

Conservation Tillage: Costs and Returns

David E. Ervin, Coy G. McNabb and Myron D. Bennett
Department of Agricultural Economics, University of Missouri-Columbia

Dallas D. Schafer
USDA, Natural Resources Conservation Service, Columbia,
Missouri

Anyone thinking about changing farming practices asks, "Does it pay?" About conservation tillage, a farmer might ask, "What are the costs and returns of conventional tillage in comparison with minimum and no-till systems?"

This publication briefly describes tillage systems and estimates costs and returns on a typical farm

Conventional tillage is the traditional way of preparing the soil for a crop. With corn production, for example, the field is tilled with a moldboard plow, disked twice, planted, and then cultivated once.

Minimum tillage replaces the moldboard plow with a chisel plow. Plowing is followed by only one disking and one cultivation. At least 30 percent of the ground surface is covered by crop residue at planting time.

No-till uses no tillage before planting. Vegetation is killed before or at planting with a contact herbicide. Pre-emergent or postemergent herbicides are used to control new weed growth. A no-till planter is used, and cultivation after planting is generally eliminated.

Regarding conservation, the goal of reduced tillage is to leave more residue on the surface to reduce erosion.

Costs and returns

The detailed crop budgets in this publication are estimated for corn and soybeans on a typical farm with the best information available (as of 1983). (MU publication [G00355](#), *No-Tillage and Reduced Tillage: Costs and Returns*, provides more recent information.)

Assumptions and procedures

- We assumed that corn and soybean yields are the same for all tillage systems. Yields of 81 bushels an acre for corn and 26 bushels for soybeans come from averaging the state yields from 1963 to 1982. We updated them to account for technology that increases yields.

From 1977 to 1982, corn grown on Mexico and other soils in north Missouri showed no significant difference in average yields between the three tillage systems. However, yield differences between the tillage systems may vary from year to year because of wet or dry weather.

- We averaged the corn and soybean prices of 1977 to 1982. They amounted to \$2.42 per bushel for corn and \$6.13 for soybeans.
- Except for machinery, we based other costs on 1983 Missouri retail prices. For machinery, we used 1981 prices.

We developed Tables 1 and 2 with the help of the Department of Agronomy. They gave recommendations on fertilizer, lime, seed, and herbicide requirements for growing corn and soybeans on a Mexico soil. Insecticide requirements are based on information from the Department of Entomology. Tillage information comes from the Department of Agricultural Engineering. Table 3 shows the average annual income and costs over a two-year rotation of corn and soybeans.

There will be differences in yields, soil types, machinery, and other characteristics between this typical farm and your own operation. Use the Your Farm column to enter costs and returns for your specific situation. For example, you may wish to omit the cost of your labor. The breakdown of costs in these tables is a useful way to compare the three tillage methods.

Summary of the budgets

1. **Herbicide and insecticide costs** either stay the same or increase slightly as you shift from conventional to minimum tillage systems. But these costs are higher for no-till.
2. **Machinery operating expenses** (fuel and repairs) have the opposite result. They decline substantially as you shift from conventional to no-till. The machinery labor costs for no-till vary from one-third to one-half of conventional tillage. This result reflects the decreased amount of field time an acre.
3. **Machinery ownership expenses** (depreciation, taxes, interest and insurance) decrease much more gradually. This result primarily reflects the lower investment in machinery as tillage is reduced. But costs can be higher if the operator keeps his or her conventional tillage equipment and buys no-till machinery. In that case, the ownership costs for the conventional machinery have to be added to the minimum and no-till production costs. Also, loans to purchase minimum and no-till machinery increase the pressure on cash flow.
4. **Return over cash costs (RCC)** indicates your income after paying cash production expenses. Note that no-till provides the lowest RCC primarily because of high chemical costs. Minimum tillage has the highest RCC, followed closely by conventional tillage.
5. **Return to land, management, and overhead (RLMO)** represents your income after paying machinery labor and ownership expenses. RLMO is available to pay land interest and principal charges, property taxes, overhead (buildings), and family living expenses. Between conventional and minimum tillage systems, the difference in RLMO increases over the comparable RCC difference. Again, this result reflects decreasing machinery ownership costs. These savings would not exist if the operator uses all tillage systems on the farm. And all tillage systems may be necessary on some farms, especially those with tight or poorly drained land.
6. **The tillage systems can be ranked** on the basis of RLMO for the corn-soybeans rotation: (1) minimum, (2) no-till, and (3) conventional. However, in this example, there is no advantage for no-till over conventional tillage soybeans because of the very high post-emergent herbicide costs. Your own situation may be different. For corn, the lower cost of postemergent herbicides makes no-till look more attractive.

Erosion control

The more residue that is left on the surface, the greater is the reduction in soil loss. Corn provides greater residue after harvest than soybeans, but soybean acreage has been increasing.

The soil loss per acre from the three tillage systems was estimated in a corn-soybean rotation on a Mexico soil with 3 percent slope. With conventional tillage, the loss was 12.5 tons per acre, followed by minimum tillage at 8.6 and no-till at 5.2 tons per acre. Both reduced tillage systems represent a substantial reduction in soil loss: 31 percent for minimum till and 58 percent for no-till, in comparison with conventional tillage.

At this point, researchers are unable to assign an accurate monetary value to a reduction in soil loss. However, anyone who has given soil conservation much thought knows erosion is a serious problem on sloping, cultivated fields. Decrease in the tilth and in crop yields are gradual and may go unnoticed until gullies appear. More immediate problems are the washing away of fertilizers and chemicals and the deposits of topsoil in low field spots, public road ditches and in streams and lakes during heavy rains. These are costs to the individual and to society.

Conservation tillage appears to be the most promising single practice for economically reducing soil erosion. However, on many farms other practices may also be required to reduce soil erosion to a level consistent with private and public soil conservation goals.

Table 1. Corn budget on Mexico silt loam (per acre).

	Conventional	Minimum	No-till	Your farm
Income: 81 bu. at \$2.42/bu.	\$196.02	\$196.02	\$196.02	_____
Cash costs				
Seed	\$11.38	\$11.38	\$12.51	_____
Fertilizer and lime	43.90	43.90	43.90	_____
Herbicides	13.24	13.24	25.45	_____
Insecticides	4.90	5.98	7.93	_____
Machinery fuel and repairs	21.31	18.16	13.17	_____
Operating interest	5.98	5.73	6.23	_____
Total cash costs	\$100.71	\$98.39	\$109.19	_____
Return over cash costs (RCC)	\$95.31	\$97.63	\$86.83	_____
Machinery labor cost	9.60	8.36	6.47	_____
Machinery ownership costs	47.74	42.86	38.57	_____
Total production costs	\$158.05	\$149.61	\$154.23	_____
Return to land, management and overhead (RLMO)	\$37.97	\$46.41	\$41.79	_____

Table 2. Soybean budget on Mexico silt loam (per acre).

	Conventional	Minimum	No-till	Your farm
Income: 26 bu. at \$6.13/bu.	\$159.38	\$159.38	\$159.38	_____
Cash costs				
Seed	\$8.33	\$8.33	\$9.38	_____
Fertilizer and lime	31.18	31.18	31.18	_____
Herbicides	19.17	19.17	37.62	_____
Insecticides	1.46	1.88	3.38	_____
Machinery fuel and repairs	16.33	13.19	8.64	_____
Operating interest	4.48	4.37	4.86	_____
Total cash costs	\$80.95	\$78.12	\$95.06	_____
Return over cash costs (RCC)	\$78.43	\$81.26	\$64.32	_____
Machinery labor cost	7.05	5.81	3.35	_____
Machinery ownership costs	42.35	37.47	33.53	_____
Total production costs	\$130.35	\$121.40	\$131.94	_____
Return to land, management and overhead (RLMO)	\$29.03	\$37.98	\$27.44	_____

Table 3. Corn and soybean budget averaged, on Mexico silt loam (per acre).

	Conventional	Minimum	No-till	Your farm
Income	\$177.70	\$177.70	\$177.70	_____
Cash costs				
Seed	\$9.86	\$9.86	\$10.95	_____
Fertilizer and lime	37.54	37.54	37.54	_____
Herbicides	16.21	16.21	31.54	_____
Insecticides	3.18	3.93	5.66	_____
Machinery fuel and repairs	18.82	15.68	10.91	_____
Operating interest	5.23	5.05	5.55	_____
Total cash costs	\$90.84	\$88.27	\$102.15	_____
Return over cash costs (RCC)	\$86.86	\$89.43	\$75.55	_____
Machinery labor cost	8.33	7.09	4.91	_____
Machinery ownership costs	45.05	40.17	36.05	_____
Total production costs	\$144.22	\$135.53	\$143.11	_____
Return to land, management and overhead (RLMO)	\$33.48	\$42.17	\$34.59	_____

To order, request G00350, *Conservation Tillage: Costs and Returns* (out of print).

• Issued in furtherance of Cooperative Extension Work Acts of May 8 and June 30, 1914, in cooperation with the United States Department of Agriculture. Ronald J. Turner, Director, Cooperative Extension Service, University of Missouri and Lincoln University, Columbia, Missouri 65211. • University Extension does not discriminate on the basis of race, color, national origin, sex, religion, age, disability or status as a Vietnam-era veteran in employment or programs. • If you have special needs as addressed by the Americans with Disabilities Act and need this publication in an alternative format, write ADA Officer, Extension and Agricultural Information, 1-98 Agriculture Building, Columbia, MO 65211, or call (573) 882-8237. Reasonable efforts will be made to accommodate your special needs.