TILLAGE, MANURE, AND WINTER RUNOFF*

Melanie Stock[1], Francisco Arriaga[2], Peter Vadas[3], Laura Ward-Good[4], and KG Karthikeyan[5]

Introduction

Wintertime land-applications of manure are a common practice because of the high cost of manure storage (Srinivasan et al., 2006). However, the presence of frozen soil and snow creates challenges for on-farm nutrient retention, as up to 75% of annual runoff can occur during thaws (Good et al., 2012). Therefore, we 1) tested practical management techniques that may reduce runoff on fields receiving winter applications of liquid dairy manure, and 2) used a soil physics approach to identify weather and soil properties that control infiltration, runoff, and nutrient losses during thaws.

Methods

A 2-year (2015-2017) field study was conducted at the UW Arlington Agricultural Research Station in Arlington, WI. A total of 18 plots (15-ft by 50-ft each) were established on a 6% slope in a continuous corn for silage cropping system. Management treatments included conventional fall tillage (chisel plow) versus no-tillage, and manure application timing (unmanured controls, early December, and late January applications). Treatment combinations were replicated three times. The manure application rate was 4,000 gal/acre. A flume was used to divert runoff at the bottom edge of each plot and collected using a gravity bucket system. Samples were collected after each runoff event.

Results and Discussion

Plots with no-tillage were twice as likely to produce runoff compared to plots with tillage during the frozen seasons. During the 2015-16 winter season, there was more runoff with no-tillage than fall chiseling (Figure 1). A similar pattern was observed during the 2016-17 winter season, but differences between tillage practices were lower.

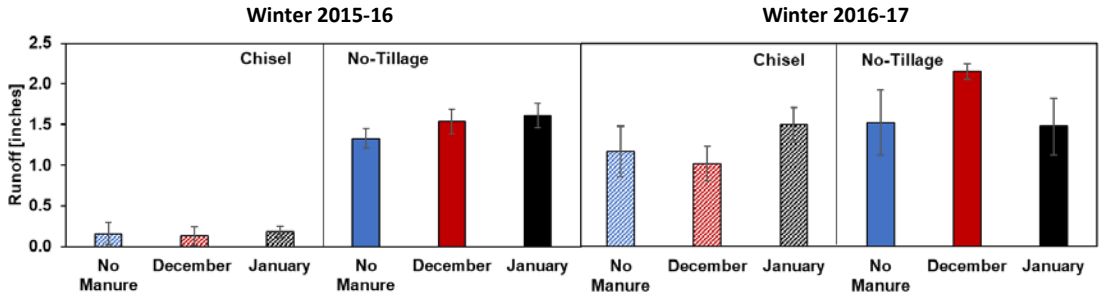

Figure 1. Total runoff amounts during the winter seasons of 2015-16 and 2016-17 for two tillage managements (fall chisel and no-tillage), and three liquid dairy manure application timings (no manure control, December, and January).

Phosphorus losses followed a similar pattern to runoff amount, where greater losses were observed with no-tillage (Figure 2). Seasonal phosphorus losses ranged from 0.0 to 0.3 lb/ac

under tillage and 0.1 to 3.3 lb/ac under no-tillage. Similarly, seasonal nitrogen losses ranged 0.5 to 2.7 lb/ac under tillage and 0.7 to 25.2 lb/ac under no-tillage.

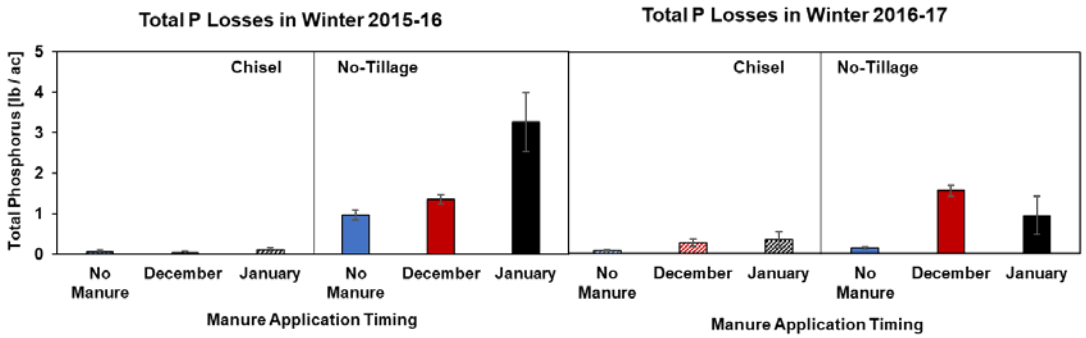

Figure 2. Total phosphorus losses during the winter seasons of 2015-16 and 2016-17 for two tillage managements (fall chisel and no-tillage), and three liquid dairy manure application timings (no manure control, December, and January).

Fall chisel tillage created depressions on the soil surface that collected meltwater, which increased the time water had to infiltrate into the soil. Manure application increased sunlight absorption, which accelerated snowmelt. This field study provides additional understanding of winter runoff processes and evaluates nutrient retention.

References

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[1] PhD Candidate, Dept. of Soil Science, Univ. of Wisconsin-Madison, 1525 Observatory Dr., Madison, WI 53706; [2]Assistant Professor and Extension Specialist, Dept. of Soil Science, Univ. of Wisconsin-Madison, 1525 Observatory Dr., Madison, WI 53706; [3]Research Soil Scientist, USDA-ARS Dairy Forage Research Center, 1925 Linden Dr., Madison, WI 53706; [4]Senior Scientist, Dept. of Soil Science, Univ. of Wisconsin-Madison, 1525 Observatory Dr., Madison, WI 53706; [5]Professor, Dept. of Biological Systems Engineering, Univ. of Wisconsin-Madison, 460 Henry Mall, Madison, WI 53706.

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