

Evaluation of cover crop mixtures for high and low rainfall areas in Alberta

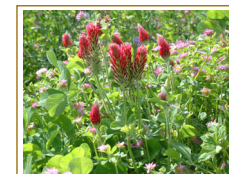
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Background

A cover crop is any living ground cover that is planted in place of or after a main crop to supply nitrogen and some weed control in the subsequent crop. Cover crops are generally incorporated into the soil using tillage to increase organic matter and stimulate microbial activity.

The majority of research on cover crops has been shown that cover crops conserve nitrogen for subsequent crops, reduce soil erosion and reduce weed, insect and disease pressure, while increasing the diversity and populations of beneficial soil organisms. On the Canadian prairies, there also is the opportunity to use cover crops for annual forage supplement as early spring or late fall grazing.



Study objectives

- Identify cover crop species or mixtures that could be grown and provide benefits to the following main crop at high and low rainfall areas in Alberta
- Evaluate the benefits of polyculture cover crops for enhancing soil biological diversity and activity, nutrient cycling and weed control
- Demonstrate the use of mowing and/or grazing of cover crops to reduce the amount of tillage in organically managed agriculture

Study description

At the field sites located in Lethbridge and Edmonton, we have combined a number of common and novel crop mixtures (Table 1) that create soil root canopies (combining deep rooted with more shallow rooted crops), rebuild both quantity and quality of soil organic matter, increase crop diversity, reduce weed, insect and disease pests and can offer spring and/or fall grazing opportunities.

Mixture	Plant species in the mixture
1	Pea, Hairy Vetch, Oat
2	Sun Hemp, Sorghum-sudan grass, Buckwheat
3	Cowpea, Sorghum-sudan grass
4	Lentil, Buckwheat
5	Lentil, Phacelia
6	Faba bean, Pea, Oat
7	Crimson clover, Oat
8	Persian clover, Oat
9	Subterranean clover, Sorghum-sudan grass, Buckwheat
10	Woollypod Vetch, Oat
11	Chickling Vetch, Oilseed Radish, Oat
12	Crimson clover, Chicory, Oat
13	White Lupin, Pea, Oat
14	Oilseed Radish, Hairy Vetch
15	Chicory, Hairy Vetch

Table 1. Cover crop mixtures grown at both field sites

At harvest, the mixtures were cut and left on the soil surface. In the following 2 years, wheat will be grown and mycorrhizal colonization, microbial community, N and C mineralization, and crop and weed community composition will be evaluated.

In 2004, we also carried out a smaller project where we seeded small plots of single cover crop species to determine how well they grow with high and low soil moisture.

Results

The results demonstrate the differing growth potential of the legumes, in particular, between precipitation zones.

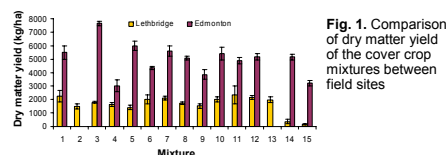


Fig. 1. Comparison of dry matter yield of the cover crop mixtures between field sites

All the mixtures were higher yielding in the higher rainfall zone. There were drought conditions in Lethbridge during 2003 that likely also affected the yields.

The legumes that established and performed well at both locations were: woollypod vetch, chickling vetch, subterranean clover, and lentil.



Fig. 2. Cover Crop Mixtures
Left upper: Chickling vetch, oilseed radish, oat
Right upper: Phacelia, lentil
Left lower: Subterranean clover, sorghum-sudan grass, oat
Right lower: Woollypod vetch, oat

In monoculture, we also found that chickling vetch, woollypod vetch, lentil and subterranean clover grew well at both high and low moisture input areas.



Fig. 3. Cover Crop Monocultures

Left: Dryland
Right: Irrigated
Top to bottom:
Chickling vetch
Subterranean clover
Black lentil
Woollypod vetch

The year following the cover crops at both sites, we found that the chicory in two of the mixtures regrew and completely out-competed the wheat. Otherwise, there were no significant effects of the previous cover crops on wheat yields at either field sites (Fig. 3).

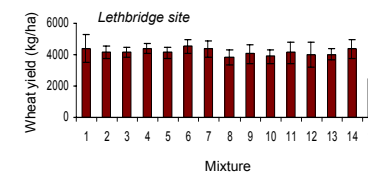


Fig. 5. Wheat g rain yield one year following the cover crop mixtures at the Lethbridge site

Future plans

Currently, we are completing analysis and summarizing the second year of this study and work is being completed on mycorrhizal colonization, microbial community and N and C mineralization for the wheat planted the first year after the cover crops. Next field season, all plots will again be cross-seeded to wheat to further understand the persistent effects of these cover crops.

Acknowledgements

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We found differences in the concentrations of micro and macro nutrients contained in the foliage of the cover crop mixtures.

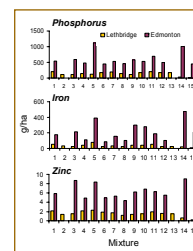


Fig. 4. Nutrients in the foliage of the cover crop mixtures

Mixture 1, 5 and 11 were generally higher in content for most nutrients. These results suggest that different cover crop mixtures can provide farmers with grazing opportunities that may reduce dietary supplements of nutrients to animals.