Stream Pesticide Loss

FIELD TO STREAM PARTNERSHIP

The Root River Field to Stream Partnership (RRFSP) is a multi-organizational effort to evaluate agricultural practices and water quality at multiple scales and landscape settings. The strategic selection of these study watersheds allows the findings to be applied to similar areas across southeastern Minnesota.

PESTICIDE PROJECT

In 2012, the Minnesota Department of Agriculture (MDA) began testing for up to 51 different pesticide chemicals at the three RRFSP stream outlets. Samples were analyzed by the MDA Laboratory. These data were paired with surveyed pesticide application records. This handout summarizes pesticide results from eight years; 2012-2019.

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DEPARTMENT OF AGRICULTURE

CLEAN WATER LAND & LEGACY AMENDMENT

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PESTICIDE DETECTIONS

Crystal Creek, one of the three small streams monitored during this study.

- **Pesticides were detected in all three watersheds every year**, with one exception. In 2017, pesticides were not detected above measurable levels in Crystal Creek.
- **11** of 51 pesticide active ingredients (AI) or pesticide AI degradates analyzed were detected in the eight years of monitoring. **Acetochlor** (Harness, Resicore, SureStart II, Warrant), **atrazine** (Atrazine 4L, Acuron, Lumax) and **metolachlor** (Acuron Flexi, Dual II Magnum, Halex GT) were detected most often.
  - Active ingredients are the chemicals in pesticides that kill, control, or repel pests.
- **Herbicides** were the most widely used type of pesticides and comprised **greater than 99%** of pesticide detections.
- **28 samples** out of 656 collected over eight years had concentrations that were above an aquatic life water quality reference value (benchmark or standard). Most of these concentrations lasted 21 hours or less.
  - To exceed a Minnesota chronic reference value, the concentration must be elevated for a specified duration of time, generally **96 hours** (4 days).
- Overall, **one percent or less** of the total active ingredient pesticides surveyed as being applied in the study watersheds were detected in the water quality samples collected from the three streams.

HIGH RISK PERIODS

- **Pesticide loss was greatest in June (75%),** followed by May (14%) and July (5%). This generally coincided with the time when most herbicides were being applied, crops were not fully established (less water uptake and more bare soil) and there were high intensity rainfall events.
- **88%** of pesticide loading occurred during **storm flow** conditions (periods of elevated flow due to rainfall).
- The highest pesticide loading occurred when the monthly rainfall was 17% to 167% **above** the 30-year monthly normal precipitation (1991-2020).
- **Most pesticide loss occurred in only a few individual years or months** (Figure 1). 2013 accounted for 67% of the Crystal Creek load and 85% of the Bridge Creek load when compared to the eight-year total pesticide loads. For the Headwaters, 2019 was 44% of the eight-year pesticide load.

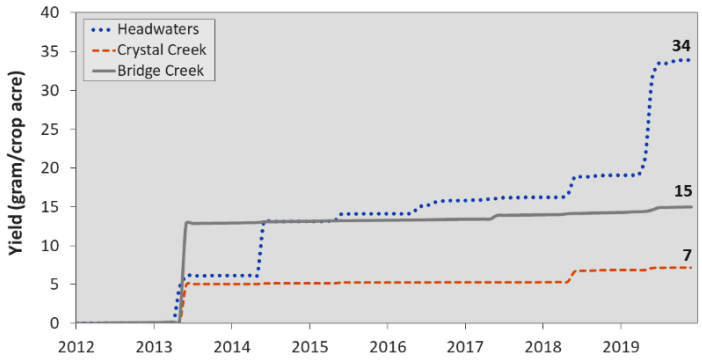

Figure 1. 2012-2019 cumulative pesticide loss from study watersheds. Only a few years or months accounted for most of the eight-year pesticide loss.

KEY PRACTICES TO REDUCE PESTICIDE LOSS

Over 95% of the samples analyzed during the study were not elevated above a water quality reference value. This reflects good conservation stewardship. However, there were instances when concentrations could pose an elevated risk to the environment. Most of these elevated concentrations occurred during high runoff risk periods in May and June with most transport likely associated with overland runoff. With an increasing trend towards more precipitation and number of days with heavy rainfall, it may not always be possible to avoid pesticide applications during these high-risk time periods.

For this reason, consider adding **additional layers of protection** to reduce the off-site movement of pesticides. These practices (layers) can also help reduce runoff, sediment and nutrient loss while providing drift setbacks.

Additional layers of protection:

- ✓ Use the **Stream Power Index (SPI)** tool to identify where runoff (flow) concentrates on your farm (Figure 2). Use the **Runoff Risk Advisory Forecast** tool to avoid time periods when runoff is likely to occur. Scan the QR codes below. Note: the SPI mapping tool is currently available for the Root River Watershed.
  - Through recent efforts by the Root River Field to Stream Partnership, over **70%** of the small watershed farmers have targeted additional conservation practices on their farms using the SPI tool.
- ✓ Where possible, avoid pesticide applications in **concentrated flow areas**. Prioritize those areas that are near or flow directly to streams (Figure 3).
- ✓ Install **grassed waterways** in concentrated flow areas and **grass field borders** to reduce pesticide transport (Figure 4 and Figure 5).

Other key Best Management Practices (BMPs):

- ✓ Follow application setbacks, both ground and aerial applied.
- ✓ Keep well organized, field-specific pesticide application records.
- ✓ Use integrated pesticide management practices rather than prophylactic or "insurance" applications.

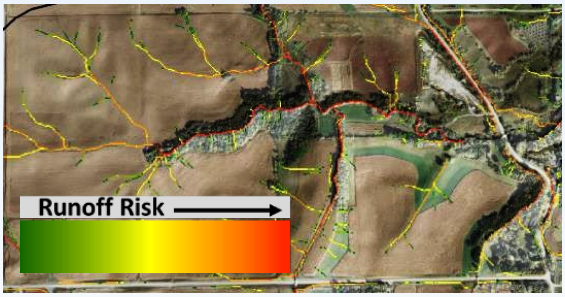

Figure 2. *High runoff risk/concentrated flow areas identified using the stream power index tool.*

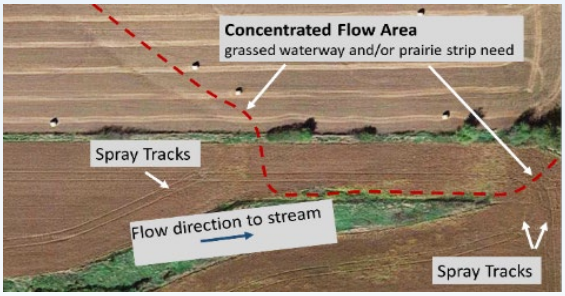

Figure 3. *Avoid pesticide applications in concentrated flow areas by installing grassed waterways.*

Figure 4*. Contour hay strips and grassed waterways in Bridge Creek Watershed.*

Figure 5. *Edge of field CRP prairie strip (60' wide) in the Headwaters Watershed.*

KEY TAKEAWAY

This study provided a unique opportunity for the collection of pesticide use and water quality data that enhances our understanding of pesticide use and transport in three small watersheds of the Root River Watershed. The results indicated that pesticide losses were generally low (less than 1% of applied product) and concentrations rarely exceeded established reference values. Pesticide losses were highly seasonal with most pesticide transport to streams occurring during the month of June, following herbicide applications to fields. The results further reinforce the need to minimize runoff from agricultural lands during this critical time.

Scan the QR code for the full **Root River Field to Stream Partnership Pesticide Project** report.

Scan the QR code for the **Stream Power Index** tool.

Scan the QR code for the **Runoff Risk Advisory Forecast** tool.