



Legume intercrops with oat or mustard in organic cropping systems

CATEGORY [agronomy](#) | July 29, 2025

Under drier than normal conditions, this study shows that intercropping legumes and non-legumes can outperform organic crop monocultures in productivity, grain weight and grain protein in the semiarid region of the Canadian prairies. Organic intercrops with non-legumes also play a role in reducing weed pressure, even under unfavorable dry environments.

In the semiarid region of the Canadian Prairies, intercropping of legumes and non-legumes under drier-than-average environmental conditions could increase biodiversity, productivity and quality of crops compared to monocultures under organic management. Intercropping legumes and non-legumes could provide an alternative to green manure and improve weed suppression and crop competitiveness.

The objectives of this two-year study were to determine if intercropping legumes with non-legumes could reduce weeds and increase grain yield and quality of crops at different seeding rate ratios. In the two years prior to the study, a mixture of a legume, an oilseed and a cereal were grown and incorporated at flowering using a tandem disk harrow.

In 2017 and in 2018, two intercrop combinations of a legume and a non-legume crop and their respective monocultures were compared at three different seeding ratios. The crops included small red lentil, yellow field pea, yellow mustard and oat. The organic seeding rates, which were 140 kg/ha for oat, 269 kg/ha for field pea, 192 kg/ha for lentil and 15.3 kg/ha for yellow mustard, were about

25% higher than what is normally recommended for conventional systems. The legumes also included a granular inoculant treatment of Novozymes TagTeam applied at a rate of 1 g per seeded row. Prior to seeding, all plots were cultivated with a cultivator with mounted harrows and leveled with a harrow packer to remove weeds and prepare the plots. The intercrop combinations were seeded as mixed rows.

The growing conditions in 2017 and 2018 were drier than average, with precipitation varying from about 46% of the long-term average in 2017 and 60% for 2018 in this semiarid region. These conditions represent moderate drought conditions during the two years of the study, and results could be different under more favorable conditions.

Intercrop productivity and quality

Overall the study showed that the intercrops outperformed the monocultures under the drier than normal conditions in the study. Non-legumes performed the best under the drier conditions and performed better than expected in the intercrops. The non-legume productivity and total biomass and grain yield mostly exceeded projections compared to their monocultures. However, the legumes had higher than expected growth reductions, with lower aboveground biomass and grain yield than their monocultures, even in intercrops at monoculture legume ratios. For the legumes, pea did show a higher tolerance than lentil to competition with its companion.

The oat and pea intercrop outperformed the oat monoculture, with higher crop biomass and oat grain yield. The grain weight of oat also increased by an average of 25% in all the pea-oat intercrops compared to oat monocultures. The intercropping of pea with oat also resulted in higher grain protein of pea than the pea monoculture. However, only lentil intercropped with mustard at the 75% lentil- 75% mustard seeding ratio had a higher grain protein concentration than the lentil monoculture. Mustard intercropped with lentil had a higher inter-crop competitiveness than oat in its intercrops with pea.

Weed density and biomass

The weed density and biomass were lower in intercrops than in legume monocultures when differences were statistically significant. The weed density in the pea-oat intercrop was lower than in the pea monoculture. The weed biomass was lower in the lentil-mustard intercrop than in the lentil monoculture. The study shows that intercrops with non-legumes play a role in reducing weed pressure, even under unfavorable dry environments.

The study shows that under drier than normal conditions, intercropping legumes and non-legumes outperformed organic crop monocultures in productivity, grain weight and protein. Intercrops with non-legumes also play a role in reducing weed pressure, even under unfavorable dry environments. In semiarid regions where drought is forecast to increase in severity and frequency due to climate change, intercropping may help improve organic crop productivity and competitiveness. The results of this study may also be of value for production under low-input nonorganic methods where intercropping could potentially reduce synthetic fertilizer and pesticide requirements.

A new organic intercropping project has been underway at the Swift Current Research and Development Centre since 2021. For more information on any research being conducted by the Organic Research Program, please contact myriam.fernandez@agr.gc.ca

This project was funded by the Western Grains Research Foundation, Saskatchewan Wheat Development Commission, and Saskatchewan Pulse Growers.

Fernandez, M. R., Lokuruge, P., Abdellatif, L., Waelchli, N., Leeson, J. Y., Schellenberg, M. P., & Chalmers, S. (2025). Intercropping of oat or mustard with legumes under organic management in the semiarid Canadian Prairie. *Agronomy Journal*, 117, e70056. OPEN ACCESS
<https://doi.org/10.1002/agj2.70056>

Photo by Myriam Fernandez