Evaluation Of The "To The Max" Harrow For RST Tillage And Residue Management In Conventional And Reduced Tillage Cropping Systems.

Purpose:

To evaluate whether using a "To the Max" Harrow (TTM) for RST tillage and residue management is an economical practice, in reducing tillage costs, fertilizer runoff and increasing crop yield and quality. For future uses in other crops, this may be a way to incorporate PPI herbicides. This is the first machine of its kind in Canada and so offers us a very unique opportunity to try it in a range of situations and crops. This will be a one-year study.

Methods:

The TTM rotary harrow is sold by Precision Planting, an Illinois-based company with a purchase cost of ~$25,650 (Cdn). All trials within the project were conducted on clay loam to heavy clay soils. No-till is often unsuccessful on these soils if cool temperatures and wet conditions occur during planting season.

The TTM is 4.5m (15') wide and requires a minimum of 130 horsepower tractor and operates best when driven at speeds of 16-20 kph (10–12 mph)

The total project was conducted as a series of sub projects as listed below:

Project A) The Effects of Using a "To the Max" harrow on frost seeding wheat. Testing for yield and quality differences between no-till and pre-tillage with the harrow in spring planting.

Project B) The Effects of Using a TTM harrow on spring wheat & triticale planting (spring cereals). Testing for yield and quality differences between no-till and pre-tillage with the harrow in spring planting.

Project C) Residue management for no-till soybeans. Measuring the effects on plant population, yield and quality.

Project D) Use of TTM harrow compared to spring cultivation for seedbed preparation of sunflowers.

Project E) Effects on stand establishment, yield and quality on Goslin oats in a broadcast situation followed by incorporation with the TTM harrow compared to conventionally planted oats.

Project F) Planting forage turnips and fall forage into burned down hay, pasture and wheat field in no-till versus following one pass of the TTM harrow.

Results:

The results across the various sub projects were variable due to the weather conditions of 2005. The data is not reported but the conclusions are discussed under the Summary section of this report.

Figure 1. TTM Harrow in Operation

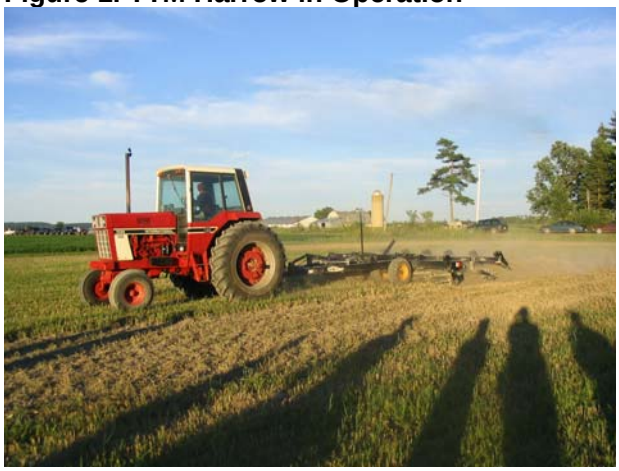

Figure 2. TTM Harrow Up Close

Figure 3. Example of Soil Disturbance with TTM

Summary:

The TTM rotary harrow performed with some successes and some failures. Additional testing would be needed in the future to better quantify the actual value contributed by the harrow to the cropping system. For this year, the versatility and potential uses of the harrow was of primary concern.

Successful Practices:

1. **TTM as a pre-plant aid in no-till conditions to crops already proven to be well adapted to no-till practices (spring cereals, soybeans).**
   - TTM harrow improved and smoothed seedbed conditions. This provided more even planting conditions, and greater comfort for operator. The largest asset is a uniform seedbed which allowed for better seed placement and even emergence.
   - TTM managing heavy residue. Reduced plugging of the no-till drill from residue. This residue management also helped improve the quality of the straw in the final crop.
   - TTM harrow warmed the seedbed allowing for earlier emergence than purely no-till conditions under cooler conditions. This also allowed for the field to be planted on average of 5 days earlier than conventional tillage and better results in no-till situations.

The loose soil layer on top of the ground helped to conserve moisture (reduced evaporation from the seed zone) during dry conditions.
- Incorporate fertilizer into the top layer of soil to reduce risk of volatilization of nitrogen or runoff from heavy rains.

2. TTM harrow as a <u>post-plant/pre-emerge</u> aid in no-till conditions.
- TTM harrow successfully disturbed the no-till surface to help cover seed trenches and complement the work done by seed packers and coulters at the back of the no-till drill. This was shown in both soybean and turnip planting.
- The loose soil layer on top of the ground helped to conserve moisture (reduced evaporation from the seed zone) during dry conditions.
- Incorporate fertilizer into the top layer of soil to reduce risk of volatilization of nitrogen or runoff from heavy rains.

3. TTM harrow as a tool to incorporate broadcasted seed as an alternative to a no-till drill or conventional planter.
- Cereals were planted quite successfully in this project using a broadcasting tool like a fertilizer spreader. Other small seeded crops like canola, flax, or even forage seeds may also be able to be seeded using this technique. Large seeded crops like corn or soybeans are unlikely to achieve similar success.
- The cooperators observed that when incorporating seed and fertilizer using the "To the Max" harrow, 90% coverage occurred, working the components into the seedbed to approximately 1 inch. For future projects they recommend increasing the seeding rate by 10%. Fertilizer should not be increased in the rate.
- For the triticale and oats planted in this project, the cooperator was able to cover 20 more acres per hour than under regular no-till. Additional trips across the field by separating the seed spreading from seed incorporation is easily offset by the savings in time. This would allow more acres to be planted in a shorter period of time and should allow for the grower to ensure the crop is being planted in ideal conditions.
- Broadcasting seed is still riskier than using a drill to position the seed at adequate depth but setting the TTM at a lower depth should help to position the seed for adequate root development to protect against drought.
- The loose soil layer on top of the ground should help to conserve moisture (reduced evaporation from the seed zone) during dry conditions.
- Incorporate fertilizer into the top layer of soil to reduces risk of volatilization of nitrogen or runoff from heavy rains.

<u>Unsuccessful Practices</u>

*Unsuccessful under this project. Future testing may be warranted.
- **TTM harrow replacing spring cultivation for crops not yet proven to be well adapted to no-till practices (sunflowers).**
- Even with 2 passes of the TTM harrow, the seedbed was not ideal for planting sunflowers.
- A corn planter is more suitable for planting sunflowers than a no-till drill due to more accurate seed placement, seed spacing and use of a starter fertilizer banded near the seed. The corn planter would not have been able to be used successfully under the heavy soil conditions.
- Using "To the Max" harrow on soil conditions that are too wet and loamy will result in build up of residue on the spirals/harrow part of the implement.
- Watch for baler twine! If it's in the ground, the TTM will find it - and you'll have hours of fun cutting it out of the harrows.

<u>Future evaluation:</u>

1. TTM harrow as a pre-emerge aid in conventional conditions

- The vertical action of the machine would make it very suitable for use on corn or conventional soybean ground where crusting is inhibiting the emergence of the crop. Reduced risk of cutting off the already emerged seedlings. CAUTION: For this purpose, the TTM harrow should be set as shallow as possible or it is possible that the vertical movement could uproot the small seedlings.

2. TTM harrow as weed control.

- The early pass of the machine may help to physically pull out or kill the smaller weeds already established in the spring to give the crop an advantage. But, it is also possible the mechanical action may stimulate annual weed growth that is often reduced in regular no-till situations.
- Use of the "To the Max" to incorporate herbicides for pre-plant incorporated (PPI) or pre-emergent conditions (PRE). Examine for cost-effectiveness, crop safety and quality of weed control.

Next Steps:

The project will be repeated in 2006

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