COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF KENTUCKY • COLLEGE OF AGRICULTURE

NO-TILL CORN

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No-till corn production has become an important agronomic practice in Kentucky. The amount of land in no-till corn has increased from one-third acre in 1962 to an estimated 320,000 acres in 1981. Since the technology necessary for no-till corn production varies from conventional techniques, widescale educational programs have been conducted to teach corn growers how and under what conditions to switch to no-till. The following discussion provides a general outline for no-till corn production.

Benefits of No-till

A recent survey conducted throughout the Southeast including Kentucky reported the major benefits of no-till production to be that it: 1) prevents or reduces erosion, 2) cuts fuel costs, 3) saves labor and time, 4) conserves moisture, and 5) makes double-cropping easier. In addition, Kentucky farmers listed “more net profit” as a major benefit. No-till has clearly become the best farming practice to conserve our resources while allowing the farmer to make a profit. It offers an effective means of reducing soil and plant nutrient losses by erosion while growing a corn crop on sloping land.

Soils for No-till Corn

The no-till system of row crop production is especially well-adapted to soils and topography In Kentucky. Corn grain yields under no-till production, reported in 1970 from 40 Kentucky locations representing 24 different soil series with slopes of 1 to 25 percent, ranged from 74 to 189 bushels per acre. The yields were excellent even on the more sloping land. There was no visual evidence of erosion on these sites.

Another comparison of no-till and conventional tillage corn production was reported in 1971 on well-drained and moderately well-drained soils of predominantly limestone origin at 10 locations. The corn yields were 12 bushels per acre higher for no-till than for conventional tillage.

No-till corn production has been most successful on well-drained and moderately well-drained, medium-textured soils. As shown in Table 1, Crider soil, which occurs extensively throughout parts of west-central and southwestern Kentucky, is an excellent no-till soil. In six years of comparisons between no-till and conventional tillage corn on this soil, the no-till corn averaged from 15 to 32 bushels per acre higher than the conventional tilled corn.

In recent years, research has been conducted to determine the adaptability of no-till on less than well-drained soils

where a higher level of management is required. No-till corn grown on a Tilsit silt loam showed that early planting dates produced lower yields and reduced stands for no-till as compared to conventional tillage. Higher no-till yields were observed at a later planting date when cooler soil temperatures and periodic excessive wetness were no longer a problem. A mulch such as rye or wheat seeded in the fall will help no-till production on wetter soils since the cover crop will dry the surface faster, resulting in warmer seed zone temperatures at earlier dates.

Delayed planting dates, precise planting procedures, and careful management of nitrogen fertilizer need to be observed in managing no-till on wetter soils.

Selection of Hybrids and Plant Populations

Corn hybrids that perform best under conventional tillage have proven best with no-till planting as well. When selecting hybrids for no-till production, look for the following factors: 1) cold tolerance, 2) early-season vigor, 3) resistance to leaf diseases, 4) strong root systems near the surface, 5) resistance to insects such as seed corn maggots and wireworms, and 6) resistance to stalk rots. Increase planting rates by 10 percent to obtain the desired stand at harvest time. No-till corn can tolerate higher plant populations than conventional corn. Recent research at the University of Kentucky has resulted in higher yields at higher plant populations with less lodging for no-till planted corn compared to conventional planted corn (Table 2).

Planting Date and Seed Placement

Soils with sod or other heavy crop residues tend to warm up slower than disturbed soils. No-till planting may need to be delayed in sodded areas 7 to 10 days if cool weather prevails. However, most well-drained soils will be warm enough for early planting of no-till corn. Corn should be planted before May 10 in Western Kentucky and May 20 in Eastern Kentucky for top yield potential.

Table 1. Average corn yields with 150 pounds of nitrogen per acre on three soil types in Kentucky.

Soil Type	Number of Years Tested	Yield (bu/A) No-till	Yield (bu/A) Conventional
Maury silt loam	12	130	125
Crider silt loam	6	159	135
Allegheny silt loam	5	175	174

Table 2. Effect of population and tillage system on corn grain yields and lodging.[1]

Plants/A	Yield (bu/A) 1972-76 No-till	Yield (bu/A) 1972-76 Conventional
14-18,000	133	114
20-23,000	148	119
26-28,000	158	128
	Percentage Lodging 1973	
14,000	3	8
20,000	10	31
26,000	23	40

[1]Research on a Crider silt loam, Hardin County, KY

Table 3. Effect of nitrogen rate and time of application on the yield of no-till corn on a moderately well-drained soil in Kentucky.

Nitrogen Rate (lb/A) Total	At Planting	Delayed	Yield (bu/A)
0	--	--	46
80	80	0	95
80	0	80	131
117	50[1]	67	140
160	160	0	164
160	0	160	185

[1]500 lb 10-10-10 at planting.

For proper seed placement, correct planter adjustment is more critical in no-till operations. Keep a close watch on depth of planting and proper alignment of the coulter and furrow opener. Seed should be placed at a slightly shallower depth with no-till than with conventional plantings. Place seed 1 to 2 1/2 inches deep depending on soil temperature and moisture. In wet soils, planter coulters need to be set to cut shallower because seed will fall to the depth of the coulter cut.

Fertilizing

Soil testing is the best way to determine the need for lime, phosphate, and potash. Surface fertilizer application at recommended soil test levels will provide the plant roots with all the nutrients that are needed. All of the phosphorus and potassium and a portion of the nitrogen are ordinarily applied at planting time. Experiments have shown little or no difference in potassium availability whether the fertilizer is applied to the surface or mixed with the soil. In the case of phosphorus, surface application has a slight advantage over either band placement or mixing with the soil. This appears to be due to: 1) the soil surface being wetter when sod and crop residues are left on the surface, and 2) less phosphorus fixation because of reduced contact with the soil. Nitrogen rates will depend on the soil drainage class, time of application, and previous crop. Research in Kentucky has indicated that risks of nitrogen losses from leaching and denitrification are slightly greater for no-till corn than for conventionally planted corn. Delayed nitrogen applications have been very effective for no-till corn, particularly on less than well-drained soils. Table 3 shows the results obtained on a moderately well-drained Kentucky soil with split applications of nitrogen on no-till corn. Delaying the application increased corn yields at both the 80 and 160 pound per acre rate of nitrogen.

Soil acidity may become severe near the surface on fields continuously no-tilled, due to the surface accumulation of crop residues and the surface application of fertilizers containing ammonium nitrogen. Routine surface applications of lime as needed, based on soil test recommendations, are effective in maintaining a favorable pH, but may be slow in overcoming a low pH at depths of several inches. Soil samples should be taken from the top 3 to 4 inches for no-till corn.

Using Hairy Vetch for Nitrogen and as a Mulch

Hairy vetch, an annual legume, may be used to provide nitrogen for continuous no-till corn. It also provides a surface mulch which reduces soil erosion, slows evaporation of soil moisture, increases infiltration of rainfall, and increases soil organic matter content. A legume cover crop recycles other nutrients, thus reducing leaching losses that often occur in soils during the winter and spring seasons. Because of numerous hard seed, hairy vetch can be a problem if used as a cover crop in a grain crop rotation involving wheat.

For best results, hairy vetch needs to be seeded early in September in central and eastern Kentucky and by early October in western Kentucky. The seed needs to be broadcast on the soil surface into standing corn about a month before harvest or drilled immediately following harvest in October. Seeding rate should be 30 pounds per acre.

After several years of research in Kentucky, a hairy vetch cover crop has been shown to provide approximately 90 pounds of nitrogen equivalent when the corn is planted no-till about May 15. The cover crop was killed at the same time. In order to obtain high nitrogen levels from hairy vetch, it is critical to delay corn planting until the hairy vetch has made substantial growth. This is normally around mid-May.

Planting hairy vetch as a cover crop not only will reduce your fertilizer bill but also is a step toward helping the nation conserve energy. One of agriculture's major uses of energy is in manufacturing nitrogen fertilizer.

Erosion across the sloping conventionally planted corn on the right thinned out the stand and stripped off topsoil. Little erosion occurred downslope on the no-till corn planted into a wheat cover crop (left).

Using Small Grains as a Mulch

It is recommended that a cover crop be used where continuous no-till corn is to be grown. In many farming situations, using an annual legume for mulch is not practical. Also, when corn is being grown in a continuous no-till situation, there are many advantages

for using a small grain as a mulch instead of an annual legume. These advantages include: 1) the ability to seed later in the fall, 2) more growth in early spring for earlier planting of corn, and 3) the lower cost to establish.

The decision between using rye or wheat as the small grain cover depends on the expected date of seeding and planting. Rye may be seeded later in the fall and will provide more growth earlier in the spring. It is usually the best small grain cover crop to use for no-till corn because it is the most tolerant to triazine carryover, is very winter hardy, and produces an excellent mulch. It should be killed with a recommended herbicide by the time it reaches a height of 30 inches. Letting the rye grow too tall may rob the soil of moisture that is needed for the corn crop. If late planting is anticipated, then wheat should be used as the cover crop.

When establishing the small grain in the fall, the seed may be broadcast onto the soil surface following corn harvest. With a heavy disk, one disking of the stalks and soil at a depth of 2 to 3 inches will sufficiently cover seed. Seeding rate for the small grains should be 2 bushels per acre.

Weed Control

Effective weed control is one of the critical requirements for successful no-till corn production. No-till corn may be planted into a cover crop (vetch, small grain, etc.), into an old pasture or hayfield, or into the residue from the previous crop. In any situation, a contact herbicide is necessary to kill the existing vegetation. A herbicide or herbicide combination with residual action is required to effectively control late-germinating weeds. In many years, it is necessary to use a postemergence application of dicamba or 2,4-D to reduce pressure from broadleafs and vines that cannot be controlled with preemergence herbicides. Fields that are heavily infested with Johnsongrass should not be planted by the no-till method. It is important to use an ample volume of spray mixture to provide thorough coverage of the vegetation. A minimum of 40 gallons of solution per acre is required for complete, uniform coverage.

Insects

Insect or pest problems may be more severe with no-till than with conventional tillage corn production. Plant-feeding insects may be present in the sod or crop stubble at the time corn is planted. Sometimes the mulch may provide a more suitable habitat for the increase of some insects than would be provided by a bare seedbed. A soil insecticide in-the-row at planting is recommended for sod-planted corn or continuous no-till corn. However, no-till corn grown in a rotation with wheat and soybeans should have fewer insect problems.

Using hairy vetch as a winter cover crop can provide about 90 pounds of nitrogen per acre for no-till corn as well as excellent erosion control and moisture conservation.

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