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'D3R' A RESIDUE MANAGEMENT AID

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INTRODUCTION

With the current concerns for residue cover on fallow and cropped fields there is a need to be able to predict, with some accuracy, the amount of residue cover on a field at a particular time. Since both type and timing of natural decomposition and tillage practices influence the amount of residue left on the surface, the question of concern may be "how do my tillage practices change residue cover?"

The computer program D3, Degree Day Decomposition, was developed to implement a residue decomposition model (Douglas and Rickman, 1992). The primary purpose of the model was to estimate wheat residue decomposition, both on and below the surface, utilizing the concept of degree days (DD) as developed by Klepper, et al., 1982. The model required knowledge of initial nitrogen content of the residue, the amount of residue left in the field after harvest, and the number of cumulative DD determined from air temperature.

The program D3 has been updated (now called D3R) to estimate the amount of residue left in a field by the previous crop and compute the amount of residue left on the surface or buried by different tillage implements, while continually determining the amount of decomposition occurring. Tables, developed by CTIC (1992), are utilized by D3R to determine the amount of residue left on the soil surface after a tillage operation.

USE OF THE PROGRAM D3R

Daily temperature is a required input of D3R. The program accepts electronic data in columnar form in either Fahrenheit or Celsius. Precipitation data, if available, are used to determine when the soil is moist enough for decomposition to begin. Either actual yearly climatic data or historical average data may be used. A date when decomposition is expected to begin can be entered if precipitation data is not available. Initially, information about crop residue and planned tillage practices must be entered. This includes nitrogen content of the residue, yield or amount of residue left in the field after harvest, and date and type of all planned tillages.

The program displays on the screen, and saves to a file, the continuing decline in surface cover and buried residue from both tillage and decomposition. These data may be examined graphically, either by scientific graphing software or a spreadsheet program. Either metric or English units may be used for entering the starting information and either may be chosen for the output.

DISCUSSION

Figure 1 shows the models decomposition prediction compared to observed decomposition of a number of soft white winter wheat varieties, buried in an irrigated field, near Twin Falls, ID. Figure 2 shows the calculated residue decomposition, both on and below the soil surface, for dryland areas near Odessa, WA. Also note that in these two figures, decomposition can be plotted against either cumulative degree days or time in weeks or months. Figure 3 shows decomposition of corn residue left on the soil surface after three tillage

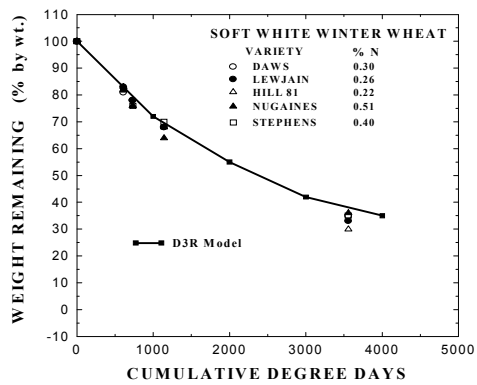

Figure 1. Decomposition of buried residues compared to the D3R model. DD calculated from 1983-84 air temperatures at Twin Falls, ID (Data from Smith and Peckenpaugh, 1992).

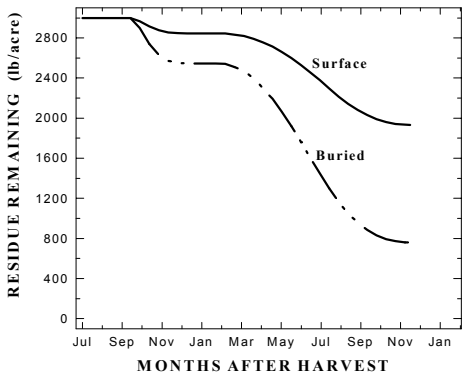

Figure 2. Decomposition of surface and buried residues near Odessa, WA. Data based on 30-yr. air temperatures.

operations near Columbia Missouri.

The effect of different shank spacing on a chisel plow is shown in Figure 4. More residue is left on the surface when chisel shanks are moved from 12 to 24 inches apart. Just one tillage early in the spring with the closer shank spacing decreased the amount of surface residue at time of seeding by 4 percent. This represents approximately 100 lbs of residue, which in some cases may be very important for obtaining adequate soil protection.

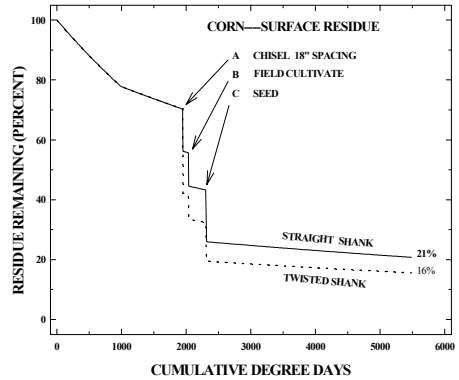

Figure 3. Effect of straight and twisted shank chisel points (Data from Broder and Wagner, 1988, Columbia, MO).

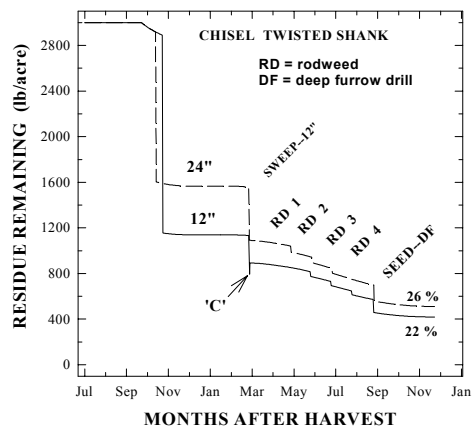

Figure 4. Effect of shank spacing on surface residue near Odessa WA. Data based on 30-yr. air temperatures.

The effect of rod weeding and sweep tillage is shown in Figure 4. The slight dip at 'C' indicates a small amount of residue is returned to the surface when a rod weeder is used immediately after sweep tillage.

The D3R program will also keep track of both surface and buried residues during a number of tillages as shown in Figure 5. Buried residues start at 0 and surface residues at 3000 lbs/acre on August 1 in this example.

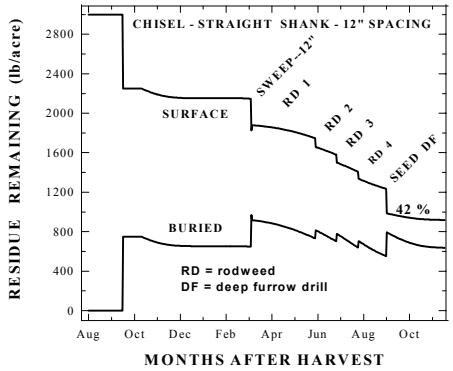

Figure 5. D3R estimation of residue left both on and below the soil surface with selected tillage operations plus decomposition. Data based on 30-yr air temperature at Odessa, WA.

Tillage with a straight shank chisel in mid-September results in approximately 800 lbs of residue being buried. The slight decrease in both surface and buried residues from mid-September until March is the result of over-winter decomposition. The remaining step changes are the result of selected tillage operations, such as a sweep and several rod-weeding operations, plus seeding. The gradual reductions in surface and buried residue from March through October is the result of decomposition.

CONCLUSIONS

The D3R program can compare a variety of tillage options for their effects on the amount of crop residue on the soil surface without actually performing the tillage. It is both an educational and planning tool. One can learn the consequences of decomposition and examine the incremental effects of tillage. The program is DOS based and can be run on any DOS (IBM compatible) computer.

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