

1. **Project Title:** Demonstrating the Effects of Red and Alsike Clover Seed Crops in Rotation
2. **Producer Group Sponsoring the Project:** Saskatchewan Forage Seed Development Commission (SFSDC)
Ray McVicar, Executive Director SFSDC
2782 Aster Crescent, REGINA SK S4V 1Z9
sfsdc05@gmail.com 306 789-1958
3. **Funder:** The project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bi-lateral agreement.
4. **Researchers:** Jessica Pratchler and Stewart Brandt, Northeast Agriculture Research Foundation (NARF), Melfort, SK
5. **Objectives:**
 - To demonstrate the effect of a cover crop on red and alsike clover for seed production;
 - To demonstrate Odyssey and Viper ADV herbicides for weed control in red and alsike clover;
 - To demonstrate the effect short-term legume seed crops have on reducing N fertilizer requirements in a wheat crop in rotations; and
 - To demonstrate direct seeding of wheat into red and alsike clover killed the previous fall by herbicide.

Northeast Saskatchewan is the centre of forage seed production in the province. Red clover is the largest forage seed crop after alfalfa in the province. Alsike clover is also commonly grown for seed in the area. These clover crops, when harvested for seed, fit well into a crop rotation. Both are often seeded with a cover crop in the seedling year and harvested for seed in the second year. Weed control is an important management practise with these crops and newly registered herbicides will be demonstrated. Wheat will be direct seeded into the stubble in year three to take advantage of the increased soil nitrogen. This increase in soil nitrogen has not been recently measured or demonstrated with these two seed crops in the area. In 2019, the project will be funded by SFSDC.

6. **Methodology:**

In the spring of 2017, an area of wheat stubble in black clay soil was selected at the Agriculture and Agri-Food Canada (AAFC) Research Farm near Melfort, SK.

Soil samples from an adjacent area were taken in spring 2017 and submitted for analysis of available N, P₂O₅, K, S and Zn as well as soil organic matter. A pre-seed weed control application of glyphosate (Roundup Ultra II) was made on May 30, 2017.

Five crop rotations were evaluated as outlined in **Table 1**. Treatments were selected to evaluate effects of growing red or alsike clovers either alone or as companion crops with canola in year one, followed by a clover seed crop in year 2, followed by wheat in year three. In an effort to identify the nitrogen benefit from the clover seed crops, wheat yields in a grain only rotation with rates of 0, 40, 80, 120 and 160 kg/ha of fertilizer N will be used in year 3.

The plot size was 8m x 7m in a randomized complete block design with 4 replications. To accommodate five different Nitrogen rate treatments in 2019, two passes of the Conserva-Pak air drill were required.

All crops were seeded on June 6, 2017 with a 3.75m wide Conserva-Pak air drill seeding on 23cm (9inch) row spacing to a seeding depth of 0.5 to 1.25 cm (¼ to ½ inch). The canola (Clearfield variety 46H75) was planted at 5.6kg/ha (5 lb/ac), along with red clover (variety

Atlaswede) at 2.8 kg/ha (2.5 lb/ac) and alsike clover (variety Dawn) at 2.8kg/ha (2.5 lb/ac). All plots seeded to canola received fertilizer N at 164 kg/ha as urea (46-0-0) sideband plus P₂O₅ at 39 kg/ha (34.5 lb/ac) as 11-51-0. All plots seeded to red or alsike clover alone received 15 kg/ha (13.3 lb/ac) of P₂O₅ as 11-52-0. For control of weeds in the red and alsike clovers, plots were mowed in July and August.

The number of red and alsike clover plants per unit area was not determined as planned due to an oversight, and uneven crop emergence. We plan to measure red and alsike clover cover using a line transect method in spring 2018 when the forages are 2.5-7.5 cm (1-3 inches) tall.

Canola yield was measured by harvesting 5 rows from each plot with a Wintersteiger plot combine on September 25, 2017. Following harvest, the canola seed was dried to 10 per cent moisture content then cleaned and weighed. The canola yield data was analysed as an RCBD.

Table 1. Crop Rotations used to Evaluate Effects of Red and Alsike Clover seed Crops in Rotation with Grains, Melfort SK 2017.

Rotation	2017	2018	2019
1.	Red Clover / Canola	Red Clover seed	Wheat
2.	Red Clover	Red Clover seed	Wheat
3.	Alsike Clover / Canola	Alsike Clover seed	Wheat
4.	Alsike Clover	Alsike Clover seed	Wheat
5.	Canola	Peas	Wheat – 5 N rates

In the spring of 2018, soil samples will be collected 0-15 and 15-30 cm depths and bulked across the 4 replicates for submission for N, P, K and S analyses.

In-crop weed control in 2018 will be applied to all treatments using Viper ADV and a graminicide. The clover treatments will be desiccated with Reglone Ion before harvest in 2018.

The level of sclerotinia infestation in the red and alsike clover plots will be measured in spring / summer 2018 to determine if underseeding clovers to canola increases the risk of disease. Pea, red clover and alsike clover seed yields will be collected in 2018 and clover samples will be submitted for seed test purity and germination analysis. Clover crops will be terminated by herbicide in the fall of 2018. Wheat yield and protein levels will be determined in 2019 in the 5 different N fertilizer rates.

The application of N to subplots on the wheat control treatment (original treatment 5) of 0, 40, 80,120, and 160 kg/ha as well as seeding, plot maintenance, harvest and seed analysis in 2019 will be funded by SFSDC.

7. Results:

The soil at this site had 8.5 per cent organic matter and a pH of 6.2. Soil available nitrogen (N) was low at 18 kg/ha (16 lb/ac) at the 0-30cm (0-12 inch) depth. Similarly, available P₂O₅ was low at 4 ppm. By contrast, the level of soil available K was high at 381 ppm with moderately available S at 27 kg/ha (24 lb/ac). Soil available Zn was adequate at 2.16 ppm. The 2017 growing season was drier and warmer than the long-term climate average (**Table 2**). July to October were at least a degree warmer than normal, with September being almost 2 degrees warmer. May and October were the only months to receive more precipitation than average. This precipitation, along with the saturated soil conditions from the previous fall made for difficult seeding conditions (**Figure 1**). Very dry conditions in early

June, just after seeding meant that the clover development was variable, but improved through the summer. (**Figures 3 and 4**). The increased precipitation in October would normally have presented a challenge, however due to the extremely dry conditions in July, August, and September; the precipitation was welcomed and did not considerably delay harvest. Overall, the warm weather was favorable for canola production in northeast Saskatchewan (**Figure 5**). This combination of environmental factors resulted in good canola yields. Lastly, the first killing frost (-2°C) occurred on October 9th after the canola crop was harvested.

Canola yields between treatments were not statistically different (**Table 3**).

Table 2: Mean temperatures and precipitation collected from the Environment Canada Weather Station at Melfort, SK., for May to October 2017.

	May	June	July	August	Sept	Oct	Average /Total
--- Temperature (°C) ---							
2017	10.8	15.2	18.7	17.2	12.5	4.3	13.1
Long-Term ^x	10.7	15.9	17.5	16.8	10.8	3.3	12.5
--- Precipitation (mm) ---							
2017	46.4	44.1	33.3	3.1	13.2	43.5	183.6
Long-Term ^x	42.9	54.3	76.7	52.4	38.7	27.9	292.9

^x Long-Term Climate normals from Melfort Environment Canada Weather Station (1981-2010) (52°49'00 N, 104°36'00 W).

Table 3: Influence of red and alsike clover on canola yield at Melfort in 2017.

Treatment	Description	Canola yield	
		kg/ha	bu/ac
1	Red Clover / Canola	1,550	27.6
2	Red Clover	-	-
3	Alsike Clover / Canola	1,630	29
4	Alsike Clover	-	-
5	Canola	1,650	29.9

Canola yield differences were not statistically significant

8. Conclusions and Recommendations:

Initial results indicate that underseeding red or alsike clover to canola did not reduce canola yields. This project will continue in 2018.

9. Acknowledgements:

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Figure 1. Planting red and alsike clover in rotation with canola. Melfort SK. June 2017.
Source: SFSDC



Figure 2. Stu Brandt describing project at field tour. Melfort SK. July 27, 2017.
Source: SFSDC



Figure 3. Red clover established. Melfort SK. July 27, 2017. Source: SFSDC



Figure 4. Alsike clover established. Melfort SK. July 27, 2017. Source: SFSDC



Figure 5. Canola alone. Melfort SK. July 27, 2017. Source: SFSDC