

# Intercropping Pea and Barley for Agronomic and Economic Considerations in North-western Ontario

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## Introduction

- Intercropping refers to growing more than one crop in the same field at the same time; usually a mix of non-legume and legume crops.
- Intercropping can have many benefits, such as: reduced input costs by lowering fertilizer and pesticide requirements; stability of crop production/economic returns due to diversity; convenience in harvesting of crop, especially pea; and efficient use of resources (e.g., nutrients – N fixation from legumes, water, light).
- Also, intercropping can lead to extra yield [called out-yielding (i.e., when yield produced by an intercrop is greater than yield produced by component crops grown in monoculture on same total land area)]. Out-yielding refers to Land Equivalency Ratio (LER), which was calculated from the ratios of seed yields of intercrops and sole crops by using formula [LER = (Intercrop1/Sole Crop1) + Intercrop2/Sole Crop2)].

## Objective

- To determine the effects of intercropping annual non-legume (barley) and legume (pea) crops on seed yield, protein content, economic returns and N uptake.

## Materials and Methods

- Field experiments were conducted in 2008, 2010 and 2011 on an Oskondoga silt loam soil at Thunder Bay, Ontario.

**Treatments:** There were 10 treatments:

1. Barley Sole Crop, 0 kg N ha<sup>-1</sup>
2. Barley Sole Crop, 40 kg N ha<sup>-1</sup>
3. Barley Sole Crop, 80 kg N ha<sup>-1</sup>
4. Pea Sole Crop, 0 kg N ha<sup>-1</sup>
5. Barley-Pea in Alternate Rows, 0 kg N ha<sup>-1</sup>
6. Barley-Pea in Alternate Rows, 20 kg N ha<sup>-1</sup> to only Barley
7. Barley-Pea in Alternate Rows, 40 kg N ha<sup>-1</sup> to only Barley
8. Barley-Pea in Same Row, 0 kg N ha<sup>-1</sup>
9. Barley-Pea in Same Row, 20 kg N ha<sup>-1</sup>
10. Barley-Pea in Same Row, 40 kg N ha<sup>-1</sup>

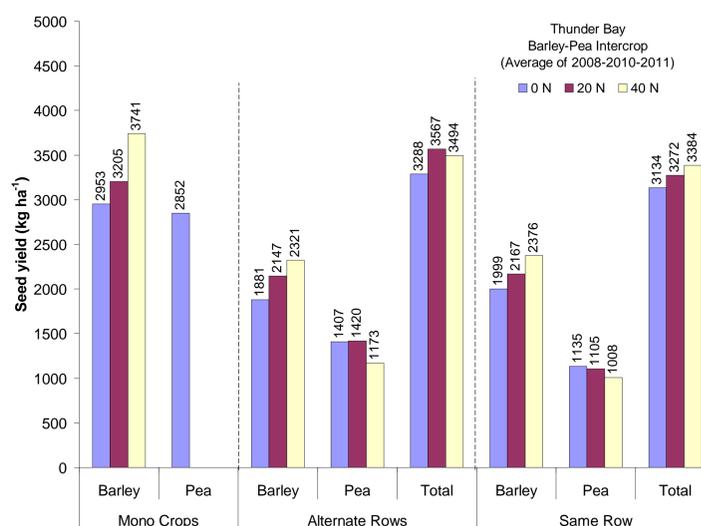
- All plots received blanket applications of P and K fertilizers, and herbicides were applied to control annual weeds.
- At maturity, the crop was harvested and threshed for seed yield. Seed samples were analyzed for total N concentration to calculate crude protein content and N uptake. Seed yields are reported in this poster.

## Summary

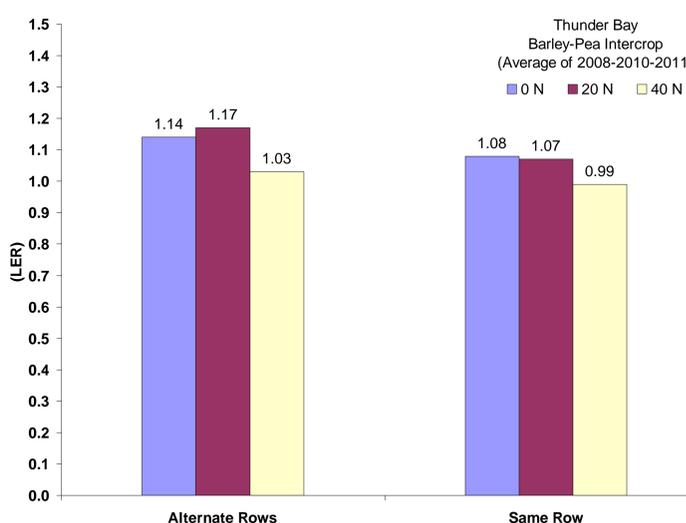
- On an average of three years, seed yield of barley as a sole crop increased considerably with N application, and also increased moderately in intercrop when both crops were seeded in alternate rows or in the same row (Figure 1).
- Seed yield of pea decreased with N fertilization in both barley-pea intercrop combinations (but more in alternate rows), while total of seed yield from the two crops tended to increase with applied N (Figure 1).
- The LER values for barley-pea intercrop decreased from 1.17 with zero-N to 1.03 with applied N for alternate rows, and decreased from 1.08 with zero-N to 0.99 with applied N when both crops were seeded in the same row, suggesting slight to moderate improvement in seed yield and reduction in land requirement with intercropping compared to barley and pea grown as sole crops without applied N (Figure 2).
- The LER values in both barley-pea intercrop combinations increased with application of N fertilizer compared to zero-N (Figure 3). This indicates that slightly greater seed yield and slightly lower land may be required when N is applied to barley in the barley-pea intercropping in alternate rows or in the same row.

## Summary (cont'd)

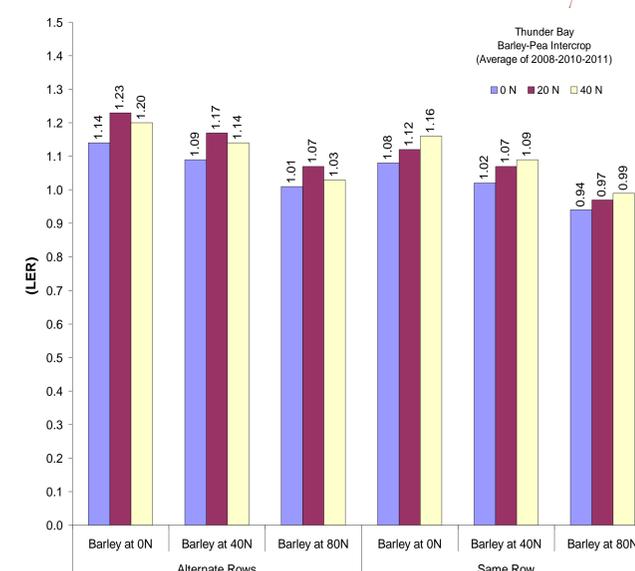
- LER values in both barley-pea intercrop combinations were highest (ranged from 1.08 to 1.23) when sole crop of barley was grown at zero-N rate, and lowest (ranged from 0.94 to 1.07) with application of N fertilizer to barley sole crop at 80 kg N ha<sup>-1</sup> rate.
- This indicates highest crop yield and lowest land requirement for barley-pea intercrop when the sole crop of barley was grown without any applied N fertilizer, and also suggesting little benefit of increase in seed yield and decrease in land requirement for barley-pea intercrop compared to barley sole crop receiving increasing rate of applied N.
- For barley as sole crop particularly at zero-N rate, the LER values increased with increasing N rates in both barley-pea intercrop combinations, suggesting increase in seed yield and decrease in land requirement for barley-pea intercrop receiving very moderate rate of N fertilizer.
- In all three crop price scenarios, net returns (after deducting N fertilizer costs in the N treatments) were highest for pea as a sole crop, followed by barley-pea intercrop when both crops were grown in alternate rows, followed closely when both crops were grown in the same row without applied N, with the least net returns when barley was grown as a sole crop even with applied N (Figure 4).



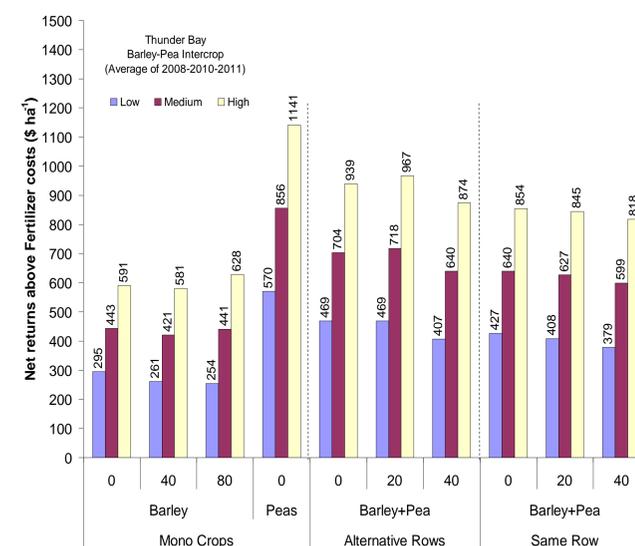
**Figure 1.** Seed yield of barley and pea grown as sole crops compared to various combinations of barley and pea intercrop treatments for similar N rates at Thunder Bay, Ontario (average of three years - 2008, 2010 and 2011).



**Figure 2.** Land Equivalency Ratio (LER) for barley and pea grown as sole crops compared to various combinations of barley and pea intercrop treatments for similar N rates at Thunder Bay, Ontario (average of three years - 2008, 2010 and 2011).



**Figure 3.** Land Equivalency Ratio (LER) for barley with or without applied N and pea without applied N grown as sole crops compared to various combinations of barley and pea intercrop treatments with or without applied N at Thunder Bay, Ontario (average of three years - 2008, 2010 and 2011).



**Figure 4.** Net economic returns for barley and pea grown as sole crops, and in various combinations as intercrop in alternate rows and in same row at low (\$100 Mg<sup>-1</sup> for barley and \$200 ha<sup>-1</sup> for pea), medium (\$150 Mg<sup>-1</sup> for barley and \$300 ha<sup>-1</sup> for pea) and high (\$200 Mg<sup>-1</sup> for barley and \$400 ha<sup>-1</sup> for pea) prices at Thunder Bay, Ontario (average of three years - 2008, 2010 and 2011).

## Conclusions

- Compared to barley and pea as sole crops, seed yields with barley-pea intercropping usually improved moderately with alternate rows combination and slightly when both crops were grown in the same row.
- Net returns of barley-pea intercrop improved greatly when no N fertilizer was applied, although the net returns were highest for pea grown as a sole crop (without applied N).
- Pea/barley-pea intercropping could be an option for organic farming systems!

## Acknowledgements

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