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Weed Control in Reduced Tillage Corn

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Weeds compete with corn plants for water, nutrients and light. Historically, the soil has been extensively tilled to prepare a seedbed and to lessen or remove weed competition. This tillage centered around moldboard plowing.

Results of a recent survey indicate that most Nebraska farmers now use some form of reduced tillage, with the moldboard plow being used on only 11 percent of Nebraska's corn acreage. Reduced tillage is used in many forms, including:

1. Single pass operations such as the till-planter
2. Slot-planting
3. Disking and surface planting
4. Disking and listing

These reduced tillage systems eliminate the use of the moldboard plow, a high energy consumer that uses about 2.25 gallons of diesel fuel per acre. With high fuel costs and supply shortages, there is a critical need for doing more work with the fuel available. Fuel use for various field operations and corn planting systems is given in *Table 1*.

Weed control is essential in any corn production system, and as mechanical tillage operations are eliminated, we must rely more on herbicides. Management skills become more critical. Mistakes can be more costly and are not as easily covered up as with clean-tillage. Perennial weeds tend to increase in reduced tillage systems because there is less frequent and less severe disturbance of the root system as compared to moldboard plowing.

Table 1. Specific diesel requirements for tilling, planting and harvesting for several corn planting systems.[1]

	Planting system				
Field Operation	*Conventional*	*Till-Plant*	*Slot-Plant*	*Disk & Plant*	*List Operation*
	(Gallons Per Acre)				
Chop Stalks	0.55	0.55	0.55	0.00	0.00
Disk	0.74	0.00	0.00	0.74	0.74
Plow, Moldboard	2.25	0.00	0.00	0.00	0.00
Disk	0.74	0.00	0.00	0.74	0.00
Harrow, Spring	0.64	0.00	0.00	0.64	0.00
Plant	0.52	0.68	0.60	0.52	0.55
Spray	0.23	0.23	0.23	0.23	0.23
Cultivate	0.43	0.43	0.43	0.43	0.43
Cultivate	0.43	0.43	0.43	0.43	0.43
Combine	1.25	1.25	1.25	1.25	1.25
Total	7.78	3.57	3.49	4.98	3.63

[1]From The Nebraska Fuel Use Survey.

Nebraska research has demonstrated that annual weeds can be controlled in reduced tillage corn systems while saving time, labor, energy, soil moisture and soil.

Weed Control in the Till-Plant System

The Nebraska till-plant system consists of planting into the ridge of the old corn row where the soil is warmer and better drained than in the furrow. Sweep and trash guards slice away the old plant residue with a layer of soil, moving it into the interrow area while corn seed is placed and firmed into the soil. Weed seed is moved from the corn rows with the soil. Thus, the potential number of weeds emerging in the corn row is reduced. Research at North Platte has shown that the till-planter leaves only about 30 percent as many weed seeds in the corn row as when the soil is prepared for planting by plowing, disking and harrowing.

Because the till-plant system reduces the number of weed seeds in the corn row, weed control throughout the season is easier. Research in northeast Nebraska has been conducted to determine whether herbicides should be broadcast or banded with the till-planter and how much cultivation is needed *(Table 2)*.

Table 2. Corn yields in the till-plant system as influenced by herbicide application method and number of cultivations at Concord, Nebraska for three years.

	Number of cultivation treatments		
Herbicide treatment	*One*	*Two*	*Average*
	----------(Bushels Per Acre)----------		
Herbicide banded	122	123	122
Herbicide broadcast	123	127	125
Average	122	125	

A herbicide banded over the row at planting time has been as effective in maintaining corn yields as when it is broadcast because the interrow area is cultivated. Corn yields have often been as high with one cultivation as with two. The number of cultivations required depends on the level of weed infestation and herbicide effectiveness. On upland Nebraska silt loam and silty clay loam soils, use of the till-plant system should allow farmers to produce maximum corn yields while controlling annual weed growth. Corn can be produced by till-planting with approximately 45 percent of the energy used in the moldboard plow system *(Table 1)*.

Weed growth is usually light on undisturbed soils ready for till-planting unless corn planting is delayed. If weed growth becomes excessive before planting, a preplant application of 2,4-D to kill broadleaf weeds or Roundup to kill grasses and broadleaf weeds may help. A shallow preplant disking can be used instead of a herbicide to control emerged weeds. Another alternative is to preplant cultivate the field using wide sweeps to destroy existing weeds between old corn rows. The old corn row can be maintained this way. These practices may be required more frequently for grain sorghum than for corn because of later planting dates for sorghum.

Use of a preplant incorporated herbicide is not adapted to the till-plant system. Weeds that are best controlled by preplant incorporated herbicides, such as shattercane and sandbur, may become a problem with the till-plant system.

Herbicides that are effective for clean-tilled soil conditions should be equally effective in the till-plant system. Consult EC 82-130, "A 1982 Guide for Herbicide Use in Nebraska," for more information.

Under dryland conditions, 30-inch rows are preferred over 40-inch rows for weed control. The reason for this is that even when the till-planter is operated at a shallow depth, enough soil is moved from the old ridges to cover established weeds in the interrow area in 30-inch rows but not in 40-inch rows. However, this system has worked well in 30-, 36-, or 40-inch rows at North Platte. Heavy residues are more easily managed in the wider row spacing.

Weed Control in the Slot-Plant System

Slot-planting in continuous corn fields is similar in energy requirements to till-planting *(Table 1)*. One method is to disk rather than chop stalks and then slot-plant as nearly as possible back in the old row. A second method of slot-planting in corn residue is to shred stalks and then plant on top of the old ridge. The old ridge is warmer, better drained, and freer of plant residue on the soil surface. Weed control in the latter method is more dependent on herbicides, however, because only a 3- to 4-inch band of soil is mechanically disturbed during planting. This system reduces soil erosion to a minimum on rolling upland fields.

Herbicide application must be adapted to the slot-plant system used. If the slot-planter is used with preplant disking, herbicides can be applied preplant incorporated or preemergence in a band, or broadcast during the planting operation. If the slot-planter is used with no preplant tillage, herbicide use must be fitted to the conditions at planting time.

Existing broadleaf weeds can be controlled with a preplant application of 2,4-D, followed by a preemergence herbicide for later emerging annual weeds. If both grasses and broadleaf weeds are established in the field, a combination contact and preemergence herbicide, such as atrazine + Lasso + Paraquat, can be used. If the herbicide is applied before planting, the action of

Table 3. Corn yields in the slot-plant system as influenced by herbicide application method and number of cultivations at Concord, Nebraska for three years.

Herbicide treatment	*Number of cultivation treatments*		
	One	*Two*	*Average*
	(Bushels Per Acre)		
Preemergence, banded	95	111	103
Preemergence, broadcast	112	122	117
2,4-D + preemergence, banded	117	123	120
2,4-D + preemergence, broadcast	119	127	123
Paraquat + preemergence, banded	94	117	106
Paraquat + preemergence, broadcast	119	130	124
Average	109	122	

the planter can disturb the soil and leave a band of untreated soil over the row where weeds will grow. For this reason, herbicide application following the planter unit is the best practice.

Some Nebraska research results with the slot-plant system are shown in *Table 3*. Stalks were first shredded, followed by slot-planting on the old row ridge.

Broadcasting the herbicide will make weed control more dependable in the slot-plant system with no preplant tillage. Two cultivations may be required in some years when climatic conditions have been unfavorable for good herbicide performance.

Weed Control in the Disk and Surface Plant System

In some areas of the state where moldboard plowing has predominated, such as the northeast, farm operators may switch to a disk and surface plant system to conserve energy *(Table 1)*. As much as 50 to 60 percent of the previous year's plant residue may be left on the soil surface, depending on the number and type of diskings.

Weed control under this sytem will generally be more difficult than on a clean soil surface left by plowing, especially on fine textured soils. Several things could be responsible for this:

1. Weed seed is incorporated by disking into the surface soil of a firm seedbed where conditions are ideal for seed germination.

2. Disked ground conserves more moisture in dry years than plowed and disked. Thus, it is more favorable for weed seed germination.

3. Plant residue left on the soil surface by disking will hold some herbicide until rain washes it off.

When relying on herbicides for weed control in a disk and plant system, it may be necessary to increase the herbicide rate over that used on plowed ground. An increase of 15 to 25 percent of the rate used on plowed ground should provide adequate weed control. However, the herbicide rate must not exceed the labeled rate for the soil type involved.

Preplant incorporated herbicides can be used effectively in the disk and plant system. Use of a preplant soil-incorporated herbicide like Sutan + has given effective grass control in Nebraska tests where a large amount of plant residue was on the soil surface. Do not operate furrow opener type planters too deep or the herbicide-treated soil will be removed from the seed row area. Preemergence herbicides appear to differ in their performance under trashier soil conditions. Lasso has given excellent grass control in Nebraska tests, even where plant residue on the soil surface was heavy. By contrast, AAtrex or atrazine; AAtrex or atrazine + Ramrod, Bexton or propachlor; and Bladex have sometimes been less effective under these conditions in Nebraska tests.

Weed Control in the Disk and List System

Large acreages of corn are produced in Nebraska's central Platte Valley using the lister. Stalk chopping, a high energy requirement operation *(Table 1)*, can be eliminated with this system. A preplant disking can be used to cut stalks and destroy one crop of weed seedlings. The lister provides considerable soil disturbance at planting time for mechanical weed control. Use of a banded or broadcast preemergence herbicide coupled with cultivation has provided dependable weed control. Preplant incorporated herbicides are not adapted for use with the lister because the herbicide is moved with the soil from the seed row into the interrow area during listing.

Other Conservation Production Systems

Several other reduced tillage systems are also being used. However, the weed control aspects of these systems have not been extensively researched in Nebraska.

Chisel and Surface Plant. Chisel plows are used to reduce the time needed for tillage, to cut soil compaction, and to provide better wind and water erosion control. In addition, the change from moldboard plowing to chisel plowing can usually save over a gallon of diesel fuel per acre on corn.

Power Rotary Plant. Most of these machines can be set for full width or strip tillage. Planting along or in the old row is advisable. Herbicides can be incorporated at planting time or surface applied. The rotary tiller should be set to incorporate 2 to 3 inches deep for maximum weed control. Deeper incorporation is unnecessary and requires more power.

Trilevel Bed Plant. This system is designed especially for limited tillage with furrow irrigation. After stalk shredding, beds are formed and corn is planted in one operation. Some operators prefer two trips with beds and furrows formed in one trip and planting in a separate operation. Often two 30-inch rows are planted on each side slope of a 60-inch bed. Weed control is largely with herbicides, but cultivation can be used. Soil incorporated herbicides cannot be used with this system.

Metric Conversion Table

English	*Multiply By*	*Metric*
Inch (in)	2.54	Centimeter (cm)
Acre (A)	0.4	Hectare (ha)
Gallon (Gal)	3.8	Liter (l)
Bushel (bu) of corn	25.2	Kilogram (kg)

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