



Intercropping systems in western Canada

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A review of intercropping systems in western Canada over the last 40 years shows that intercropping has a critical role to play in a more sustainable agriculture that optimizes producers' profit. The review found that over 60% of small plot combinations were pulse-oilseed combinations and 30% pulse-cereal combinations, many showing a Land Equivalent Ratio (LER) >1.

Interest in integrating intercropping into existing crop rotations is increasing across Western Canada. Producers are interested in gaining agronomic knowledge that could help address logistical challenges, reduce risk and optimize intercropping systems. This project reviewed intercropping systems research conducted over the last 40 years in Western Canada to provide agronomic information that will help producers address potential challenges and possible solutions. The review will also provide valuable insights for researchers and policymakers, as well as identify research gaps.

There were four main objectives of this review. The first was to summarize intercropping agronomy studies conducted over the last 40 years in Western Canada. A second objective was to highlight the challenges of adopting intercropping and possible solutions. A third objective included a discussion

of the implications of incorporating intercrops in rotations. The final objective was to identify intercropping research gaps.

The review included information from 30 articles, focused only on field-based studies with annual intercrops; mixtures with perennial crops were not included. The Land Equivalency (LER), which is defined as the land area of monocrops required to produce the corresponding yield of the intercrop, was used as the measure for productivity.

The agronomic review summary showed a wide range of crop combinations in three categories, including cereals, oilseeds and pulses/legumes. Various factors were assessed, such as growth conditions, locations, seeding rates, designs and nutrient management strategies. Pulse-oilseed combinations involving up to four crops were the most common at over 60%, followed by cereal-pulse combinations at 30%.

The LER for pulse-oilseed intercrops averaged 1.11, while the LER for pulse-cereal averaged 1.13. The majority of intercrops that showed LER > 1 had incorporated a legume as a component crop, which can be a sustainable way to manage N. In some cases, a significant amount of fixed N was reported to benefit the nonlegume.

Key challenges

The review identified several key challenges to optimizing intercropping systems. Understanding different intercrop combinations and how they interact with management factors is key. Challenges included determining optimum seeding rates, seeding depths, cultivar selection and plant combinations, equipment choice, in-season herbicides, staging for maturity, grain separation and markets. Other factors, such as nutrient availability, N rates and environmental factors such as soil type and weather conditions were also important.

The review showed that incorporating intercrops into rotations will shorten the rotation length and have a bearing on disease management. The most studied crop in the review was peaola, an intercrop of pea and canola, which was generally selected to demonstrate the incorporation of intercrops into a traditional 4-year crop rotation. Typically, peaola can result in a 3-year rotation, taking into account disease considerations. Including nonhost crops in rotation reduces the survival of pathogens for diseases, with a 2-year break from all crops that are susceptible to the same diseases highly recommended. Avoiding the buildup of disease inoculum over time is important, particularly for diseases such as clubroot in canola, fusarium head blight (FHB) in wheat and barley, and root rots in pulses.

When considering the adoption of intercropping systems, producers are mostly concerned about the impact on existing crop rotations and optimizing their return on investment in their cropping systems. Decisions on incorporating intercrops in rotation are a knowledge-intensive process that combines both scientific and applied know-how. Adapting intercrops to local conditions and production systems is important to be able to address producers' productivity objectives and variability with climatic conditions and soil types.

New technology can be a solution to logistical intercropping challenges such as seeding equipment selection or changes, such as for seeder tanks and seed openers, harvesting and grain separation solutions. Advancements in precision agriculture and 4R seeders make it possible to accurately sow multiple species at different depths and times. The review shows that other strategies required to meet challenges include a need for the agriculture industry and government to develop in-crop herbicides for common intercrop combinations, establish large grain separation facilities, and develop crop insurance, as policies that cover intercrops seem limited.

Additional support for intercropping research is required, especially for its impact on the following crop in rotation, and to provide producers with carbon credits for the carbon sequestered in intercropping systems. Further research is needed to address existing logistical intercropping challenges, reduce risk and optimize intercropping systems. The review showed that except for a few field studies, most of the research was conducted on small plots. Therefore, further testing of promising intercropping systems needs to be repeated on-farm at the field scale to evaluate the effects of intercrops on the following crops on productivity, disease management, and soil health adapted to local conditions and production systems. The review shows that intercropping has a critical role to play in a more sustainable agriculture that can reduce risk and optimize producers' profit.

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