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Crop Production Systems Research Unit

FACT SHEET NO. 2010-02

Rye Cover Crop Reduces Water, Sediment, and Pre-emergent Herbicide Loss in Acreage Requiring Tillage to Control Glyphosate-Resistant Weeds

Glyphosate-resistant crops (GRCs) facilitated the adoption of no-tillage cropping systems. No-tillage, that is, omitting all tilling, disking, or harrowing operations, promotes crop residue accumulation on the soil surface. Crop residues protect the soil surface from rainfall impact, impede surface crust formation, and reduce soil erosion. No-tillage also improves soil structure, often enhances water infiltration, and purportedly reduces pesticide runoff. Since GRCs lead to the widespread implementation of no-tillage, GRCs are accredited with improving U.S. soil and water quality.

Unfortunately, glyphosate-resistant weeds threaten the environmental gains afforded by GRCs. The number of glyphosate-resistant weeds and the acreage they infest are increasing. The current recommendation for the control of glyphosate-resistant weed biotypes in GRCs is integrated weed management, that is, tillage coupled with the application of pre- and post-emergence herbicides. This recommendation could reduce no-tillage acreage across the U.S. For example, in Tennessee no-tillage cotton decreased four-fold from 2005 to 2008 because tillage was needed to control glyphosate-resistant horseweed. Thus, if environmental gains afforded by GRCs are to be maintained, then a viable alternative to strict no-tillage is required to combat glyphosate resistant weeds (Figure 1).

Figure 1. Water, sediment, and pre-emergent herbicide loss from cotton established under rye cover crops were less than or equal to that of cotton established in no-tillage systems at Stoneville, MS.

Research Objectives

These observations lead USDA-ARS scientists in Stoneville, MS to evaluate water, sediment, and pre-emergent herbicide loss in glyphosate-resistant cotton when planted into reduced tillage and no-tillage systems with or without a rye cover crop.

Water Loss

Cumulative water loss at study termination decreased in the order of reduced tillage no cover > no-tillage no cover > no-tillage rye cover = rye (Figure 2). Thus, regardless of tillage practice, rye cover reduced water loss (Figure 2). Our results indicate that if tillage is required to control glyphosate-resistant weed biotypes, then a fall rye cover crop can reduce runoff losses in the spring to levels less than those observed in traditional no-tillage systems.

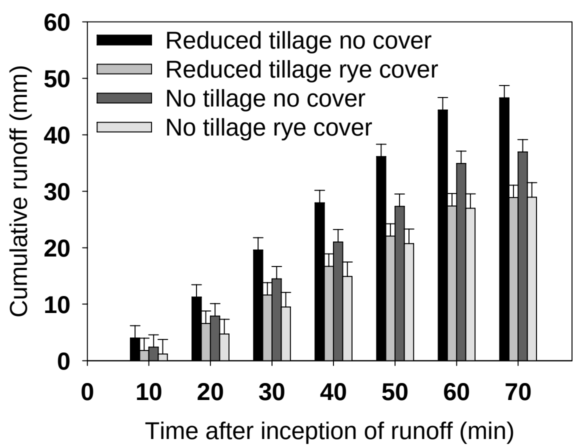

Figure 2. Cumulative runoff from a simulated rainfall experiment conducted in Stoneville, MS.

Sediment Loss

Regardless of tillage, establishing a rye cover reduced cumulative sediment loss in the spring (Figure 3). Furthermore, erosion in the spring was higher from no-tillage plots than from systems that received a fall tillage operation but were subsequently established in rye cover. This indicates that acreage infested with glyphosate-resistant weed biotypes could be tilled in the fall, planted with a rye cover crop , and have lower sediment losses in the spring than traditional no-tillage systems.

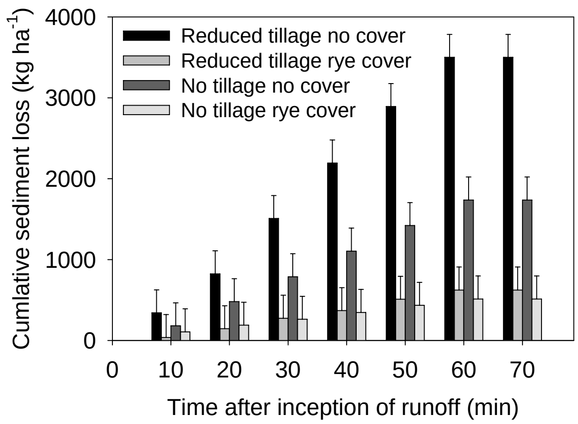

Figure 3. Cumulative sediment loss from cotton plots established in Stoneville, MS.

Pre-emergent Herbicide Loss

Independent of tillage, metolachlor loss was lower in cotton systems established in rye cover crops (Figure 4). Conversely, neither cover crop nor tillage affected fluometuron loss (Data not shown). Our study indicates, therefore, that establishing a fall rye cover crop can reduce or maintain herbicide loss to levels equivalent to that observed under traditional no-tillage.

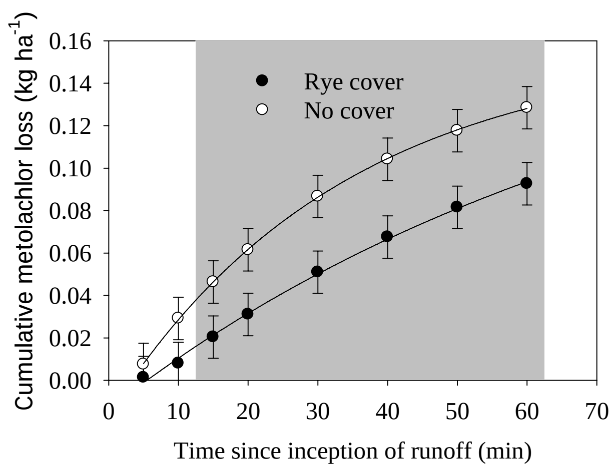

Figure 4. Cumulative metolachlor loss from cotton plots in Stoneville, MS.

Conclusions

When tillage is required to control glyphosate-resistant weeds, establishing a fall rye cover crop can reduce or maintain water, sediment, and herbicide loss in the spring to levels equivalent to that of traditional no-tillage systems. Find out more about this USDA-ARS joint research project at our web site: www.ars.usda.gov/msa/jwdsrc/cpsru.