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New Ways to Prepare Corn Ground

W. E. Larson
Iowa State University and United States Department of Agriculture

F. W. Schaller
Iowa State University

Walter G. Lovely
United States Department of Agriculture

Wesley F. Buchele
Iowa State University and United States Department of Agriculture

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Abstract
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We've studied some of these methods extensively and have had experience with all of them. Some look more promising than others, though each may have a place. Our research is continuing. While we haven't reached final conclusions on all phases, this article reports what we've found so far.

Disciplines
Agriculture | Bioresource and Agricultural Engineering

Comments

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New Ways to Prepare CORN GROUND

by W. E. Larson, F. W. Schaller, W. G. Lovely and W. F. Buchele

You’ve probably heard of several new tillage methods for corn being proposed. Some of these methods include ridge planting, mulch tillage, listing, minimum tillage and tractor track planting. Question: What are they and do they fit in on your farm? If so, how and where?

We’ve studied some of these methods extensively and have had experience with all of them. Some look more promising than others, though each may have a place. Our research is continuing. While we haven’t reached final conclusions on all phases, this article reports what we’ve found so far.

Our research on corn tillage methods has had two general aims. First, to develop equipment and methods that leave soil less subject to runoff and erosion. Second, to develop cheaper methods of tillage.

Conventional Methods: The main tillage practices for corn haven’t changed much in Iowa for a long time—very little since the days of horses. Then, as now, land was disked to cut up plant residues, plowed early, worked with a disk-harrow once or twice and finally harrowed with a spike-tooth or drag harrow. Corn was planted with a runner-type planter.

This system usually prepares a firm, finely pulverized seedbed that has produced good corn stands and yields. Clods and trash don’t interfere with rapid cultivation. So, if this system works, why bother trying to find other ways?

First, all of the conventional operations add up to a relatively expensive way to prepare a seedbed. The many trips over the field produce very firm and often packed seedbeds. This helps destroy favorable tilth. It tends to “seal” the surface and to reduce water intake—making the soil more susceptible to runoff and erosion.

You’ve already found out that a firm seedbed in the row helps keep the soil from drying out. A firm, moist seedbed usually leads to good stands. But, even though it’s desirable to have a firm seedbed in the row, is it also desirable to have a firm seedbed between the rows? It looks as if the answer may be “no.”

Field studies are indicating that loose, uncompacted soil between rows has a real advantage. The loose condition discourages weed growth and makes weed control easier. It lets water enter the soil at a faster rate—conserving rainfall and reducing erosion.

Now let’s take a look at some of the other methods.

Listing: Lister planters place corn in furrows 4 to 7 inches deep. The planters are built with two or four furrow openers which look like two plows with landsides welded together. If the ground hasn’t been plowed prior to listing, the practice is called hard-ground listing. If the soil was plowed first, it’s called loose-ground listing.

Tests have shown that listing is well adapted to the coarse loess soils of western Iowa and to the bottomlands along the Missouri River. Corn yields from listing in this area have been equal to or greater than from conventional plowing.

One big advantage of hard-
ground listing is that it's a once-over operation. It prepares the seedbed and plants the corn at the same time. Farm operators on the Missouri bottomlands like this. Here the crop can be planted in a hurry to help evade wet soil conditions.

On hill ground, the contour-lister furrows trap rainwater and hold it until it can soak into the ground—saving water for dry summer periods and reducing erosion.

Hard-ground listing works well on land following corn, small grains or soybeans. If listing follows sweetclover or alfalfa catch crops, subsurface sweeps aid in killing these plants before corn planting. Some farmers, however, believe this to be unnecessary. Loose-ground listing works best following sod crops. For best results, listing should always be used on the contour on sloping fields. Starter fertilizer has proved to be a great help in getting the corn off to a good start.

Listing has some disadvantages, too, as do other tillage methods. Occasionally an intense rain erodes the ridges. This tends to bury the corn seed or seedlings in the furrow and may reduce stands.

Special tools necessary for listing are a lister planter and, sometimes, a lister cultivator. Some prefer to harrow or rotary hoe listed corn for the first cultivation to knock down the ridges and follow with a standard cultivator for additional cultivation.

Ridge Planting: Ridge-planted corn is planted on ridges spaced 40 or 42 inches apart. Ridges are made with a plow and maintained throughout the year. On the deep loess soils of western Iowa, the ridges are made on the contour. On other soils, they're made with a slight grade from the contour. Furrows between the ridges hold rain—allowing more of it to soak into the ground. On level ground or in slight depressions where flooding is a problem, the corn on top of the ridges is less likely to drown out.

Though ridge planting is not new, its use for corn was largely developed here at Iowa State College. The method was outlined in "Ridge Planting Saves Soil and Water" in the June 1955 IOWA FARM SCIENCE and reprint FS-607.

Ridges are made with a 14-inch, single-bottom, two-way moldboard plow. The 14-inch furrow slice is turned over onto a 26- or 28-inch unplowed strip. The two-way plow is reversed at the end of the row, and a second row is made on the return trip. Disking before plowing isn't necessary on stubble land but is needed on sod ground to cut the surface into small pieces. Ridges can be made in either spring or fall.

After the ridges are formed it's usually desirable to shape them with a disk cultivator. This gives some cultivation before planting and results in a better shaped ridge. Treading the row with a rotary hoe pulled backwards before planting helps firm and break clods before planting if it seems necessary.

On plowed ground, ridges can be made with a double pass with a disk-hiller cultivator. Where corn follows corn, ridges made the previous year may be turned or the stalks shredded, and the old ridges worked for planting with a disk cultivator. Planting is best done with an ordinary mounted planter equipped with single disk furrow openers.

Early weed control can be difficult with ridge-planted corn. We've used an application of 2,4-D ester at planting time. This controls broadleaf weeds and sets back grassy weeds. Ordinarily only two mechanical cultivations with a disk-type cultivator are needed.

Ridge-planted corn has yielded about the same as conventionally planted corn. Its greatest advantage seems to be where erosion or drowning out is a problem. It fits well where several years of continuous corn are grown; it's not necessary to lay out new ridges each year. Extra operations are needed to level the ridges before planting small grains or meadow.

Needed equipment not found on every farm is the disk hiller. A slightly modified two-way plow is sometimes desirable.

Mulch Tillage: With this system, all plant residues are left on the soil surface—rather than turned under and incorporated into the soil as with turn-plow methods. Considerable research on mulch tillage has been done by Iowa State College as well as in other states.

Land is prepared for planting with underground sweeps which loosen the soil to a depth of 7 or 8 inches. Two passes usually are desirable. Sweeping should be preceded by disking or stalk chopping if corn was grown the year before.

Often a light disking after sweeping helps kill small weeds and firms the soil. Planting can be done with conventional planters. It's a good idea to use single or double disk furrow-openers on the planter; they help place the seed below the trash. Furrow openers also make weed control easier. One machine on the market combines double sweeping and planting in a single once-over operation.

Research shows that mulch tillage is an excellent erosion-control practice. Surface trash protects the soil from rain and wind but still lets water enter the soil readily. While mulch tillage gives better water erosion protection when corn is planted on the contour, it protects to a lesser degree in straight planting. Land preparation for planting is often less costly than conventional methods.

Corn yields from mulch tillage are sometimes lower than from conventional methods—especially in cold, wet springs. Recent studies indicate that the surface mulch keeps the soil cooler in early spring and that this is a major factor in slowing down early growth. Nitrogen and potash availability in the soil may also be lower—sometimes making larger amounts of fertilizer desirable. Obtaining the best stands is sometimes a problem with mulch tillage.

Mulch tillage is best adapted on medium- and coarse-textured soils that are well drained. It has given excellent results on sandy land where wind erosion is a problem. It's not recommended in Iowa for poorly drained soils.

The only special equipment
needed is the sweeps or duckfoots. These can be obtained as a separate tillage tool or mounted on tractor tool bars.

**Minimum Tillage:** You may or may not have heard about "minimum tillage," tractor track planting, plow-plant system and a few others. We've tried these systems in Iowa, though most of the research has been done in eastern states.

Research on minimum tillage systems stems from the belief that we may work our soil too much. Too much working compacts the soil, slows down water intake and results in unnecessary tillage expenses.

There are several ways to go about reducing the number of tillage operations. One method is to pull a rotary hoe section backwards or a spike-tooth harrow section behind the plow and then plant in the tractor wheel tracks. The rotary hoe or harrow breaks up the large clods and helps smooth the soil. The tractor wheels further break up clods and pack the soil in a band just ahead of planting. If the soil works up well, it may not be necessary to plant in the tractor tracks. Some have tried planting in the tractor tracks without using a rotary hoe, harrow or similar device.

In most of these systems, a rotary hoe can be used for the first cultivation to further break up clods and to kill small weeds.

Certainly tractor-track planting has some real advantages. It cuts costs since fewer operations are needed to prepare a seedbed. It produces a firm band in which to plant and a loose area between the rows to soak up rain. Weeds are slow to start in the loose seedbed between the rows. Our results indicate yields equal to conventional methods—if good stands are obtained.

Minimum-tillage systems are best adapted to medium-textured soils in good physical condition—soils where clods break up easily. With most minimum-tillage systems, planting should follow soon after plowing. Many Iowa farmers won't want to wait that long to plow, though a part of their acreage might be handled this way.
Minimum-tillage systems don’t call for special equipment, though a small tractor may be best for tractor-track planting. Adapters can be made to decrease the wheel spacing of some tractors.

**Where Do They Fit?**

All of these tillage methods for growing corn are being used to some extent. Each seems to offer real advantages for certain farm operators and farming conditions. It will take time to find out finally where each fits best and how important each will be over time.

Changing over to a new tillage method for a major crop shouldn’t be taken lightly. Consider carefully to make sure the method will fit your soil and cropping conditions. Also make sure that the proper machinery is available and that the method you choose will lead to the results you want.

Find out all you can about the methods that interest you. Talk with farmers who are using the method; observe their procedures and results. Check research reports for comparisons of tillage methods, their advantages and shortcomings. Visit with machinery dealers about the kinds and availability of equipment. All new methods call for some know-how which can be gained only through experience.

Here is a summary of the information we have to help decide if any of the new tillage methods have a place on your farm. Can one of them help reduce your tillage costs? Or can one help you save moisture and reduce erosion?

**Listing** is already a proven practice for the loess soils of western Iowa. It’s also used on Missouri River bottomlands. It may have possibilities on other deep permeable soils. On stubble land, plowing and diskking are eliminated. This speeds up tillage operations and cuts cost. Lister furrows trap water, reduce erosion and make weed control easier.

**Ridge planting** is a new practice in the Corn Belt and needs additional testing under farm conditions. Weed control may be difficult. It provides excellent opportunities, however, to cut costs and to control erosion. It often prevents drown-outs on wet land.

**Mulch tillage** is an excellent method for increasing soil “soak up.” It works best on well-drained soils. It may reduce yields in wet years and may require more attention to fertilizer use and weed control. Special machines are needed, but many kinds are available. It usually, but not always, reduces costs.

Minimum tillage methods largely use conventional machinery. Some of the diskking, harrowing and cultivating operations are eliminated and costs are cut. Overworked soil and soil compaction are avoided. This results in improved soil tilth, better water “soak up” and easier weed control. Planting must be done right after plowing.

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### Summary of Tillage Operations

<table>
<thead>
<tr>
<th>System</th>
<th>Stalk cutting</th>
<th>first-year corn</th>
<th>second-year corn</th>
<th>Planting preparation</th>
<th>Planting operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional</td>
<td>Disk or chop stalks</td>
<td>Plow</td>
<td>Plow</td>
<td>Chop stalks, harrow</td>
<td>Conventional planting</td>
</tr>
<tr>
<td>Listing</td>
<td>Disk or chop stalks</td>
<td>None⁴</td>
<td>None</td>
<td>None</td>
<td>Lister planting</td>
</tr>
<tr>
<td>Ridge planting</td>
<td>Chop stalks</td>
<td>Make ridges</td>
<td>None</td>
<td>Disk cultivate</td>
<td>Plant with mounted planter; pre-emergence spraying</td>
</tr>
<tr>
<td>Mulch tillage</td>
<td>Disk or chop stalks</td>
<td>Sweep</td>
<td>Sweep</td>
<td>Disk</td>
<td>Conventional planting using furrow openers</td>
</tr>
<tr>
<td>Minimum</td>
<td>Disk or chop stalks</td>
<td>Plow</td>
<td>Plow</td>
<td>None</td>
<td>Conventional planter in tractor tracks</td>
</tr>
</tbody>
</table>

⁴Plow if following sod crops.

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### How They Fit In—

<table>
<thead>
<tr>
<th>System</th>
<th>Reduces costs as compared with conventional</th>
<th>Reduces erosion as compared with conventional</th>
<th>Special machinery required</th>
<th>Soil condition where best suited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listing</td>
<td>Yes</td>
<td>Yes</td>
<td>Lister planter</td>
<td>Coarse loess and Missouri bottomland</td>
</tr>
<tr>
<td>Ridge planting</td>
<td>Yes</td>
<td>Yes</td>
<td>Disk hiller cultivator</td>
<td>Fine and medium textured</td>
</tr>
<tr>
<td>Mulch tillage</td>
<td>May or may not</td>
<td>Yes</td>
<td>Sweeps</td>
<td>Well drained medium or coarse textured</td>
</tr>
<tr>
<td>Minimum</td>
<td>Yes</td>
<td>Yes</td>
<td>None</td>
<td>Medium or coarse textured</td>
</tr>
</tbody>
</table>