

## **A COMPARISON OF ZERO-TILL SEED OPENERS FOR SOD-SEEDING ALFALFA FOR PASTURE REJUVENATION**

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### **Introduction**

Beef producers frequently debate the merits of different methods to improve pasture productivity and carrying capacity, commonly called pasture rejuvenation. Sod-seeding is a term used for introducing new forage species into an existing pasture without removing the existing plants with invasive tillage. However, new forage plant seedlings must have sufficient soil moisture to germinate, emerge and become established plants. In regions where precipitation is reliable, sod-seeding has been more widely adopted than in Saskatchewan where drought conditions are common.

Saskatchewan is a world leader in the development of zero-till seeding equipment for annual crops. Several different opener designs are widely available from manufacturers such as Flexicoil (Case-New Holland), Morris, Dutch Industries, Bourgault Tillage Tools, Seed-Master and Atom-Jet. These openers have been widely demonstrated for seeding annual crops or for seeding perennial forages on cultivated soils (PAMI Research Update 733 1997; AgTech Centre 2007) and are currently popular for seeding annual crops. However, producers have questioned whether any particular opener design is superior to another when sod-seeding to improve hay and pasture productivity.

Older research on a previous generation of seed drill opener designs and technologies concluded that they were satisfactory for sod-seeding (Waddington 1992), but no research has been conducted using current seed drill technology. Successful sod-seeding requires reliable seeding depth control because perennial forages are sensitive to deep seeding (> 1 in or 2.5 cm). At the same time, good soil-to-seed contact is needed for water absorption and germination and, as a result, opener penetration into the mineral soil layer is essential.

When sod-seeding, down-pressure on the opener for adequate soil penetration must be balanced with reliable depth control. Modern air-drills are characterized by the combination of a hoe, shovel, or disk opener on a shank with an attached press wheel for on-row packing and independent depth control. The concept should work well in sod-seeding, however, wider hoes for double-shooting (separating seed and fertilizer into separate bands) or double hoe shanks (eg. SeedMaster) may create more soil disturbance and rougher surfaces than narrow hoes or disk openers.

The objectives of a project conducted at the Western Beef Development Centre's Termuende Research Ranch were to:

1. Compare alfalfa seedling establishment success when sod-seeded with five commonly available zero-till seed openers.
2. Compare the draft requirements of five commonly available zero-till seed openers.
3. Compare the degree of sod disturbance and surface roughness (sod strips on the surface) following five commonly available zero-till openers.
4. Determine the effect of herbicide application for prior forage stand termination to no vegetation control on alfalfa seedling establishment and draft requirements.

### **What we did**

A long-established crested wheatgrass (*Agropyron cristatum*) pasture (approximately 50 years old) was selected for sod-seeding alfalfa at Termuende Research Ranch at Lanigan, Saskatchewan. The pasture consists of gently rolling topography with Thin Black Oxbow soil association.

The main treatment plots were staked on May 20, 2011. Following setup, the treatment plots were sprayed with 1 L/ac of glyphosate to suppress the existing grass stand. On June 1, a PAMI specialized plot drill (see Figure 1) was modified and equipped with five commercially available seed-opener shank assemblies. The shanks were selected to be easily and quickly fitted with different zero-till opener tips from multiple manufacturers. The plot drill was equipped with accurate seed metering and draft measurement equipment. The openers (see Figure 2) tested were:

1.  $\frac{3}{4}$ " (19 mm) knife – Narrow knife single-shoot opener places seed in a narrow row, with minimal soil disturbance.
2. Paired-Row ( $\frac{3}{4}$ " deep band) – Double shoot opener places 2 rows of seed 4" (10 cm) apart, with a fertilizer row centered between and  $\frac{3}{4}$ " below the seedbed, ensuring good fertilizer and seed separation.
3. Paired row (same plane) – Double shoot opener places 2 rows of seed 4" apart, with a fertilizer row down the centre and on the same plane as the seedbed.
4. Sideband ( $\frac{3}{8}$ " (9 mm) deep band) - Double shoot opener places seed on a shelf 1  $\frac{3}{4}$ " (4.5 cm) to the side of a centre fertilizer row  $\frac{3}{8}$ " below the seedbed.
5. Sideband (same plane) - Double shoot opener places seed to the side and on the same plane as a centre fertilizer row.
6. Twin Shank – Twin shank, double shoot opener places seed 1  $\frac{1}{2}$ " (3.8 cm) to the side of a centre fertilizer row  $\frac{3}{4}$ " below the seedbed.

Two additional treatments were added to the experiment. A disturbed control plot was created by running opener #1 without any alfalfa seed in one set of plots. Also, an undisturbed control was not seeded or disturbed with any openers.

7. Disturbed Control
8. Undisturbed Control

A gang of five shank assemblies was fitted to the 3m wide PAMI drill, and each of the selected opener designs was evaluated for seeding in crested wheatgrass pasture (either sprayed with herbicide or not). The control treatment with no seeding provided benchmark forage production. The AC Grazeland alfalfa seed was pre-inoculated for N fixation and seeded at 8 lb/ac (8.8 kg/ha).

**Figure 1.** PAMI plot drill sod-seeding at Termuende Research Ranch on June 1, 2011.



**Figure 2.** Six zero till openers tested for sod seeding at WBDC.



## Results

Glyphosate application improved alfalfa seedling establishment and alfalfa presence in the hay (Figure 3), but also reduced hay yield and increased the proportion of weeds in the forage.

Alfalfa seedling establishment was successful, with all six openers yielding similar establishment numbers (Figure 3). There was no difference among treatments for forage yield or weed contribution to forage biomass. There was less alfalfa in the forage when sod-seeded with the paired row -same plane (#3) opener. When the control treatments were dropped from the

analysis, there was no difference in alfalfa seedling establishment, forage yield or botanical composition among the openers (data not shown). These results indicate that all six commercially available openers performed similarly for sod-seeding alfalfa. However, caution should be exercised in application of these results as they are only from a single year and a single location, and may not represent the results from other years or other locations in Saskatchewan.

Average mean temperatures in 2011 were near normal for the entire growing season at Lanigan. Precipitation was above normal through July at 4.5 inches (115 mm) but then below normal for August and September. Weather conditions were almost ideal for forage seed germination and seedling growth.

Draft requirements:

**Table 1.** Drawbar draft (mean and standard deviation) for six seed openers in sod-seeding application at Termuende Research Ranch on June 1 2011.

Opener	Mean draft (lbs)	Standard Deviation
1	1050	211
2	1401	644
3	1389	327
4	1041	205
5	1548	287
6	2276	310

The twin-shank opener (#6) exhibited higher draft requirement than the other five openers tested (Table 1). The other five openers did not differ significantly in draft requirement.

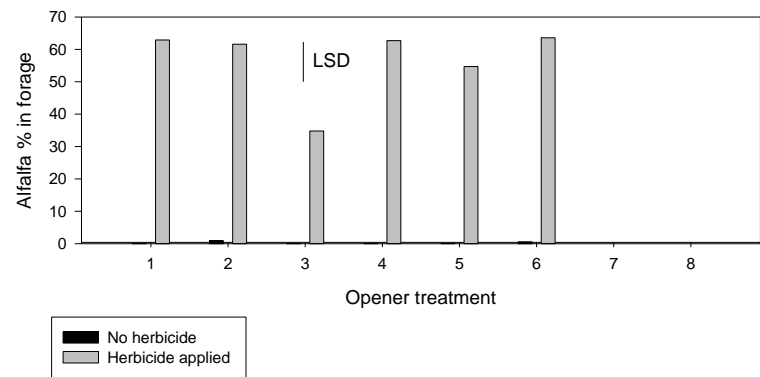
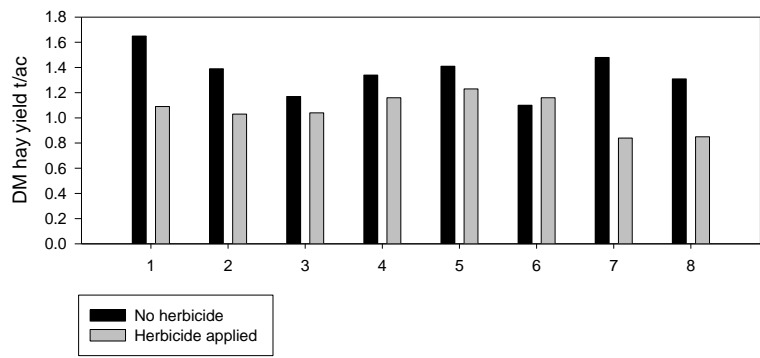
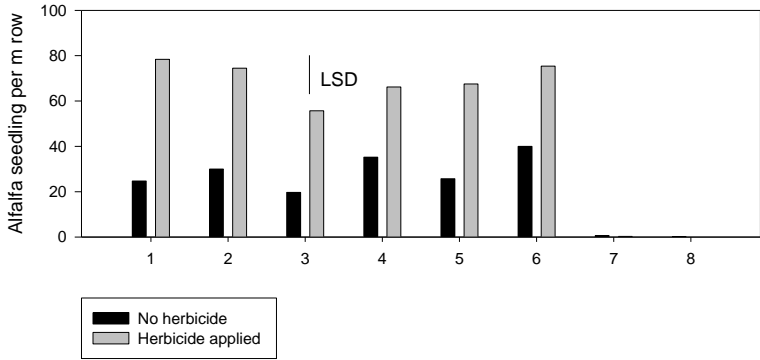
Surface finish:

All openers left the field surface in reasonably smooth condition. For the most part, clods of soil and root mass (clumps of sod) were not turned up onto the surface. The openers tended to slice into the soil, forming a trench to place the seed, and then folded the sod back down with the packer wheel. Prior to performing the plot treatments, there was concern that sod would build up on the opener point, especially the broader tipped side-band and paired-row openers, and create a rough, uneven field finish. However, all the openers cleared any built-up material quickly. The twin-shank opener disturbed the soil slightly more than the other openers, displacing a ribbon of sod cut by the twin shanks, but still left a relatively "clean" and even field finish.

## Conclusions

All six commercially available zero-till seed openers worked well for sod seeding alfalfa at Termuende Research Ranch in June 2011. Seedling counts and alfalfa contribution to forage yield were improved by pre-seeding spraying of the grass with glyphosate at the recommended rate. However, herbicide did not eliminate the grass completely and grass recovery and regrowth occurred. Some weed growth was noted on herbicide treated plots. The twin shank opener had higher draft requirement than the other five openers. Caution should be taken as these results represent only one year with favourable weather at one location. Further research should be done to determine the impact of fertilizer application, weather, and soil type and texture on the variability in sod-seeding results with zero-till seed openers.

**Figure 3.** Alfalfa seedling establishment, hay yield and proportion of alfalfa in the hay for six openers (1 to 6) and two control treatments (7&8) at Termuende Research Ranch in 2011.



**Figure 4.** Alfalfa Seedlings on October 31, 2011



a) No glyphosate pre-seeding



b) Glyphosate pre-seeding



For more on this and other WBDC projects visit:  
<https://www.youtube.com/user/WSTRNBEEF>

## References

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