FFF Review

Root Zone Banding Speeds Up MSP

Improved soil tilth improves water-holding capacity and creates a more favorable environment for growing plants.

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

Root zone banding (RZB) is nothing new. RZB is accomplished by injecting a complete liquid fertilizer with knifing implements or fertilizer attachments on chisel plows, field cultivators, or other tillage equipment. It is the only way subsurface nutrients can be built without plowing. Deep bands of fertilizer via RZB develop deep soil tilth and speed up maximum soil productivity (MSP).

Achieving MSP is a long-term program. Soil quality is improved by accelerating the production of soil organic matter, balancing soil fertility, and eventually incorporating this organic matter and fertility deep into the soil profile.

On-farm history shows this is working. Previous issues of the FJ have shown farmers who have more than doubled yields above 300 bu/A. Deep soil high in organic matter stored more water. Additional residue from larger yields controlled erosion and made MSP environmentally friendly.

Farmers successful with MSP will also tell you the process requires patience. Developing the deep fertile soils that produced the 300-bu/A yields reported in Iowa and Illinois took anywhere from 8 to 20 years.

Modern soil conservation tillage does little to incorporate the rather immobile elements such as phosphorus, potassium, and zinc into the deeper soil profile. Notice in Table 1 that even after eight years the phosphorus was not uniformly incorporated and could become positionally unavailable, especially under drought conditions. Similar data show that potassium can likewise become positionally

TABLE 1. Phosphorus distribution as influenced by tillage system over eight years.

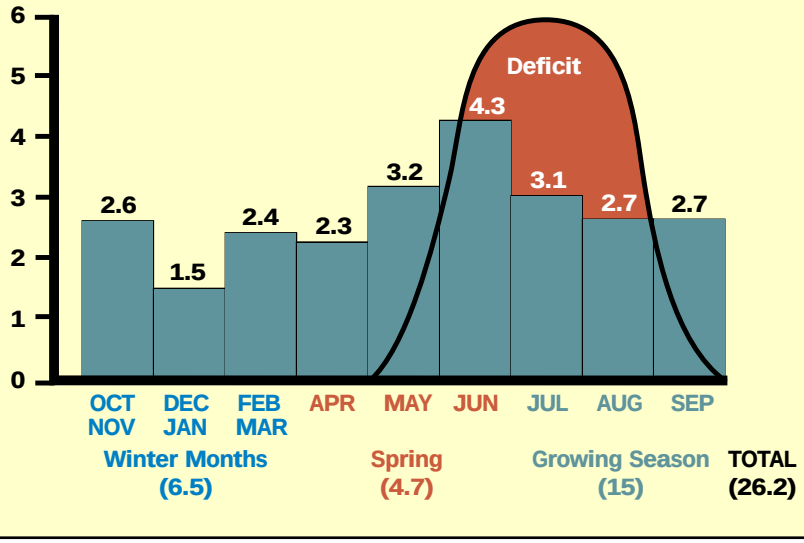
	Phosphorus (ppm)		
Depth Inches	Chisel Plow	Disk	No Tillage
0-2	57	68	69
2-4	52	53	43
4-6	38	25	22
6-9	18	14	17
9-12	9	8	12

Minnesota

TABLE 2. Soil test from Warsaw field compared to fence row shows deep distribution of nutrients.

Depth	High-Yield Farm		Fence Row	
Inches	%O.M.	P (ppm)	%O.M.	P (ppm)
0-3	6.6	132	5.8	25
3-12	5.4	70	4.2	9
12-24	3.9	26	2.5	8

FIGURE 1. Water requirement of corn vs. precipitation (rain and snow).



unavailable. RZB can change all this. Compare the data in Table 1 with Table 2. The phosphorus level in the Warsaw corn field, which produced 377 bu/A, contained from 3 to 8 times the P level measured in a nearby fence row!

Water-use efficiency critical

Constant rainfall does not occur throughout the entire growing season, especially in the westem Corn Belt. Figure 1 shows the amounts of rainfall during different months of the year. A Corn Belt farmer must charge the subsoil with moisture from fall, winter, and early spring rain so the summer corn crop can draw on this reserve. For example, rainfall in July and August averages 5.8 inches, but the crop needs 12 inches of water. Water-use efficiency can be improved via deeper fertility in the subsoil (RZB), which will also provide additional root volume. More vigorous root systems can absorb more water and nutrients, speeding up attaining maximum soil productivity(MSP). The result is more bushels with less water, or a higher water-use efficiency.

For high-yield reduced-till corn producers, who top 300 bu/A and practice MSP, water-use efficiency is as high as 11.0 bu/inch of water! This high rate of efficiency can be attributed to a deeper profile and better tilth, which improves water-holding capacity and creates a more favorable environment for growing plants.

Benefits of RZB

Improves soil. RZB offers a long-term program to improve soil quality, producing maximum crop productivity. It builds deep fertility with high water-holding capacity. It improves soil texture and aeration. A deep spongy soil (versus compacted) is produced that can support high plant populations, thus high yields. Water-use efficiency is increased.

Deep fertility. Notice in Table 1 how chisel plowing and disking produce the most severe nutrient stratification. Phosphorus tends to concentrate in the upper zones promoting a shallow root system. The table clearly shows that phosphorus does not move and must be incorporated mechanically (RZB) to move it into the lower profile where roots can grow and proliferate.

Improves uptake. Because of the chemistry of phosphorus, there is greater uptake in the moist soil environment where the fertilizer is placed by RZB. Fixation of phosphorus compounds is also reduced.

Nutrients interact. Nitrogen enhances phosphorus uptake when they are placed together through deep root banding. Generally speaking, about 1 to 3 pounds of nitrogen should be applied with every pound of P_2O_5. These ratios promote the greatest uptake of both N and P.