

# Winter Rye Best Management Practices to Reduce Loads of Sediment and Nutrients to Minnesota Surface Waters

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## Background

Surface runoff from agricultural fields is potentially harmful to our environment because of excessive loads of sediment and nutrients. Industrialized agriculture has provided food for the world, but has also created unintended water quality problems. Excessive nutrient contamination in the Gulf of Mexico has created a zone of hypoxia where dissolved oxygen levels are too low to support aquatic life. The Upper Midwest agriculture is mostly comprised of corn and soybeans and a large amount of the nitrogen (52%) reaching the Gulf of Mexico is a result of this cropping rotation (Alexander, 2008). In addition, up to 50% of applied synthetic fertilizer on Midwestern soils is lost every year due to rainfall and surface runoff (Tonitto, 2006). However, adding cover crops to an agricultural rotation provides soil cover and retention of nutrients. Various studies have shown that a winter rye cover crop can reduce nitrate leaching by 70% (Tonitto, 2006; Ball Coelho, 2005; Staver and Brinsfield, 1998). However, the use of cover crops in the United States Corn Belt is not widely accepted nor implemented. A survey where 3,500 farmers were asked to provide information on cover crop use showed that only 11% of farmers in the Upper Midwest have used cover crops in the last five years (Singer, 2007).

This study will develop Best Management Practices (BMPs) for beef and dairy producers that will make cover crops economically viable. Winter rye offers great potential for environmental benefits on land where corn silage or stover is removed to feed livestock. If the winter rye is established early enough, it can be grazed or harvested as forage in the spring before a cash crop is planted. Two locations in southern Minnesota have been selected for monitoring surface runoff and developing viable cover cropping BMPs. Each location consists of a paired watershed design where one watershed is the control (conventional practice) and the other is the treatment (winter rye following corn harvest). The first location will have winter rye aerially seeded into standing corn grain with spring grazing of the winter rye. The second location will have drilling of winter rye following corn silage harvest with winter rye harvested as forage in the spring prior to soybean planting. This study will encompass two full growing seasons from 2009 to 2011. Additional small plot experiments with the use of a rainfall simulator to evaluate surface runoff differences between conventional practices and cover crop BMPs.

## Our Goals

1. Develop viable winter rye BMPs for beef and dairy producers in Minnesota who harvest corn silage or bale corn stover
2. Quantify the reduction in sediment and nutrient loads in surface runoff from winter rye BMPs relative to conventional production practices

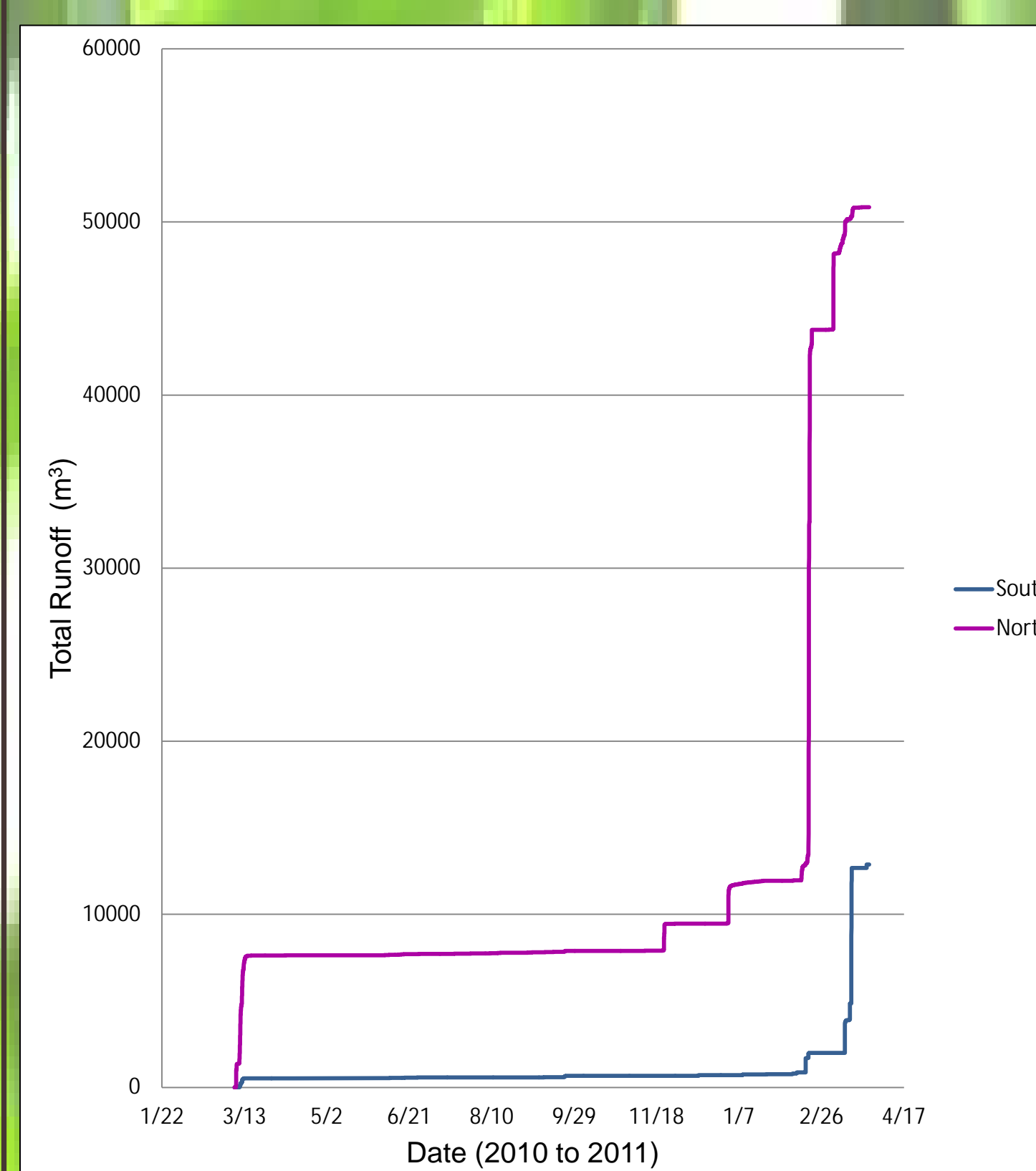
## Methods

- Continuous surface runoff monitoring using ISCO 4230 Bubbler Flow Meter and 3700 Portable Sampler (water samples analyzed for NH<sub>4</sub>-N, NO<sub>3</sub>-N, Mehlich III P, and TSS) at two Paired Watersheds at Plainview and Lewiston, MN that are evaluating surface runoff from corn grain, corn silage and winter rye
- Rainfall Simulations evaluating surface runoff quantity and quality for winter rye (grazed and harvested) vs. bare soil

## Watershed Scale

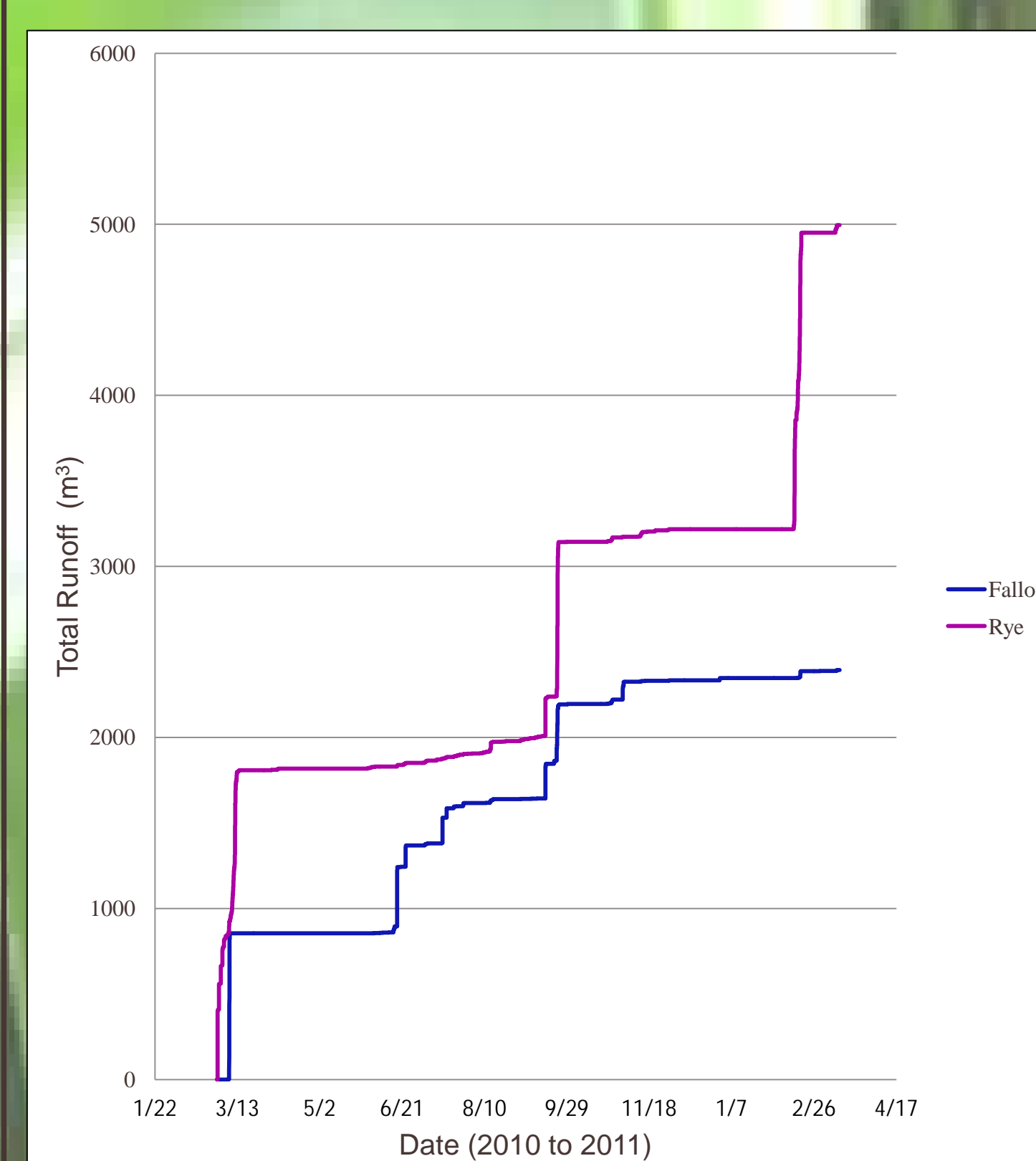
### Plainview, MN

- Two years of corn grain followed by soybeans
- Winter rye was aerially seeded into standing corn grain using a helicopter in fall 2010
- Control watershed is 14 acres and treatment watershed is 2.5 acres



### Lewiston, MN

- Two years of corn silage followed by soybeans
- Winter rye was drilled following corn silage harvest in 2009 and 2010
- Control watershed is 14 acres and treatment watershed is 3.5 acres.



## Preliminary Findings

### Plainview, MN

- First year observations provide background information on watersheds
- As may be expected, the rate and volume of runoff has been higher for the larger watershed, but the general runoff characteristics are similar between watersheds which will aid in data interpretation after treatment imposition
- The soil parameters for the two watersheds were similar which suggests that these watersheds behave the same

### Lewiston, MN

- Different watershed sizes as well as different management practices likely resulted in differences in rate of runoff and cumulative runoff
- Soil NO<sub>3</sub>-N depletion was observed in rye treatments at both the watershed and plot scale
- Soil NH<sub>4</sub>-N concentration were generally low relative to soil NO<sub>3</sub>-N, and no treatment effects were observed
- No differences in Mehlich III P were observed suggesting that any benefit gained by the rye will be because of reduced sediment (and therefore P) transport in the rye treatments, and not because of P uptake by the rye
- The rainfall simulations conducted resulted in the rye treatments having little to no runoff compared to the fallow treatments. The volume and rate of runoff is yet to be determined
- Rye yield was 0.11 tons/acre in fall 2009 and 2.8 tons/acre in spring 2010.

### More Information

For more information call or email Adam Herges at 612-625-1798 or [herge010@umn.edu](mailto:herge010@umn.edu).

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