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TILL-PLANT

System....

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What Is the Till-Plant System?

The till-plant method is a system of minimum tillage which consists of the following essential field operations. Other operations may be added.

Cut Stalks¹

The rolling stalk cutter or the power-driven rotary stalk cutter may be used.



Plant

In one operation till and plant in old ridge, apply insecticide, herbicide and starter fertilizer when needed.



Cultivate^{1, 2, 3}

Cultivate the first time when corn is 10 to 16 inches tall. Use two sets of disk hillers in front and sweeps or furrowers in the rear.



Harvest

Conventional harvesting equipment is used.

1. Nitrogen fertilizer may be applied before planting, during or after cultivation, according to recommended practices.

2. Corn is ridged under irrigated conditions. Ridging is generally a separate operation.

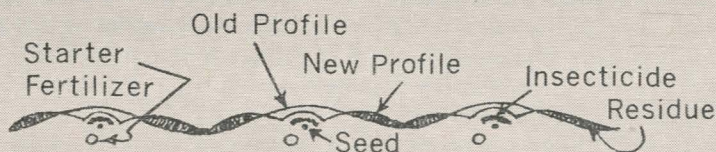
3. Under dryland conditions only one cultivation may be required and sweeps may be replaced by furrowers.



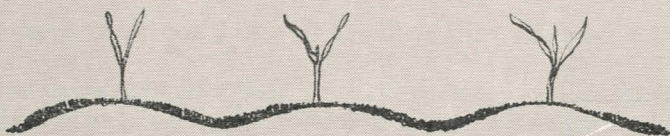
Sketches of soil profiles after each field operation show the proper depth of tillage and the placing of seed, insecticide and starter fertilizer for irrigated conditions.



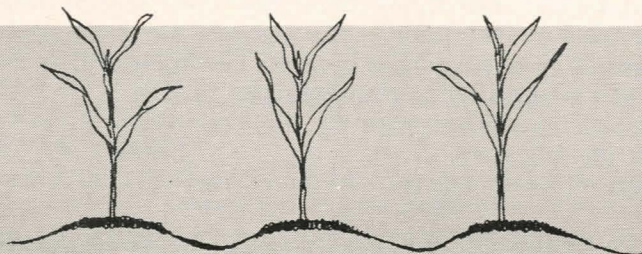
Stalks are cut 1 to 10 inches above the ground to keep residue from collecting on till-planter shanks and bunching up.



Seed is planted in old ridge where soil is warmer and better drained than that in the furrow. Old roots in ridge keep seed from washing out. Distribution of residue and placement of seed, insecticide and starter fertilizer is shown.



Cultivation is necessary for weed control and some ridging. A separate ridging operation may be required for gravity irrigation. Residue is moved from furrow to corn row during ridging operation and furrow is cleared of residue for irrigation.



Field is left undisturbed from harvest until stalks are cut the following year.

How It Began

Delbert E. Lane and Howard Wittmuss¹

Farmers in the state of Nebraska can save 15 million dollars annually if they adopt the till-plant system for corn and sorghum production. They can also save up to 50 percent of the labor presently involved in tillage operations for corn and sorghum production. At the same time, use of the till-plant system offers the opportunity for improvement in soil and water conservation.

Research on the till-plant system of corn production started in 1955 on the Agricultural Engineering Experimental farm at Lincoln, Nebraska. Professors L. W. Hurlbut and H. D. Wittmuss started with the IHC till-planter, using different machine modifications until the present machine and till-plant system was developed.

Six years of research and three years of field testing have been involved in developing the machine and the till-plant system of corn production. The till-planter described in this publication is simple and combines many of the advantages of tillage research findings.

Tillage research principles used in developing the present machine and till-plant system include:

1. Reducing tillage operations to a minimum without affecting stand, weed control, or crop yield.
2. Packing soil at seed level and covering with loose soil for rapid germination and uniform stand.
3. Reducing soil compaction by reducing number of field trips and tillage operations.
4. Leaving residue on surface to reduce wind and water erosion hazard.
5. Eliminating tillage prior to planting and reducing tillage to a minimum at planting in order to keep soil moisture evaporation losses to a minimum.
6. Planting in ridge to place seed in warmer, better drained soil.

Other corn belt states are using principles of minimum tillage developed by research in all of the states. Other systems involve different operations without a change in objectives. Most other systems include plowing. If plowing can be eliminated, tillage cost and labor requirement can be greatly reduced and soil moisture conditions will be more favorable for seed germination at planting time.

Some long time experiences with the till-plant system at the University include the following:

1. Five years of continuous corn on same 35-acre field at Lincoln, Nebraska.

¹ DELBERT E. LANE is Instructor in Agricultural Engineering (Agricultural Extension); HOWARD WITTMUSS is Assoc. Prof. of Agricultural Engineering.

2. Three years of continuous corn on same 20-acre field at North Platte, Nebraska.

3. Two years of continuous corn on eight till-plant and eight conventionally planted plots at North Platte, Nebraska.

Yields were in agreement with results in Table 1. There have been no observable changes in weed control problems or soil structural conditions with the till-plant system. It appears that continuous corn can be raised as well with the till-plant system as with any other system of corn production.

What are the Results?

Yield and Moisture Content of Grain

In 1960, Extension Agricultural Engineers and Agricultural Extension Agents studied 16 comparison plots in the state, consisting of 2½ acres of till-planted and 2½ acres of conventionally planted corn. The corn on the till-planted plots yielded 2 bushels per acre more and contained 1.9 percent less moisture at harvest than that on the conventionally planted plots.

Table 1. Yield and moisture content of grain from conventional and till-plant plots, 1960.

Location	Yield, bushels per acre ¹		Moisture Content of Grain, %	
	Conventional	Till-plant	Conventional	Till-plant
Boone	121	124	32.0	32.0
Boone	141	136	25.0	24.0
Clay	117	131	30.5	27.3
Fillmore	126	119	16.6	18.8
Furnas	108	105	18.4	18.2
Garfield	100	99	21.6	21.0
Hamilton	121	103	21.7	20.9
Howard ²	128	121	*	*
Kearney	53	61	27.3	21.7
Merrick	134	156	27.3	26.6
Phelps	135	141	25.0	21.9
Platte	100	118	40.0	32.7
Red Willow	94	98	19.9	18.1
Seward	151	150	26.1	23.2
Sherman	149	150	24.0	22.0
Valley	86	84	19.8	18.7
Average	117	119	25.0	23.1

¹ Machine harvested yields plus field losses. Yields based on 83 percent shelling percentage and corrected to 15.5 percent moisture content.

² Not a true comparison as the conventional was planted 3 weeks later.

Cost of Tillage

The cost of tillage operations for irrigated corn production using till-plant and conventional systems is shown in Table 2. The costs are based on custom rates with 4-row equipment and 4-5 plow tractor. The tillage cost can be as low as \$6.00 per acre with the till-plant system.

Table 2. Cost of tillage operations for conventional and till-plant systems.¹

Operation	Cost, dollars per acre	
	Conventional	Till-plant
Cut stalks	1.00	1.00
Disk (2)	3.00
Plow	3.00
Harrow (2)	1.00
Plant	1.00	2.50 ²
Rotary hoe (2)	2.00
Cultivate (dryland) ³	1.25	1.25
Cultivate (irrigation)	1.25	1.25
Total cost per acre	13.50	6.00

¹ University of Nebraska "Farm Custom Rates Paid in Nebraska in 1959" used to compute costs. All rates based on 4-row equipment.

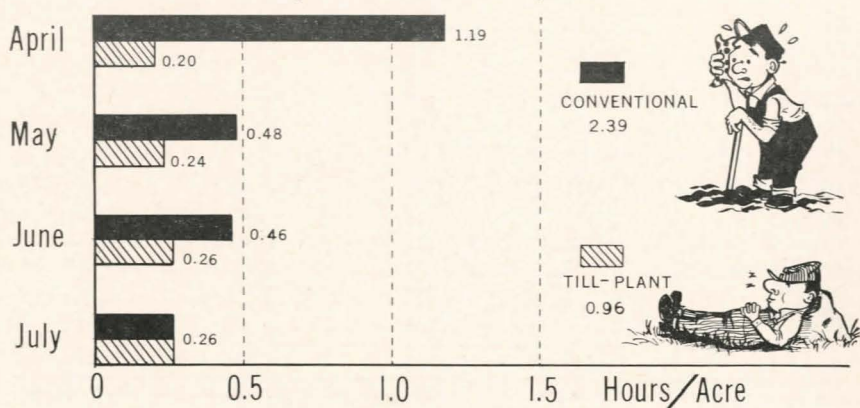
² Includes application of herbicide.

³ One cultivation needed under dryland conditions.

Labor Requirement

The annual labor required to till an acre of corn using the till-plant and conventional systems is shown in Table 3. Operations shown in Table 2 were used to figure the labor requirements. The annual labor required to till an acre of corn can be as low as 0.96 man hours with the till-plant system.

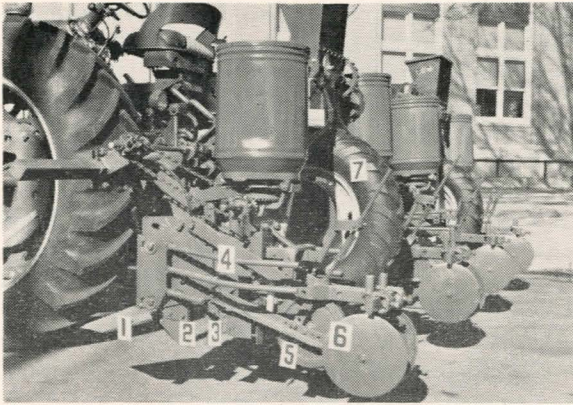
Table 3. Annual labor required to till an acre of corn using the till-plant and conventional systems.



What About Equipment?

Some equipment has been developed by the University for use with the till-plant system. The equipment is shown in detail so farmers can build a machine from component parts of different companies. Manufactured till-planters are also available.

Equipment Developed for Use by the University



Till-planter developed for use in 1961. This arrangement will produce the best results but other equipment arrangements are possible. Essential operating parts are:

1. Sixteen-inch sweep cuts and removes residue and weeds from the row.
2. Root cutter clears roots and opens soil for seed tube and stabilizes till-planter.
3. Seed tube places seed in location for best germination and stand.
4. Trash guards push residues to side of row. Leaves an area 10 inches wide free of weeds and residue.
5. 1" x 10" press wheel presses seed firmly in undisturbed soil for rapid germination and uniform stand.
6. Covering disks place a cover of loose soil over the seed. The loose soil reduces surface crust and moisture loss around the seed.
7. Gage wheel drives planting mechanism and sets depth of tillage.



An effective cultivator arrangement used for five years with the till-plant system.

- A. Front set of disk hillers till soil and remove weeds next to row.
- B. Rear set of disk hillers till soil and start ridging operation.
- C. Sweeps in rear kill weeds between row.
- D. Furrowers replace sweeps for ridging operation.
- E. Other cultivator arrangements may be used effectively.

What Other Equipment Is Available?

1. Some manufacturers have till-planters available. Other manufacturers have component parts available for construction of till-planters. Machines may not be field tested.

2. There are several modified IHC till-planters available. Machines have been used five years by the University with good results. Users are limited to 2-row equipment.

3. Rigidly mounted rotary moldboard listers have been used by farmers and University for one year with excellent results when machine is set to plant shallow in the old ridge. It is possible to remove rotary moldboards and substitute sweeps and trash guards. Commercial equipment is available.

4. Disk lightly with the row and plant in ridge with surface planter. In 1960 plots yielded nearly as well as till-planted plots. Weeds may be more of a problem.

Comparison of Conventional and Till-Plant Systems

Advantages of Till-Plant System

1. Tillage costs are less for the till-plant system (\$7.50 less per acre, see Table 2).

2. Less labor required per acre for till-plant system (1.43 man hours less per acre, see Table 3).

3. Less soil compaction in the corn or sorghum row.

4. Higher water intake rates.

5. Amount of volunteer corn in the row is reduced.

6. Less danger of wind and water erosion.

7. Better soil structural condition in the row because corn is planted in undisturbed soil.

8. Corn matures earlier.

9. Can work in field with equipment sooner after a rain because residue remains on the surface and the soil is firm.

Disadvantages of Till-Plant System

1. Yields may be reduced if crop is not properly managed.

2. Sight of trashy field condition may be objectionable.

3. Adjustment of equipment is more critical than for conventional tillage.

4. Winter annual weeds may need to be sprayed prior to cutting stalks.