Soybean Tillage Systems

Purpose:

No-till has many proven economic and environmental benefits. However, producers are becoming increasingly dissatisfied with the performance of soybeans in no-till planting systems. Wet and cold planting conditions along with increased problems associated with corn residue has forced some growers to reconsider the viability of no-till production. This project assessed if there is actually a yield drag associated with no-till and if so, what can be done to mitigate this problem.

One possible strategy to overcome any yield drag associated with no-till is to increase seeding rates. Perhaps yield reductions in no-till are the result of poor plant stands. Other possible strategies include the use of a precision planter, the removal or corn stalks, or chopping corn stalks to increase breakdown, and improve seeding performance.

Methods:

In 2013 two trials assessed three different tillage levels, two seeding rates, a planter compared to a drill, chopping the stalks, as well as corn residue removal. The trials were located near Woodstock and near Milverton, ON. The previous crop at all sites was corn.

Table 1.The treatments included:

No.	Tillage	Planter or Drill at Two Seeding Rates
1	Disc Ripper	Planter 180 000 seeds/ac
2	Disc Ripper	Planter 250 000 seeds/ac
3	Disc Ripper	Drill 180 000 seeds/ac
4	Disc Ripper	Drill 250 000 seeds/ac
5	Disc Ripper	Planter 180 000 seeds/ac + Residue Removal
6	Disc Ripper	Planter 180 000 seeds/ac + Stalk Chop
7	RTS*	Planter 180 000 seeds/ac
8	RTS	Planter 250 000 seeds/ac
9	RTS	Drill 180 000 seeds/ac
10	RTS	Drill 250 000 seeds/ac
11	RTS	Planter 180 000 seeds/ac + Residue Removal
12	RTS	Planter 180 000 seeds/ac + Stalk Chop
13	No-till	Planter 180 000 seeds/ac
14	No-till	Planter 250 000 seeds/ac
15	No-till	Drill 180 000 seeds/ac
16	No-till	Drill 250 000 seeds/ac
17	No-till	Planter 180 000 seeds/ac + Residue Removal
18	No-till	Planter 180 000 seeds/ac + Stalk Chop

These treatments were randomized and replicated three times. Trials were planted with a Kearney 15” vacuum planter with precision seed monitor and a 1560 JD no-till drill.

Results:

Figure 1. 15 Inch JD Row Unit Precision Planter used in these trials.

The two trial locations responded differently to tillage, so yield responses are reported in separate tables.

Table 2. Soybean Yield Response to Tillage at Milverton (2013)

Tillage	Yield (bu/ac)	Yield Advantage (bu/ac)	(5%)
Disc Ripper	56.9	4.5	A
RTS	54.1	1.7	AB
No - till	52.4	-	B

*Yield differences followed by the same letter are not statistically significant

There was a large response to tillage at the Milverton site (Table 2) over no-till, but there was no yield difference at the Woodstock site (Table 3).

Table 3. Soybean Yield Response to Tillage at Woodstock (2013)

Tillage	Yield (bu/ac)	Yield* Advantage (bu/ac)	(5%)
Disc Ripper	54.5	1.2	A
RTS	53.9	0.6	A
No - till	53.3	-	A

*Yield differences followed by the same letter are not statistically significant

There was no statistical yield advantage to the planter or higher seeding rate at either of the two locations across tillage practices in this study.

Table 4. Planter Compared to Drill Yield Response (Milverton, Woodstock, 2013)

Planter or Dill and Seeding Rate	Yield (bu/ac)	Yield Advantage (bu/ac)	(5%)
Planter 250 000 seeds/ac	54.6	0.8	A
Planter 180 000 seeds/ac	54.4	0.6	A
Drill 180 000 seeds/ac	53.9	0.1	A
Drill 250 000 seeds/ac	53.8	-	A

*Yield differences followed by the same letter are not statistically significant

Table 5. Residue Removal and Stalk Chopping Yield Response (Milverton, Woodstock, 2013)

Treatment (No-till)	Yield (bu/ac)	Yield Advantage (bu/ac)	(5%)
Planter 180 000 seeds/ac + Corn Residue Removal	54.3	1.9	A
Planter 180 000 seeds/ac + Stalk Chop	53.0	0.6	A
Planter 180 000 seeds/ac	52.4	-	A

*Yield differences followed by the same letter are not statistically significant

There was no statistical yield advantage to removing the corn stalks or chopping the corn stalks averaged across the two sites.

There were no large yield differences at the Woodstock site with any of the treatments tested in these trials. However, there were significant differences at the Milverton site, from as low as 50 bu/ac to as high ast 59 bu/ac. The treatments have been listed from the highest yielding to the lowest yielding in Table 6.

Summary:

- No yield gains were found to tillage or any other treatment at the Woodstock site. The Woodstock site was a well drained silt loam soil. There was no yield lag associated with no-till at the Woodstock site and no-till was economically more profitable. This concurs with over 50 previous Ontario soybean tillage trials that have shown only a small yield increase to tillage on average. (approximately 2 bu/ac)
- At the Milverton site an average yield gain of 4.5 bu/ac was found with the disc ripper over no till. This was a heavier textured soil than at Woodstock. Increasing the seeding rate, the use of a precision planter or chopping the stalks did not win back the yield lag associated with no-till at this site. However, when

corn stalks where removed and the planter was used in a no-till system yields were statistically equivalent to the disc ripper.

Table 6. The Effects of Tillage, Seeding Method, and Seeding Rate on Soybean Yield (Milverton, 2013)

Tillage	Planter or Drill	Yield Advantage (bu/ac)	(5%)
Disc Ripper	Planter 180 000 seeds/ac	58.9	A
Disc Ripper	Planter 250 000 seeds/ac	57.4	AB
Disc Ripper	Planter 180 000 seeds/ac + Residue Removal	56.9	AB
Disc Ripper	Planter 180 000 seeds/ac + Stalk Chop	56.6	ABC
Disc Ripper	Drill 180 000 seeds/ac	56.4	ABC
RTS	Planter 180 000 seeds/ac + Residue Removal	55.7	ABC
RTS	Planter 180 000 seeds/ac + Stalk Chop	54.9	ABCD
Disc Ripper	Drill 250 000 seeds/ac	54.9	ABCD
No-till	Planter 180 000 seeds/ac + Residue Removal	54.3	ABC
RTS	Drill 250 000 seeds/ac	54.1	ABCD
RTS	Planter 250 000 seeds/ac	53.9	BCD
No-till	Planter 180 000 seeds/ac + Stalk Chop	53.7	ABCD
RTS	Planter 180 000 seeds/ac	53.1	BCD
RTS	Drill 180 000 seeds/ac	52.6	BCD
No-till	Drill 180 000 seeds/ac	52.6	BCD
No-till	Planter 250 000 seeds/ac	51.9	CD
No-till	Drill 250 000 seeds/ac	51.9	CD
No-till	Planter 180 000 seeds/ac	50.0	D

Next Steps:

2013 was the 10th year of soybean tillage trials conducted in Ontario. No further studies are planned.

Acknowledgements:

We would like to thank the co-operators who lent their time and land to this project. We would also like to acknowledge the University of Guelph, Environmental Sustainability Directed Research Program of OMAF and MRA, the Farm Innovation Program of AAC, Grain Farmers of Ontario and John Deere for their contributions to this project.

Project Contacts:

Horst Bohner, OMAFRA, horst.bohner@ontario.ca