



## Diversified flax rotations improve weed control

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A flax rotation that included 3 years of alfalfa with reduced herbicide applications provided similar wild oat and cleaver control as a flax-barley-flax-oat rotation with recommended herbicide applications. Including 2 successive winter cereal crops in a 5 year rotation also improved wild oat control.

Wild oat and cleaver control in flax can be a challenge. Herbicides used for wild oat control consist mainly of Group 1 herbicides, but Group 1 herbicide-resistant wild oats were found in 58% of fields in the most recent field surveys on the Prairies. Pre-emergent Group 3 Trifluralin and Group 15 Triallate are also registered for wild oat control. The herbicide choices for cleavers is even smaller, with only Group 6 Bentazon registered for cleaver control, and pre-emergent Group 13 Authority as suppression. Plus, flax is not a good competitor with weeds.

This research study looked at whether a functionally diverse rotation with high seeding rates and reduced herbicide application could control wild oat and cleavers. The research was carried out over five years from 2015 through 2019 at Saskatoon Kernen Farm and Indian Head, Saskatchewan, and Carman, Manitoba.

The standard herbicide treatment included a herbicide application at recommended rates in each of the cropping years, except the first year when no herbicide application was applied to allow for weed establishment. The reduced herbicide treatment did not have a herbicide application in the first, second and fourth years of the crop rotations. Herbicides were not applied to alfalfa in any year.

Crop rotations compared with standard or reduced herbicide treatments included:

- Flax-barley-flax-oat-flax
- Flax-barley-LL canola- oat-flax
- Flax-barley-LL canola- silage oat-flax
- Flax-barley-LL canola-winter wheat-flax
- Flax-barley-peas-winter triticale-flax
- Flax-barley-peas-oat-flax
- Flax-barley-peas-silage oat-flax
- Flax-barley-winter triticale-winter wheat-flax
- Flax-alfalfa-alfalfa-alfalfa-flax

The conventional crop rotation was considered to be a flax-barley-flax-oat-flax rotation with a standard herbicide treatment. Alfalfa was cut twice at 10% bloom each year. Silage oat was cut at the soft dough stage (Zadoks 85). The rotations varied somewhat by location, with no winter cereal crop at Kernen and in some years at Indian Head. These crops were replaced with spring wheat at Kernen and spring triticale at Indian Head.

The crop rotations began and ended with flax so that changes in weed density and biomass could be compared.

Crops were seeded with no-till drills with hoe openers ranging from 8, 10 and 12 inches (20, 25, and 30 cm). Weed counts were taken 2 to 3 weeks after planting, and weed biomass measurements were taken at the late flowering stage of the crops.

### **More diverse rotations improved weed control**

At Saskatoon, all crop rotations had significantly higher wild oat densities and biomass with reduced herbicide application treatments. Rotations with the standard herbicide treatment had 73% lower wild oat densities than the reduced herbicide treatment. The standard herbicide treatment also reduced wild oat biomass by 90%. The exception was the alfalfa rotation with reduced herbicides, which had similar wild oat density and biomass to rotations with the standard herbicide treatment.

Similarly, cleaver density and biomass at Saskatoon was higher under reduced rotations with three flax crops and two spring cereal (spring triticale-spring wheat) crops compared with the conventional crop rotation with herbicides. The alfalfa rotation with reduced herbicides had lower cleaver density and biomass and was comparative to all rotations with standard herbicides.

At Carman, wild oat density did not differ between standard and reduced herbicide treatments, but biomass was 23% lower in the standard herbicide treatments. Rotations with two consecutive winter cereals, grain oat and silage oat had lower wild oat densities. Two consecutive winter cereals in rotation were also more effective than 3 years of alfalfa in reducing wild oat densities. Alfalfa in rotation was the most effective in reducing wild oat biomass with a reduction of 80%. Other rotations that were effective in reducing wild oat biomass included winter cereals and pea-grain oats.

Cleaver density at Carman was lowest in the alfalfa rotation under both herbicide treatments, with a 60% reduction compared to the conventional crop rotation.. Winter cereal rotations also had significantly lower cleaver density compared to conventional rotations. The alfalfa rotation also had lower cleaver biomass than all other rotations with either herbicide treatment. Among rotations with standard herbicide treatment, the grain oat following pea, and a single winter cereal crop in rotation had low cleaver biomass than the conventional crop rotation. Overall, rotations with winter cereals had better cleaver control than rotations with only spring seeded crops.

At Indian Head, wild oat densities were the same for standard and reduced herbicide treatments. Again, alfalfa rotations had lower wild oat densities than the average of all rotations in both herbicide treatments. The flax-barley-canola-spring wheat-flax, alfalfa rotation, and flax-barley-canola-oat-flax under the standard herbicide treatment had lower wild oat densities than the conventional crop rotation. The alfalfa rotation had the highest reduction in wild oat biomass compared to the conventional rotation. Crop rotations with canola-grain oat, canola-silage oat, and canola-spring wheat also had significantly lower biomass in both herbicide systems.

Crop rotations all had similar cleaver densities and biomass at Indian Head. The standard herbicide treatment had significantly lower cleaver density but similar biomass compared to the reduced herbicide treatment.

Overall, including 3 years of alfalfa in the 5 year rotation ( flax–barley–alfalfa–alfalfa–alfalfa–flax) improved wild oat and cleaver control in flax rotations. Rotations with two consecutive winter cereals also had improved wild oat control compared to the conventional crop rotation. Including silage oat in the rotation provided similar weed control as the conventional crop rotation.

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