

Yahara Pride Farms 2019 Phosphorus Reduction Report



Yahara Pride Board of Directors

May 20, 2020

Introduction

*First and foremost – Thank you to all the farmers in the Yahara Pride Watershed program for working with Yahara Pride Farms and Yahara WINS to implement practices that reduce the potential for phosphorus loss to the streams and rivers that contribute water to the Yahara Lakes. The farmers in this area continue to be supportive of Yahara Pride Farms and continue to seek alternative farming systems and conservation practices that reduce phosphorus and sediment loss. This report shows how hard each and every one of you works to keep soil and nutrients on your fields and out of our water. **Farmers are the heart and soul of the Yahara Pride Farms program and we thank you!***

Yahara Pride Farms and the farmers in the Yahara Watershed are also indebted to “The Yahara Watershed Improvement Network (Yahara WINS), led by MMSD”, which began in 2012 as a four-year pilot project to reduce phosphorus loads and meet more stringent water quality standards established by the Wisconsin Department of Natural Resources (WDNR). This groundbreaking program employs watershed adaptive management, a strategy in which all sources of phosphorus pollution in an area work together to meet water quality goals. This strategy is more effective and less expensive than the sources working separately on individual solutions. **Partners in Yahara WINS include cities, villages, towns, wastewater treatment plants, agricultural producers, environmental groups and others.**

Thanks also to the businesses and organizations who provide support (both financial and in-kind), to Yahara Pride Farms. It takes people and money to offer this cost share, certification and outreach and education events, and we wouldn't be able to do it without your support. This farmer-led watershed approach has become a model for others around the state because we have been able to offer programs and events based on your support. Thank you for being an important of the Yahara Pride Farms program.

Finally, thanks to the members of the Yahara Pride Farms board of directors and all the staff who have worked with us over the past many years. Your guidance and support have shaped this program and we cannot thank you each of you enough for your time and commitment to this organization.

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Programs offered in 2019

In 2019 the Yahara Pride Farms (YPF) board of directors continued operating and implementing several agricultural conservation programs designed to reduce the loss of phosphorus within the Yahara Watershed. There were six major incentive programs offered within the watershed in 2019 and an incentive for implementing more than one practice on a field. The practices cost shared included:

1. Planting an over-wintering cover crop,
2. Planting a non-over-wintering cover crop,
3. Low disturbance deep tillage and cover crop (LDDT+CC),
4. Low Disturbance Manure Injection (LDMI),
5. Strip tillage,
6. Headland Stacking of Manure / Composting and
7. Using multiple practices on a field.

The reason that YPF offered bonus payments to farms that implemented a combination of practices on the same field (two or more practices) is that over several years of data analysis it is apparent that using more than one practice increases the benefits of each individual practice. Each of these programs offers 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, fields and farms involved in each of these programs. The Wisconsin Phosphorus Index (P Index) is a model that estimates the pounds of phosphorus prevented from reaching the nearest waterbody. The nearest waterbody would, in most cases, be streams and rivers. These estimates of the pounds of phosphorus prevented from reaching a waterbody can then be used (with the appropriate delivery factors) to estimate the pounds of phosphorus prevented from entering the Madison chain of Lakes.

What the data represents

This report provides the data and summary information for the 45 farms (up from 41 in 2018) that provided SNAP Plus plans to Yahara Pride Farms (YPF) for evaluation of the impact of their cost share program. In 2019, there were 5 new farms in the program and a few previous participants decided not to participate due to challenging weather conditions. There was also one farm that implemented practices but did not provide a SNAP+ file for evaluation or payment. The information provided is based on the difference in predicted phosphorus loss from the adoption of a practice such as strip tillage, low disturbance manure injection, cover crops, headland stacking of manure or combination of two. The 2019 data is based off the "SNAP+" plans provided to YPF by the farmers and/or their crop advisors.

All of the data presented in this report are derived from the individual farms nutrient management plan, which takes into account tillage, crop rotations, and nutrient applications from both manure and fertilizer, and crop yields. This is the best representation of what is actually happening on the

farms that participate in the Yahara Pride Cost Share program. Each farm and field has unique characteristics that influence yields, the tillage system and the risks for sediment and nutrient loss. That is why we see such large variation in losses within this data set.

Summary of phosphorus reductions for each cost share program:

1. Cover Crops

Table 1 shows a comparison of the number of farms, acres and phosphorus reductions achieved through the **cover crop program** from 2013 to 2019.

Year	2013	2014	2015	2016	2017	2018	2019
Farms	20	37	35	37	33	37	43
Fields	80	53	160	290	212	274	309
Acres	2,436	4,732	4,908	5,851	4,483	7,294	5,903
Average (lbs/acre)	0.7	0.8	1.8	1.5	1.8	2.1	2.2
Total P reduction (In pounds)	1,730	3,691	6,572	7,130	7,300	11,497	11,843

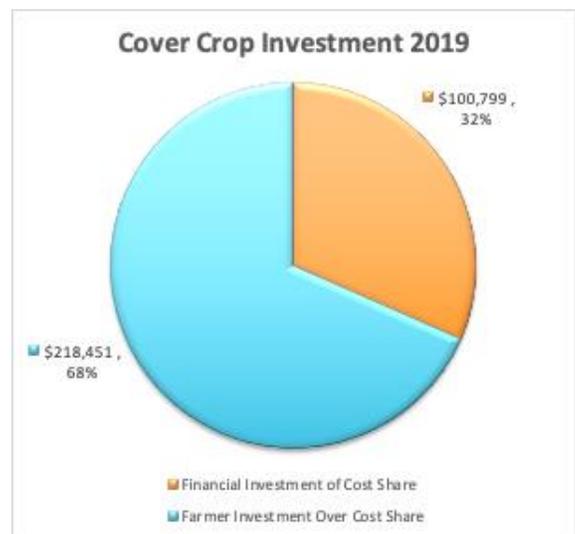
Table 1 Number of farms, acres and phosphorus reductions through the cover crop program

Despite challenging weather conditions, the number of farms and fields participating in the cover crop program grew in 2019, while the number of acres saw a small decrease. The following page provides a summary of all the data contained in the individual cover crop spreadsheet as well as a breakdown of the participation based on the sub-watershed.

It is important to understand that while the average reduction in the risk of phosphorus loss in 2019 was 2.2 pounds per acre, the range in reduction was from 22.2 pounds to (- 1.1)! That is correct, the impact of planting a cover crop was modeled to reduce the risk of loss by as much as 22 pounds on one field. However, there were several fields where planting a cover crop increased the risk of loss because of the impact of running a drill or other implement over the field to establish the crop. This is why it is important for farmers and crop advisors to evaluate each practice to determine if that practice reduces loss, increases loss or has no effect on the risk of loss.

2019 Phosphorus Report - Cover Crops						
Field	Acres	Slope	Soil Test P PPM	Predominant Soil used	Critical Soil used	Tolerable Soil Loss for the field
2019 Yahara Pride Cover Crop Cost Share Program						
Acres	5902.7		Phosphorus Reduction by sub-watershed			
			Reach	Pounds P	Acres	# Fields
Fields	309		62	698.5	392.3	22
			63	3221.2	1277.6	87
Farms	43		64	7272.7	3184.2	173
			65	3.5	17.1	1
			66	70.8	103.1	11
			69	576.1	928.4	15
				11842.8	5902.7	309
Average phosphorus reduction				2.2		
Total phosphorus reduction					11842.8	
Average Soil loss reduction						0.5
	Cost shared acres		Total planted acres			
	1863.7		5902.7			
	Acres Planted by farmers without cost share payment 4,039					
	Financial Investment of Cost Share		Farmer investment over cost share			
	\$ 100,799		\$ 218,451			

The information contained in the table above shows the number of acres, fields and farms involved in the 2019 cover crop program. As stated previously, the challenging weather conditions made it extremely challenging to plant cover crops in the fall of 2019. The growth in acres is surprising and the farmers in this watershed are to be commended for the efforts in adopting conservation practices.



The graph provides a visual representation of the level of farmer participation compared to the cost share provided. This graph further depicts the level of financial investment funded either through cost share (32% provided by YWINS, DATCP and The Nature Conservancy) or by the farmers themselves (68%). As you can see the farmers in the Yahara Watershed are very committed to adopting conservation farming systems.

Notably, the information in the above table does not take into account the number of acres planted to a cover crop after low disturbance deep tillage. The next section of the report provides the data from the LDDT + cover crop.

2. Low disturbance deep tillage with planting of a cover crop

Table 2 shows a comparison of the **low disturbance deep tillage plus cover crop program** (LDDT), which was first offered to farmers in the watershed in 2016. Interest in this program continues to grow and the YPF board of directors feels it is important to encourage reduced tillage when conducting deep tillage.

Year	2016	2017	2018	2019
Farms	8	11	7	9
Fields	?	52	24	22
Acres	730	956	448	550
Average (lbs/acre)	1.48	2.2	2.6	1.9
Total P reduction (In pounds)	1,080	1,981	1,165	1,071

Table 2 Number of farms, acres and phosphorus reductions through the LDDT + cover crop program

Despite challenging weather conditions, the number of farms and fields cooperating in the cover crop program grew in 2019, while the number of acres saw a small decrease. The table below provides a summary of all the data contained in the individual cover crop spreadsheet as well as a breakdown of the participating based on the sub-watershed.

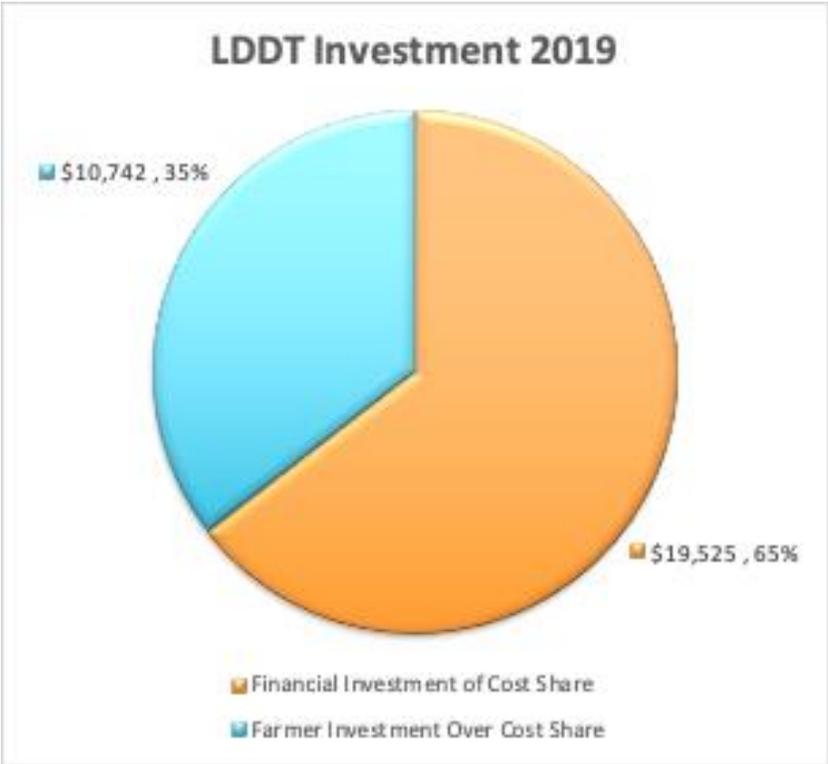
2019 Yahara Pride LDDT + CC Cost Share Program					
Acres	550.3	Phosphorus Reduction by sub-watershed			
		Reach	Pounds P	Acres	# Fields
Fields	22	62	249.7	107.5	8
		64	821.6	442.8	14
Farms	9		1071.3	550.3	22
Average phosphorus reduction			1.9		
Total phosphorus reduction				1071.3	
Average Soil loss reduction					0.4
Cost shared acres		Total planted acres			
355.0		550.3			
Acres Planted by farmers without cost share payment		195.3			
Financial Investment of Cost Share		Farmer investment over cost share			
\$ 19,525		\$ 10,741.5			

The number of acres in the LDDT + cover crop increased over 2018, but is still lower than 2017. The average in the risk of phosphorus reduction also decreased to 1.9 pounds per acre. The range was from 6.0 to (-0.4) lbs per acre.

Farmers conducted low disturbance deep tillage plus planting a cover crop on a total of 550 acres, of which 355 acres were cost shared. Again, the challenging weather conditions made it very difficult for farmers to get into the fields and conduct deep tillage during the fall of 2019.

This graph provides a visual representation of the level of financial investment funded either through cost share (65% provided by YWINS, DATCP and The Nature Conservancy) or by the farmers themselves (35%). As you can see the farmers in the Yahara Watershed are very committed to adopting conservation farming systems.

Hopefully, soil conditions are favorable in 2020 so that farmers can get into the fields to implement more practices. This practice commonly occurs in the fall after harvest.



3. Low disturbance manure injection

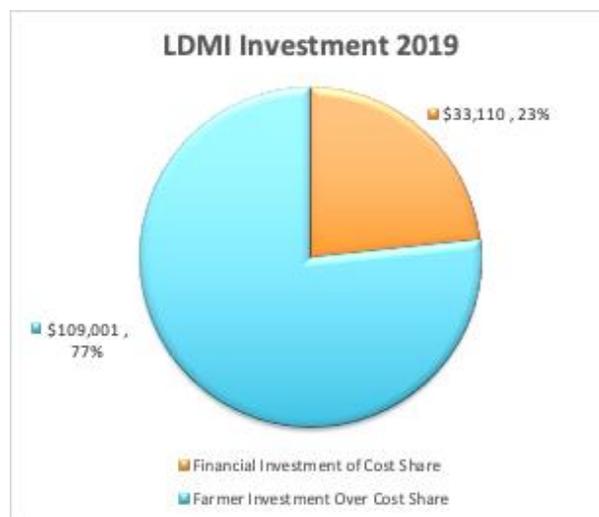
Table 3 shows a comparison of the number of farms, acres and phosphorus reductions achieved through the low disturbance manure injection program from 2013 to 2019.

<i>Low Disturbance Manure Injection Program</i>	2013	2014	2015	2016	2017	2018	2019
Number of farms	11	14	4	7	15	15	24
Number of fields	20	20	32	76	223	196	243
Tillable acres in program	361	841	566	1,203	3,885	3,293	4,450
Average phosphorus reduction (lbs./acre)	1.0	0.6	1.9	0.9	1.4	1.1	1.6
Total phosphorus reduction (in pounds)	357	530	1,081	1,106	6,039	3,945	7,103

Table 3 Number of farms, acres and phosphorus reductions through the LDMI program

The LDMI program saw a very good increase in the number of farms, fields and acres this year compared to previous years. This was despite challenging weather conditions in the fall and spring, which decreases the amount of time available for manure application. This table shows the impact of the investments made by farmers, Dane County and Yahara WINS and others in supporting purchasing low disturbance manure injection equipment.

This graph provides a visual representation of the level of financial investment funded either through cost share (23% provided by YWINS, DATCP and The Nature Conservancy) or by the farmers themselves (77%). As you can see the farmers in the Yahara Watershed are very committed to adopting conservation farming systems. This graph also demonstrates that investing in the conservation equipment can greatly increase the level of implementation throughout the watershed.



The data contained in the table on the following page shows the number of farms, fields and acres where LDMI was conducted in 2019. The table also shows the level of usage on a sub-watershed basis. It should not be surprising to see that the vast majority of the usage came north of the lakes in reach 64. The average reduction in the risk of phosphorus loss for LDMI was 1.6 lbs/acre with a range of 8.2 to (-0.6).

4. Strip Tillage

Table 4 shows a comparison of the number of farms, acres and phosphorus reductions achieved through **strip tillage program** from 2013 to 2019.

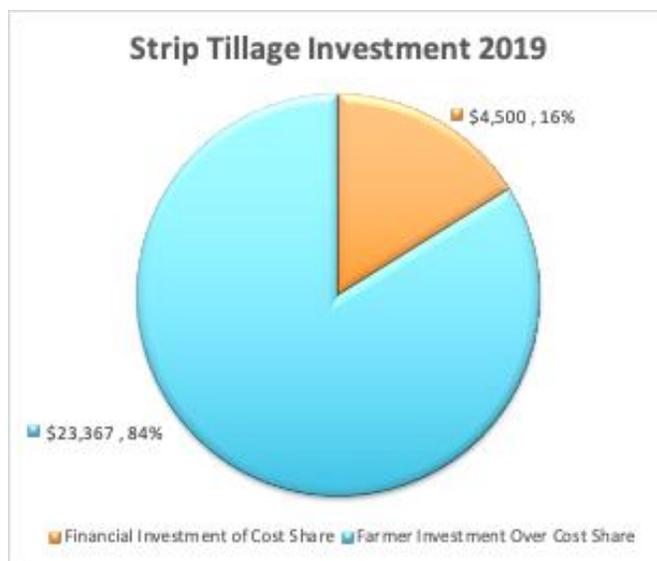
<i>Strip Tillage Program</i>	2013	2014	2015	2016	2017	2018	2019
Number of farms	3	3	3	3	4	3	5
Number of fields	11	15	20	21	35	39	56
Tillable acres in program	156	253	1,489	917	1,829	2,422	1,858
Average phosphorus reduction (lbs./acre)	1.4	0.9	0.8	0.9	0.8	1.3	1.7
Total phosphorus reduction (in pounds)	225	220	1,221	703	1,458	3,110	2,608

Table 4 Number of farms, acres and phosphorus reductions through strip tillage program

Strip tillage had the highest number of farms participating since the beginning of the cost share program. The reduction in acres is probably because one large cash grain operation that did not participate in the program in 2019. The average phosphorus reduction was also the highest this year compared to the previous six years. This year the strip tillage cost share program had the largest reduction in the risk of phosphorus loss in the history of the program.

The table on the following page provides a summary of the information gathered through the individual field analysis. As can be seen in the table, there were a lot more acres planted through strip tillage than the funding provided by the cost share program. Cost share provided funding for 300 acres while the farmers using strip cropping planted 1,858 acres. That means that 1,558 acres were planted without cost sharing.

The graph on the right shows the level of investment in the strip tillage program by our funding partners compare to farmers. As you can see cost share amounted to about 16% of the total investment, while farmer provided the remaining 84%. Once the investment in equipment has been made farmers can use that equipment on a larger percentage of their tillable acres. **The average reduction was 1.7 lbs/acre with a range of 6.0 to (-0.1).**



5. Manure stacking and/or composting

Table 5 shows a comparison of the reduction in the risk of phosphorus loss from **manure stacking and/or composting during the critical runoff period**. This program was first offered to farmers in the watershed in 2016. Interest in this program continues to grow and the YPF board of directors feels it is important to encourage farmers to not apply manure during high-risk periods. This practice is also one that has a significant reduction in soluble phosphorus loss.

Year	2016	2017	2018	2019
Farms	1	9	9	15
Fields	1	9	44	96
Acres	50.4	301	898	1632
Average (lbs/acre)	2.1	2.1	2.0	1.5
Total P reduction (In pounds)	106	665	1,855	2610

Table 5 Number of farms, acres and phosphorus reductions through the LDDT + cover crop program

2019 Phosphorus Report - Manure Stacking/Composting						
Field	Acres	Slope	Soil Test P PPM	Predominant Soil used	Critical Soil used	Tolerable Soil Loss for the field
2019 Yahara Pride Manure Stacking/Compost Cost Share Program						
Acres	1632.3		Phosphorus Reduction by sub-watershed			
			Reach	Pounds P	Acres	# Fields
Fields	96		62	237.4	311.1	22
			63	78.2	77.1	6
Farms	15		64	2283.1	1228.1	67
			66	11.2	16.0	1
				2609.9	1632.3	96
Average phosphorus reduction				1.5		
Total phosphorus reduction					2609.9	
Average Soil loss reduction						0.0

As can be seen in the table above, manure stacking/composting occurred in four of the sub-watersheds in the Yahara. There was a very large increase in the number of farms cooperating in 2019 compared to past years (15 compared to 9 and 1). This is consistent with the interest in the stacking/composting program. This is one area that has the potential for substantial growth and this program could quickly outgrow the level of funding available.

While there was a significant amount of manure composted outside the cost share program, based on the data collected through the program it is not possible at this time to do a cost share / farmer investment comparison. That said, as farmers become more comfortable with not applying manure during the high risk runoff conditions, there is an extremely high potential for this program to grow.

It is important to note that manure stacking and composting was the only practice that did not increase the risk of phosphorus loss. The average reduction in the risk of phosphorus loss in 2019 was 1.5 lbs/acre and the range was from 4.8 to 0.0 lbs/acre.

Based on data collected at the Discovery Farms and Pioneer Farms, winter runoff events that occur as a combination of increased temperatures and rainfall, along with frozen soils and deep snow cover, produces a high potential for surface runoff from fields. Livestock producers who make manure applications to cropland during this high-risk period need to understand that spreading manure during snowmelt does have an extremely high risk of runoff. Studies from farms cooperating in the Discovery Farm Program indicate that manure applied to snow covered and/or frozen soils during conditions of snowmelt or rain on frozen soils **can contribute the majority of the annual nutrient losses. One inappropriately timed manure application can generate large losses of phosphorus to surface waters.**

Yahara Pride Farms decided to provide an incentive to farmers who sometimes have to clean out lots with solid manure during this critical runoff period. The goals of this program were to reduce the risk of manure run off by:

- Offering an incentive to farmers for stacking, reloading and spreading manure during a low risk runoff period.
- The incentive payment is offered to help offset the cost of double handling manure.

Calculating the predicted reductions in phosphorus loss from headland stacking during critical runoff periods can be accomplished using the SNAP+ program by comparing the risk of a manure application in the winter (surface applied) and in the spring (incorporated). The predicted reductions in phosphorus loss are shown in appendix 5.

As shown in the table in appendix 5, stacking manure during the critical runoff period reduced the loss of phosphorus by 1.5 pounds per acre. It is also important to note that headland stacking of manure during the critical runoff period is the only practices where soluble phosphorus losses are the dominant form of phosphorus reduction.

Manure application rates were the same on each field, the only variable was whether manure was spread during the winter on frozen and/or snow covered ground or during the spring and incorporated within 72 hours. Practices that reduce losses of soluble phosphorus are of particular importance because once phosphorus is in runoff water there is little that can be done to remove it prior to reaching nearby surface water. Most conservation practices are designed to capture and slow water running off of fields so that particulate soil particles fall out of the runoff and remain in the buffers settling basins and wetlands. However, soluble phosphorus is not tied to particles and, therefore, flows with the water. Keeping soluble phosphorus out of runoff is a critical factor in reducing the overall phosphorus loads to the Madison Chain of Lakes.

6. Combining multiple practices

The incredible cooperation of the local crop advisors and farmers provided YPF with an adequate data set so that we could evaluate “How does stacking different best management practices impact the potential for phosphorus loss?” **This question was evaluated on 107 fields in 2019 and the data is contained in appendix 6.** It is important to note that not all fields had a benefit in excess of the two individual practices. **The average reduction in the risk of phosphorus loss on these fields was 1.8 lbs/acre with a range of 24.3 to (-4.1).**

To determine the impact of applying more than one best management practices, we first ran the SNAP calculation with all the practices in place. Then one practice was removed from the field and the numbers were entered into the table for that practice. Then the practice that was removed was added back to the field and the second practice was removed. Those numbers were then entered into the spreadsheet for that practice. Finally, both best management practices were removed from the field and the impact on the potential phosphorus loss was recorded. The data contained in the tables in appendix 6 compare fields with and without both practices. The numbers in the data (column AF) show the difference in the annual change in the risk of phosphorus loss with and without both practices in place.

The phosphorus reductions for these fields appear in the individual practice sections of the report (LDMI, strip tillage and cover crops) but the reductions in predicted phosphorus loss for each single practice are included in the data so that the calculations could be made. The phosphorus reductions taken at the bottom of the table is only the impact of adopting two practices above and beyond the individual practices.

In 2019, YPF provided a bonus payment for farms that combined two practices on a field (one practice was always cover crops while the second practice was either strip tillage or LDMI). On some fields there is no calculated benefit to combining practices when you take into account the individual benefits of each practice. However, there are fields where the benefit of adopting two practices was greater than the individual benefits of both practices.

Year	2018	2019
Farms		16
Fields	98	107
Acres	2,010	2,133
Average (lbs/acre) Over the total of individual practices	0.8	1.8
Total P reduction (In pounds)	1,608	4,130

In 2019, the average predicted phosphorus reduction for combining two practices was **1.8 pounds per acre**. This year's data set contained 107 fields compared to 98 in 2018. This reduction in phosphorus is over and above the phosphorus reductions for each of the two practices. The individual practice reductions are included in corresponding data sets.

The table on the following page provides the data for each of the sub-watersheds in the Yahara. There was very good participation by farmers in a number of sub-watersheds. It appears that farmers in this watershed are adopting more than one conservation practice and the benefits of using more than one practice is apparent.

2019 Phosphorus Report - Multiple Practices						
Field	Acres	Slope	Soil Test P PPM	Predominant Soil used	Critical Soil used	Tolerable Soil Loss for the field
2019 Yahara Pride Multiple Practices Cost Share Program						
Acres	2133.3		Phosphorus Reduction by sub-watershed			
			Reach	Pounds P	Acres	# Fields
Fields	107		63	380.1	255.0	18
			64	2145.3	1486	84
Farms	16		66	44	17.5	2
			69	1560.8	374.8	3
				4130.2	2133.3	107
Average phosphorus reduction from multiple practices						1.8
Total phosphorus reduction from multiple practices						4130.2

Conclusion:

The 2019 Yahara Pride Cost Share Program has engaged a large number of farmers in one or more of the six cost share programs. This report provides information on the predicted reductions in phosphorus loss by farmers adopting one or more of these practices. The report provides both a total for the entire watershed and the reductions for each of the six stream reaches that Yahara Pride Farms is working with farmers on adoption of conservation systems.

This report did not evaluate multiple year data but a closer look at the impact of farms continuing a conservation practice is desirable. Future analysis should attempt to do a better job of looking at multiple years of adoption to understand the impacts of multiple years on a field.

The headland-stacking program is the only program that has a dramatic potential reduction in soluble phosphorus loss.

Additional work should also be done to accurately reflect the cost that farmers bare in adopting these conservation systems. The cost of seed, planting, killing and impact of the cover crop on yield have not been examined. The cost of handling manure twice and hauling to an approved stacking site and then to the field also need to be considered. A report evaluating the cost to farmers for adoption should be done to accurately reflect the total cost of these programs. Protecting water quality is important to everyone and everyone needs to be part of the solution.

2019 Summary of Predicted Phosphorus Reduction

<u>Practice</u>	<u>Average P Reduction</u>	<u>Total Predicted P Reduction</u>
➤ Cover Crops	2.2	11,843 lbs
➤ LDDT + cover crop	1.9	1,071 lbs
➤ LDMI	1.6	7,103 lbs
➤ Strip Tillage	1.7	2,608 lbs
➤ Headland Stacking Manure	1.5	2,610 lbs
➤ Combined Practices	1.8	<u>4,130 lbs</u>
	Total	29,365 lbs

***Total from 2018 was 22,097 pounds.**