SUMMARY REPORT
2012 Judith River Watershed Farmer Survey

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Overview:

This survey effort is part of a larger study by researchers from Montana State University and Utah State University. The overall study is designed to better understand natural and human-driven sources of elevated nitrate levels in local groundwater, and to evaluate the effectiveness of various management strategies to reduce nitrate losses.

This report summarizes results of a baseline mail survey of farmers in Judith Basin and Fergus counties conducted in spring 2012. The survey was designed to provide current and scientifically valid information about the use of various farming practices and the views of farm operators in this area. The survey included questions about farm characteristics, the use of various farming practices, and farmer experiences and ideas about crop and nitrogen management practices. These results will be used to ensure that our research and outreach better reflects local needs and is relevant and useful to producers.

Methods:

Survey respondents were randomly selected from a publicly available list of persons with land in Judith Basin and Fergus counties who received USDA Farm Security Administration payments for participation in a range of federal farm programs in 2010. This list included over 2,000 names, but duplicate listings and addresses allowed us to consolidate to sampling frame of roughly 1,000 possible recipients. This compares to an estimate of roughly 1,200 total farms that provided information in the 2007 US Census of Agriculture (which suggests that the FSA list included most farms in these counties).

From that list, we randomly sampled 339 persons (292 with Montana mailing addresses and 47 with out-of-state addresses). We sent full surveys to all Montana addresses. We also contacted all persons with non-Montana addresses to identify the person who was responsible for operating their farmland in Montana. This led to the identification of 17 new sample points for operators who rent land from non-Montana landowners.

The combined sample thus included 309 possible respondents. From these, 69 were disqualified because they no longer farmed their own land (or because they were non-operator landlords only – in which case we replaced them with the person responsible for operating most of their land). From the remaining 240 sampled operations, we received completed surveys from 142 farms. This is a 59.2% response rate.

Given the estimated size of the farm population in these two counties (roughly 800 working commercial farms), and the number of respondents (142), statistical methods suggest that our results are accurate to within +/- 6%. Statistically significant differences between subgroups are noted where appropriate.

Profile of Respondents

Table 1 summarizes the characteristics of farmers who responded to our survey. Since we were particularly interested in farmers who raise wheat, throughout this report we separate out the results in three columns: farmers who did not raise wheat, farmers who did raise wheat, and the combined total for the entire sample.

Based on the survey results, most farmers in this watershed raise both livestock and crops. Over 80% of all respondents had beef cattle (whether or not they raised wheat), and roughly quarter had horses. Most farmers also raised some crops. The most common crop was hay – again over 80% of our respondent had land in forages and hay (including almost three-fourths of the wheat growers). About 41 percent of our respondents raised wheat.

Most wheat growers raised winter wheat, but only about 62% reported also raising spring wheat. The wheat growers were also split into two distinct groups – those that relied primarily on the sale of cereals for their farm income (54% of wheat farmers) and those that made most of their net income from beef (41%).

Table 1. Characteristics of Survey Respondent Farms

	Non-Wheat Farms	Wheat growers	Overall
	percent of respondents		
Raise commodity:			
Livestock			
Has any livestock	87.7	82.0	85.2
Beef	82.7	82.0	82.4
Sheep/goats	12.3	3.3	8.5
Horses	28.4	16.4	23.2
Crops			
Manages any cropland	84.0	100.0	90.8
Raises Winter wheat	0.0	96.7	41.1
Raises Spring wheat	0.0	61.7	26.2
Raises any wheat	**0.0**	**100.0**	**43.0**
Raises other grains	16.5	45.9	29.3
Raises any Forages	86.4	75.4	81.7
Raises Hay only	65.4	0.0	37.3
Commodity that provided most income last year			
Beef	71.4	40.7	58.1
Cereals	2.6	54.2	25.0
Hay	16.9	1.7	10.3
Other	9.1	3.4	6.6

Respondents to the survey operated farms that ranged from a few acres to tens of thousands of acres in size. The average respondent operated 5,317 acres, of which 56% was owned and 44% was leased. Wheat growers operated larger farms (6,552 vs. 4,452 acres), but leased a higher share of their land (50%). The average wheat farmer harvested 1,143 acres of cereals, and idled or fallowed 653 acres of cropland in 2011. Both wheat and non-wheat farmers reported harvesting an average of 400 acres of hay last year. Most of the reported acres in farming operations (an average of over 3,600 acres) was used to graze livestock.

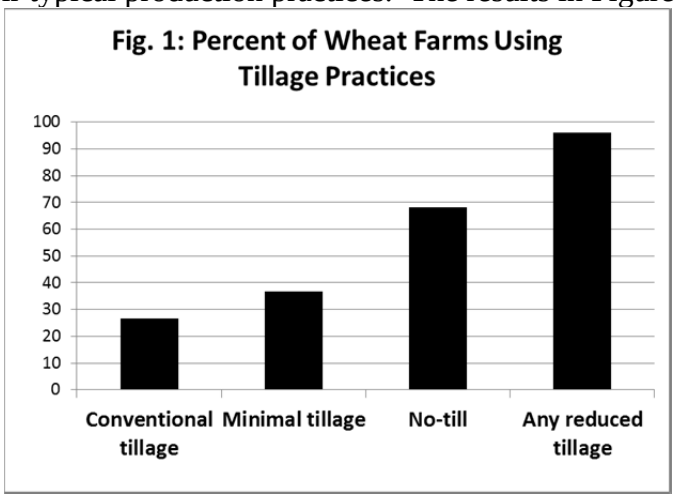
Characteristics of the cropland on their farming operations are summarized in Table 2. Most of the respondents reported a predominance of fine-textured soils (though nearly 15% had dominant soil types with more than 25% gravel). Significant numbers of respondents reported soil conditions that might limit crop production, including saline seeps (43%), hardpan layers (42%) and poor drainage (33%). These limitations were much more common on wheat farms. Nearly two thirds of our respondents reported that their average soil depth was less than 2 feet.

Table 2: Characteristics of Cropland on Responding Farms

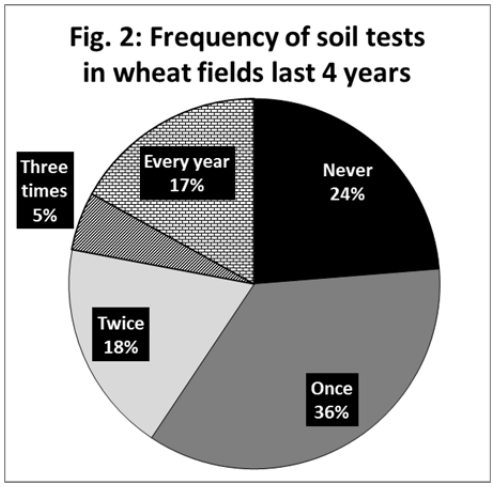
	Non-Wheat Farms	Wheat growers	Overall
	percent of respondents		
Soil Texture			
Fine textured	52.4	39.7	45.0
Fine textured w/ >25% gravel	7.1	10.3	9.0
Coarse textured	19.0	17.2	18.0
Coarse textured w/ >25% gravel	4.8	5.2	5.0
Other & Combinations	9.6	20.6	16.0
Not sure	7.1	6.9	7.0
	100.0	99.9	100.0
Presence of soil conditions			
Cement gravel	18.2	35.0	27.9
Hardpan layer	27.3	53.3	42.3
Poor drainage	22.7	40.0	32.7
Saline seeps	15.9	63.3	43.3
Average Depth of Soil			
Less than 2 feet	65.9	67.8	67.0
2-4 feet	20.5	22.0	21.4
> 4 feet	2.3	5.1	3.9
Not sure	11.4	5.1	7.8
Irrigate any fields	14.0	14.0	14.0

Wheat Production Practices

To enable our team to better understand the way producers currently manage their wheat fields, the survey asked wheat farmers to describe their typical production practices. The results in Figure 1 suggest that nearly all wheat farms in the Judith Basin use minimal-tillage or no-till practices (or a combination of both). Producers also reported a wide range of approaches to the use of soil tests in wheat fields (Figure 2) – with roughly 40% testing soil at least every other year.



All but 3 wheat producers in our sample reported using commercial nitrogen fertilizer on their wheat fields in 2011. A number of questions in the survey explored the methods, timing, and decision-making factors that wheat farmers use when making decisions about nitrogen fertilizer applications.



The results are summarized in Table 3 below. Wheat farmers currently apply nitrogen at during several distinct windows throughout the year. The most common time for application is in the spring (pre-planting), but significant numbers of farmers are also applying nitrogen in the late summer/fall and late spring/early summer. The most common application methods for nitrogen fertilizer were broadcast on the surface or drilling below the surface below planting. Very few of our respondents used foliar application, banding, or subsurface injection methods.

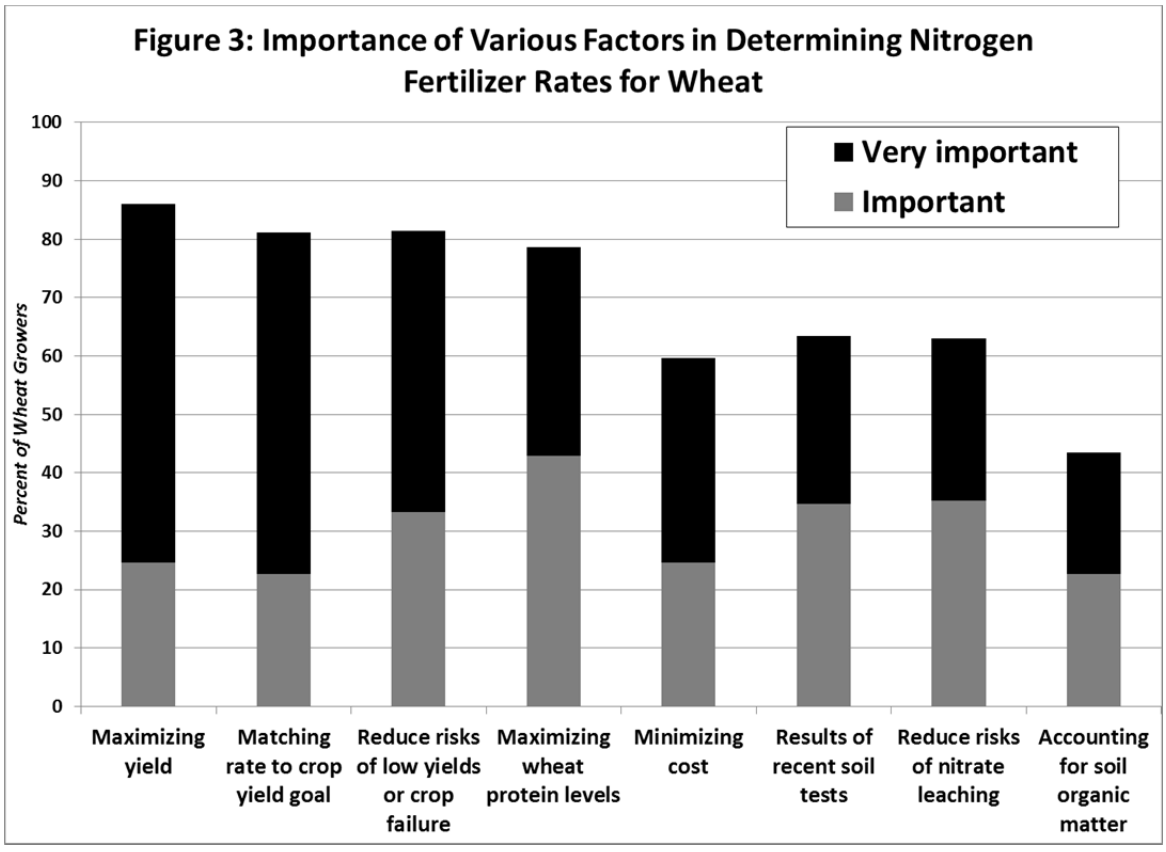
About 70% of the wheat farmers indicated that they were the person most responsible for determining nitrogen fertilizer application rates on their wheat fields. Twenty percent indictated that they relied on a hired agronomist/consultant, private fertilizer dealer, or farm cooperative employee to make nitrogen rate decisions.

About half of the respondents indicated having increased their rates of nitrogen fertilizer application over the last 20 years (another 15% said they decreased their rates). Just under half (45%) reported that they have adjusted the timing of when they apply nitrogen fertilizer, and about a third said they had changed the type or form of nitrogen applied to their wheat fields.

Factors that were considered important in determining nitrogen fertilizer application rate decisions are summarized in Figure 3. Results suggest that maximizing yield and protein levels, crop yield goals, and reducing the risk of crop failure are the most important goals for farmers.

Table 3. Wheat fertilization practices

	Percent of Wheat Farmers
Of these - timing of application (check all that apply)	
Late summer/fall	44.6
Winter	8.9
Spring (pre-plant or before tillering)	55.4
Spring/early summer (tillering or after)	41.1
Application method for N fertilizer	
Broadcast on surface	82.1
Drilled below surface during planting	66.1
Injected or banded below surface	7.1
Spray on plants (foliar application)	3.6
Factors considered important or very important in deciding when to apply N fertilizer	
When I expect rainfall to come soon	90.7
When my dealer is available to apply	38.0
When soil conditions allow access to field	30.0
When fertilizer prices are lowest	23.7
When I have time to apply	21.5
Puts animal manure on wheat fields	16.7
Planted to legume prior to wheat crop	25.0



Fallowing Practices

All farmers who reported raising any crops were asked whether or not they used summer or chemical fallow in 2011. The results (in Table 4) suggest that two-thirds of all crop farmers use fallow, but that wheat growers were much more likely to fallow fields than farmers who only raise other crops. The most important reasons for fallowing fields differed by type of farm. For wheat growers, retaining soil moisture and reducing pests and weeds were most important. Given the unusually wet year in 2011, it is not surprising that a large percentage of both wheat and non-wheat crop farms were forced to fallow fields because they were too wet to seed last year.

Over the last 20 years, about half of our respondents reported a decline in their use of fallowing. Among wheat growers, decreased fallowing is most associated with the planting of cereal crops for more years in a row. Among non-wheat farmers, decreased fallowing is associated with increased planting of noncereals.

Table 4: Use of Fallow in 2011 by Type of Farm

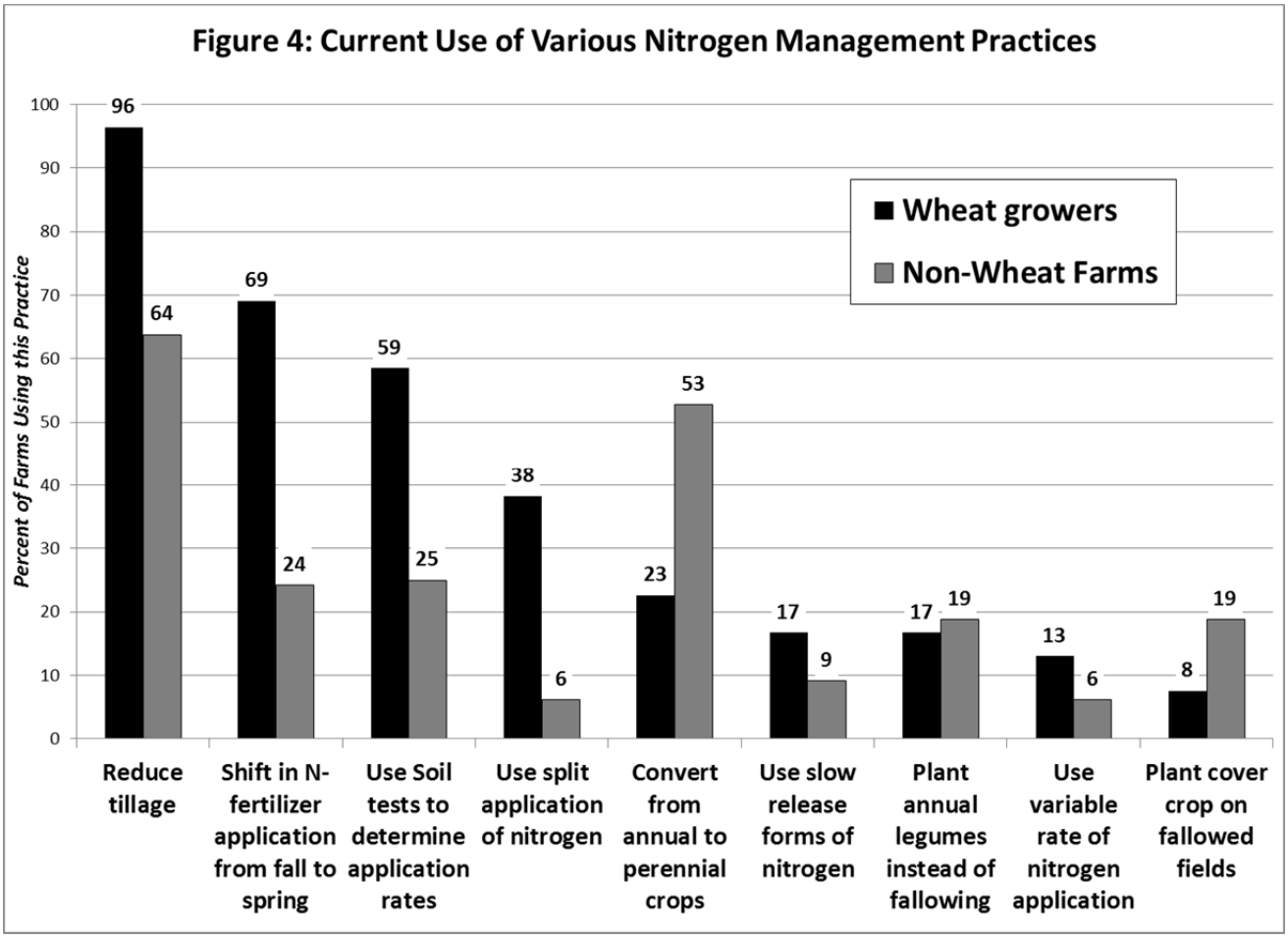
	Non-Wheat Farms	Wheat growers	Overall
Used summer fallow or chemical fallow on any of your crop fields in 2011	34.2	88.1	67.0
	% of those using fallow		
Purpose of fallowing these fields			
Retain soil moisture	23.1	71.2	61.5
Reduce pests & weeds	61.5	69.2	67.7
Too wet to seed	61.5	51.9	53.8
Build soil nutrients	30.8	44.2	41.5
Time constraints	0.0	11.5	9.2
How has your use of fallowing changed in last 10-20 yrs?			
NO change	38.5	44.2	43.1
INCREASED	0.0	3.8	3.1
DECREASED (all types combined)	61.6	44.2	47.7
DECREASED: planting cereals more years in a row	*15.4*	*34.6*	*30.8*
DECREASED: planting more noncereals for harvest	*46.2*	*9.6*	*16.9*

Use of Various Nitrogen Management Practices

Both wheat and nonwheat crop farmers were asked about their current use of a range of nitrogen management practices that can have impacts on nutrient flows on their farms. These practices were selected from lists of 'best management practices' (or BMPs) that are recommended by state and federal agencies to manage nitrogen and other agricultural nutrients. While our project has yet to do the research to verify if these are indeed effective practices in the Judith River watershed, we were interested in which of these practices were already widespread among farmers in the area.

Figure 1 shows the current level of use of some key practices for both wheat and non-wheat crop farmers. As noted above, virtually all wheat farmers currently use some form of reduced tillage, and almost 70% have shifted some of their nitrogen fertilizer applications from fall to spring. About 60 percent of wheat farmers use soil testing (but as noted above, with varying frequency). Roughly 40 percent of wheat growers split their applications of nitrogen, and 17% are using slow release forms of nitrogen or plant annual legumes in lieu of fallowing.

In general wheat farmers are much more likely to use nitrogen management 'BMPs' than non-wheat crop farmers in the Judith River watershed.



A number of questions in the survey explored levels of awareness about nitrogen management BMPs and the perceptions farmers have about possible impacts of BMPs on their operation. Table 5 summarizes the current use and levels of awareness of these BMPs among wheat growers in our sample. The results highlight that only three BMPs (use of perennial crops, use of legumes in fallowed fields, and slow release forms of nitrogen) are unfamiliar to more than 10% of wheat growers in the Judith Basin. For many practices, farmers are aware of the BMP, but have never tried it on their farm.

Table 5: Use and Awareness of Nutrient Management BMPs among Wheat Farmers

BMP	Category	Do It Now	Tried it but no longer use it	Heard of it, but never tried	Not familiar with BMP
Reduce tillage		96	2	0	2
Convert from annual to perennial crops	Crop rot.	23	4	53	21
Plant annual legumes instead of fallowing	Crop rot.	17	7	65	11
Plant cover crop on fallowed fields	Crop rot.	8	8	77	8
Base N app rates on annual soil tests	Fert. rate	59	17	23	2
Use variable rate fert apps	Fert. rate	13	4	80	4
Shift from fall application to late winter/spring	Timing	69	4	24	4
Use split application of N fertilizer	Timing	38	6	49	7
Use slow release forms of n fertilizer	Timing	17	6	63	15

Perceptions about the pros and cons of nutrient management BMPs were determined for three selected practices. Table 6 shows the percent of wheat growers who agreed or disagreed with various statements about the perceived costs and benefits of each type of practice.

Table 6: Perceptions of Barriers to Use of BMPs among Wheat Farmers

	Percent agreeing or disagreeing with statement					
	Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**	***not sure***	**% perceived as having negative impact (combined grey cells)**
SLOW RELEASE FORMS OF NITROGEN						
Would increase farm expenses in long run	5	11	**32**	**14**	***38***	**46**
Would be difficult to implement on my farm	17	43	**15**	**2**	***23***	17
Would require I buy fertilizer from a new person	15	36	**13**	**0**	***36***	13
Would increase risk of crop failure	9	44	**9**	**4**	***33***	13
Would increase availability of N for crops	**2**	**10**	**52**	14	***23***	12
Would increase my profits	**2**	**9**	44	0	***44***	11
Would reduce nitrate losses from my soil	**4**	**4**	**50**	13	***30***	7
Would make it harder to get crop insurance	32	46	**0**	**0**	***22***	0
ANNUAL SOIL TESTING						
Would increase farm expenses in long run	14	25	**39**	**4**	*18*	**43**
Would requires equipment I don't have	16	49	**24**	**7**	*4*	**31**
Would reduce nitrate losses from my soil	**2**	**21**	38	8	***32***	**23**
Would increase availability of N for crops	**2**	**15**	59	6	*19*	17
Would increase my profits	**2**	**15**	43	11	***30***	17
Would be difficult to implement on my farm	20	56	**11**	**6**	*7*	16
Would increase risk of crop failure	28	50	**11**	**0**	*11*	11
Would make it harder to get crop insurance	31	60	**0**	**0**	*9*	0
SHIFT FROM FALL TO SPRING APPLICATION						
Would be easy for dealer to accomodate	**9**	**16**	44	6	***26***	**26**
Would increase farm expenses in long run	13	45	**23**	**2**	*17*	**25**
Would increase my profits	**0**	**19**	44	11	***26***	19
Would reduce nitrate losses from my soil	**2**	**13**	48	13	***24***	15
Would increase availability of N for crops	**0**	**15**	54	15	***24***	15
Would be difficult to implement on my farm	18	55	**13**	**2**	*13*	15
Would increase risk of crop failure	15	67	**2**	**0**	*17*	2
Would make it harder to get crop insurance	23	64	**0**	**0**	*13*	0

Table 7: Trusted Sources of Accurate & Reliable Information about Nitrogen Management.

	Non-Wheat Farms	Wheat growers	Overall	Non-Wheat farms	Wheat growers	Overall
	percent trusted or highly trusted			*highly trusted alone*		
MSU faculty and staff	**80**	**76**	**77**	**57**	**33**	**42**
Other farmers	56	**66**	**62**	16	17	17
Local extension agent	**72**	**66**	**68**	**59**	20	**35**
Fertilizer dealers	44	**65**	57	19	22	21
MT Dept of Ag	52	53	52	**39**	18	26
Local NRCS staff	**71**	42	72	**45**	13	24
Local CD staff	58	40	46	**39**	9	20
Farm organizations	42	40	41	13	8	10
Local FSA staff	**67**	39	49	**43**	17	26

Table 8: Perceptions and Concerns about Water Quality and Nitrate Issues

	Non-Wheat Farms	Wheat Growers	Overall
		percent of respondents	
Perceived WQ as Poor/Fair on my farm			
Overall	8.7	26.4	16.0
Surface waters	8.9	25.0	15.7
Shallow groundwater	15.4	26.7	25.1
Deep groundwater	5.3	5.4	5.3
Perceived WQ as Poor/Fair in Judith River Watershed			
Overall	9.0	16.3	12.0
Surface waters	14.9	16.7	15.7
Shallow groundwater	22.4	16.7	20.0
Deep groundwater	5.4	7.4	6.2
Perceived WQ changes last 20 yrs			
Nuch worse	0.0	3.4	1.4
Somewhat worse	11.1	15.5	13.0
Remained the same	53.8	60.3	56.5
Somewhat better	10.0	5.2	8.0
Much better	6.2	1.7	4.3
not sure	*18.8*	*13.8*	*16.7*
Concerned or Very concerned about nitrates in…			
My household drinking water	25.3	36.9	30.4
My livestock water source	21.1	35.7	27.3
Drinking water for nearby hhs	26.3	39.6	32.1
GW in JB and F counties	40.8	44.0	42.2
SW in JB and F counties	40.8	47.4	43.7

Table 9: Sources of Drinking Water for Farm Households

	Non-Wheat Farms	Wheat growers	Overall
	percent of respondents		
Source of household drinking water			
Municipality	7.6	17.2	11.7
Bottled	16.5	17.2	16.8
Private well	82.7	81.4	82.1
If respondent has a private well….			
Depth of Private Well			
Under 25 ft	31.8	13.0	24.1
25-100 ft	19.7	23.9	21.4
Over 100 ft	45.5	60.9	51.8
not sure	*3.0*	*2.2*	*2.7*
Tested well for nitrates?	70.8	74.5	72.3
Regularly treat drinking water for nitrates?	9.1	10.9	9.8
Ever abandoned a shallow well?	11.7	14.3	12.8

Table 10: Awareness and Beliefs about Nitrogen Levels in Groundwater

	Non-Wheat Farms	Wheat growers	Overall
	percent of respondents		
Over last 4 years, how much heard about issue?			
None	30.9	18.0	25.4
A little	28.4	31.1	29.6
Some	30.9	37.7	33.8
A lot	9.9	13.1	11.3
Elevated nitrate levels in local shallow GW…			
are not likely to ever be a problem	36.8	19.6	29.5
are not yet a problem, but could get worse if nothing is done	28.9	35.7	31.8
have become a problem in the last decade	13.2	12.5	12.9
have become a problem in the last 50 years	13.2	19.6	15.9
have become a problem since pioneer settlement	2.6	3.6	3.0
Were here prior to pioneer settlement	5.3	8.9	6.8
I believe elevated nitrate levels in local wells are…			
Not something that needs to be addressed	11.3	6.4	9.3
Something individual landowners can fix on their own	31.0	40.4	34.7
Something the community can address by itself	25.4	14.9	21.2
A situation where outside help is needed to fix	32.4	38.3	34.7

Table 11: Perceived importance of Sources of Nitrates in Local Groundwater

Possible Sources	Non-Wheat Farms	Wheat growers	Overall
	Percent reporting this as a 'moderate' or 'major' source		
Agricultural Fertilizers	**59.4**	**56.9**	**58.4**
Livestock wastes	**27.0**	**32.1**	**38.0**
Decomposing organic matter in soil	17.6	**28.5**	**22.3**
Rain and Snow	17.6	17.9	17.7
Household wastes	16.9	14.5	15.9
Wildlife	10.7	10.7	10.7
Bedrock	9.5	9.3	9.4

Table 12: Percent of respondents who agree or strongly agree with various statements.

Statement	Non-Wheat Farms	Wheat growers	Overall
I am concerned about the future of farming in this area	66.3	67.8	69.2
I would encourage my children to become farmers	37.2	54.2	44.5
People around here work well together to solve problems	60.3	57.7	59.1
I would be very sorry to leave this community	83.3	83.3	83.3
I feel at home in this community	89.8	84.8	87.6
My children cannot afford to take over this farm	45.9	29.9	39.0
I am concerned that water quality regulations will hurt my farm	34.9	62.8	46.7
Minor environmental issues are often blown out of proportion	74.3	83.1	78.1
I want to protect local water quality for future generations	89.8	89.8	89.7
There are too many environmental regulations on farms	65.4	64.4	64.9
I would quit farming if I could make more money doing something else	7.7	8.6	8.0
I am always looking for ways to improve my farm	88.3	96.7	91.9
I am reluctant to change the way I do things until I see them working for people around me	33.3	27.1	30.7
I believe that management changes made on individual farms would be able to reduce nitrate levels in the Judith River Watershed	54.6	44.1	50.0
I believe the current quality of scientific knowledge about nitrate issues in this area is strong	26.0	38.0	31.1
I believe that past scientific research on nitrate issues in this area has been done objectively	22.1	27.1	24.3
I believe that future scientific research on nitrate issues in this area could be done objectively	53.3	52.7	53.0

Table 13: Other Characteristics of Respondents

Characteristic		Non-Wheat Farms	Wheat growers	Overall
Age				
	Under 45	12.5	11.9	12.2
	45 to 54	26.2	32.2	28.8
	55 to 64	33.8	32.2	33.1
	65 to 74	20.0	18.6	19.4
	75 and over	7.5	5.1	6.5
Gender				
	Male	85.2	89.8	87.1
	Female	14.8	10.2	12.9
Role in Operation				
	Primary operator, joint operator or partner	88.9	93.2	90.7
	Spouse of key decision-maker	4.9	6.8	5.7
	Hired manager	1.2	0.0	0.7
	Other	4.9	0.0	2.9
Years Farming				
	Under 10 years	13.8	8.6	11.6
	10 to 19 years	11.2	12.1	11.6
	20 to 29 years	18.8	17.2	18.1
	Over 30 years	56.2	62.1	58.7
	Has school aged kids at home	30.9	28.8	30.0
Dependence on Farm Income				
	All of household income from farming	29.5	41.7	34.8
	More than half household income from farming	35.9	50.0	42.0
	Most household income from off-farm sources	34.6	8.3	23.2
Years Expect to Continue Farming				
	Unable to continue much longer / 1 to 2 years	5.2	5.1	5.1
	3 to 5 years	16.9	6.8	12.5
	6 to 10 years	13.0	20.3	16.2
	Indefinitely - sufficient farm returns	39.0	59.3	47.8
	Indefinitely - sufficient off-farm income	26.0	8.5	18.4