Residues: A Problem or an Opportunity

Recent studies show why residues are the key to maximizing soil productivity (MSP).

Years ago, after harvest, there was barely enough residue left on the surface for erosion control. Residue from a 100-bu/A corn crop amounted only to about 2 tons of tops and 1.2 tons of roots, hardly enough to control erosion and certainly not enough to incorporate into the soil for possible soil quality improvement.

For the past 40 years, however, U.S. corn yields have been steadily rising. Concomitant with this steady rise has also been the production of more and more residue. Though such heavier accumulations of residue can and have caused tillage and weed control problems, properly handled, these residues can be a great asset to growers.

Today, with a 200-bu/A crop, which is commonplace, 4.7 tons of residue gives enough tops and roots for both erosion control and soil quality improvement. The higher the yield, the greater the opportunity to increase yield even more. Proper residue management can produce a soil with:

- higher organic matter
- lower bulk density
- higher water holding capacity
- higher water infiltration rate
- erosion control

But that's not all. As we shall see from a recent study, residues can increase nitrogen and phosphorus availability many years into the future.

Managing residue

Unfortunately, many farmers are not aware of the high value of corn residue. Many bale it for bedding or feed or even burn it, when they should be building soil quality with it.

Why is the residue so valuable?

Residue consists of leaves, husks, and stems on the surface, and roots in the ground. Such residue contains about 45 percent carbon. Organic matter contains 58 percent carbon and 5.3 percent nitrogen (N). It also contains 1.7 percent phosphorus (P_2O_5) and 0.7 percent sulfur (S). The carbon can be sequestered into organic matter in the soil under certain environmental conditions. This organic matter, which is eventually distributed deeply into the soil profile, can improve soil quality —essential for high yields.

As yields increase, residues (roots and tops) increase. As residues increase yields increase. It's like a snowball rolling downhill! It amounts to proper management of corn residues, making it possible to obtain yields significantly higher than the national average.

Documentation

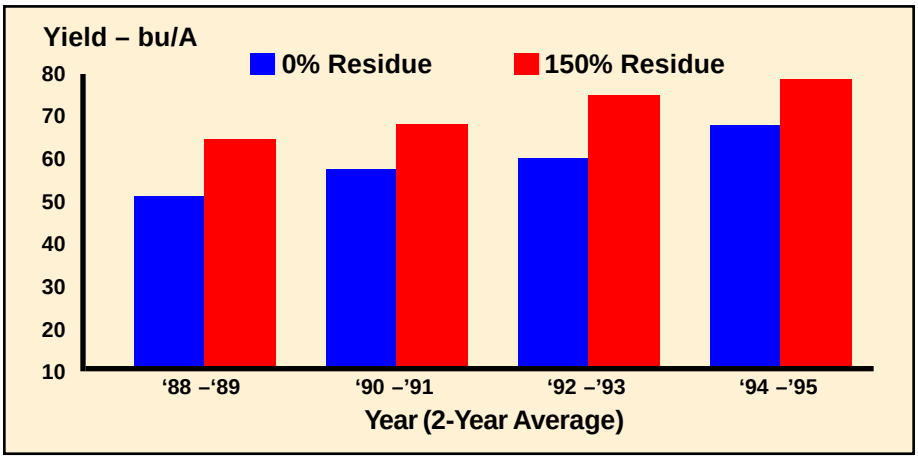
A recent study by Power, et al., in Nebraska shows that residue contributes more to soil properties than just organic matter. In these trials, residue was returned to the soil in variable amounts. Some plots were clean (0% residue), while others contained 50, 100, and 150 percent of the previous corn yield. The study continued for eight years (1978-1985).

The second part of the trial began in 1986. Continuous corn was grown on these plots and something amazing happened. For 10 years the plots with residue outyielded the plots with residue removed! In fact, yields (150% vs. 0% residue) were 16 percent better throughout the 10 years (Figure 1)! As reported in the study: "Results show that use of increased residues for 8

TABLE 1. Effect of corn residue on soil properties after applying 150% vs. 0% residue, J.F. Power, et al., 1997.

- Yields up 16% for ten years after application
- Estimated N availability up 13%
- Bray soil P up 21%
- Soil density down 22%
- Increased organic matter

FIGURE 1. Residual effect of corn residue applied from 1978 to '85 on corn yield in trials run from 1988 to '95, Power, et al., University of Nebraska.



years improved growth of the next 10 crops with no evidence of decline in this response with time. The results suggest that this crop growth response was probably caused by changes in soil properties and soil nutrient availability."

In Figure 1, 150 percent residue is compared with 0 percent residue. Note that only 54 lbs/A of nitrogen (N) was applied. This explains the low yields. At this low fertility level it was probably easier to measure the effect of the residue treatments made earlier. The difference in yields between treatments illustrates how corn residue can affect soil productivity for at least 10 years. As Power's report suggests: "This leads us to believe that the previous greater crop residue amounts improved some soil physical, chemical, or biological properties important to crop production."

Indeed, after soil samples were taken in 1992, there were changes in soil properties as clearly shown in Table 1.

Residues key

Sufficient documentation is making it apparent that the long-term benefits of proper residue management are improved soil quality and increased yields. Power's studies offer convincing evidence that corn residues play a key role in maximizing soil productivity (MSP). There's nothing mystical about MSP. It's a relatively simple program. Residues are chopped. Nutrients are applied. Finally, residues are incorporated by tillage equipment.

These Nebraska studies confirm that incorporated residues will contribute long-lasting improvements in soil quality—another step toward MSP.