by FFF Review

Putting MSP To Work

It involves implementing the ABCs–the basic fundamentals–of a soil improvement program that will maximize your soil's productivity and increase yields.

In past articles we have discussed the various ways that residue can increase soil quality, which in turn can provide the growing crop with many benefits such as increased water-holding capacity, increased water infiltration rate, and decreased compaction, to name a few. We have referred to the soil improvement program as MSP (maximizing soil productivity).

In this article we'll delve more into the ABCs of MSP. What kind of fertilizer program do you need? What kind of tillage equipment? How deep do you till? How much will it cost? And most important, how long will it take?

Why MSP?

Many soils in the central Corn Belt are shallow. The dark soil rich in organic matter may be only 6 inches thick—about the length of a ballpoint pen (Figure 1). In dry spells, such shallow soil won't hold enough water. The probable result below this thin layer is compaction that will restrict root growth. Lack of aeration will rob soil of a healthy microbial environment. The antidote is MSP. Organic matter will be built and move deeply into the soil profile, making the soil ideal for extensive root proliferation. The soil will be able to support higher populations, resulting in higher yields. A study of 300-bu/A corn growers has shown one common thread: soils are deep, high in both nutrients and organic matter.

How it works

There are five critical steps to establishing MSP.

Chop stalks. These stalks plus roots provide the residue that can be converted to organic matter. There is roughly 3.5 tons of residue for every 100 bushels harvested.

Fertilize residue. We know that organic matter contains 5.3 percent nitrogen, 1.7 percent phosphate (as P_2O_5) and 0.7 percent sulfur (as S). Yet corn stalks and most residues are deficient in these nutrients. Applying fertilizer to the residue will restore the necessary nutrients and aid in the formation of organic matter. The amount to apply is determined by last year's yield (see Table I). Tops and roots left in the field after harvest are estimated. The lbs/A of 22-7-0-3 indicated adjusts the nutrients in the residues for maximum conversion to organic matter. You might call this product a "residue digester."

Soil test. Nutrients in addition to 22-7-0-3 should be applied according to soil test requirements and the removal of nutrients by harvested crops (Table 2).

Till. Treated residue should next be tilled into the soil with a tool such as a twist shank chisel. The object is to move as much residue into the soil as possible and still leave enough on the surface for erosion control. A substantial portion of the fresh residue should be placed in the 3- to 4-inch zone because this is the zone where maximum biological activity occurs. In the years that follow, deeper and deeper tillage will move organic matter down into the 15- to 18-inch zone. This could take 8 to 10 years.

Increase population. Plant population should be increased as yields increase.

Nuts and bolts

The proof is in the pudding. Let's

Table 1. Pounds of nutrients to add to residue for MSP.

Last year's yield bu/A	Total residue roots/tops tons/A	Net residue* tons/A	Nutrients 22-7-0-3 lbs/A	lbs/A N	P	S
140	5.0	3.3	330	73	23	10
160	5.7	3.9	390	86	27	12
180	6.5	4.6	460	101	32	14
200	7.1	5.2	520	114	36	16
220	7.8	5.8	580	128	41	17
240	8.6	6.4	640	141	46	19
260	9.1	6.9	690	152	48	21
280	9.9	7.7	770	169	54	23
300	10.7	8.3	830	183	58	25
320	11.4	8.9	890	196	62	27

* Some residue is left on the surface to control erosion, etc.

Table 2. Amount of nutrients removed by harvested corn (grain only).				
Yield, bu/A	N, lb/A	P_2O_5, lbs/A	Sulfur, lbs/A	Zinc,lbs/A
140	137	56	14	1.4
180	176	72	18	1.8
220	216	88	22	2.2
260	255	104	26	2.6
300	294	120	30	3.0

Table 3. Herman Warsaw MSP program (1973-1974)	
Yield	225 bu/A
Extra N applied	175 lbs/A
Residue	16,000 lbs (7,200 lbs Carbon)
N in residue	143 lbs/A
C/N ratio	24
Estimated Organic matter produced	6,000 lbs (.3% in 0 to 6")

take a good look at MSP at work.

Let's suppose a corn grower is now producing 180 bu/A. Total residue left above ground after harvest is 4.3 tons/A of stalks, leaves, and husks. Adding 2.2 more tons/A of roots brings the total to 6.5 tons/A. Following tillage, he should have left 1.9 tons on the surface for erosion control. Net residue to work into soil is 4.6 tons/A (Table 1).

Following Table 1, the grower would apply 460 lbs/A of liquid 22-7-0-3 (101 lbs/A of N. 32 lbs/A of P_2O_5 and 14 lbs/A of S). These nutrients will adjust carbon/nitrogen, carbon/phosphorus, and carbon/sulfur ratios needed to promote conversion of residue to organic matter. It is also necessary that the grower apply his normal fertilizer program to replace nutrients removed and to satisfy the soil test requirements mentioned earlier.

The fertilized residue is then incorporated with a tool similar to a twist shank chisel. The trick is to leave enough residue on the surface yet incorporate the balance into the soil.

Patience by the grower is a virtue. During the first few years the chisel may go only 6 to 8 inches into the soil. As years pass, the chisel should reach 15 to 18 inches. Biological conversion occurring initially in the 3- to 4-inch zone should eventually move into the deeper soil profile. In 8 to 10 years, a deep fertile soil should be forming that holds more water and nutrients and is ideal for root proliferation. As yields increase, plant population can be increased, resulting in higher yields.

The bottom line reduces to simple mathematics. If farming at 6 inches deep produces 25,000 half-pound ears for a 180 bu/A crop, why not farm at 15 inches deep and produce 42,000 half-pound ears for a 300 bu/A crop?

Figure 2 is an actual example of how MSP works. The Herman Warsaw field increased yields from 160 bu/A to a high of 370 bu/A over a period of about 22 years (a bushel of corn contains a pound of nitrogen).

The extra nitrogen applied adjusted the carbon/nitrogen ratio (24/1), favorable for the production of organic matter (Table 3). For example, in 1973-74 an estimated 6,000 lbs of organic matter (.3% in the 0 to 6-inch zone) improved soil quality, making possible yields of up to 370 bu/A.

The question is often asked, "What does it cost to rebuild my soil?" As the program proceeds, our estimates suggest that extra yields will, to a large extent, pay for this extra fertilizer applied to digest residue.

What's ahead?

The FFF is applying research to MSP projects to further document and verify the benefits of MSP. Research will be taking place in different geographical areas with different crops. Readers of the FJ will receive updates. In addition, merchandising packets on MSP containing a 22-minute VCR video, a CD ROM with backup research and tables, and a supply of bulletins and literature are available now from the FFF office in Manhattan. These aids can be used to introduce the MSP program to growers (see ad in this issue).

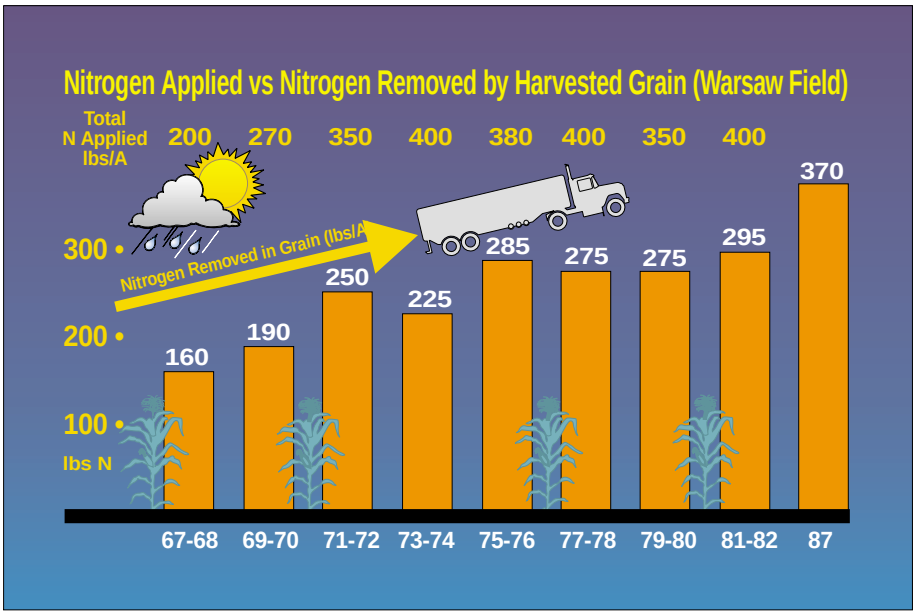

Figure 2. N applied vs. N removed by harvested grain (Warsaw field).