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DECOMPOSITION OF WHEAT AND THISTLE RESIDUE

Clyde L. Douglas, Jr., Stephan L. Albrecht, Tami R. Johlke,
Katherine W. Skirvin, and Amy A. Baker

Introduction

Winter wheat (*Triticum aestivum* L.) grain yields are often low in the traditional wheat summer-fallow areas of agronomic zones 4 and 5 (Douglas et al., 1990). Sometimes there is insufficient residue left after seeding to control wind and water erosion and to meet the conservation tillage requirement of 30 percent residue cover. Weeds are serious problems in these two zones, and occasionally there is more Russian thistle (*Salsola iberica* Sennen) (Whitson et al., 1991) residue than wheat residue (Schillinger et al., 1999). Russian thistle residue can provide cover that will contribute to erosion control. However, we need to know the decomposition rate of Russian thistle to be able to estimate the amount of residue left after a summer-fallow season.

The objectives of this project were to evaluate the effect of winter wheat straw size on decomposition rate and to compare decomposition rates of winter wheat and Russian thistle left on the soil surface.

Materials and Methods

Winter wheat and Russian thistle stems were put into fiberglass cloth bags. Bags were placed on the surface of a Walla Walla silt loam (coarse-silty, mixed, mesic Typic Haploxeroll) soil located at the Columbia Plateau Conservation Research Center near Pendleton, OR. Treatments, replicated four times, were wheat straw length (one, two, and three inches), wheat straw split lengthwise, and thistle straw. Winter wheat residue was placed on the soil surface on October 3, 1994, and samples were retrieved on December 21, 1994, March 27, 1995, and July 10, 1995. Russian thistle residue was placed on the soil surface on November 17, 1994, and samples were retrieved on January 26, March 27, and June 21, 1995. Residue samples were taken from bags, washed carefully by hand to remove all soil, dried, and weighed to evaluate mass loss with time. Total precipitation from September 1994 through July 1995 was 4.27 inches greater than the 67-year average (Anonymous, 1996b). Total cumulative degree days for this same period was approximately 50 more than the 65-year average (Anonymous, 1996a).

Results and Discussion

Decomposition rate was independent of wheat straw length ($p \preceq 0.10$) (Figure 1).

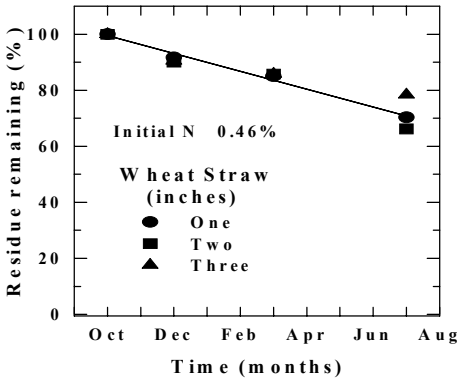

Figure 1 Decomposition of wheat straw as a function of straw length. 1994. Columbia Plateau Conservation Research Center.

Splitting wheat straws did not increase decomposition rate over not splitting straws (data not shown). Residue-decomposition rate can be increased by increasing the straw surface area available to the microorganisms that decompose the residue. Cutting residue into one-inch lengths did not increase the

surface area enough to change the decomposition rate.

Initial N content of Russian thistle residue was approximately the same as N content of wheat straw. Decomposition rates of thistle residue (0.07 g/d) and wheat residue (0.10 g/d) (Figure 2) were not significantly different ($p \preceq 0.10$). Russian thistle residue, left on the soil surface after wheat harvest, will decompose at approximately the same rate as wheat straw and be available the same length of time as wheat residue, to help control wind and water erosion.

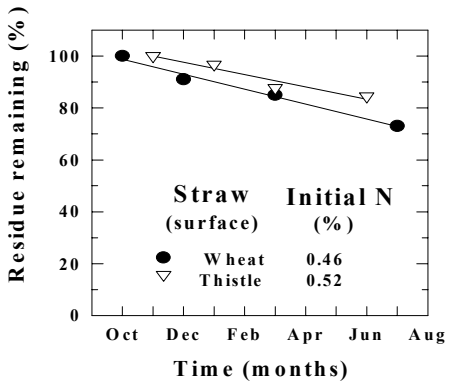

Figure 2. Decomposition of winter wheat and thistle straw. Columbia Plateau Conservation Research Center. Pendleton, OR

Average winter wheat yields and straw to grain ratios in zone 4 are 35 bu/acre and 1.69, and in zone 5, they are 50 bu/acre and 1.48, respectively (Douglas et al., 1999). Thus, residues (straw) left after harvest average 3550 (35 bu/acre × 60 lb/bu × 1.69 straw/grain ratio = 3550 lb/acre) to 4440 lb/acre across these two zones. Winter wheat residue decomposition (Figure 1), assuming no tillage, would leave approximately 2130 lb residue/acre [3550 lb residue/acre × 0.60 (estimated fraction decomposed by October) = 2130] in zone 4 and 2660 lb residue/acre in zone 5 at seeding time in October. This amount would correspond to greater than 50 percent surface cover (Renard et al., 1997). However, grain yields in some areas of zones 4 and 5 may be around 20 bu/acre. Twenty bu/acre × 1.69 (straw/grain ratio) would equal approximately 2030 lb residue/acre after harvest. If all residues were left on the soil surface, there would be only 1220 lb/acre of wheat straw on the surface at seeding the next fall.

When residue is buried by tillage, it is difficult to leave enough on the soil surface to help control erosion. As an example, consider a tillage system that is used in some dryland areas: chisel and sweep in the fall, sweep and fertilize in the spring, rodweed three times during the summer, and seed with a deep furrow drill in the fall (W.F. Schillinger, personal communication, 1999). Residue left on the soil surface as a result of this tillage system can be estimated from residue burial tables published by The Conservation Tillage Information Center (CTIC) (1992). Burial by tillage, plus loss from decomposition, would reduce the residue from 2030, 3550, and 4440 lb residue/acre left after harvest to an estimated 290, 510, and 630 lb residue/acre after fall seeding. Renard et al. (1997) indicates it takes approximately 550 lb wheat residue to equal 30 percent ground cover. Only the 50-bu/acre-wheat yield (4440 lb at harvest and 630 lb residue/acre at seeding) meets the 30 percent ground cover requirement.

If 2000 lb thistle residue/acre and 2030 lb wheat residue/acre were on the soil surface in the fall after wheat harvest, and if the same tillage sequence as above was used, there would be approximately 350 lb thistle and 290 lb wheat residue, a total of 640 lb residue/acre, left on the soil surface after seeding. This amount of residue would meet the 30 percent requirement and help control soil erosion by wind and/or water.

Conclusions

Straw length did not effect decomposition rate of winter wheat residue. Thistle residue decomposed similarly to winter wheat residue when left on the soil surface, and should be as effective as wheat residue in helping control wind and water erosion.

Acknowledgements

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