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No Plow Tillage Systems for Corn

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A few Indiana farmers have sold their moldboard plows and jumped to a radically new type of tillage-planting system. Many more farmers are taking a critical look at their adventurous neighbors and are seeking research results on the new systems.

There are several reasons why farmers are considering the new tillage systems. Several types of no-plow tillage-planting equipment have become commercially available in the last few years. Low grain prices have caused a more critical look at equipment and labor costs. Some of the new systems offer an opportunity to reduce these costs, but, in many cases, the savings are offset by increased chemical costs. Farmers who have serious wind or water erosion can definitely help their problem with some form of no-plow tillage.

Probably the greatest benefit from no-plow tillage comes from getting the crop planted in a shorter time. With acreage per farm getting larger and the proven yield advantage for early planting, timeliness becomes all important.

In 1967, Purdue started a research project which compares several no-plow tillage systems with conventional tillage. The experiments are located at Regional Research Stations in northern, east central and southern Indiana and involve 5 soil types. Some obvious advantages and problems have shown up in our 2 years' experience with the new systems.

Chiseling Planting

Chisel plows are being used with several types of planting systems in the Midwest. Our system has included 2 full-width tillage operations, deep tillage in the fall with chisel points and shallow tillage at planting, replacing the points with wide sweeps.

This is an excellent system from the standpoint of water management and erosion control. The fall pass offers an opportunity to break-up plow soles, apply anhydrous ammonia, and partially incorporate residues and surface applied phosphorus and potassium.

Problems with the chisel system have included reduced stands when heavy soils were moist at planting and poor grass control with herbicides on heavy soils. Cultivation is usually delayed until the corn is 10 to 12 inches high, due to the rough soil surface.

Rotary tillage

Tilling an 8-inch strip to a depth of 4 inches has resulted in good stands of corn except when heavy rains followed planting on a silt soil. Incorporating herbicide and insecticide in the 8-inch
strip provides good pest control in the row. However, chemical weed control between the rows has sometimes been poor. Some farmers use the rotary machine for full-width tillage, but this increases power requirements and erosion hazards. Volunteer corn and cumbersome turning when pulling a planter are problems in some fields.

Wide-strip tillage (till-plant system)

Planting in a pre-formed ridge with the till-plant system allows earlier planting than other no-plow systems. Soil in the ridge dries out and reaches germinating temperature ahead of non-plowed soils with a level surface profile. Our 1968 experiments show excellent stands for the till-plant system on all soils. Chemical weed control has been good with this system. Erosion control potential is excellent when ridges go across slope.

We have noted some difficulty in keeping the disc tiller-type cultivator centered between rows when forming ridges. Other types of cultivators might be more successful when soils are cloddy.

Narrow-strip tillage or "no-til" planting

Use of the fluted coulter to till a 2.5-inch strip for each row allows early rapid planting with low power requirements. Per cent stand, plant growth, and weed control, however, have often been less satisfactory than with conventional tillage. Using a disc ahead of the "no-til" planter should help to incorporate residues and chemicals but may not solve the weed control problem. One hundred to 200 pounds of extra weight per row on the planter aids penetration of the coulters in dense soil and should improve stand.

This system, with residues left on the surface, cuts soil loss to a minimum, but may provide poor water intake cue to the compacted surface on medium-textured soils.

Research at the Purdue Agronomy Farm at Lafayette has shown that corn root growth in the compact soil resulting from 6 years of "no-til" planting was severely reduced compared to corn roots with conventional tillage. The effects of the smaller root system on fertilizer and water uptake by the corn plants are now being studied.

General comments

Few problems were encountered with all no-plow tillage systems on lighter soils such as sandy loams. On heavier soils, better management and some equipment adaptations may be necessary to control weeds, produce adequate stands and maintain yield potential.

Purdue research indicates that surface-applied phosphorus and potassium remained in the top two inches of soil after six years of no tillage. Such methods as chiseling, rotary tillage, ridging and discing offer some incorporation to about four inches, but far less than deep plowing. This indicates that soils which are low in fertility should be built up to a medium or high soil test level before switching to shallow tillage.

Soil testing in non-plowed fields should separately represent tilled and untilled portions of the soil profile. Depletion of phosphorus or potassium in the major part of the root zone may indicate the need for periodic plowing.

In the long run, questions concerning insect and disease problems, fertilizer placement, and the effect of soil density on root development must be answered to properly evaluate the no-plow systems.