in 6 of 15 fields; and
- one farm saw an increase in 1 of 5 fields.

These figures are not surprising in that farms that have adopted a high level of no-till will often see an increase in phosphorus from the planting of cover crops. This is because we lack adequate data and discussion to determine how and if manure will be applied to these fields.

Based on the 43 fields with data, the **estimated annual phosphorus loss was reduced in the range of -3.1 to 6.2 lbs/acre by the adoption of planting cover crops, with an average reduction of 1.0 lbs per acre.**

Based on the field data collected during the 2013 seasons, the cover crop incentive demonstration program reduced phosphorus loss by 1,957 pounds this year. The average reduction in phosphorus was calculated to be 1.0 lbs/acre, and efforts should be directed on farms/fields with high potential for soil loss (based on slope and tillage). On a typical dairy farm within the Yahara Watershed with a 8 year crop rotation (1 year new seeding, 4 years hay, 1 corn silage & 2 corn grain); phosphorus loss could be reduced about 3 lbs/year during the corn years for farms using tillage systems.

This year's phosphorus reduction = 1,957 lbs

Rotational phosphorus reduction (3 years corn) = 5,870 lbs

Calucalations based on 2013 SNAP where possible

Previous Practice				Cover Crops				Annual	3 Yr Rotational	Average
Rot. Pl	Ann Pl	Part	Sol	Rot. Pl	Ann Pl	Part	Sol	Lbs Phosphorus reduced	Lbs Phosphorus reduced	Annual / Acre
2.0	4.0	4.2	0.0	1.0	1.0	1.2	0.0	7.2	21.5	3.0
1.0	1.0	0.6	0.0	1.0	1.0	0.7	0.0	-0.6	-1.9	-0.1
2.0	2.0	1.7	0.1	1.0	0.0	0.2	0.1	17.7	53.2	1.5
4.0	1.0	1.1	0.2	6.0	4.0	4.3	0.1	-26.6	-79.7	-3.1
1.0	1.0	0.6	0.2	1.0	1.0	0.6	0.2	0.0	0.0	0.0
3.0	2.0	1.3	0.5	3.0	2.0	1.6	0.5	-0.9	-2.6	-0.3
5.0	3.0	2.0	1.0	3.0	3.0	1.8	1.0	0.6	1.7	0.2
7.0	5.0	4.9	0.6	6.0	5.0	3.9	0.7	4.3	13.0	0.9
2.0	1.0	0.4	0.6	2.0	1.0	0.5	0.6	-0.7	-2.0	-0.1
2.0	1.0	0.7	0.6	2.0	1.0	0.5	0.8	1.6	4.8	0.1
2.0	1.0	0.5	0.6	2.0	1.0	0.2	1.0	-2.4	-7.1	-0.1
1.0	2.0	2.0	0.1	1.0	0.0	0.3	0.1	6.0	17.9	1.7
1.0	1.0	0.4	0.2	1.0	1.0	0.8	0.5	-10.5	-31.5	-0.7
1.0	2.0	1.1	0.7	2.0	2.0	1.3	0.7	6.8	20.4	0.2
2.0	1.0	1.0	0.3	1.0	1.0	0.7	0.5	0.9	2.6	0.1
										0.2
3.0	4.0	3.2	0.4	3.0	3.0	2.8	0.4	48.8	146.3	0.4
5.0	9.0	8.8	0.7	4.0	8.0	7.7	0.7		0.0	1.1
5.0	10.0	8.8	0.7	4.0	8.0	7.7	0.7		0.0	1.1
3.0	4.0	3.4	0.2	3.0	3.0	3.0	0.2		0.0	0.4
3.0	3.0	2.7	0.3	3.0	3.0	2.6	0.3		0.0	0.4
									0.0	0.7
1.0	0.0	0.2	0.2	1.0	0.0	0.3	0.2	-5.0	-15.0	-0.1
1.0	0.0	0.2	0.2	1.0	0.0	0.3	0.2	-1.1	-3.3	-0.1
1.0	0.0	0.2	0.2	1.0	0.0	0.3	0.2	-9.2	-27.7	-0.1
3.0	2.0	0.9	1.5	2.0	3.0	0.4	2.8	-42.2	-126.7	-0.8
4.0	6.0	5.0	0.7	4.0	6.0	5.2	0.7	-6.4	-19.3	-0.2
5.0	5.0	4.2	0.7	4.0	4.0	2.7	1.4	57.9	173.8	0.8
									0.0	-0.1
3.0	4.0	3.3	0.1	3.0	3.0	2.9	0.2	4.5	13.5	0.3
3.0	3.0	2.8	0.2	2.0	1.0	0.9	0.2	41.8	125.4	1.9
3.0	4.0	2.9	1.1	3.0	4.0	2.6	1.1	7.5	22.5	0.3
									0.0	0.8
5.0	7.0	5.6	0.9	5.0	6.0	5.2	0.9	18.0	54.0	0.4
5.0	5.0	4.8	0.4	4.0	4.0	4.0	0.4	18.4	55.2	0.8
7.0	6.0	5.8	0.6	6.0	4.0	3.1	1.2	71.4	214.2	2.1
3.0	3.0	2.5	0.3	3.0	2.0	2.2	0.3	1.5	4.5	0.3
									0.0	0.9
								700.0	2100.0	1.0
6.0	8.0	7.1	0.8	6.0	4.0	3.0	0.9	81.2	243.6	4.0
4.0	9.0	7.9	0.8	4.0	8.0	7.2	0.8	11.6	34.7	0.7
									0.0	2.4
5.0	5.0	2.0	3.3	5.0	5.0	1.5	3.2	0.0	0.0	0.6
10.0	8.0	5.5	2.1	6.0	8.0	4.0	4.0	0.0	0.0	-0.4
4.0	5.0	2.6	2.0	4.0	6.0	1.9	3.8	-8.8	-26.4	-1.1
5.0	6.0	4.2	1.7	5.0	6.0	3.1	3.2	-1.5	-4.5	-0.1
4.0	4.0	2.1	1.7	4.0	5.0	1.6	0.5	17.0	51.0	1.7
									0.0	0.1
5.0	6.0	4.4	1.2	5.0	6.0	4.6	1.0	46.4	139.2	0.0
4.0	11.0	9.9	0.7	3.0	4.0	3.9	0.5		0.0	6.2
4.0	8.0	8.0	0.4	4.0	6.0	5.7	0.3		0.0	2.4
									0.0	2.9
								28.0	84.0	1.0
								25.0	75.0	1.0
2.0								26.0	78.0	1.0
1.0									0.0	1.0
1.0									0.0	1.0
								120.0	360.0	1.0
									0.0	
									0.0	
								54.0	162.0	1.0

Yahara Pride Farms 2013-2014 Cover Crops

Calucalations based on 2013 SNAP where possible

70.0	210.0	1.0
25.0	75.0	1.0
9.0	27.0	1.0
5.0	15.0	1.0
3.0	9.0	1.0
12.0	36.0	1.0
18.0	54.0	1.0
4.9	14.7	1.0
11.7	35.1	1.0
20.0	60.0	1.0
22.9	68.7	1.0
11.7	35.1	1.0
21.0	63.0	1.0
34.3	103.0	1.0
17.0	51.0	1.0
17.0	51.0	1.0
20.0	60.0	1.0
37.0	111.0	1.0
10.0	30.0	1.0
40.0	120.0	1.0
25.0	75.0	1.0
44.3	133.0	1.0
12.9	38.7	1.0
77.0	231.0	1.0
1956.8	5,870	1.0

Phosphorus reductions from cover crops ranged from -3.1 to 6.2 lbs/acre and averaged 1.0 lbs/acre (calucaltions based on 2013 SNAP 2).

2,382 acres of cover crops = estimated annual reduction of 1,957 lbs/acre, estimated 3 year rotation phosphorus reduction of 5,870 lbs/acre

D. Farm Certification Program:

Yahara Pride Farms started a sustainable/environmental certification program in 2013. The goal of this program was to provide farmers in the watershed with a non-regulatory/confidential evaluation of the environmental risks as well as documenting the beneficial practices occurring on their farms. The certification program involves four evaluations:

1. An assessment of the potential risk of loss from the facilities and non-permeable areas of the farm. This assessment is broken into six areas of the operation:
   - the farmstead,
   - pesticide and fertilizer storage and handling,
   - petroleum storage and handling,
   - farm and household waste removal,
   - manure storage,
   - silage leachate.

   The rating system is the same as that used for the crop and soil fertility program, meaning that the answers to each question is ranked on a scale of 1 - 9 and further divided into one of three colors (green, yellow and red). A green rating requires a score of 7 - 9; a yellow rating a score of 4 - 6; and a red score is a 1 - 3. For the facilities assessment the following scores are possible:

   a. Farmstead — 15 questions = 135 possible points
   b. Pesticide, fertilizer storage and handling — 14 questions = 126 possible points
   c. Petroleum storage and handling — 8 questions = 72 possible points
   d. Farm and household waste removal — 3 questions = 27 possible points
   e. Manure storage — 13questions = 117 possible points
   f. Silage leachate — 6 questions = 54 possible points

2. An assessment of the farms crop and soil fertility program including how they establish application rates, methods and timing of nutrients applications. It also includes record keeping, soil testing, soil conservation planning and a general understanding of nutrient and conservation management systems. This assessment has three areas with the following score possible:

   a. General crop and soil fertility program — 3 questions = 27 possible points
   b. Recording keeping and soil testing — 3 questions = 27 possible points
   c. Soil fertility planning — 4 questions = 36 possible points

3. A walkover of the fields (the tillable and the non-tillable land) to determine if the current farming system is adequately meeting the environmental needs of the operation. It is one thing to write a nutrient management plan that meets the state requirements. Doing so requires someone familiar with the program and knowledgeable about the farm and the farming system. However, evaluation of the implementation of that plan is critical to the long term goals of reducing sediment and nutrient losses and achieving the overall goals of the

program. The walkovers allow us to evaluate how the current farming system fits with the needs of the land. For example, in 2013 we conducted most of our walkovers in June after the spring rains. Many fields had evidence of soil erosion because of the timing of the rainfall events. It was easy to assess that on farms planting and harvesting rye as a forage crop and then applying manure and planting to corn, there was a lot of soil erosion. This is because many of these farms incorporated the manure with a chisel or chisel disk system. These systems leave little residue on the soil surface and have a high potential for erosion.

Other areas that were identified as challenges in the Yahara Watershed include grass waterway. There were several farms that had removed waterways or had seeded their waterways to alfalfa instead of grass. Many of these concentrated flow channels showed signs of erosion and have a high potential for sediment loss to streams and lakes. The final critical sites discovered during our walkovers was the non-farmed land. Streams and other concentrated channels show signs of significant erosion and the farmers need to think about installing practices to protect these areas.

4. The final assessment in the certification program is an evaluation of the SNAP plan. On the following page are two summary pages from data collected on farms within the Yahara Watershed. It is important to note that both of these farms are extremely well managed and that one farm is not better than another. However, a review of the soil loss, phosphorus index and soil test values clearly indicates that these two farms are managed under very different farming systems. However, just to be clear both operation have livestock based systems and therefore they have manure as well as alfalfa and other forage crops in their rotation.

   As you can see on farm A there are 547.2 crop acres with an average rotational soil loss of 2.4 tons/acre; a 3.0 rotational phosphorus index and an average soil test phosphorus level of 49.3 ppm. With this data it is possible to evaluate three areas of the farming system:

   - ✓ tillage program, 41.6% of the fields have a calculated soil loss of 0.6 - 2 tons/acre and the remaining 58.4% of fields range from 2.1 - 4 tons per acre. None of the fields exceed tolerable soil loss levels, but based on the total number of fields evaluated in the watershed, this farm uses a fairly aggressive tillage system.
   - ✓ soil test indicate that applications of manure are well managed and that the farm has a good balance between nutrient applications and crop needs.
   - ✓ The average rotational P index is higher than most of the farms evaluated in the watershed. This is largely because of tillage and manure applications.

Farm A

Rot. Ave Soil Loss				Phosphorus Index				Soil Test Phosphorus (ppm)		
Ave	2.4			Ave	3.0			Ave	49.3	
Min	0.8			Min	1.0			Min	9	
Max	4.0			Max	5.0			Max	116	
Individual Field Data				Individual Field Data				Individual Field Data		
Loss	# Acres	% of Total		Field PI	# Acres	% of Total		Soil Test	# Acres	% of Total
<0.5	0.0	0.0%		0	0.0	0.0%		< 20	170.3	31.1%
0.6 - 2.0	227.5	41.6%		1	97.0	17.7%		21 - 50	221.1	40.4%
2.1 - 4.0	319.7	58.4%		2	122.5	22.4%		51 - 90	109.4	20.0%
4.1 - 5.0	0.0	0.0%		3	123.2	22.5%		91 - 150	46.4	8.5%
> 5.1	0.0	0.0%		4	124.4	22.7%		151 - 200	0.0	0.0%
				5	80.1	14.6%		> 201	0.0	0.0%
Total	547.2	100		6	0.0	0.0%				
				7	0.0	0.0%		Total	547.2	100
				> 7	0.0	0.0%				
				Total	547.2	100				

Farm B

Field Name	Acres	Field Slope	Field Slope Length	Field "T" t/ac	Rot Avg Soil Loss	Rot Avg PI	Soil Test P ppm	Rot P2O5 Bal
115	1,562.00	Ave		3.8	1.0	1.6	60.1	-314.1
		Maximun		5.0	3.8	5.0	329.0	245.0
		Minimum		2.0	0.0	0.0	5.0	-605.0

Soil Loss		
Category	Acres	% Land
< 0.5	539.0	34.5%
0.6 - 2.0	761.8	48.8%
2.1 - 4.0	261.0	16.7%
4.1 - 5.0	0.0	0.0%
> 5.1	0.0	0.0%
Total	1,561.8	

Rotational P2 O5	
Low	-605.0
High	245.0
Ave	-314.1

Rot Phosphorus Index		
Category	Acres	% Land
0	263.9	16.9%
1	500.3	32.0%
2	457.7	29.3%
3	172.4	11.0%
4	103.9	6.7%
5	63.6	4.1%
6	0.0	0.0%
7	0.0	0.0%
>7	0.0	0.0%
Total	1,561.8	

Soil Test P		
Category	Acres	% Land
< 20	143.4	9.2%
21 - 50	833.7	53.4%
51 - 90	376.4	24.1%
91 - 150	125.0	8.0%
151 - 200	74.9	4.8%
> 201	8.4	0.5%
Total	1,561.8	

On the other hand, farm B has 1,562 crop acres with an average rotational soil loss of 1.0 tons/acre; a 1.6 rotational phosphorus index and an average soil test phosphorus level of 60.1 ppm. With this data it is possible to evaluate three areas of the farming system:

- ✓ tillage program, 83.3% of the fields have a calculated soil loss of less than 2 tons/acre (if fact, 34.5% is <0.5 tons/acre). This farm has very low soil loss levels and most likely has a strong component of no-till in their program. **This is a farm where implementing practices like strip-tillage or cover crops has to be done judiciously because there is a high risk that these practices will increase the potential phosphorus loss.**
- ✓ soil test indicate that applications of manure are well managed but that the land under the management of this farm has received manure for a long period of time. A closer review of the soil test data indicates that 9.2% of the acres have soil test levels below 20ppm which would benefit from additional phosphorus. Another 77.5% of the land has soil test levels between 21 - 90 ppm which are within the range of what most agronomist want to see. These levels will test as excessively high but they have a high potential for yield and their potential for phosphorus loss is acceptable. The remaining 13.3% of the land ranges in soil test P from 91 - >201. On this land plans should be made to reduce soil test levels on the 8.4 acres testing > 201 ppm as well as the 74.9a acres testing between 151 - 200 ppm. However, this farm has a really good balance between nutrient applications and crop needs.
- ✓ The most impressive statist of this data set is the rotation phosphorus index. Many people would think that because this farm has high soil test levels, the potential for phosphorus loss is high (in fact, this is a bias in most models like SWAT). The average rotational P index for this operation is 1.6 with a range of 0 - 5. A closer evaluation of this data indicates:
  - 16.9% of the land = 0
  - 32.0% of the land = 1
  - 29.3% of the land = 2
  - ✓ 11.0% of the land = 3
  - ✓ 6.7% of the land = 4
  - ✓ 4.1% of the land = 5

  This means that 78.2% of the total tillable acres has a P-Index of 2 or less. Any changes to this farming system would have to be carefully evaluated to determine if they have a positive or negative impact on phosphorus loss.

During 2013 Yahara Pride Farms worked with 10 farms on various stages of the certification program. Six of these farms are done and have been recommended for certification while another 5 - 8 are working on it now.

Conclusions:

In 2013 the Yahara Pride Farms conducted four major phosphorus reduction program for farmers in the watershed. Each of these programs appeal to a number of audiences and when combined with their information and education program, have produced significant results over a short period of

time. Based on estimates available through the SNAP Program, the following reductions in phosphorus can be calculated:

1. Strip tillage
    a. 2013 annual reduction 170.5 lbs
    b. 3 year reduction for years in corn 511.0 lbs
2. Vertical manure injection
    a. 2013 annual reduction 674.0 lbs
    b. 3 year reduction for years in corn 1,676 lbs
3. Cover Cropping
    a. 2013 annual reduction 1,957 lbs
    b. 3 year reduction for years in corn 5870 lbs
4. Farm Walkover Evaluation of Conservation:

Yahara Farms				May-14			
		Acres	SNAP	Walkover	NM Survey	Facility Sur	Certification
1		1,149.2	X	X	X	X	X
2		539.6	X	X	X	X	X
3		848.6	X	X	X	X	X
4		8,056.4	X	X	X	X	X
5				X	X	X	
6		1,716.6	X	X	X	X	X
7		547.2	X	X	X	X	X
8		1,127.4	X				
9		1,561.8	X				
10		719.3	X				
11		275.0	X		X	X	
12			have				
13		189.1	X	X			
14				X			
	Acres	16,730.2					

The three cost sharing program produced a phosphorus reduction to the Yahara Watershed of 2,801.5 pounds in 2013 and a three year phosphorus reduction of 8,057 pounds. If we assume that trading were established at a rate of $60 per pound, the saving through these three program alone equals:

$168,090 - $483,420

Putting a value on the certification program, the educational events (seminars and field days) are much more difficult. However, it is clear that these activities are leading to changes within the watershed and that additional efforts should be continued and expanded. The information gathered through the certification program is extremely valuable in targeting fields and farming systems that benefit from alternative practices (such as strip-tillage and cover crops). Based on the data from 2013, vertical manure injection is a practice that could benefit all farms within the watershed.