

Pulse Replicated On-Farm Independent Trials

Lentil Seeding Rate Trial 2017

Background

Research performed by Dr. Steve Shirtliffe from the University of Saskatchewan over the past several years, suggests that small red lentils could benefit in yield and economics by increasing the current provincial recommended seeding rate of 120 plants per metre squared (m^2), to up to 240 plants/ m^2 (Shirtliffe¹, Smith²).

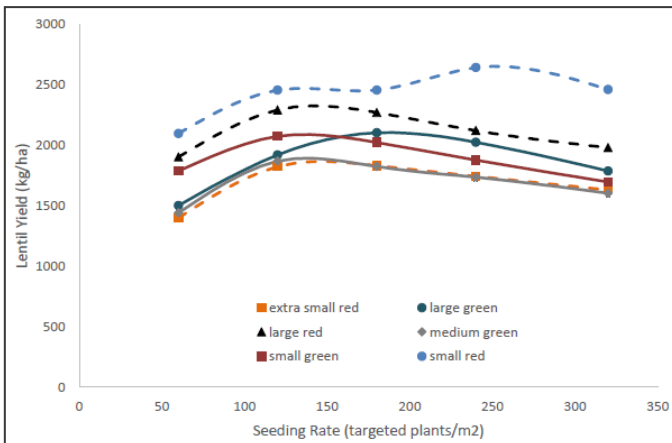


Figure 1: Small Plot Lentil Seeding Rate Study. Small red lentil class is shown to have an increased yield response at higher seeding rates, as compared to other lentil classes. *Source: Shirtliffe¹*

Purpose of the Project

Dr. Shirtliffe's results were based on controlled conditions in small plots. This Pulse Replicated On-Farm Independent Trial (PROFIT) was established to validate the research findings under large-scale field trials, using grower equipment, under various environmental conditions. The purpose of the project was to identify the impact of increased seeding rates on yield, disease pressure, weed suppression, and net return.

Design of Experiment

Twelve producers were recruited to participate, using their own management practices and field-scale equipment.

Each grower targeted seeding rates of 1 times, 1.5 times, and 2 times the recommended seeding rate of 120 plants/ m^2 , and replicated each seeding rate three times. The size of each replicated plot was the width of the grower's seeder, by a length of at least 1,000 feet. This typically gave an area of one to two acres for each replicate plot at each site. Sites were visited six times throughout the crop season (May to September 2017), in order to collect key trial information. At harvest, each strip was weighed separately using a weigh wagon to provide gross yield weights.

Yield measurements for each plot were then normalized to 13 per cent seed moisture content.

The experiment included three different small red lentil varieties, based on producer preference (CDC Maxim — nine sites, CDC Dazil — two sites, and CDC Proclaim — one site). All three are ClearField® varieties, which enabled weed control during the trial when necessary.

Results

Dry conditions in Saskatchewan in 2017 may have impacted the results of the study, as lower yields were obtained at some locations. The dry conditions also led to lower disease pressure over all sites. One site (Outlook) was also damaged by hail prior to August, but was taken to harvest. Individual site information can be found in Table 1.

Initial seeding rates at 1 times ranged from 46 to 75 pounds per acre (lb/ac), with the majority of growers seeding at 50 to 60 lb/ac. The range in seeding rates resulted in a wide range of plant densities, as shown in Figure 2. The target density at 1 times was 120 plants/ m^2 as shown by the green line. Eight of the 12 sites had starting densities well above the target plant stand and ranged from 139 to 197 plants/ m^2 . There was no correlation between seeding rate in lb/ac and plant density at the initial seeding rates. It was observed that seed size ranged dramatically from grower to grower, but no information was collected on thousand kernel weight (TKW). Seed quality and emergence rates could also vary by grower, and could influence actual plant stands.

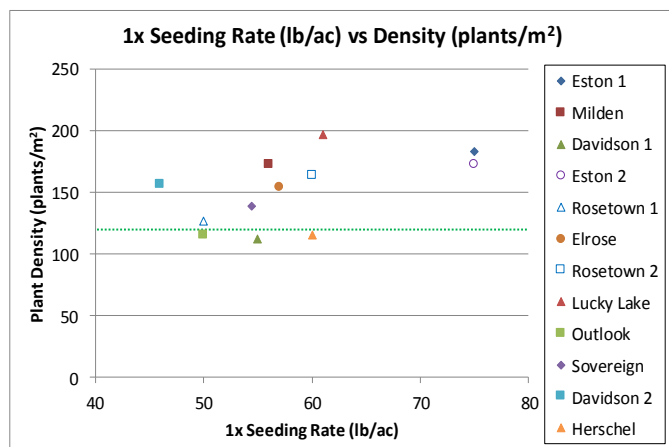


Figure 2: Actual 1 Times Seeding Rate Versus Average Plant Count Across All Trial Sites. The target plant stand density was 120 plants/ m^2 (green horizontal line) for the 1.0 times seeding rate.

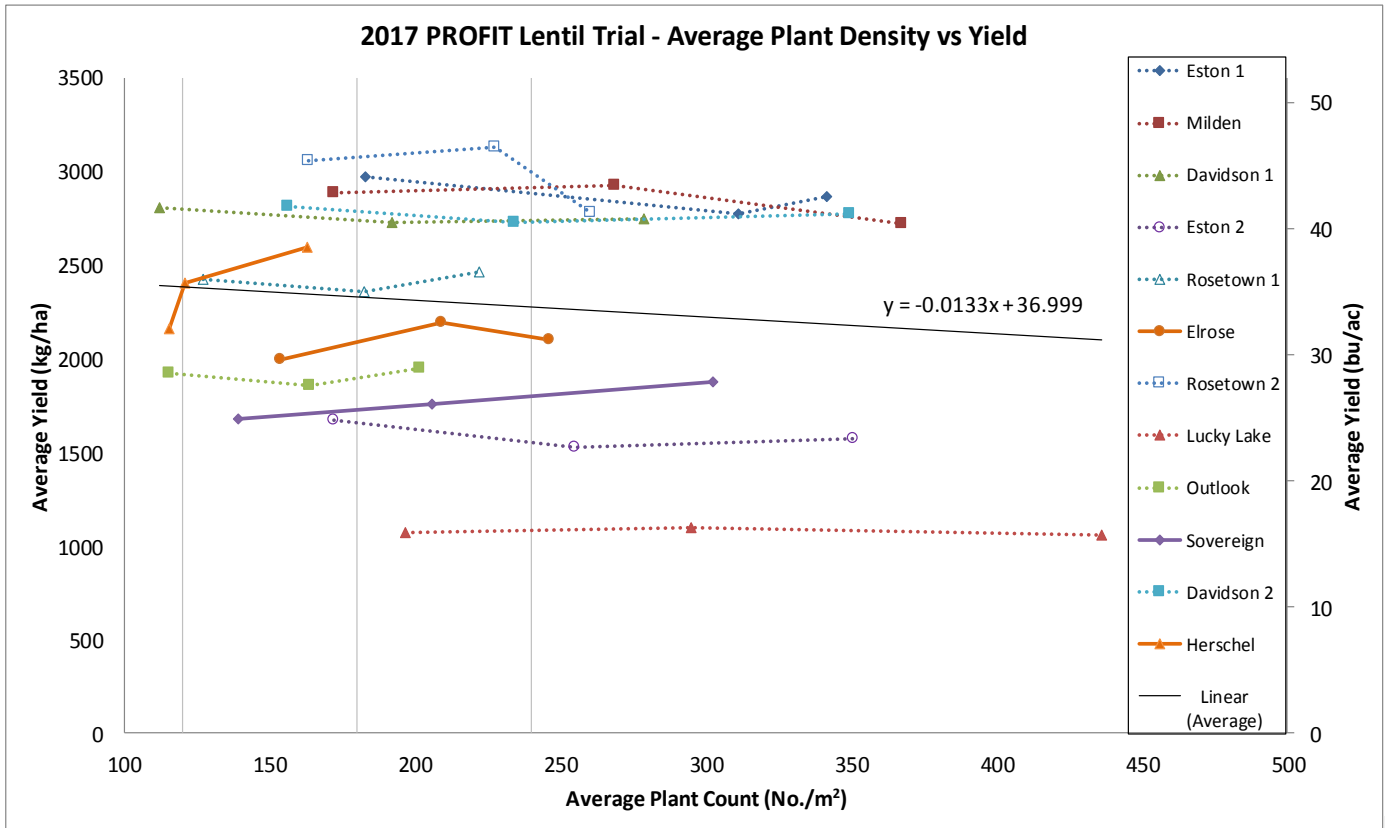


Figure 3. 2017 Lentil Seeding Rate Trial – Average Plant Count Versus Normalized Yield. Yields were normalized to 13 per cent seed moisture content. Average plant count/m² and yields over three replicates per seeding rate (1 times, 1.5 times, 2 times) are shown for each of the 12 grower sites. The plant count/m² targets (1 times = 120; 1.5 times = 180; 2 times = 240) are shown as vertical lines. Sites with statistically significant yield responses are shown as solid lines.

Yield response to increasing plant density across all 12 sites is shown in Figure 3. Overall, yield did not show a correlation with plant count, and at several sites showed a flat response in yield across the range of seeding rates. However, three trial sites did show an increase in yield as the seeding rate was increased — Elrose, Sovereign, and Herschel. When actual seeding rates were

compared in these three sites (Figure 4), there was little difference in actual lb/ac at the three rates. However, plant populations were quite different as shown in Figure 3. Herschel had much lower plant populations compared to the other two responsive sites, due to a low germination rate that may have been caused by heavy straw cover.

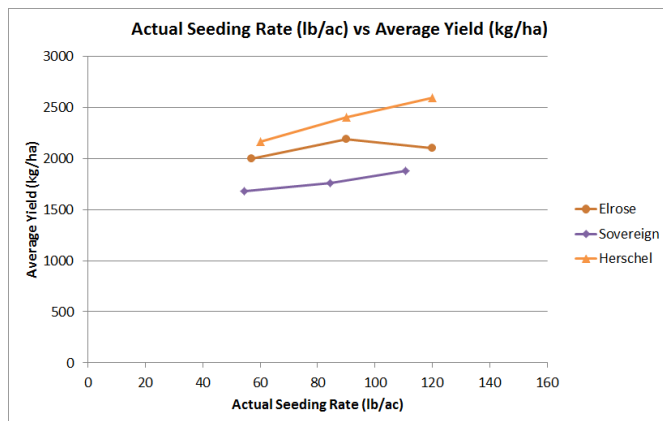


Figure 4: Yield response to actual lentil seeding rate (lb/ac) of three responsive sites.



Lentil Emergence and Plant Density. Emergence of rate at 1 times (left) versus a rate of 2 times (right) is shown at the Eston 1 site in June, 2017.

Location	Rural Municipality	Variety	1x Seeding Rate (Avg Plant Count/m ²)	1x Seeding Rate (lb/ac)	Seeding Depth (inch)	Row Spacing (inch)	Growing Conditions	Rainfall (mm)	Weed Pressure (1 high to 5 low)
Lucky Lake	Canaan No. 225	CDC Dazil	197	61	1	10	hot and dry	77	4
Davidson 1	Arm River No. 252	CDC Maxim	112	55	1.25	12		70	5
Davidson 2	Arm River No. 252	CDC Maxim	156	46	0.75	12		74	4
Elrose	Monet No. 257	CDC Maxim	154	57	1.5	10	hot, good moisture	97	5
Eston 1	Snipe Lake No. 259	CDC Maxim	183	75	1.5	10		93	5
Eston 2	Snipe Lake No. 259	CDC Maxim	172	75	1.5	10		61	4
Outlook	Rudy No. 284	CDC Maxim	115	50	0.5	12		106	5
Milden	Milden No. 286	CDC Proclaim	172	56	1.5	12	hot and dry	98	4
Rosetown 1	St. Andrews No. 287	CDC Maxim	127	50	1.5	12	hot, good moisture	98	3
Rosetown 2	St. Andrews No. 287	CDC Maxim	163	60	1.5	10	hot, good moisture	98	5
Sovereign	St. Andrews No. 287	CDC Dazil	139	54	2	10	dry	98	4
Herschel	Mountain View No. 318	CDC Maxim	115	60	1	12		98	3

Table 1: 2017 Small Red Lentil Seeding Rate Study – Site Locations and Details. Rainfall amounts are regional from planting date to harvest date. Weed pressure is rated as effect on yield (1 - high pressure, to 5 - low pressure).

Weed pressure was generally low, but did increase to moderate levels in a few sites (Table 1). On a site-by-site basis, there was no correlation between plant counts and weed pressure.

This year’s trial also had low disease pressure overall, and no correlation was found between plant count and disease scores.

The target plant counts/m² for this study were 120 plants (1 times), 180 plants (1.5 times), and 240 plants (2 times). The actual average 1 times rate in this year’s study had a plant count of 154 plants/m², and ranged across the sites from a low of 112 plants/m², to a high of 197 plants/m² (Figure 3). This suggests that presently some



2017 Lentil Seeding Rate Study – Seeding at Outlook site. Seeding lentil plots May, 2017.



2017 Lentil Seeding Rate Study – Harvest at Davidson 2 Site. Weigh wagon setup at harvest, Aug 2017.

producers seed small red lentils at higher rates than currently recommended, and have recognized the benefits of higher seeding rates. Therefore, as part of normal operations, producers may have already captured the yield benefit as found in the previous small plot studies (Shirtliffe¹). This could also mean that growers are not accurately calculating seeding rates, but are targeting a certain rate based on lb/ac. Consequently, when seed size is smaller in a given planting year, there are more seeds put into the ground than when seed size is larger. Discussions did find that there was smaller seed size at some locations with 2017 trials, and some growers targeting seeding rates based on weight (i.e., 60 lb/ac), versus accurately calibrating seeding rates based on seed size by using TKW.

Economic Implications

Out of the 12 field scale trials, three showed a positive response for at least one rate comparison (statistically significant to $p < 0.1$) under 2017 growing conditions. The Herschel site had a dramatic increase of 437 kilograms per hectare (kg/ha) or 6.5 bushels per acre (bu/ac) when the plant stand went from 115 to 163 plants/m². This equates to a \$178/ha increase in profitability by going from a 1 times rate to the 2 times rate (Figure 5). The Elrose and Sovereign sites that had a positive yield response this year had smaller net profit increases at the 1.5 times seeding rate as compared to the 1 times rate. But at the 2 times rate, the Sovereign site was \$47/ha more profitable, while the Elrose site saw a slight drop in profitability (-\$13/ha), because the cost of extra treated seed was more than the gain in yield (\$). These economics were based on an estimated cost of \$0.52/lb for treated seed, the actual seeding rate for each site, and a harvested commodity price of \$0.29/lb.

Due to the flat yield response in general, the cost of seed inputs decreased the net return for producers at most sites. Comparing

the average profitability of 1 times seeding rate across the 12 sites, the 1.5 times seeding rate decreased the net return by \$14.59/ac, and the 2 times seeding rate decreased the net return by \$29.40/ac. Many producers seeded much more heavily, and actual plant densities were higher than the target plant counts. This could have resulted in lower net returns if higher seeding rates were used for normal operations.

Recommendations Based on Trial

Based on conditions at the sites in 2017, there was only a 25 per cent chance (3 out of 12 sites) of seeing a positive yield response to seeding rates higher than the targeted 120 plants/m² with small red lentils. However, target plant populations were missed at the majority of sites, with higher plant stands resulting. To improve recommendations on seeding rates, there needs to be further studies on the expansion of seeding rates to include a lower seeding rate, and additional parameters in place to ensure seeding rates are calculated on seed size.

An interesting finding from this project is that small red lentils can be seeded at higher rates with no yield penalty as shown by no yield drop with even very high rates. Higher rates may be advantageous for increasing weed competition, but may pose an increased risk of disease under a wetter year.

In order for producers to maximize profits, these results highlight the need to calculate seeding rates based on the TKW of each seed lot as opposed to simply using a standard lb/ac rate that has been used in previous years. It is important to calibrate seeding equipment to deliver the correct rate (lb/ac) to achieve the recommended stand density (120 plants/m² is a good starting point), based on the actual seed viability of the seed lot.

References:

¹ Shirtliffe, S. "The Effect of Seeding Rate and Seed Size on Lentil Diseases, Weeds, Yields and Profitability". Growing Forward 2 Pulse Science Cluster Project AIP-CLO3 annual report 2017.

² Smith, L. "Ramp Up Rates Without Fear". Pulse Point March 2017, Saskatchewan Pulse Growers, Ed. Andrea Lauder. <http://saskpulse.com/communications/magazines/pulse-research/march-2017>.

Acknowledgements:

AgCall Inc. provided recruitment, trial management, and reporting services for this study.

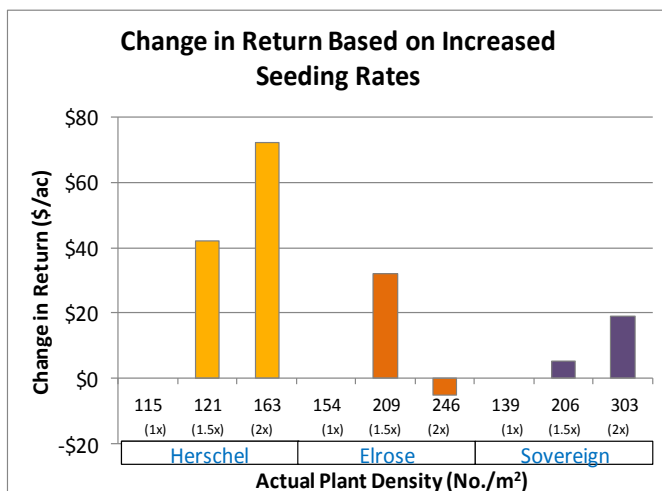


Figure 7: Plant Density Versus Increase in Profit at the Three Responsive Sites. Change in profitability at higher seeding rates compared to the 1 times seeding rate profitability of each site.