Research Update: July 2015

Judith River Watershed Nitrogen Project

Newsletter #3: How do alternative management practices affect nitrate leaching and net profit?

This is the third newsletter in a series designed to provide residents of Judith Basin and Fergus Counties with information about what we've learned from working with local farmers on this project. Previous newsletters included results from 2013 studies that documented advantages of replacing fallow with pea and described the process and timing of nitrate leaching. This newsletter shows the effects of alternative management practices on both nitrate leaching and net revenue for both study years. We hope this information can help farmers develop management practices that will put more nitrogen into their crops and less into groundwater, while protecting their bottom line.[1]

1. Replacing fallow with pea or another crop can decrease leaching and increase net revenue.
2. The benefits of fallow replacement vary based on market conditions, precipitation patterns, and the ability of the crop to use available soil moisture and nitrogen.

Alternative management practices

Numerous practices have potential to decrease nitrate leaching. Our advisory groups selected three practices for testing on farmers' fields in the Judith River Watershed over the last three years: growing field pea in place of fallow, splitting nitrogen applications, and using slow release fertilizers. Nitrate leaching was estimated using a budget approach (which accounts for nitrogen inputs, outputs, and

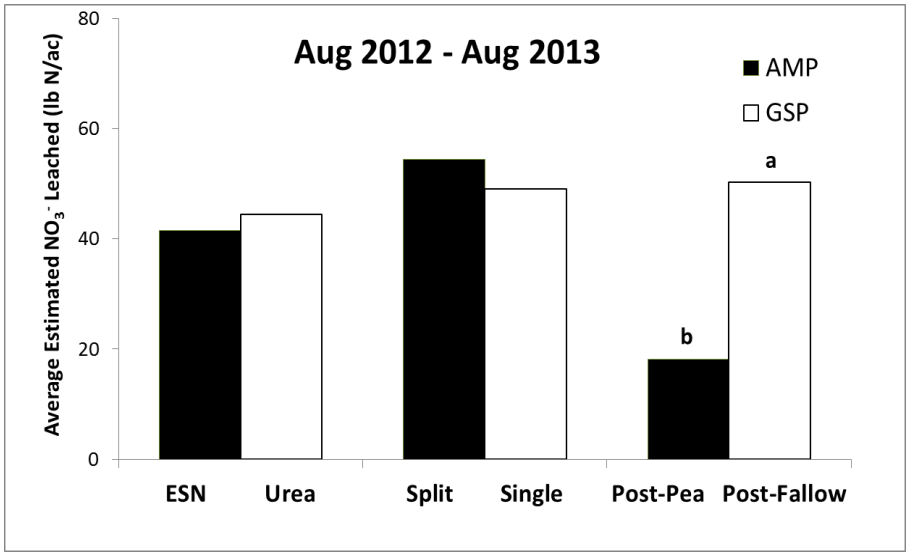

Figure 1. Estimated amount of nitrate leached from alternative management practices (AMP) compared to grower standard practices (GSP) during study in 2012-13. AMPs include slow release N (ESN®), split application, and pea as a replacement to fallow. Different letters indicate at least a 95% chance that averages are different between AMP and GSP.

[1] Copies of newsletters and other Judith River Watershed Nitrogen project information can be found at: waterquality.montana.edu.

changes in soil nitrate). Net revenue was calculated with an 'enterprise budget' that includes gross revenue minus crop production expenses.

Nitrate leaching amounts

In the first crop year of the study (Aug 2012- Aug 2013), the two alternative fertilizer practices (splitting nitrogen fertilizer into two applications or using a slow release form of urea applied with winter wheat seed) did not significantly affect the estimated rates of nitrate leaching (Figure 1). Conversely, the estimated rate of nitrate leaching was approximately 32 lb N/acre less after fields were planted to spring pea compared to those in a normal summer fallow rotation. Even though a pea crop 'fixes' nitrogen from the atmosphere, it also takes up soil nitrate and water, therefore reducing the potential for nitrate leaching.

In the second year of the study (Aug 2013-Aug 2014), none of the three alternative management practices significantly decreased nitrate leaching (data not shown). The difference in years was likely due to precipitation: Fall to early spring was much drier in 2012/13 than 2013/14, minimizing the amount of nitrogen released from the pea treatment fields and allowing the pea treatment soils to soak up more of the rain that finally started in mid-May.

Net Revenue

Net revenue was not significantly different between alternative and standard practices in the first year of the study (data not shown), but net revenue was about $40/acre higher for the combined pea-winter wheat treatment than the comparable fallow-winter wheat fields in the second year of the study (Figure 2). Again, rainfall differences between years likely caused these different results; much higher September rainfall in 2013 made for better winter wheat seeding conditions and increased soil water and nitrate for the following winter wheat after pea.

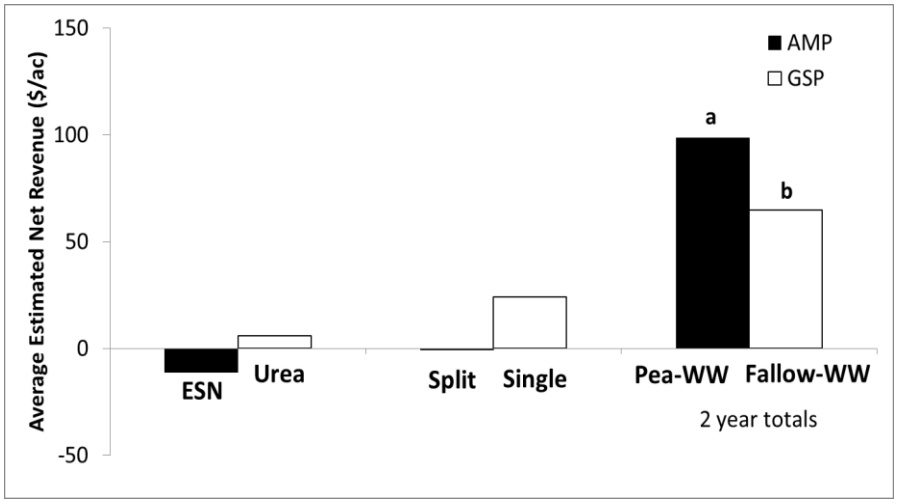

Figure 2. Average net revenue for each alternative management practice (AMP) compared to the grower standard practice (GSP). There's at least a 90% chance that pea-winter wheat (WW) produced higher net revenue than fallow-winter wheat in 2013-2014. There were no net revenue differences for spring wheat between fertilizer AMPs and GSPs in 2014.

Our study shows that different water years matter a great deal to outcomes from a given cropping system, but in the end, pea in place of fallow held most potential for reduced nitrate leaching and increased revenue.