Decomposition of Clover and Wheat Residues under Different Tillage Systems on Severely Eroded Soil

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INTRODUCTION

Tillage methods that allow crop residues to remain on the soil surface in multiple cropping systems are becoming more widespread. Multiple crop canopies and residues protect Southern Piedmont lands from even moderate soil erosion during the vulnerable soil erosion period (April-August). Return of residues not only reduces soil erosion but increases water storage capacity and returns nutrients to the soil. The recent use of cool season legumes to supply residue cover of the surface and biologically fix N is even more important in conservation tillage systems. In view of a lack of information on crop residue decomposition in conservation tillage systems on eroded Southern Piedmont soils an investigation was initiated to determine rate of decomposition and N release from clover and wheat residues under minimurn tillage and conventional tillage systems.

MATERIALS AND METHODS

The investigation was conducted under natural conditions at the Southern Piedmont Conservation Research Center on severely eroded Cecil series (Typic Hapludults). Above ground portions of Coker 747 wheat (Tritrium aestivum L.) and Tibbee crimson clover (Trifolium incarnatum were harvested at or near maturity and dried. Grain was removed from the wheat. Crop residues of 25 g each of wheat and clover were placed in separate 0.25 mm mesh nylon bags (15x23 cm). Bags were placed in grain sorghum (Sorghum bicolor L.) plots on June 10, 1983 on a severely eroded (2.5-5.0 cm topsoil mixed-with subsoil) site under conventional tillage (monocrop, disked Fall and Spring and cultivated) and minimum tillage coulter) treatments.

The site was previously used for low management fescue and native grass and had one season of crimson clover grown in minimum tillage treatments. Grain sorghum was seeded May 17, 1983 at a rate of 400 kg ha^{-1} and was approximately 15 cm tall at initiation of study. All residue samples were placed between stalks of grain sorghum to prevent disturbance by implement traffic. Samples in minimum tillage treatments were seated in the residue to approximate natural conditions. Conventional tillage plots received 90 kg ha-1 N from NH_4N0_3 but minimum tillage plots were not fertilized with N. Weeds were controlled with a combination of Paraquat and Atrazine herbicides. Bags containing residues were retrieved at random at two week intervals. Samples were dried and N was analyzed by standard TKN methods.

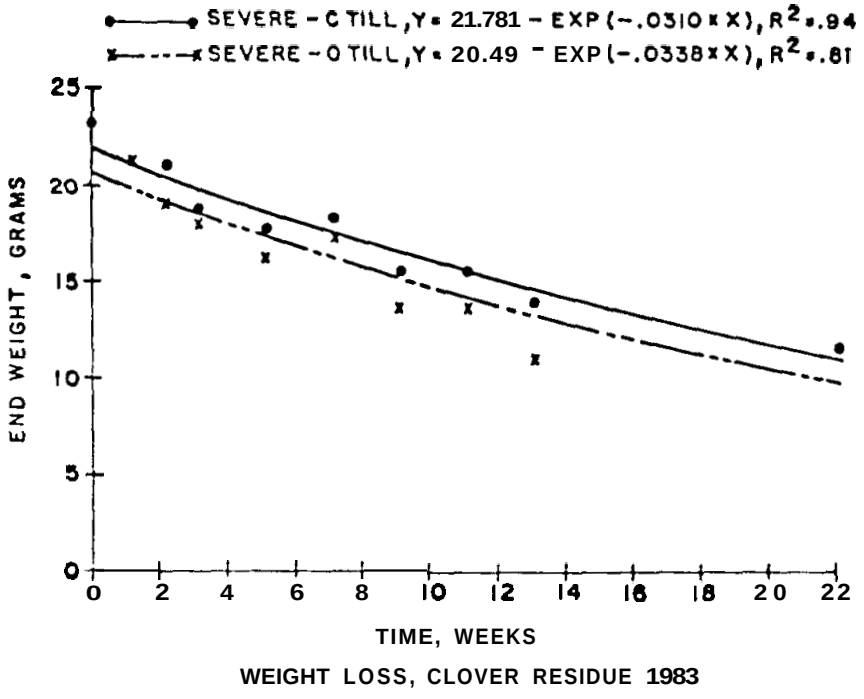
RESULTS

Dry weight and N loss of clover and wheat residues during 22 weeks of decomposition on eroded soils are presented in Figs. 1 and 2. The symbol "c" refers to conventional and "o" refers to minimum tillage as described in Material and Methods.

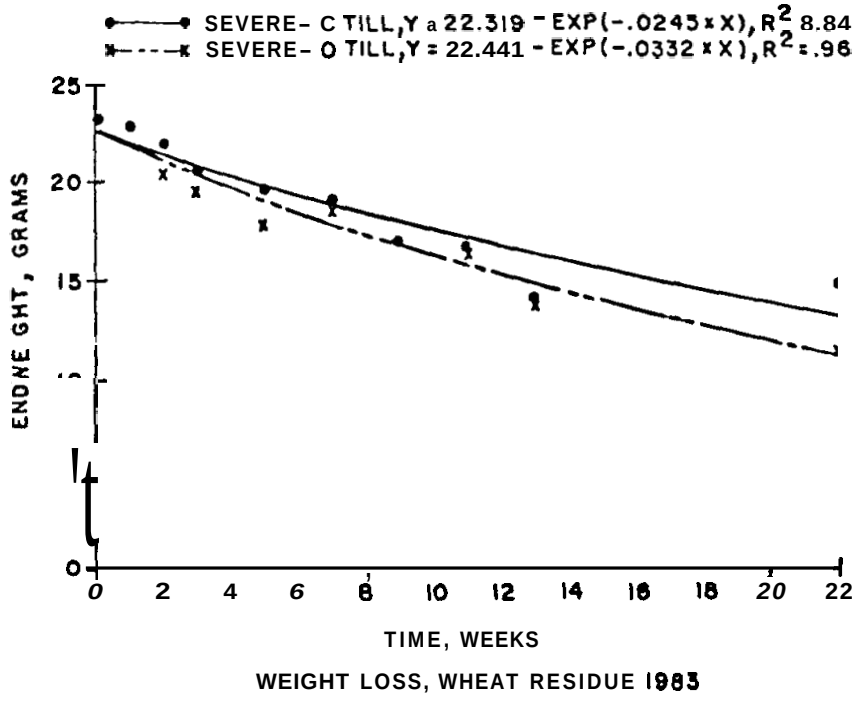
Weight loss of clover residue under conventional ("c") and minimum tillage ("o") systems decreased (R^2=0.94* and 0.81*, respectively) following application in early June (Fig. 1). There were no significant differences between rate of decomposition under conventional and minimum tillage. Similar results were obtained with wheat where conventional and minimum tillage systems resulted in R^2 values of 0.84* and 0.96*, respectively. Approximately 50% of each residue decomposed during the course of the grain sorghum growing season.

Loss of N from clover and wheat residues during the 22 week period of study is shown in Fig 2. A reduction of N occurred in conventional (R^2=0.88*) and minimum tillage (R^2=0.75*) systems although tillage systems were not significantly different. There was no effect of time or tillage system on loss of N from wheat residues.

Nitrogen losses in clover residues appear to be directly related to weight losses. The continuous release of N during summer months supplies most of the N requirement for non-irrigated grain sorghum. The use of a crimson clover and grain sorghum sequence in conservation tillage modes provides the potential to restore soil productivity on severely eroded Southern Piedmont lands.



WEIGHT LOSS, CLOVER RESIDUE 1983



WEIGHT LOSS, WHEAT RESIDUE 1983

Figure 1. Weight loss during decomposition of residues on severely eroded soils under different tillage systems.

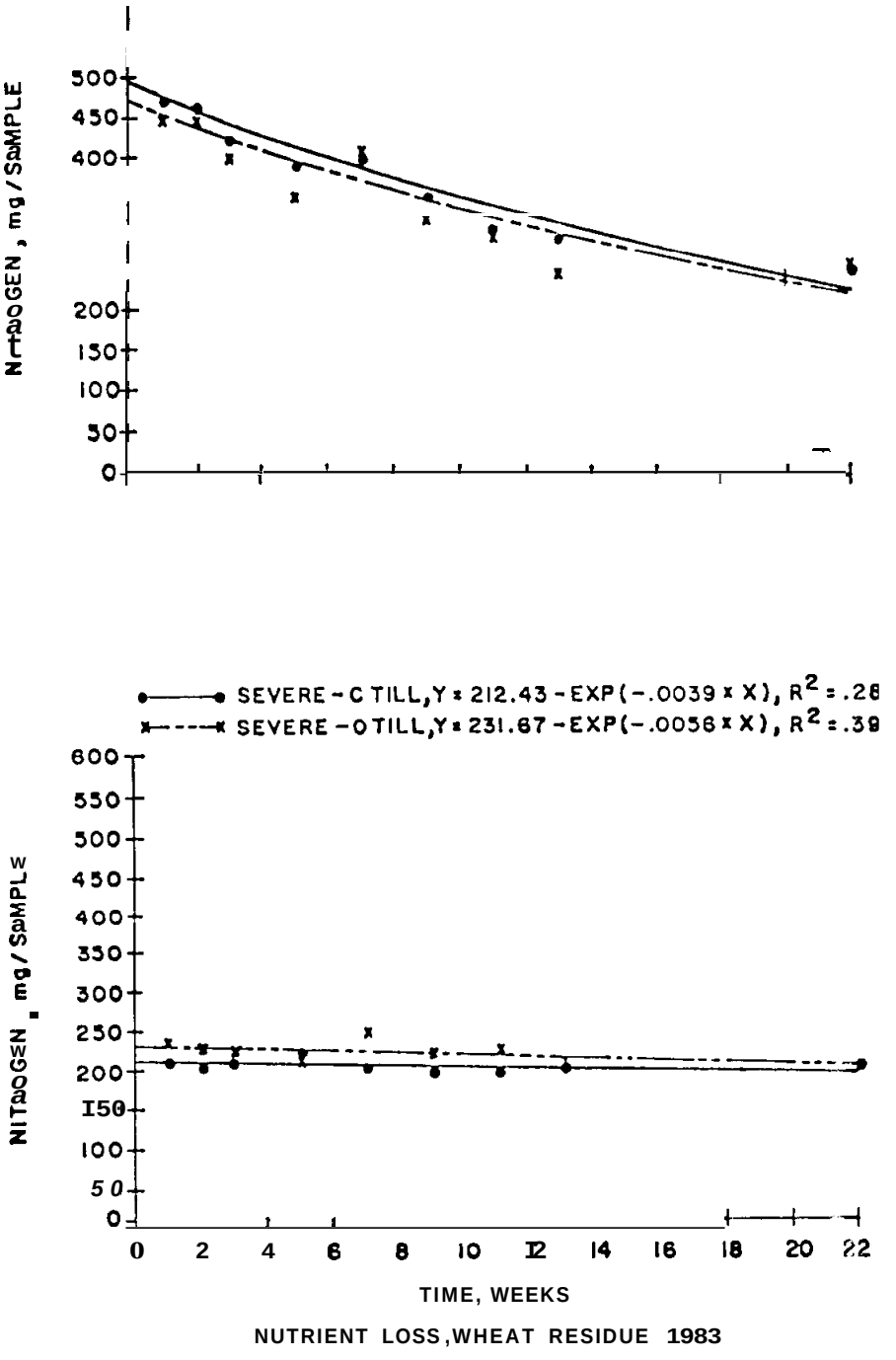


Figure 2. Nitrogen loss during decomposition of residues on severely eroded soils under different tillage systems.