



## Higher wheat and canola yield after two years of legume forages

CATEGORY **soils and fertility** | December 12, 2018

Wheat yield was up to 45% higher after two years of alfalfa and up to 60% higher after two years of red clover compared to barley-flax rotations. The yield advantage carried over into the second year with up to 55% higher canola yield after the red clover rotation and up to 64% higher canola yield after the alfalfa rotation. The higher yields are a reflection of the N-supplying power of legumes rather than an indication that flax is a poor rotational crop because no fertilizer N was applied in the two years following barley-flax.

A field study was conducted in four Saskatchewan soil zones to assess the effect of two years of forage legume versus barley, flax and pea rotations on yield and P uptake of wheat and canola grown in the two subsequent years. Additionally, the effect of the complete four-year rotation on soil P dynamics and P balance was assessed.

Four different crop sequences of alfalfa-alfalfa, red clover-red clover, barley-pea and barley-flax were grown in the first two years of crop rotation. These rotations were then followed by wheat in year three and canola in year four, when no fertilizer N or P was applied.

### **Wheat yield higher on legume forage stubble in wetter soil zones**

In the Brown soil zone at Swift Current, wheat suffered a yield loss of 37% following two years alfalfa compared to the barley-flax rotation – likely due to lower soil moisture following alfalfa.

In general, wheat yield was higher on alfalfa and red clover stubble compared to barley-flax rotation in soil zones with higher moisture. For example, at Saskatoon (Dark Brown), wheat yield was 45% higher after the alfalfa rotation and 60% higher after the red clover rotation compared to the barley-flax rotation.

Wheat yields on the barley-pea rotation were often statistically similar, but not always, to the forage rotations.

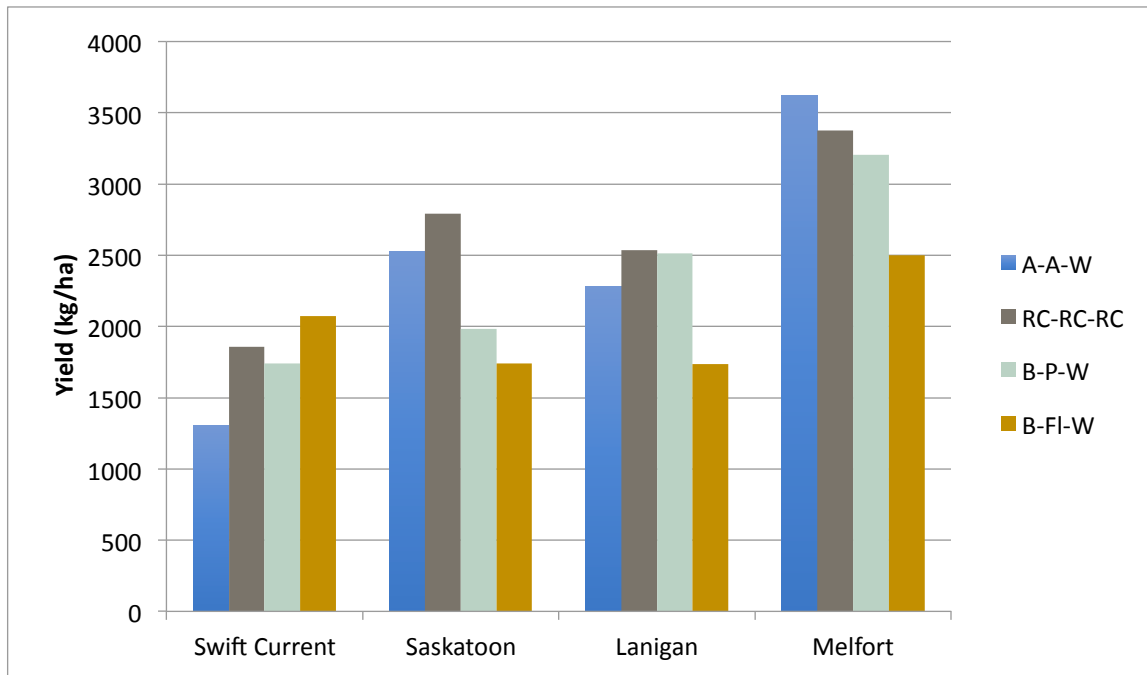
### **Yield benefits carried over to canola**

At Saskatoon, Lanigan, and Melfort canola yield was higher on alfalfa and red clover stubble compared to the barley-flax rotation. Melfort had the highest response with canola yield 64% higher in the alfalfa rotation compared to barley-flax rotation. At Saskatoon and Melfort, canola yield was 55% higher in the red clover rotation compared to barley-flax. Canola yield was not significantly affected by previous crop rotations at Swift Current.

Canola yields on the barley-pea rotation were often statistically similar to the forage rotations.

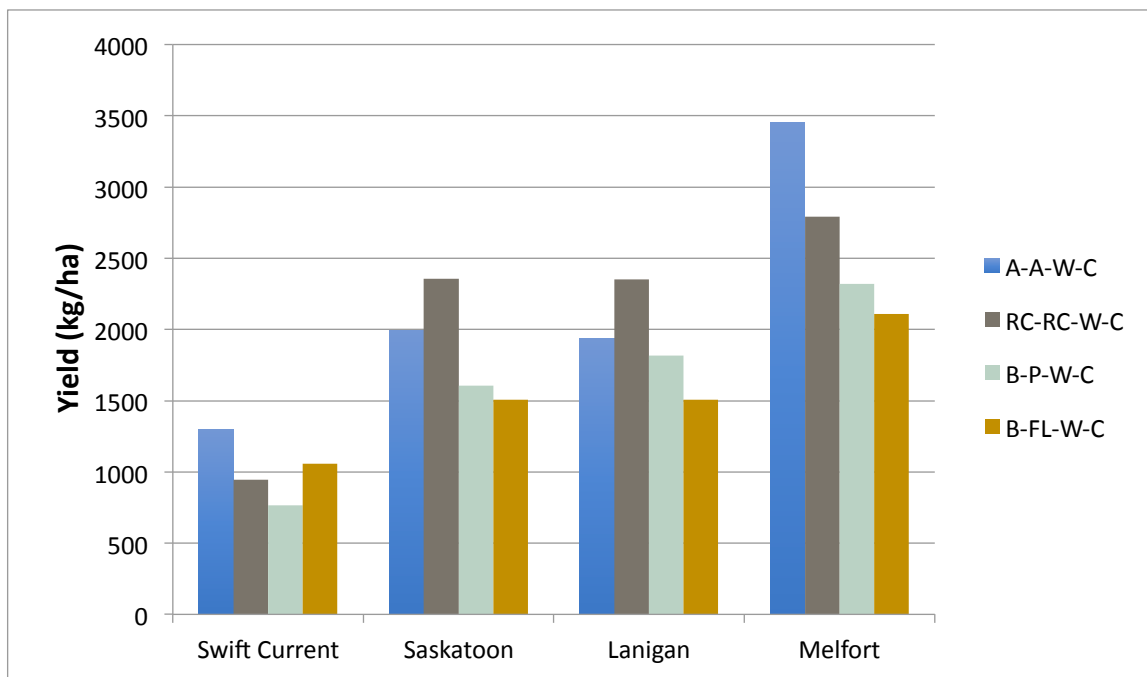
These higher yields are primarily due to the N-supplying rotational benefits of legumes.

### Effect of crop rotation on wheat yield



Source: Miheguli et al. 2018

### Effect of crop rotation on canola yield



Source: Miheguli et al. 2018

### Changes in soil P

After the four-year rotation, P balance was calculated as the difference between the total P added from fertilizer P and harvested P removed from the system in crop biomass. Each crop was fertilized with 15 kg P<sub>2</sub>O<sub>5</sub> per ha in the first year only. This relatively low amount of P fertilization resulted in a gradual drain on soil P fertility.

Without adequate P replenishment through fertilizer addition or manuring, especially in the forage legume rotations where P removal is higher, the researchers anticipate that yield impacts caused by lower P fertility will eventually occur. Therefore, it is critical to apply sufficient P to match the crop P removal over time in order to preserve the soil P fertility over the long-term.

---

Saskatchewan Agriculture Development Fund and Natural Sciences and Engineering Research Council provided funding for the research.

Mihguli, R., Schoenau, J.J. and Jefferson, P.G. (2018) Yield and Uptake of Phosphorus by Wheat and Canola Grown after Two Years of Forage Legume and Annual Crops. American Journal of Plant Sciences, 9, 1807-1825. <https://doi.org/10.4236/ajps.2018.99132>