Maximizing Soil Productivity

Improving soil quality points way to higher yields, higher profits, and a cleaner environment

Editor's note: This is the second in a series dealing with soil quality improvement for higher yields and profits.

Records set by some top corn producers, producing yields well in excess of 300 bu/A, have sent a strong message to other growers that doubling their yields (without buying more land) is more than a dream.

In the spring issue of the Fluid Journal, we discussed how the late Herman Warsaw of Saybrook, Illinois, indeed doubled his corn yields to a maximum of 377 bu/A with a relatively simple long-term maximum soil productivity (MSP) agronomic program. In this issue we'll examine a similar MSP program that doubled the yields of Francis Childs of Manchester, Iowa.

Their secret? Improving soil quality over several years by 1) applying sufficient nutrients to assist in conversion of residue (stover and roots) into stable organic matter, and 2) incorporating stable organic matter into the soil profile (as deep as 15 inches). The result was what we call MSP.

As the years passed, organic matter apparently improved soil texture, infiltration rates, water-holding capacity, aeration, and fertility levels. Compaction was lowered. Nutrient distribution was extended to greater depths and the zone of root proliferation was increased. All this resulted in improved soil characteristics. The net result was a soil that could support the high populations needed for high yields. We call this MSP.

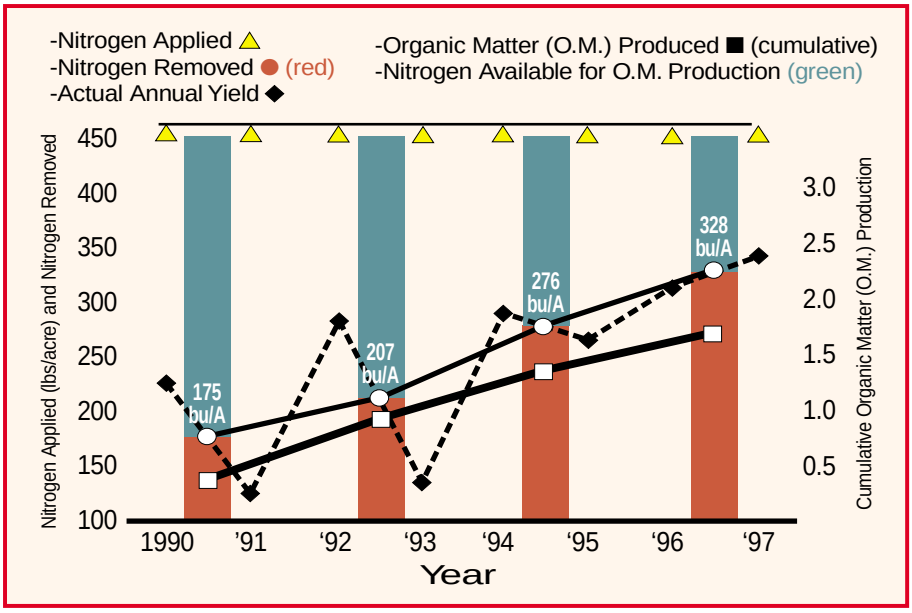

Figure 1. Nitrogen applied vs. nitrogen removed and organic matter production, Childs' farm.

Proof it works

Like Warsaw, Childs' program increased corn yields (2-year averages) from 175 bu/A in '90-'91 to 328 bu/A in '96-'97, with a record yield of 345 bu/A. Over that period, soil organic matter increased approximately 0.2 percent per year, very similar to the rate increase recorded by Warsaw. Nitrogen available for organic matter production gradually decreased as yields increased and N application rate remained flat. Carryover N may have been supplying some of the needs of N for organic matter stabilization. Figure 1 tells a similar and dramatic story of the results of intensified crop management.

Nitrogen removal in the grain increased from about 175 lbs/A of N in 1990-91 to approximately 328 lbs/A of N in 1996-97. Assuming a net residue production of 5 tons/A/yr (175-bu/A crop) and 9.4 tons/A/yr (328-bu/A crop), the substantial quantities of N not removed in the crop were consumed in the conversion of residue into stable organic matter.

The average ratio of carbon to the three major nutrients, well established through research, bears repeating here: $C/N/P_2O_5/S = 110/10/3.2/1.3$. An organic matter content of 58 percent C would relate to the approximate analysis of 5.2 percent N, 1.7 percent P_2O_5, and 0.75 percent S. With that analysis, stabilization of residue to organic matter from 328 bu/A (9.4 tons residue/A) would require approximately 206 lbs/A of N, 65 lbs/A of P_2O_5, and 28

lbs/A of S. Figure 1 indicates that N available for organic matter production would have been largely consumed in the process.

It is significant that the constant rise in organic matter content parallels the yield curve (as indicated by the crop removal line in Figure 1).

Interestingly, over a 12-year period in Kansas a similar increase of 0.2 percent organic matter was recorded with high fertility rates in a soybean-wheat-grain sorghum rotation where residue amounts were doubled.

Deep tillage a must

As described in the spring issue of the Fluid Journal, Warsaw used a twist shank chisel to move stable organic matter as deep as 15 inches and gain MSP. Childs uses a mini-moldboard plow that leaves 28 to 30 percent residue on the surface. This process provides what Childs describes as a "very loose" soil environment in which to build good corn root systems for the following spring's seed population. An added benefit of the residue left on top, Childs claims, is less soil erosion.

In the past, getting good root development was Childs' big challenge. When he found soil compaction at 8 or 9 inches, this limited root growth and corn yields usually went down. Deep tilling and moving stable organic matter as deep as 15 inches solved his problem. The incorporated decomposed residue (stable organic matter) produced a porous soil with high water-holding capacity to support the extremely high plant populations required to produce over 300 bu/A.

For more information about MSP, call or write the Fluid Fertilizer Foundation, 2805 Claflin Rd., Suite 200, Manhattan, KS 66502, (785) 776-0273.