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 P₂O₅ 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.