



DIRECT SEEDING IN ALBERTA - MAKING IT WORK ON YOUR FARM

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INTRODUCTION

Farmers will always seek out practices that are viable in the short term and sustainable for the future. Reducing tillage in prairie cropland has become a proven method for *immediate* cost reduction such as fuel and machinery repair, with *promise* for more productivity from the land over time. A recent survey¹, conducted on behalf of Alberta Reduced Tillage LINKAGES (RTL), shows a declining trend in conventional seeding (tillage-based cropping systems) along with an increase in low disturbance direct seeding (often referred to as *no-till* or *zero-till*). Provincially in 2005, 7 out of 10 farmers reported their main seeding practice as no-till or a system that *retains most of the crop residue on the surface*. Almost half (47%) of these direct seeders indicated this has been their seeding system for over 5 years. The survey also points out that operators with more than 2 sections of seeded cropland are less likely to use tillage for residue management (i.e. no spring or fall tillage, other than a seeding operation). Geographically, the only significant difference found in direct seeding practice was a slightly higher trend amongst farmers in southeast Alberta to use fall tillage (33% vs 23% in the overall sample).

To quote a colleague of ours: *Crop farmers are facing more difficult challenges than the beef producers have faced recently [with BSE]. Direct seeding is the only system that can make economic sense...²*. We believe that if something is practical and profitable, farmers will accept it... and most likely improve it.

In our presentation we plan to address, in a motivational and technical manner, the **reasons** (moisture, erosion, efficiency, etc.); the **barriers** (residue management, weeds, soil texture, costs, etc.); and the **benefits** (agronomy, economics, etc.) of direct seeding. We will use examples of various methods and machinery based on regional and innovative reduced tillage adaptations that all farmers should relate too. However, our primary message is to novice direct seeders - with discussion especially for farmers and other industry folk (i.e. Certified Crop Agronomists, Equipment, Crop-health Product & Service Reps, etc.) -any one who wants to better understand **how to make direct seeding work** - anywhere, any time.

KEY POINTS

[Don Wentz] There are several **management decisions** to be considered in a move into direct seeding:

1. Long-term agronomic benefits: increased soil quality
2. Potential for yield increase
3. Soil conservation
4. Herbicide management
5. Economy and efficiencies: fuel, labour, fertilizer, etc.
6. Changes in machinery requirements
7. Return on investment (system transformation)
8. New management challenges: crop rotation, disease, insects, weeds, etc.

[Ron Heller] Farmers must understand these **key principles** of direct seeding:

- a. Standing stubble: crop residue conserves moisture and protects seedlings
- b. Residue management: uniform distribution of straw and chaff enhances the performance of a direct seeding implement.
- c. Herbicide use: spraying reduces tillage, soil erosion, and equipment costs - while providing timely weed control (i.e. pre-seed burnoff).
- d. Fertilizer placement: fertility should favour the crop and not weeds.
- e. Low disturbance: the first pass is the easiest (mixed soil & crop residue interferes with seeding).
Farmers must also investigate the **machinery features** involved:
- f. Seeding implements: openers, fertilizer placement, single and double-shoot, row width, row spacing, furrow closure, soil firming, etc.
- g. Air carts & fertilizer tanks: product handling, type, placement, etc.
- h. Tractors: power, traction, hydraulics, etc.
- i. Straw choppers, chaff spreaders, heavy harrows, balers, etc.

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j. Sprayers

Farming enterprise can significantly influence direct seeding practices:

- k. Livestock: feed and fodder
- l. Seed grower
- m. Perennial forages in rotation
- n. Manure
- o. Rancher

For more information about direct seeding, see Alberta Reduced Tillage LINKAGES' (RTL) website: www.reducedtillage.ca

¹ RTL 2005 *Program Assessment Survey* (A.J. Phillips & Associates) } Sample number = 601 Alberta farmers

² Nick Underwood - RTL agronomist, Grande Prairie (Invitation to the 2006 workshop *Direct Seeding in the Peace*)

DIRECT SEEDING IN ALBERTA - MAKING IT WORK

PART A. by Don Wentz

“Zero-tillage (ZT) is a one pass operation which places seed and fertilizer into an undisturbed seedbed, then packs and retains adequate surface residue to prevent soil erosion” (Soil Works, 1993...).

There are several key factors that should be considered when making a management decision to move into ZT:

1. The long-term agronomic benefits: increase in soil organisms and the resulting increase in soil organic matter.
2. Potential yield increases: better moisture infiltration and retention.
3. Better soil conservation: reduction of wind, water and tillage erosion.
4. A change in herbicide use and management.
5. Potential fuel and labor savings.
6. Changes in farm machinery requirements.
7. Total investment requirements.
8. An increase in the management requirements: insect, disease and weed control, crop rotations and fertility management and other general BMP's.

Some of these issues have short-term effects and others are longer-term factors affecting your farming operations (Brown...).

Canada presently ranks fourth in the world with 4.1 million ha of ZT, behind the USA with 19.3 million ha, Brazil with 11.2 million ha, and Argentina with 7.3 million ha. (The Daily - Nov 21, 2005). The bulk of the producers practicing ZT are in the \$50,000 to \$500,000 yearly sales range with the bulk of those in the \$100,000 to \$250,000 range. Saskatchewan has the highest percent of ZT farmers with 38%, Ontario next with 34% and Alberta third with 17% (The Daily, 2005). This data is from Statistics Canada and is somewhat dated. Monsanto's data shows a steady increase in ZT acres over the past 10 years in Alberta. In 1994 we had 24% of producers in a high disturbance (HDS) reduced tillage system and 10% in low disturbance system (LDS). In 2004 we had an increase to 32% HDS and 35% LDS with a total change from 34% in 1994 to 67% in 2004 (RTL Steering Committee rpt).

1. Long Term Agronomic Benefits:

The long-term benefits of ZT are no longer questioned as before. The elimination of tillage increases the soil's population of earthworms and micro-organisms. It is now understood that conventional tillage reduces earthworm populations by preventing access to surface air and thus suffocating them. As a result populations never increased to a level that would be beneficial. “Farmers must not forget how useful earthworms and soil arthropods are, when building channels and leaving digestive materials in the soil profile. These animals are the best plow for the soil” (Carlos Crovetto. DS Advantage, 2005). The undisturbed soil creates an environment that encourages higher populations of earthworms. Pore holes facilitate moisture infiltration faster and to a greater depth. The result is less runoff with greater stored soil moisture in the root zone. As one of my ZT farmers stated, “when I drive on my field after a rain, it's soft and spongy, but when I drive on my neighbor's conventionally tillage land, you slip and slide throwing mud balls all over, but once you're down to the hard pan, the soil is dry”.

The second long term benefit is the enhancement of soil quality by increasing soil organic matter (OM). Over the past century we have lost about half of our OM. Increasing soil OM is a slow process, but elimination of tillage means a reversal or slowing of degradation and a potential increasing can begin. Research has shown that availability of organic nitrogen (N) is higher in long term ZT fields than in conventionally tilled fields. In some cases farmers have found that they can begin to reduce nitrogen fertilizer inputs



because of higher N levels in their fields (Brown...). ZT drills that are designed to place fertilizer beside the seed-row means better efficiency of fertilizer with fewer losses and reduced GHG contribution, for example, nitrous oxide emissions from saturated soils.

2. Soil Moisture Retention

Soil moisture is often the limiting factor on the Canadian prairies. Making the best use of all the moisture that falls is beneficial to crop yields. Retention of surface residue will help trap snow and reduce surface evaporation. Surface mulch improves moisture infiltration resulting in higher moisture levels in the root zone. This factor, combined with better management practices (BMP's) such as ZT, will result in higher yields.


3. Soil Conservation

One of the biggest factors supporting the move to ZT is long-term sustainability. "If a practice is not sustainable, it will eventually end". ZT reduces erosion by wind, water and most importantly, tillage. Standing stubble reduces wind speed at ground level. Residue holds snow and rain and prevents or slows runoff, keeping soil and water in the field where they belong. As well, conventional tillage has been a major contributor to soil movement off of hills and knolls. Some research shows that tillage has resulted in more soil displacement over the past few decades than either wind or water erosion (Soil Works...).

4. Herbicide Requirements

Glyphosate herbicides make up a large proportion of the cash cost for ZT. The reduced price for Roundup or glyphosate has had a dramatic effect on the adoption and profitability of ZT (Brown...). The benefit of using Roundup or glyphosate in your herbicide selection has changed the weed spectrum in ZT. As one farmer stated, "my weed spectrum has changed with direct seeding from a lot of hard to kill weeds like buckwheat and Russian thistle to more easy to kill weeds like stinkweed and flixweed". Most ZT farmers also note a decrease in wild-oat pressure and the one time "dreaded" perennial weeds, like Canada thistle and quack grass, are now being controlled with herbicides. There is no doubt that herbicide reliance increases with ZT, but with other benefits. For example, many weed seeds that remain on the soil surface do not germinate and eventually lose their viability. Zentner's chart shows the difference in herbicide costs between conventional tillage and ZT.

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Table 2: Estimated Herbicide Costs for Direct and Conventional Seeded Stubble Crops

Crop Type	Conventional seeded stubble crops \$/acre			Direct Seeded Stubble Crops \$/acre		
	Brown	DBrown	Black	Brown	DBrown	Black
Spr wht	10.49	14.46	14.46	13.88	17.84	17.84
Canola	-	19.73	19.73	-	23.70	23.70
Feed Peas	-	18.98	20.30	-	22.37	23.52
Lentils	33.19	33.19	33.19	36.58	36.58	34.90
Mustard	16.00	-	-	16.72	-	-
Flax	20.64	21.04	21.04	24.02	24.42	24.42
Feed Barley	10.80	15.03	15.03	14.19	18.41	18.41

1. Source: Saskatchewan Agriculture and Food and Rural Revitalization, 2002

5. Labor and Fuel Savings

ZT and direct seeding requires less time in the field. The pre-seed herbicide application that often replaces tillage requires less time and fuel. A recent survey of farmer in RTL's direct seeders network asked: "what is the most limiting factor on your farm". Many of them answered, "time". Many producers have taken on more land or face a reduced labor supply. ZT has enabled these producers to cover greater acres in less time than what conventional tillage requires. As one farmer told me, "My children have married and moved away and if it weren't for ZT, chemical fallow and direct seeding, I would have to reduce my acres or try and hire help". The second



savings with ZT is reduced fuel costs. ZT and direct seeding often combine the seeding, fertilizing and packing operations into one operation so there is less tractor time required. The Nebraska tests show savings as high as 40-60% can be obtained with ZT (Brown...). As well, spraying as a substitute for conventional tillage required less horsepower. The following chart taken from Zentner's paper shows the savings that is realized with using herbicides versus conventional tillage.

Table 1: Net Fuel Savings from Substituting Spraying for Tillage

Western Canada				Cost Saving		
Litres of Diesel				\$0.60/litre	\$0.70/litre	\$0.80/litre
# Of tillage passes	Per acre	Spraying	Net Diff	\$/acre	\$/acre	\$/acre
1	2.4	0.3	2.1	1.29	1.50	1.68
2	4.4	0.3	4.1	2.46	2.87	3.28
3	6.3	0.3	6.0	3.63	4.23	4.80

2. Source: Nagy, 2001 (Modified)

6. Machine Investment and Use

Converting to ZT will require some investment in specialized equipment. It is said that ZT begins at harvest, so the first upgrade should be made to your combine for straw or residue management. This is beneficial in both ZT and conventional tillage.

A positive side to ZT is you no longer need cultivators, disks and other tillage equipment. There is a reduction in tractor hours, so tractors last longer. As well, a smaller tractor is often utilized for most spraying operations, decreasing horsepower requirements. The two main purchases in ZT are a direct seeding drill and probably a larger sprayer. I asked one of my farmer friends who purchased a ZT drill if he was thinking of ZT. He said “no, I still intend to till the soil, I bought a ZT drill because of even seed placement, and I can seed a 160 acres without stopping for seed and fertilizer and I can band fertilizer beside the seed row without seed injury”. There are advantages to owning a ZT drill without converting to ZT or reduced tillage. But my guess is that eventually the transition to reduced tillage and ZT will begin to occur.

Many ZT producers say the most valuable piece of equipment on their farm now is their sprayer. Newer sprayers have special attachments that allow herbicide mixing to occur outside the water tank so there is never excess mixed herbicide left over. Newer technology will soon be available that will select for green color wave, allowing spot spraying of selected herbicides on selective weeds. This technology is just beginning to occur along with the recent developments in GPS and GIS (Zentner...).



7. Other Investment Requirements

One of the biggest savings that ZT producers talk of is their primary tractor. Less hours of heavy draft have increased the life of most tractors. Decreased usage also results in less maintenance costs. An AAFRD study by Lorne Erickson, quoted in Zentner's paper, showed annual repair costs of \$3.70 per acre for ZT, \$4.00 per acre for min-till and \$5.10 per acre for conventional tillage. Many producers find their primary tractor is now the one pulling the sprayer. This tractor is usually smaller, has less investment costs, requires less fuel to operate and has lower maintenance costs.

8. Management Requirements

One of the biggest challenges that farmers face when adopting ZT is to select a cropping system that is economically viable for the area you farm in from year to year. The system includes cropping rotation and sequence including weed, insect and disease control. Of equal importance are environmental considerations like precipitation, growing season, heat units and other related factors.

ZT producers note that developing a good rotation is one of the most difficult management decisions they make. Research has shown that cereals, oilseeds and pulses are well adapted to ZT. One ZT producer described his rotation as follows. For his cereal option he has hard red spring wheat, prairie utility wheat, durum wheat, winter wheat and winter triticale. This producer doesn't grow these crops but there is also oats, barley and fall rye. For oilseeds he grows canola and flax. There is also mustard for areas in the south. For pulses he grows field peas, lentils, chickpeas. There are also new pulse crops on the horizon like faba-beans. There are enough choices that stacking crops is not necessary. His rotation may be cereal, oilseed, cereal, pulse, cereal etc. With 3 or 4 cereals in your rotation you have a least 4 years before coming back with the same crop. This helps prevent disease and pest build up and also helps in weed control. Cereals help maintain surface residue. Both pulse and oilseed residue breaks down faster than cereals and there is less residue to begin with. It is easier to control grassy weeds in a broadleaf crop and likewise easier to control broad leaf weeds in cereal crops.

Discussion

The basic reason for converting to ZT is knowing that reducing or eliminating tillage combined with direct seeding offers long-term conservation benefits. If you have a low input, cropping/fallow system for example, converting to ZT may require some transitional time. The benefits have to be weighed against costs and risks of changing to ZT. There is research that generally shows ZT increases average yields over conventional tillage but this may take a few years to achieve. Reducing costs and increasing efficiencies are also factors that support a move to ZT. Machine investments are probably the largest cost associated with converting to ZT and are probably the largest deterrent to adoption of ZT. Borrowing large sums of money when commodity prices are low and input costs are high doesn't make good economic sense. Producers should continue to modify their farm equipment with the option of making the conversion to ZT easier (Brown...).

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(For Part B See Page 68 - Ron Heller)