Cereal-legume intercropping for more environmentally- and economically-sustainable brewing and distilling

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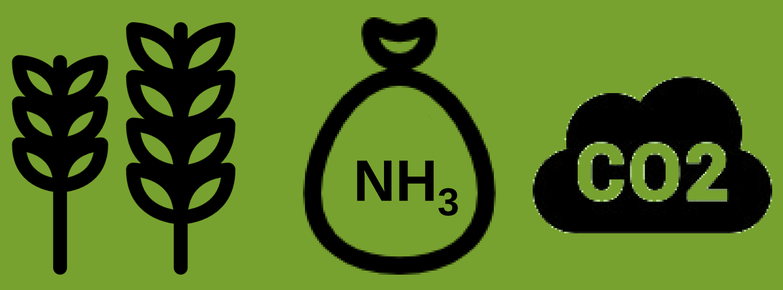
Introduction

Nitrogen (N) fertiliser is essential for good crop yields but comes at a significant financial, and carbon footprint, cost [1,2,3].

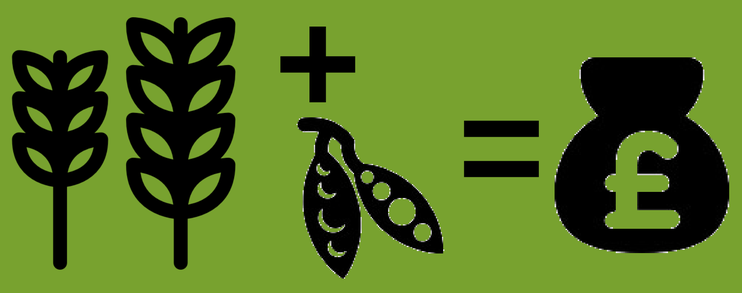
'*Intercropping*', cultivating two or more crops in the same field at the same time, can allow cereal production without added man-made N fertiliser [4,5].

2016 UK Spring Barley



682k ha grown[6] | 75 kt applied[3] | 420 kt emitted[2]

Intercropping with legumes



Nitrogen fixed from atmosphere | £13.5 m savings[1]

+ 420 kt CO_2e reduction from fertiliser non-application is equivalent to removing 176,000 cars / year[7,8]

Methods

- Field experiments involving five barley and five pea cultivars were grown as mono crops (at full seeding rate) and in combinations (50:50 seeding rate).
- A sixth barley treatment was formed using all five cultivars at a 10% seeding rate per cultivar.
- All plots received pre-emergence weed control but no fertiliser or later weed control.
- Desiccant was applied at maturity of the barley (glyphosate).

Field Data: During growth, data was collected on pea establishment and barley tillers, and statistical analysis employed. On harvest both the barley and pea crop was dressed and weighed to establish yield used in determining the Land Equivalent Ratio.

Results

- **Yield: intercrop yield (50% seeding rate) = monocrop yield (at 100% rate)**

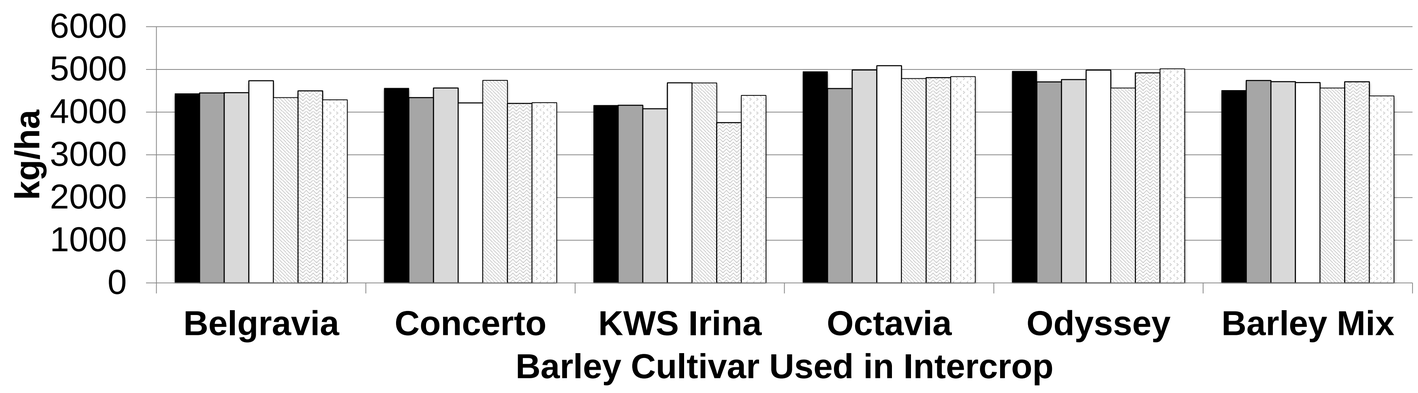


Figure 1. Barley yield (kg ha^{-1}) for monocrops and intercrops, including cultivar mixtures.

Table 1. Average yields and LER for barley and pea grown as monocrops and as an intercrop - with no fertiliser, pesticide or post-emergence weed control.

Treatment (seeding rate % of conventional)	Grain Yield (kg/ha)			LER
	Barley	Pea	Total	
Barley, monocrop (100%)	4595		4595	
Pea, monocrop (100%)		1917	1917	
Barley-Pea Intercrop (50%)	4590	299	4890	1.15

- **Land Equivalent Ratio (LER):** is the land area needed under sole cropping to produce the same amount as 1 ha of intercropping or mixed cropping.
- **Intercropping results in an increased LER (15 % more yield)**

Conclusions

- **Intercropped barley (50% seeding rate) yields = that of monocrops (100% rate)**
- **Protein levels in both species increased by 10% or more**
- **Higher LER = increased yields (15 %) or may decrease land requirements**
- **Current work assesses cost efficiency plus malting, brewing and distilling qualities**

Acknowledgements

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