Alternative tillage systems to save time and fuel*

Dr. Tarlok Singh Sahota CCA

Primary purpose of tillage is to control weeds and to obtain good tilth for seeding crops. It ensures good seed to soil contact required for seed germination and crop emergence. However, tillage (particularly in wet soils) can lead to soil compaction, and development of hard pan restricting root growth and nutrient availability. Zero tillage or conservative tillage on the other hand may keep the soils wet and cold for a longer period than the tilled soils, more so in early springs. This can delay land preparation and seeding operations in spring, and can impact crop yields in areas with short growing season, such as the Northwestern Ontario. Besides, left over residues in conservation tillage systems can attract slugs and other harmful insects such as cut worms and army worms that lay eggs on crop residues. Surface residues though good for soil protection and conservation of soil moisture can harbour crop diseases (for example Take All of wheat on corn residues). Alternate tillage systems such as disking/or sub soiling in the fall and disking/cultivation in the spring or no tillage in the fall and disking and cultivation in the spring could probably overcome negative effects of conventional tillage/or conservative tillage, and help spread operations to overcome time constraints especially under adverse weather conditions such as excessive soil wetness.

Conventional tillage in Ontario/Canada usually meant (mould board) ploughing in the fall, and spring disking and cultivation in the spring before seeding. Alternate tillage systems, could meet the primary purpose of tillage (weed control and good tilth). Apart from short growing season, escalating fuel prices also warranted evaluation of more efficient (alternative) tillage systems. Two sets of experiments, one after spring oats and another after clover, were conducted at Thunder Bay Agricultural Research Station (2004-2007) on barley-soybean-barley crop rotation, with 11 different tillage systems, involving conventional, zero, and alternative tillage systems. The results revealed that:

- Tillage effects on barley were not influenced by previous crops (oats and clover).
- Barley grain yield in the first year was over one tonne per hectare higher after clover than after oats. This is attributed to 20% higher tillering in barley after clover than after oats.
- Next year, soybean yield was 25% higher after oats-barley than after clover-barley. This was a direct reflection of the increased number of pods per plant after oats-barley than after clover-barley.
- By the third year, favourable effect of previous legume on barley yield, as compared to a cereal crop, came down to only ~5%.
- No fall tillage, two disking and cultivation in spring or one disking in fall, another disking and cultivation in spring before seeding gave as much barley and soybean grain yields as the conventional tillage (fall ploughing, spring disking and cultivation). The practices resulted in ~40% saving in time and fuel as compared to the conventional tillage.
- Conventional tillage appeared to produce higher barley and soybean grain yield than zero tillage. This was probably because we didn’t have a zero till drill for seeding.

- Fall chisel ploughing, spring disking and harrowing were as good as conventional tillage in terms of barley grain yield. The practice seemed to be less efficient than conventional tillage in soybean. Chisel ploughing saved 27% fuel as compared to conventional tillage.
- At the end of three years crop cycle (barley-soybean-barley), organic matter and available phosphorus, potassium, and copper were significantly higher with tillage systems involving disking and cultivation than that with conventional tillage. However, available manganese seemed to be higher with the conventional tillage than that with the alternate tillage systems.
- Chisel ploughing didn't improve available soil phosphorus as compared to conventional tillage.
- Soil organic matter was highest (6.7%) with zero tillage and lowest (4.6%) with conventional tillage; organic matter with alternate tillage systems was in between (5.6-6.3%) the two extremes. Nutrient availability, mainly phosphorus and potassium, was more with alternate tillage systems including disking in fall or spring than that with zero/or conventional tillage.

In view of the foregoing findings, it may be advisable that our growers abandon time and fuel consuming practices such as fall ploughing/conventional tillage and opt for alternate tillage systems involving fall or spring disking!

Growers may even consider getting a portion of their farm land ready in the fall itself as a risk management strategy for timely seeding in the cold and wet springs; as was the case this year. Last fall, we roto tilled our plots in long term experiments that were direct seeded with barley this spring on May 1. At that time, Thunder Bay growers weren't even able to enter their fields with tractors.

It may also be kept in mind that tillage at a constant soil depth year after year can create a hard pan at that particular depth. It may therefore be desirable to resort to sub-soiling or (mould board or chisel) ploughing once in every 3-4 years to break the hard pans (if you follow the alternate tillage systems advocated in this note). This type of tillage is known as 'Strategic Tillage'.

*Based on the paper presented at Plants & Soils '08 Montreal, July 13-16, 2008.

Readers may like to visit our website (www.tbars.net) that was updated recently!

Published in Northwest Link September 2008, Pages 4-5!