Evaluation Of Strip Tillage Systems For Corn Establishment On Heavy Clay Soils In The Golden Horseshoe Region

(Interim Report)

Purpose:

To determine if a fall strip tillage system would benefit corn growers on heavy clay soils by offering a wider window for planting corn in the spring. There are several components of the project and this report focuses on a "Comparison of strip tillage to conventional and or no-till systems for suitability on clay soils". Can more acres be planted using strip till systems.

Methods:

Three sites were selected in the fall of 2004, with two being heavy clay soils and the third a loam soil. All were in the Ancaster to Binbrook region of the Golden Horseshoe SCIA region. Two of the cooperators chosen have fully adopted the strip till system on their farms and the third was willing to allow the UofG-OMAFRA Cropping Systems Team to conduct the trial with the Teams equipment.

All sites were in soybeans during 2004. Trials were laid out with 3 replicates on field scale plots and the strip tillage and fall tillage component of the conventional system were conducted in December. The plots were laid out to accommodate two planting date possibilities for the spring of 2005. The goal was to have the cooperator plant the various tillage system plots when they were "fit" to be planted on the assumption that there would be differences in when the soil conditions of the various treatments were fit for planting. In the spring of 2005, the cooperators were instructed to plant each individual system when it was ready. At the first planting date of the last system to be planted the, the remaining plots were to be planted. In this manner each tillage system would be planted at its optimal time and at the same time there would be a direct comparison of tillage system on the same planting date.

The sites were otherwise maintained with normal farm practices. Assessments included planting date, number of tillage passes for conventional system, berm temperatures, crop stand, harvest yield and grain moisture.

At all sites the corn was planted with Notill competent planters, which in strip till and notill systems must perform the seedbed tillage operation while the crop is being planted. Conventional planters are not sufficient for planting Striptill plots.

Table 1. Site And Treatment Profiles				
Site	**Soil**	**Drainage**	**Treatments**	**Planting Dates**
Binbrook_E	Clay	Poor, Unimproved	1. Fall and Spring Striptill 2. Fall Soil Saver, Spg Disc + Culitivate 3. Notill	22-Apr-05 09-May-05
Binbrook_W	Clay	Poor, Tile Drained	1. Fall StripTill 2. Fall Soil Saver + Spg Cultivate	10-May-05 17-May-05
Ancaster	Loam	Good	1. Fall Striptill 2. Fall Soil Saver + Spg Cultivate 3. Notill	12-May-05 21-May-05

Results:

In both the spring of 2004 and 2005, the season developed with relatively warm open weather so that there was no difference in the systems with respect to when they were fit to plant for striptill vs when conventional ground could be worked. Therefore for all sites, the all tillage systems were planted on the same dates within a site. An arbitrary delay for a second planting date was used to establish another date for comparison of the treatments to see if systems responded differently to planting date.

No significant differences in planting zone temperature were detected between the systems (data not reported). There was visual differences between the tillage system plots throughout the season and was most pronounced at the Binbrook_E site, and least at the Ancaster site.

Table 2. By Site Yield Response to Tillage System 2005							
Site	**Soil Type**	**Tillage**	**Planting Date**	**Yield bu/ac (t/ha)**	**Sign***	**CV**	**# of Spring Cult Passes Required**
Binbrook_W	Clay	CT	PD2	176 (11.04)	A	3.46	2
Binbrook_W	Clay	ST	PD2	174 (10.92)	A		
Binbrook_W	Clay	ST	PD1	160 (10.04)	B		
Binbrook_W	Clay	CT	PD1	143 (8.97)	C		2
Binbrook_E	Clay	CT	PD2	165 (10.35)	A	5.78	6
Binbrook_E	Clay	CT	PD1	162 (10.16)	A		6
Binbrook_E	Clay	ST	PD2	147 (9.22)	B		1
Binbrook_E	Clay	ST	PD1	147 (9.22)	B		1
Binbrook_E	Clay	NT	PD1	135 (8.47)	BC		
Binbrook_E	Clay	NT	PD2	133 (8.34)	C		
Ancaster	Loam	CT	PD1	179 (11.23)	nsd	3.28	2
Ancaster	Loam	ST	PD1	179 (11.23)			
Ancaster	Loam	CT	PD2	177 (11.11)			2
Ancaster	Loam	NT	PD1	175 (10.98)			
Ancaster	Loam	ST	PD2	171 (10.73)			
Ancaster	Loam	NT	PD2	168 (10.54)			

CT=conv with fall soil saver, ST=fall strip till, NT=notill
*** Treatments followed by the same letter are not significantly different at the 10% level within each site.**

At the Ancaster site (Table 2.), there was no significant difference between tillage treatment or planting date in final yield. Conventional plots only required a two spring passes with a cultivator to make a satisfactory seedbed. There was some significant soil crusting that occurred at the site and whole trial area was harrigated to break the crust.

A Notill treatment was not applied at the Binbrook_W site. The Planting Date 1 plots for both tillage systems received several centimeters of heavy wet snow the day after planting. The results suggest that the Striptill plots did not suffer the same degree of impact from this event as the conventional plots which had been tilled 3 days before receiving the snowfall (160 (10.04) vs 143 (8.97) bu/ac (t/ha) respectively). With the second planting date under ideal conditions for both systems, there was not difference in yield between Striptill and Conventional.

The Binbrook_E site required 6 passes of spring tillage to meet the seedbed fitness of the cooperator and with the near equal yield to Striptill likely makes Striptill a more economical and environmentally favourable practice. At this site the ground was very wet at fall Strip establishment. The berms were barely visible in April of 2005 and a decision was made to re-establish the strips with a spring operation.

Table 3. 2005 Tillage Project - All Site Analysis

Treatment		Yield (bu/ac)	Yield (t/ha)	Sign*
A. Planting Date				
Planting Date 2		162	10.2	nsd
Planting Date 1		159	10.0	
B. Location				
Ancaster		174	11.0	A
Binbrook_W		159	10.0	B
Binbrook_E		148	9.3	C
C. Tillage Type				
Conventional		167	10.5	A
Strip Tillage		163	10.2	A
NoTill		152	9.5	B
D. Tillage x Planting Date				
Conventional	Planting Date 2	173	10.8	A
Strip Tillage	Planting Date 2	164	10.3	AB
Strip Tillage	Planting Date 1	162	10.2	BC
Conventional	Planting Date 1	162	10.1	BC
NoTill	Planting Date 1	154	9.7	CD
NoTill	Planting Date 2	150	9.4	D

Analysis CV = 6.74, Treatments followed by the same letter are not significantly different at the 10% level.

When the three 2005 sites were analyzed together the data suggests that there was no impact of planting date across all sites and tillage systems (Table 3.). Location effects were significant with the Ancaster > Binbrook_W > Binbrook_W. This suggests that the productive capacity of the site has a greater effect then the differences between the tillage systems. The sequence of the sites in yield potential is directly related to the soil type and drainage of the locations. The analysis suggests there was no difference between Conventional Tillage and

Striptill Tillage systems across these sites but the Notill achieved significantly less yield in general. However, the No-till system was only present in two sites and at the Ancaster site it was not different from the other two tillage systems.

In the interaction of tillage x planting date, there was no significant difference between the Conventional and Strip Tillage Systems at each planting date, but that there was a minor effect of planting date, likely impacted by the big difference in yield between the two tillage systems at Binbrook_W for the first planting date before the snow.

Summary:

The data from this year would suggest that there essentially no difference in yield potential between Conventional and Striptill systems at these sites. The Notill system did suffer a yield penalty compared to the other two, although it was not significant at the Ancaster site.

The conventional system would have used more fuel, put more emissions into the environment, had a greater negative impact on soil organic matter and soil structure over time, required more labour and was harder on the soil in terms of soil building parameters.

Next Steps:

A third year of this study needs to be completed since the results from the first year were impacted by weather and other effects. The fall of 2005 in the Wentworth region was extremely wet and we were unable to establish the fall tillage treatments. The plan is to conduct the trials again starting with establishment in the fall of 2006 and completing the field studies in the fall of 2007.

An economic and environmental impact analysis will be completed. Based on the similar yields achieved by the Conventional and Striptill systems, these further analysis will likely show that there is greater potential for profit from the Stiptill system over the Conventional system. As well, the environmental impact with Striptill is likely to prove less because of reduced fuel use, less soil disturbance, better N use efficiency among other factors.

Acknowledgements:

Funding for this project was provided through the Greenhouse Gas Mitigation Program for Agriculture supported by Agriculture and Agri-Food Canada and administered nationally by the Soil Conservation Council of Canada. In Ontario this program is delivered by OSCIA in partnership with IFAO,OMAFRA and the University of Guelph.

We would like to thank the project cooperators for their important contribution.

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