INTRODUCTION

No-till is one of this century's biggest breakthroughs in agricultural technology.

It gives meaning to the term "sustainable agriculture", because it is practical, profitable, maintains production targets, and protects soil and water quality on and off the farm.

For centuries, the moldboard plow was used to till land. It works well on flatter, wetter, fine-textured ground where solid manure, hay and pasture are part of a cropping system. But where moldboard tillage is used repeatedly on sloping, lighter, and medium-textured soils, it is a major cause of soil erosion. Most of us have witnessed one or more of the following: degraded farmland, eroded topsoil during snowmelt and rainstorms, dust storms in spring, sediment-choked streams, reduced yields, increased inputs, and dwindling returns.

In the past 30 years, innovative farmers have turned their attention to soil conservation. One area they've examined in partnership with researchers, extension staff and agribusiness is tillage. Their imaginative explorations have led us to the subject of this book.

Many who have adopted no-till, now swear by it. There are some farmers for whom no-till hasn't worked. Others are in the process of implementing it.

Whether you're a cash cropper, livestock producer or vegetable grower, you'll find information and tips in these pages that will help make no-till work in your operation. It's based on the combined experience and talents of no-till farmers, researchers, agri-business professionals, and soil and crop experts.

No-till is a system. Take the time to evaluate each component to perfect it.

Laurence Taylor, Huron County

JC Allin and Sons Inc/ Rural Life

This photo from 1914 shows that no-tilling wheat after soybeans is not a new idea.

NO-TILL DEFINED

In a no-till crop production system:

- the field is left virtually undisturbed from harvest to planting, except for nutrient injection
- fields are no longer plowed, and plant residues remain on the soil to offer protection from erosion
- a narrow seedbed is prepared by the planter or drill during the planting operation, to allow adequate seed and fertilizer placement
  - alternatively, the row strip may be pre-tilled during a separate pass
- weed control is accomplished primarily with herbicides, but shallow inter-row cultivation may still be used for emergency weed control.

No-till farming will reduce cropland erosion and runoff. When soil and crop inputs stay on cropland, water quality can be maintained. Less sediment in surface waters means less costly ditch and harbour clean-outs.

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TYPES OF NO-TILL

LESSONS LEARNED FROM T-2000

In 1985, 23 farmers working 40 farms across Ontario began cooperating in T-2000, a five-year research project. They were all committed to trying to make a conservation tillage system work.

Aided by soil conservation advisors, within two years cooperators had overcome common difficulties and were sharing many concepts with their neighbours. By Year 3, it was obvious that results were as good as, if not better than, conventional systems. Conservation tillage and no-till systems were being accepted.

Strip Till. Planters and drills are set up with one or more coulters per seed row, and sometimes row cleaners, to prepare narrow strips of soil that optimize seed-to-soil contact. Strip till can be adapted to many conditions, regardless of crop.

Slot Planting. A slot is opened in untilled soil, and seed is placed at an appropriate depth. Several combinations of seed-firming devices and press wheels are used to close the slot, helping achieve adequate seed-to-soil contact. This is no-till in its purest form, and is especially suited to soybeans, wheat and other cereals on many soils. Slot planting doesn't work well in heavy crop residue, and moist, fine-textured soil.

Pre-till. A narrow strip is tilled with one of a variety of implements. The process encourages the loosening and decomposition of residue over winter, and speeds drying in the spring. Come spring, soils are ready to plant earlier. Pre-tilled strips speed germination and emergence, and help keep cereals in rotation. An extra pass over the field is required, but for some farmers, it's worth it.

Ridge Till. Using sweeps, disc openers, coulters or row cleaners, the ridge is cleared for planting. Residue is left on the surface, between ridges. Warmer soil temperatures in the ridges encourage seedlings to push through earlier. Ridges are re-formed with a cultivation. This also provides mechanical weed control, reducing herbicide use. Ridges require controlled wheel traffic and reduce seedbed crusting. Ridge till also works well in fine-textured soils, especially during cold, wet springs.

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MAKING IT PAY

In nearly all cases, conserving soil and water is a given in a no-till system. Today, the focus of making no-till work is to reduce costs. No-till saves money by:

- ▸ reducing labour
- ▸ reducing fuel requirements
  - ▷ in a 1986 Ontario study, no-till was three times more fuel-efficient than a system based on the moldboard plow
- ▸ reducing investment in capital
  - ▷ investment in equipment in a typical 1000-acre operation can be slashed by a third
- ▸ increasing long-term productivity.

Experienced no-till farmers will tell you that the first three years require commitment, compromise and courage.

In 1973, I did 500 acres, and now in 1996 I crop more than 1,000 [without an increase in labour]. All because of no-till.

T-2000 participant Clinton Pottruff, Brant County

A crop system is like an ecosystem. Every time we change one component, all of the other components are affected – often in a chain reaction.

Don Lobb, Huron County

A SYSTEMS APPROACH TO CHANGE, ADAPTED FROM DON LOBB

A crop production system includes all the components that you control while producing the crop – such as management practices, crop inputs and soil conditions.

For overall effectiveness, each component in the system should be considered on its own and as part of the whole system.

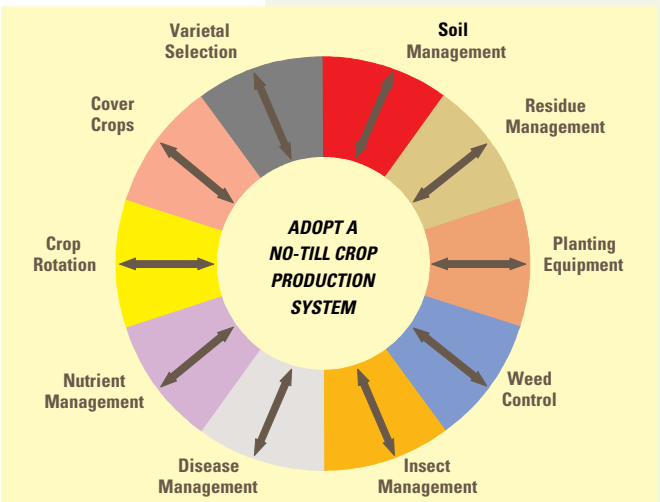
In a management system, an introduced change in practice will always affect more than one component in the system.

The diagram on the right illustrates the principles of the no-till system concept. Key components of the system are placed around the perimeter. The arrows in the diagram point in both directions to show that each component affects the whole system – and the system affects each component. (Each component is interactive.)

Understanding the systems approach is the key to making no-till work.

The remainder of the book is earmarked according to the components of the wheel by the shading of the wedges in the wheel.

Further, where there are interactions in each section, the interacting components will be highlighted.



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HOW IT WORKS – A CASE STUDY

A cash crop producer wants to try no-till soybeans into corn residue. The following outlines how this change will affect other components within the system.

WEED CONTROL AND VARIETAL SELECTION

Primary and secondary tillage are no longer part of the system. Tillage will no longer destroy weeds ahead of planting. Also, over time, a new weed spectrum will develop, requiring a new weed control strategy. The strategy may include herbicides that decrease yield. This may in turn require different varieties that are more tolerant of the herbicides used. A yield reduction, which at first is associated with the tillage change, may in fact be caused by a different level of tolerance to a new herbicide.

RESIDUE AND DISEASE MANAGEMENT

Reduced tillage will leave more residue on the soil surface, making it more difficult to plant the crop. This results in the soil being cooler and wetter, and having a greater potential to cause root disease.

Check the system for the following opportunities to reduce this risk:

- ▸ add tillage coulters to the planter to loosen and dry the soil along the crop row
- ▸ delay planting date if necessary to allow the soil to warm and dry
- ▸ select a disease-tolerant variety, and
- ▸ use crop rotation (i.e., soybeans after corn; not soybeans after soybeans) to reduce the risk of root disease problems.

Disregarding any of these solutions can cause a yield reduction that need not be attributed to the change to no-till. Check the system for all opportunities to reduce the potential for a yield reduction. Watch for further interactions within the system. For example, in time, earthworm populations will increase, improving aeration and drainage in the soil, and reducing the need for aggressive strip tillage.

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NO-TILL CALENDAR

A successful no-till program starts at harvest ... and goes all year round. It takes planning to help no-till work. The following calendar provides general guidelines to help you get ready.

CALENDAR FOR NO-TILL BEST MANAGEMENT PRACTICES

	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.
LEARN MORE ABOUT NO-TILL	Attend farm shows, no-till meetings and tours. Contact local experts, agribusiness and extension staff to assist with troubleshooting.											
	Read extension material. Try the internet.						Visit no-till seed variety plots to evaluate varieties.					
NUTRIENT MANAGE-MENT		Plan nutrient management practices.			Apply starter fertilizers.				Soil test.			
							Inject nitrogen fertilizer or liquid manure.					
									Apply lime (if necessary).			
									Apply solid manure.			
						Apply liquid manure.						
PLANTING / TILLAGE EQUIP-MENT	Repair/ modify planting equipment.									Pre-till or disc (if necessary).		
							Prepare drill for winter cereals.					
						Cultivation and ridging in ridge till.						
CROP ROTATION AND RESIDUE MANAGE-MENT	Study crop variety results. Place orders for spring planting.								Plant cover crops and winter cereals.			
					Renovate pasture by inter-seeding legumes using no-till.					Harvest and spread residue evenly.		
								Spread cereal residue at harvest and bale straw.		Review crop rotation. Make changes where necessary.		
INSECT, WEED AND DISEASE MANAGE-MENT	Repair spraying equipment.				Apply pre-plant contact herbicides and burndowns.				Apply pre-harvest burndowns where appropriate.			
					Apply residual herbicides.							
						Cultivate and band-spray in ridge till system.				Make note of weeds at harvest.		
						Apply post-emergent herbicides.						
	Finalize weed control program.						Scout crops carefully and frequently for weeds, insects and diseases.					