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Strip Till: A Viable Option?

Kansas research shows strip-till produced better early-season growth and higher corn grain yields in 2003 trials.

Summary: *Results to date from field studies conducted at three Kansas locations in 2003 indicate that strip-till provides for warmer temperatures early in the season, resulting in better early-season growth and higher grain yields than in no-till. Fertilizer applied during the fall strip-till performed similarly to fertilizer applied at planting where fall strip-till was done.*

Conservation-till practices leave residue from the previous crops on the soil surface, reduce soil erosion, and decrease trips across the field with heavy tillage equipment. Although no-till provides soil and water conservation benefits to producers, the cooler, wetter soil conditions found in no-till systems result in potential problems for planting and establishing crops. Crop residues affect the soil surface energy balance by providing insulation and reflective properties. Thus, covered and bare surfaces have different energy balances. Soil under a thick residue layer stays cooler and wetter in comparison to bare soil. The inherent residue layer associated with no-till contributes to cooler temperatures in the seed zone at spring planting. Lower soil temperatures negatively affect seedling emergence and early-season growth, especially with early planting dates. Corn root growth increased fivefold when soil temperature increased from 63o F to 88o F. If no-till systems are limited by crop residues on the soil surface, then seed-row residue removal should lead to corn

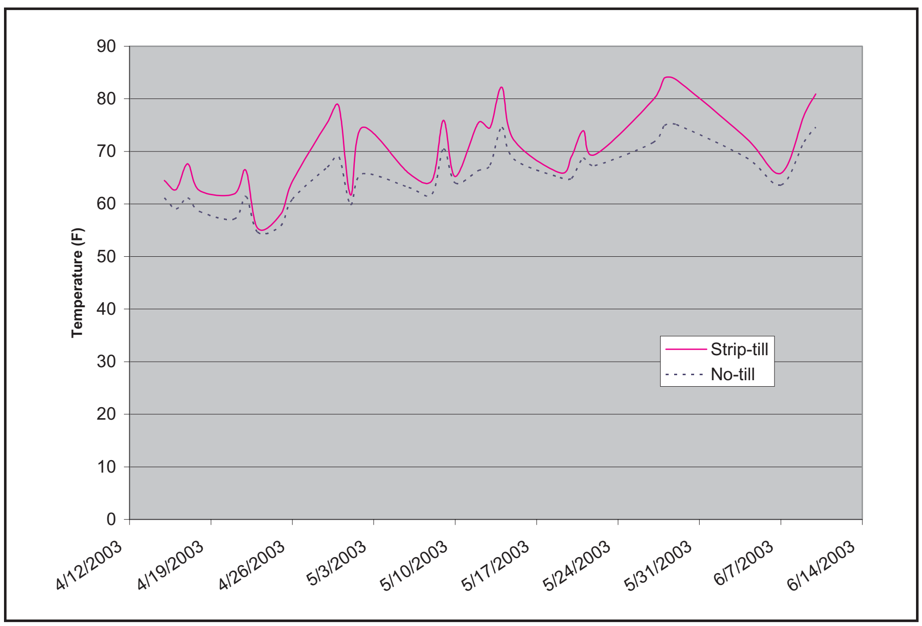

Figure 1. Daily soil temperatures at seeding depth, Manhattan.

growth similar to that of tilled systems. Strip-till provides an ideal combination of no-till with conventional-till. Residue removal from within the row should allow for rates of development that are similar to that of conventional-till. Maintaining a concentration of residue in the inter-row will allow the no-till advantages of lower soil water evaporation and reduced runoff to be salvaged. Strip-till also offers the option of applying fertilizer nutrients during the fall strip-till operation. A second option is to apply nutrients in the spring at planting after creating the strip-till in the fall.

Overall objective of the research presented here was to compare strip-till and no-till as options for early-planted corn in Kansas by evaluating:

1. seed row temperature differences between strip-till and no-till, and effects on a) emergence, b) early-season growth, and c) grain yield
2. management options for rates and timing of fertilizer application.

Strip-till vs. no-till

Soil temperature. Although there were no differences in final plant stands due to tillage, corn in the strip-till treatments emerged quicker and more uniformly than in no-till (data not shown). Average daily soil temperatures at both Manhattan and Belleville through April and May were higher in strip-till compared to no-till (Figures 1 and 2). The effect of higher soil temperatures in strip-till was reflected in the increased V6 dry matter production compared to no-till at all locations (Tables 1, 2,and 3).

Grain yields. In addition to the better early growth, the use of strip-till significantly increased corn yields in comparison to no-till at all locations in 2003 (Tables 1, 2, and 3).

Grain yields were especially good at the Manhattan site for dryland corn owing to early planting and timely rains through mid-July, with strip-till significantly increasing early-season growth over no-till and producing a 28 bu/A corn grain yield advantage over no-till (Table 3).

Grain yields at Belleville were reduced owing to dry conditions, but even with lower yields, strip-till yields were 12 bu/A higher than no-till yields at the Belleville site (Table 3).

Advantages in early-season dry matter production and grain yield were also observed for strip-till at the Ottawa field site.

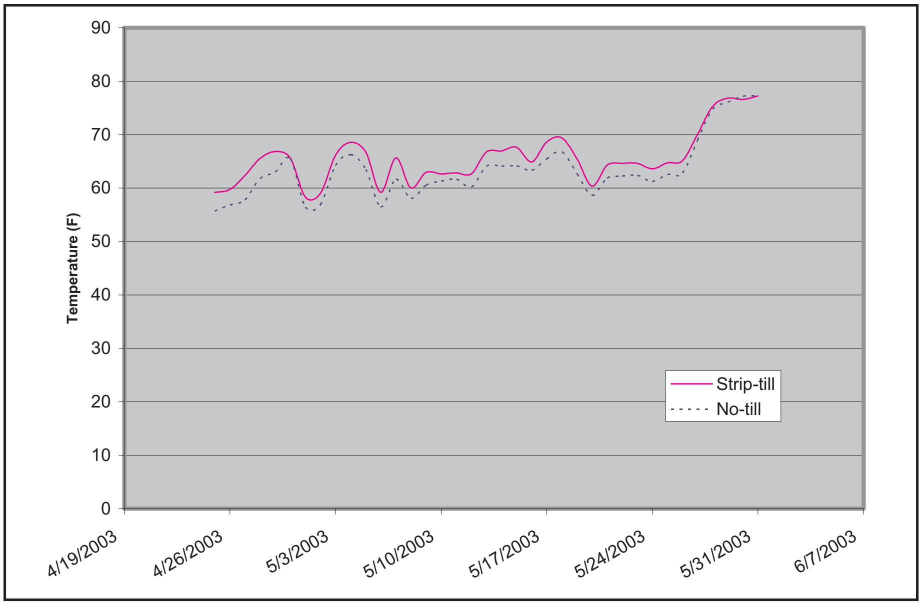

Figure 2. Daily soil temperatures at seeding depth, Belleville.

Table 1. Effects of tillage, time of fertilizer application, and N rate on corn.

Tillage	Timing	Rate N	Rate P	Rate K	Rate S	Manhattan V6 Dry wt	Manhattan Yield	Belleville V6 Dry wt	Belleville Yield
		—lbs/A—				lbs/A	bu/A	lbs/A	bu/A
Strip-till		0	0	0	0	339	170	155	42
Strip-till	Fall	40	30	5	5	417	182	276	56
Strip-till	Fall	80	30	5	5	450	193	284	58
Strip-till	Fall	120	30	5	5	452	205	361	67
Strip-till	2/3 Fall 1/3 Planting	120	30	5	5	493	193	406	75
Strip-till	Planting	40	30	5	5	468	185	263	52
Strip-till	Planting	80	30	5	5	485	187	283	60
Strip-till	Planting	120	30	5	5	424	187	353	71
No-till	Planting	40	30	5	5	366	152	178	45
No-till	Planting	80	30	5	5	360	167	189	48
No-till	Planting	120	30	5	5	310	174	198	51
No-till		0	0	0	0	263	121	105	36

Table 2. Effects of time of fertilizer application and N rate on strip-till corn.

Variable		Manhattan V6 Dry wt	Manhattan Yield	Belleville V6 Dry wt	Belleville Yield
		lbs/A	bu/A	lbs/A	bu/A
Timing:					
Fall		440	193	307	60
Planting time		459	186	300	61
N rate (lbs/A):	40	443	184	269	54
	80	468	190	283	59
	120	438	196	357	69

No significant difference existed between fertilizer applications made in the fall with the strip-till operation as compared to applying fertilizer in the spring after fall strip-till (Table 2). Results suggest that under similar conditions, fertilizer can be applied during fall strip-till without concern of yield reduction.

Nitrogen (N) rate effects varied by location and previous crop, but increasing N rates generally increased grain yields.

Table 3. Effects of tillage and N rate on corn*

Variable		Manhattan V6 Dry wt	Manhattan Yield	Belleville V6 Dry wt	Belleville Yield
		lbs/A	bu/A	lbs/A	bu/A
Tillage:					
Strip-till		429	182	264	57
No-till		325	154	168	45
N rate (lbs/A):	0	301	146	130	40
	40	417	169	221	49
	80	423	177	236	54
	120	367	181	276	61

* averaged across treatments receiving fertilizer at planting time

Methodology

Soil was a Crete silty clay loam at Belleville, a Reading silty loam at Manhattan, and a Woodson silty clay loam at Ottawa.

Tillage. A four-row strip-till rig was used in the fall to disturb the soil to a depth of approximately 6 inches in the row with a 4- to 5-inch wide area of residue-free soil over the row. Inter-row regions were left undisturbed.

Fertilizer treatments included either 40, 80, or 120 lbs/A of N applied with 30 lbs/A of P_2O_5, 5 lbs/A of K_2O, and 5 lbs/A of S.

Placement. Fertilizer was placed approximately 5 to 6 inches deep with the strip-till operation or in a 2 x 2 placement with the planter on no-till plots and strip-till plots receiving spring application.

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