Can We End the Debate on No-Till Yields?

by Mike S. DeFelice, Paul R. Carter, and Steven B. Mitchell

SCIENCE

DeFelice, Carter, and Mitchell are scientists with Pioneer Hi-Bred International.

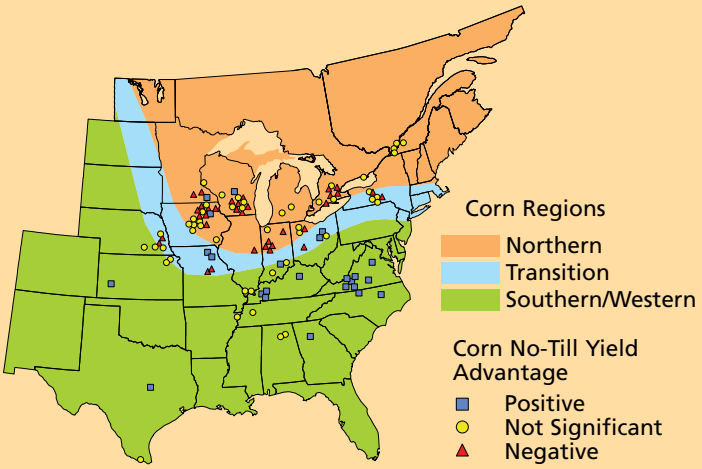
The following is excerpted from an article originally published in June 2006 by Plant Management Network entitled 'Influence of Tillage on Corn and Soybean Yield in the United States and Canada.' Reprinted here with permission of Plant Management Network and the authors.

An extensive literature review was conducted of corn and soybean research that compared yields of no-tillage to conventional-tillage systems. The search revealed 61 experiments that compared corn yields by tillage, representing 687 site-years of data, and 43 full-season soybean trials representing 455 site-years of data. All of the trials summarized used a close variant of a true no-tillage system, with minimal surface disturbance only utilized at planting and/or during fertilizer application. (Strip-till was not included in this analysis, because of few published studies and widely varying methods.)

No-tillage provided equal or better yields than conventional tillage in many studies despite the short life span and less-than-optimal management practices sometimes used in the no-tillage plots.

The objective was to test the hypothesis that no-till has a different effect on corn and soybean yields in different regions of the United States and Canada. The trial results were mapped to look for geographic and environmental patterns in the relative performance of no-tillage to conventional tillage on corn and soybean yield. The national average difference in corn and soybean yield between no-tillage and conventional tillage was negligible. However, the results clearly showed regional differences (see table and maps). No-till clearly provides greater yields in the eastern, southern, and western United States where high temperatures, soils with low water-holding capacity, and/or unfavorable rainfall patterns often cause drought stress. No-till yields are equal or slightly less than conventional tillage in the northern United States and Canada where cold, wet spring conditions and poorly drained soils cause slower emergence and crop development in short maturity zones.

Corn No-Till vs Tillage Experiments



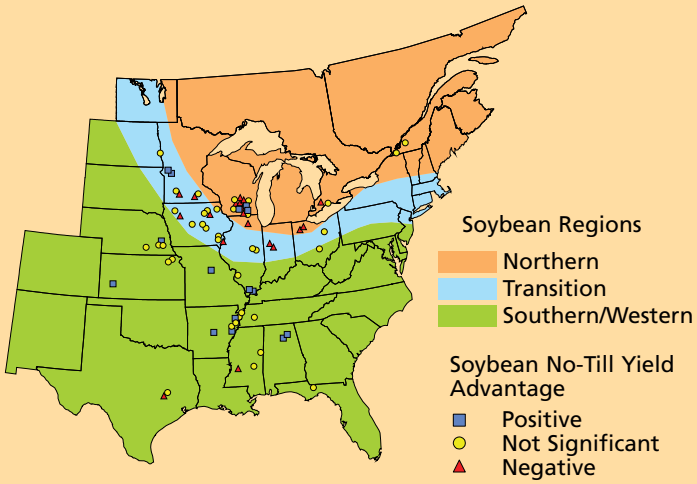
Experiments conducted for a short number of years (less than 4 or 5) without prior years of no-tillage in the no-till plots probably do not provide a completely fair comparison to conventional tillage because the no-till soils have not had time to stabilize. Some researchers may also still have been learning how to manage no-till-

Corn and soybean yield advantage of no-tillage over tillage

		% Yield advantage of no-till (no. of comparisons)	
		Corn	Soybean
All Experiments		-0.5 (104)	0.7 (67)
Geography	Southern/Western	12.2 (26)	5.0 (26)
	Transition	-1.8 (16)	-0.6 (22)
	Northern	-5.5 (62)	-3.9 (19)
Soil drainage	Moderate/ well-drained soils	2.0 (64)	2.0 (41)
	Poorly drained soils	-4.5 (40)	-1.4 (26)
Crop rotation	Corn-soy rotation	1.9 (38)	0.7 (40)
	Continuous	-1.5 (60)	1.1 (23)

The national average difference in corn and soybean yield between no-tillage and conventional tillage was negligible.

Soybean No-Till vs Tillage Experiments



age while conducting this type of research for the first time. Other than tillage itself, it was apparent that some researchers used the same management practices in both tillage systems [*Editors: and those practices were generally optimized for the tilled system by habit of thought*]. Planting rate, fertilizer rate and application, and sometimes even weed control practices were the same in both tillage systems. No-tillage and conventional tillage usually require distinctly different management practices for planting rate and date, fertilizer rate and placement, irrigation management, herbicide weed management, and insect control. Some of the early experiments conducted prior to the 1980s also had problems maintaining seeding rates and planting depth in no-tillage because they lacked the improved high-residue planter technology introduced after that time. Using uniform management practices across tillage systems is probably not a fair comparison of the overall tillage management systems. It is interesting that no-tillage still managed to provide equal or better yields than conventional tillage in many of these studies despite the short life span and less-than-optimal management practices sometimes used in the no-tillage plots. This is an indication that the comparisons in this review are somewhat conservative towards the performance of no-tillage relative to conventional tillage.

Overall, it is the authors' opinion that conducting additional side-by-side comparisons of no-tillage and conventional tillage corn and soybean production systems is probably not widely needed in the United States. This review indicates corn and soybean producers in most of the United States will not suffer a yield disadvantage in switching from conventional tillage systems to no-tillage. Even in areas where no-tillage yields are lower, the economics of no-tillage and other factors such as soil conservation and government incentives probably make the switch to no-tillage a small economic issue. It is likely other factors such as environmental stewardship, personal experience, equipment availability, switching costs, farm size, time and labor availability, fuel prices, and government incentive programs will be a far greater influence on the decision to no-till than the effect on crop yield. Future tillage research would most profitably focus on optimizing successful high-residue no-tillage systems . . . instead of making comparisons to conventional tillage systems.

Additional comparisons of no-tillage and conventional-tillage corn and soybean systems are not widely needed. Corn and soybean producers in most of the U.S. will not suffer a yield disadvantage in switching to no-tillage.

Editors: The minor yield drag (-2 to -6%) for no-till in the northern cool/wet areas may not be important when cost efficiencies are considered, and would likely be eliminated with improved practices such as the use of cover crops.