

Crop Mixtures

Welcome 😊



We will start at 17.30

This meeting will be recorded 😊

@agricology

@SEAMixtures

@plantteams



Agenda

- **Ali Karley and Rob Brooker, James Hutton Institute** - Overview of crop mixtures in research and practice
- **Andrew Gilchrist, Scottish Agronomy** – Experience of trialling 7 different cereal – legume mixtures
- **Gordon Cairns, Stracathro Estates** - Growing Beans and Rye for for whole crop (AD)
- **Charlotte Bickler, Organic Research Centre** - Selecting mixtures and what to do with the end product?

18.30: Comments, questions and discussions



Technical bit..

- Small chance of being ejected into cyberspace – log back in! 😊
- Chat box – comments and questions / personal messages
- Questions
 - Add in chat to ‘everyone’ or ‘raise hand’
 - Pick up some as we go and discussion at end
 - Share your own experiences
- We are recording



WHAT IS AGRICULTURE?



Sharing farmer experience

Demonstrating agroecology in practice on farm throughout the UK, including 40 profiled farmers



Research evidence

600+ Technical guides, researcher blogs and field trials in our free online library



Podcasts

Interviews with farmers and researchers discussing agroecology in practice



Field Days

On farm walks with farmers and researchers – focusing on key agroecological practices



Video

Over 320 videos sharing the latest ideas, opinions and innovations in the field

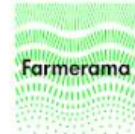


Discussions

Engaging farmers and researchers in conversation at Field Events such as Groundswell and Cereals and on social media @agricology



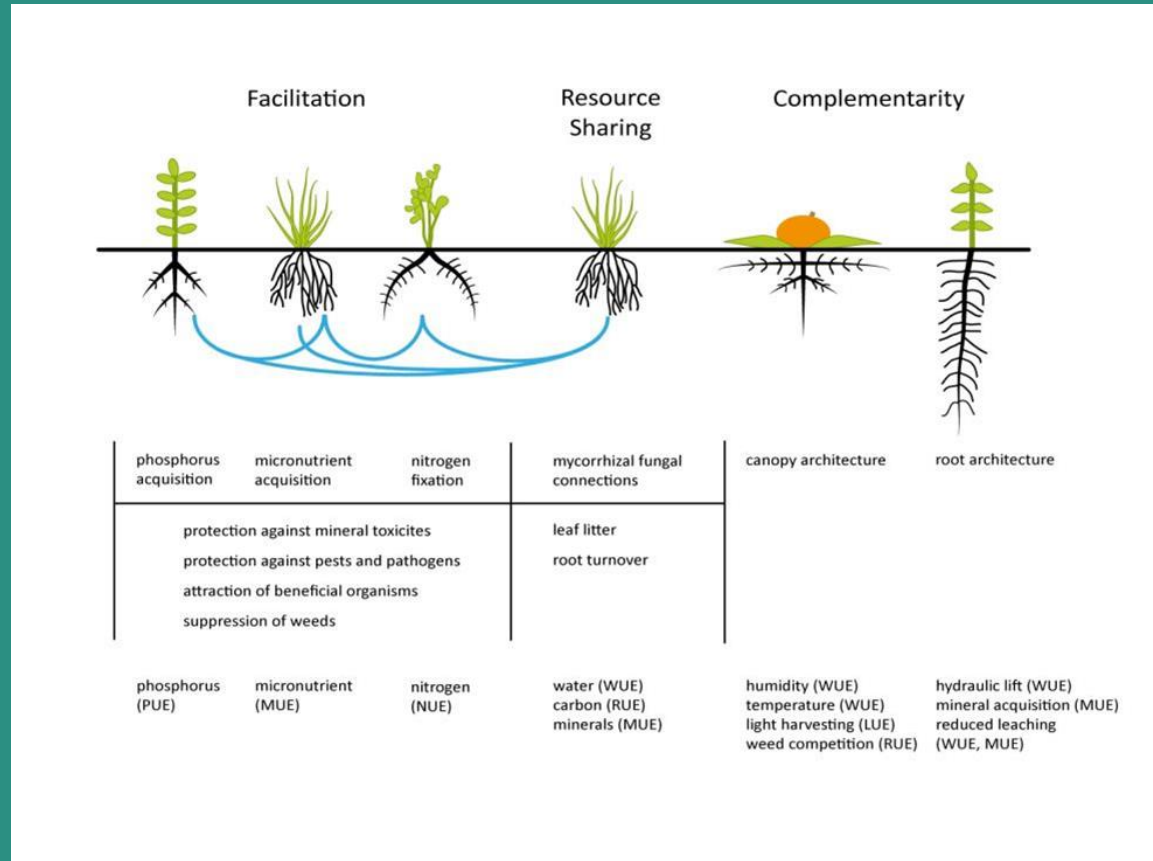
COLLABORATION



What is a crop mixture?

“The growing of two or more crop species where part or all of their crop cycle overlaps temporally and/or spatially, where one or more of the component species is taken to harvest”

Andy Howard – Nuffield Report 2016



Facilitation, resource sharing and complementarity (Brooker et al, 2015)





Ali Karley and Rob Brooker, James Hutton Institute



Science-practitioner knowledge exchange in DIVERSify

DIVERSify: Designing InnoVative plant teams for Ecosystem Resilience and agricultural Sustainability

Optimising the performance of crop species mixtures or 'plant teams'

Horizon 2020 project with 23 academic and industry partners in the EU and internationally



Science-practitioner knowledge exchange in DIVERSify

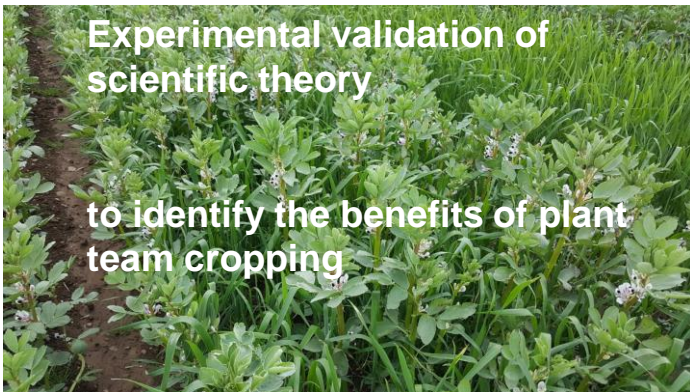


Tacit knowledge of stakeholders



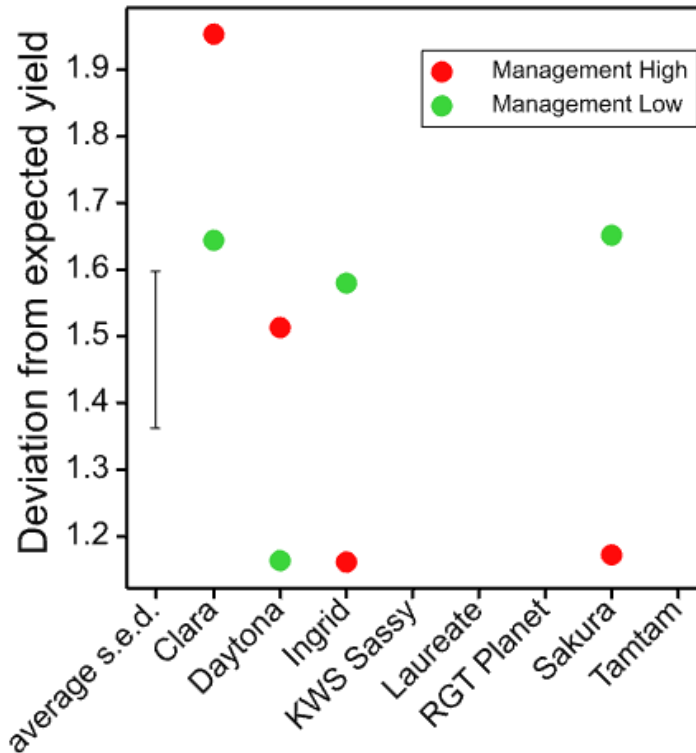
sharing expertise and best practice

Experimental validation of scientific theory



to identify the benefits of plant team cropping

Means for Pea Variety at different levels of Management



Over-yielding depends on component cultivars and management intensity mixtures (e.g. pea in pea-barley mixtures)

Science-practitioner knowledge exchange in DIVERSify



Tacit knowledge of stakeholders

sharing expertise and best practice



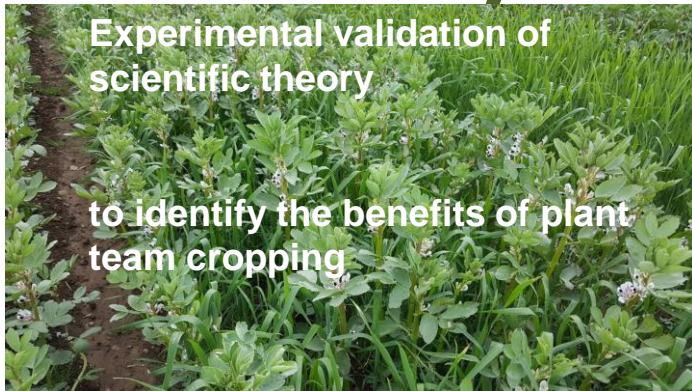
Participatory research with farmers to trial plant teams

to validate the best-performing plant teams



Experimental validation of scientific theory

to identify the benefits of plant team cropping



Extending the experimental trials

adding new plant teams suggested in workshops



Farmers and scientists work together for data collection, trial evaluation and to share findings

SEAMS



Sustainability in Education and Agriculture using Mixtures

Four year project

Funded by the Esmée Fairbairn Foundation

Coordinated by the James Hutton Institute



Project Aims

Develop, promote and implement crop species mixtures as:

- A sustainable crop production system for Scotland
- A resource for knowledge exchange on food production, agricultural ecology and environmental sustainability to a wider audience including school groups

SEAMS



Project Activities

Cores sites – 2020, 2021, 2022

SEAMS

Hubs for KE with:

- Schools
- Farmers – “farmer cluster” approach
- Buyers
- Policy makers

Network sites – 2021, 2022 – trial crop mixtures; help tailor them to local needs/conditions

Provide guidance and support for growing crop mixtures





Peas and barley, Duns Field



Peas and barley, Duns Field



Peas and barley, Hutton Bog Field, June 2020



Peas and barley, Hutton Bog Field, June 2020



**Andrew Gilchrist,
Scottish Agronomy**

Peas and oats



Beans and oats



Peas and barley



Beans and barley



Beans, oats and peas



Barley and clover



Beans and SOSR







**Gordon Cairns , Stracatho
Estates, Beans and Rye for AD**



Beans and Rye, Stracatho Estates 28th July 2020

Beans mono, Stracatho Estates 28th July 2020



A photograph of a rye monoculture plot. The plot is a rectangular area defined by a black grid of thin lines. The grid is supported by white PVC pipes at the corners and along the sides. The rye plants are tall and green, with some seed heads visible. A ruler is visible in the bottom left corner, and a small white daisy-like flower is visible in the bottom left corner of the plot. The text "Rye monoculture, Stracatho Estates 28th July 2020" is overlaid in white at the bottom of the image.

Rye monoculture, Stracatho Estates 28th July 2020



Rye monoculture, Stracatho Estates 28th July 2020



**Charlotte Bickler,
Organic Research Centre**

Thank you to all the farmers involved in the DIVERSify Intercropping Group on Innovative Farmers (innovativefarmers.org)



Wheat and beans, Roundhill Farm, Wiltshire

Motivations: Weed suppression (especially wild oat), increase wheat protein?

Establishment: 1 ha strips, wheat and beans in two passes

2018

Tundra

Mulika

Wheat 174kg/ha Beans 125kg/ha	Beans 125kg/ha
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2019

Tundra

Mulika

Wheat 100kg/ha Beans 200kg/ha	Beans 200kg/ha
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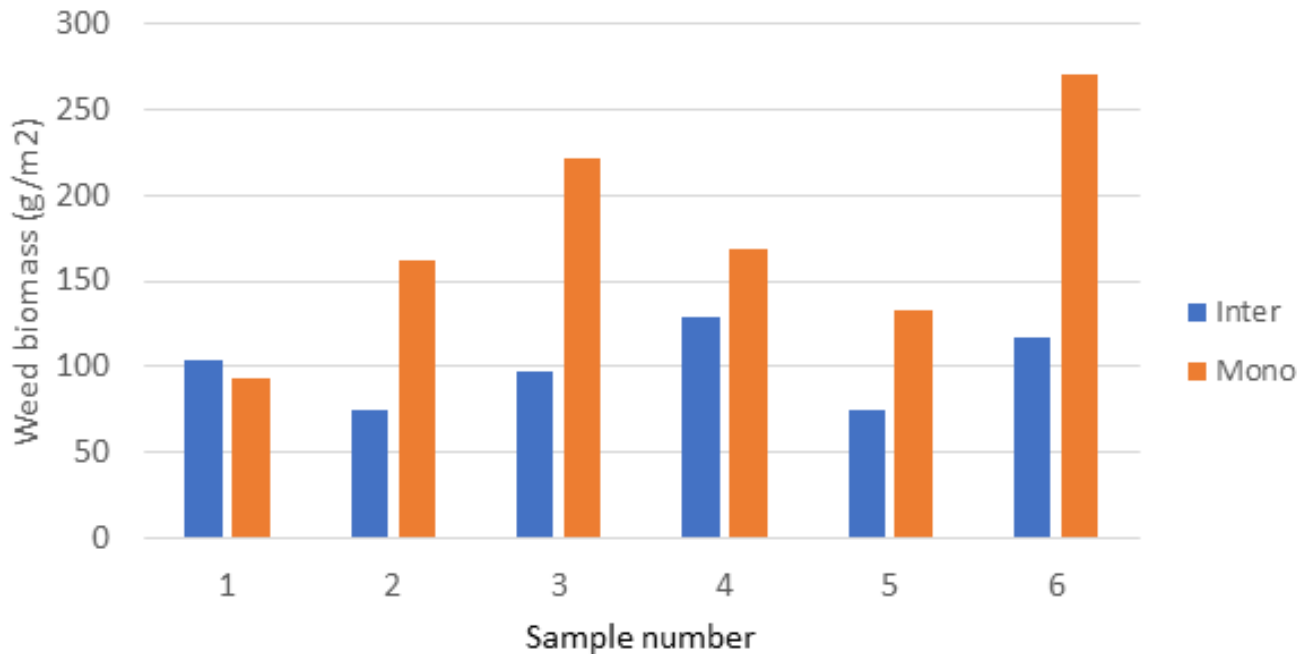
Processing and use: Harvested together and used on farm as a mixed feed for livestock.



Wheat and beans, Roundhill Farm, Wiltshire

Results:

- 2018
 - **Weeds:** 74% less dry weed biomass in intercrop than monocrop
 - **Yield:** Small bean yield penalty in intercrop (wheat rate too high?)
- 2019
 - **Weeds:** 73% less dry weed biomass in intercrop than monocrop
 - **Yield:** Monoculture crop destroyed due to high weed burden



Some indication of improved wheat quality in intercrop in 2019 with protein content of 10.94 v 10.67 in monocrop.



Linseed and oats, Bockhanger Farm, Kent (18/19)

Motivations: Oats to aid linseed establishment via reduction of pest pressure.

Establishment: Linseed and oats drilled with cross slot in one pass on 27/03/19;

- Linseed at 700 seeds/m² / Oats at 0, 70 and 140 seeds/m²



Flax Flea Beetle Trial

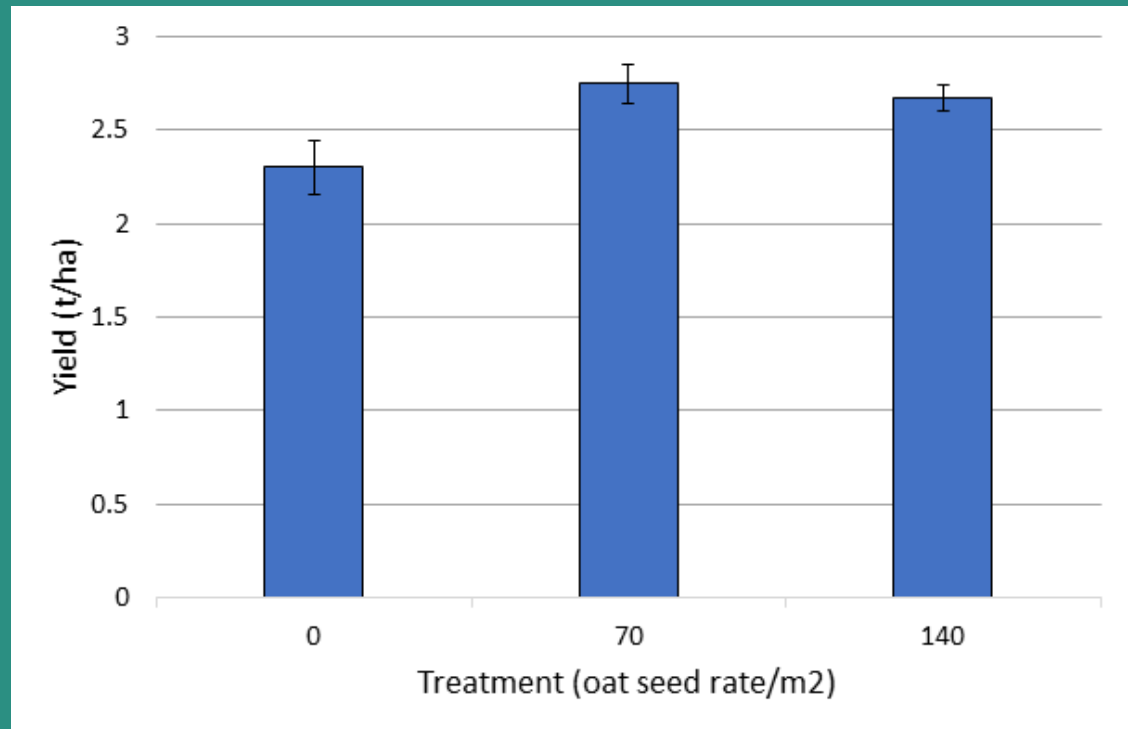
Plot No. (Ha)	Linseed Seeds M2	Oats Seeds M2
1 (0.72)	700	0
2 (0.66)	700	70
3 (0.61)	700	140
4 (0.59)	700	0
5 (0.54)	700	70
6 (0.51)	700	140
7 (0.50)	700	0
8 (0.51)	700	70
9 (0.54)	700	140

1 2 3 4 5 6 7 8 9

Linseed and oats, Bockhanger Farm, Kent (18/19)

Results

- Higher average linseed yield in treatments with oats
- Pest traps confirmed presence of flax flea beetle although in low abundance
- 70 seeds/m² seed rate had a slightly lower pest damage score (NS)





Linseed and oats 2019/20

OSR, Peas and oats, Bockhanger Farm, Kent 18/19

Motivations:

- a) **Aid OSR establishment** via reduction in pest pressure;
- b) OSR in supporting the pea crop and **reducing lodging**.

Establishment:

Marrowfat peas drilled at 70 seeds/m² with and without OSR and an oat companion on 30/03/19.

The treatments were:

- Monoculture peas;
- Peas + OSR at 35 seeds/m²;
- peas + OSR at 50 seeds/m²;
- peas + OSR at 50 seeds/m² plus oats at 70 seeds/m².

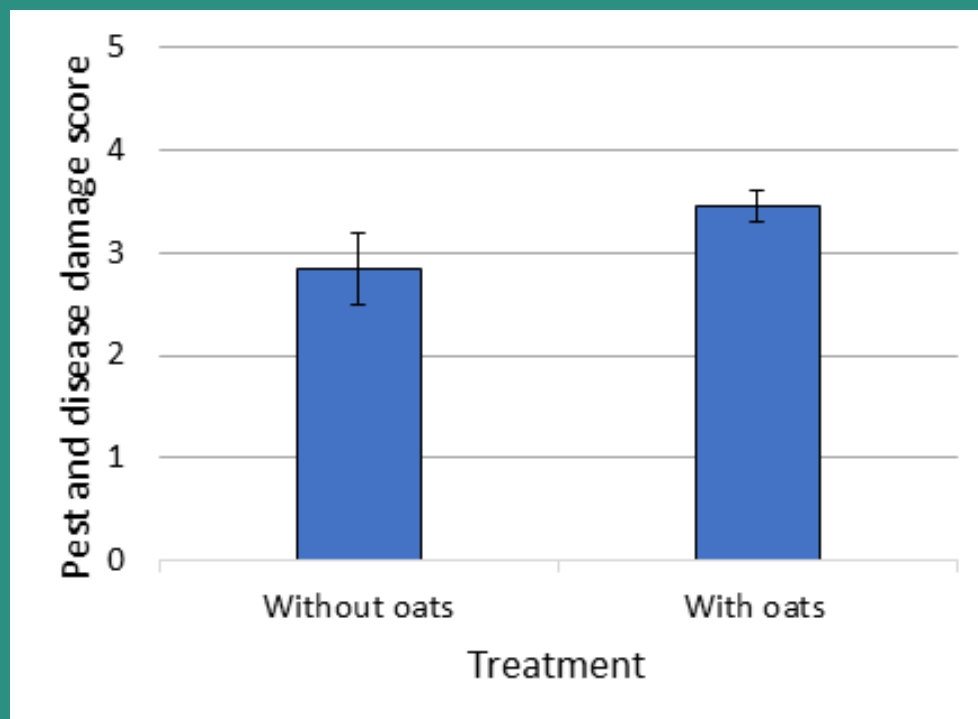
These were replicated twice in strips across the field with monocrop replicated three times to assay in-field heterogeneity.



OSR, Peas and oats, Bockhanger Farm, Kent 18/19

Results

- Average pest and disease damage T2 'Peola' was higher in strips without oats (NS)
- Two cabbage stem flea beetle pests were trapped across the entire trial
- Poor establishment of the OSR
- No detrimental effect on the pea in terms of nutrition or yields across treatments



Bockhanger Farm, Kent, 19/20

- Peas and oats
- Lentils and oats
- Beans and oats
- Undersowing with microclover



Beans and Oats, 50 plants m²: Alternating rows



As above: Alternating 6m strips





Beans and oats 2019/20



Peas and oats 2019/20



Triticale and Carlin peas, Greenacres Farm, Shropshire



Motivations: Scaffolding for peas; pea quality; weed suppression and harvestability

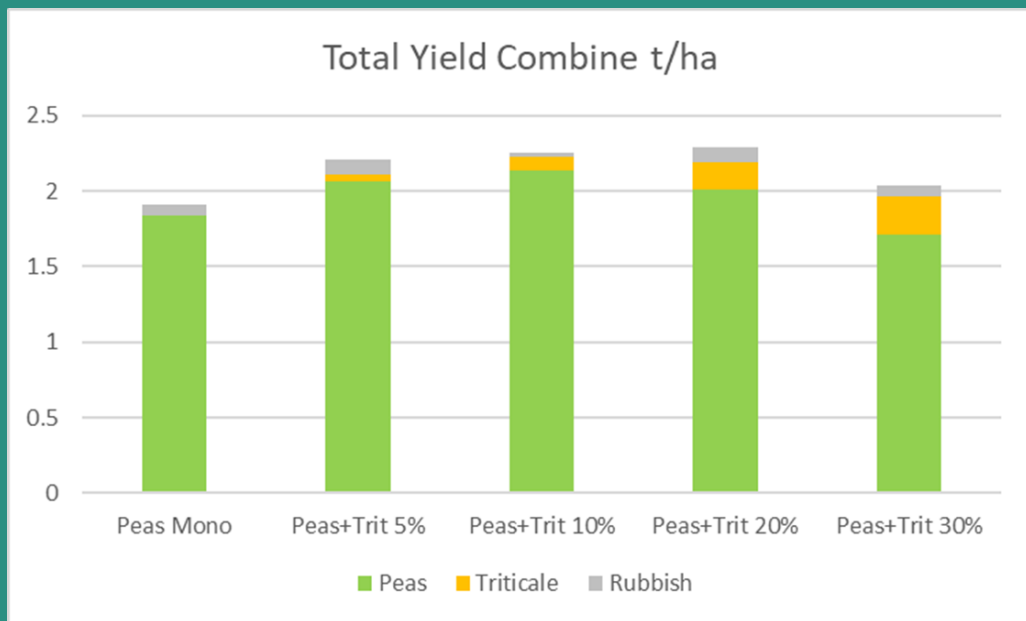
Establishment: 1 ha, 12m strips
Drilled 25th April 2018 in 2 passes

Peas 250kg/ha	Peas 250 Trit 5% RD (12.5kg/ha)	Peas 250 Trit 10% RD (25kg/ha)	Peas Trit 20% RD (50kg/ha)	Peas Trit 30% RD (75kg/ha)
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Triticale and Carlin peas, Greenacres Farm, Shropshire

Results



30% RD
triticale

- Best harvestability in 30% RD treatment (75kg/ha)
- Repeated in 2019 with triticale at 20 and 40% RD
 - Suffered low yields – 40% too high
 - Foot rot issue with increasing legume in rotation?





Processing and use:
Separated with cleaner on farm. Carlin peas for Hodmedod's and Triticale for animal feed



- <https://www.plant-teams.eu/watch>
- Like DIVERSify page on Facebook and/or follow @PlantTeams on Twitter



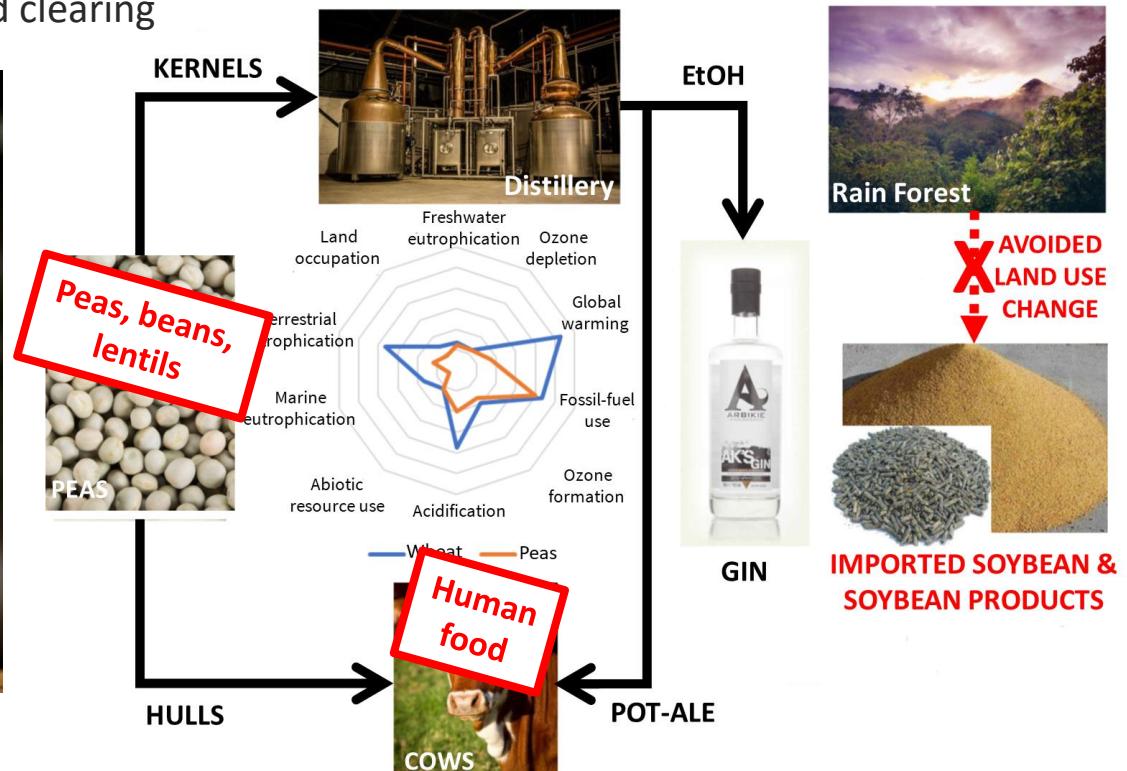
Intercropping and true cost accounting

Gin made from pea (starch)

- better than wheat-gin in 12/14 environmental impact categories
- 12% lower global warming potential
 - 2.2kg CO₂-eq avoided L⁻¹ pea gin
 - due in part to avoided land clearing



www.bbc.co.uk/news/uk-scotland-tayside-central-51559180



Reported in:

[Leinhardt et al., \(2019a\), Environment International, 130](#); and,
[Leinhardt et al., \(2019b\), Data in Brief, 15.](#)

For more info. email: pete.lannetta@hutton.ac.uk



Other popular products for intercroops & LCA



The James
Hutton
Institute

- “*LCA of diet*” approach is being developed and applied too, for:
 - beer & brewing co-product; and,
 - baked faba-beans.

CoolBeans™

- Registered under three product categories (with Hutton Ltd.) ;
 - beers,
 - neutral spirits; and,
 - agricultural services.



UNIVERSITY
OF ABERDEEN



Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

Brewers Spent Grains

- **Currently:** brewers pay for uplift (used for energy/AD).
- **Future:** barley-bean coproduct trialled as feed or food.
Bean-beer LCA is underway.



Manuscripts for peer-reviewed
publication are in preparation

For more info. email:

pete.lannetta@hutton.ac.uk

Over to you...



...questions, comments and ideas?



Opportunities...

- **Scotland**

- SEAMS – contact Rob to get involved rob.brooker@hutton.ac.uk
- Innovative Farmers and Diversify project – ali.karley@hutton.ac.uk

- **East of England**

- PGRO looking for farmers interested in intercropping with beans and other pulses (within 2 hours radius of Peterborough, Cambs) – contact roger@pgro.org

- **England and Wales**

- Intercropping in Arable Systems Field Lab and Diversify project – contact charlotte.b@organicresearchcentre.com



Find out more...[@agriculture](http://www.agricology.co.uk) and YouTube

Agricology @agricology · 20 Sep 2017
 Beans and wheat #intercropping: a new look at an overlooked benefit
bit.ly/2xdSuu4 @OrgResCent #organic #sustainablefarming #Farming




1 13 18

ORC Bulletin No. 112 - Spring/Summer 2013

Beans and wheat intercropping: a new look at an overlooked benefit

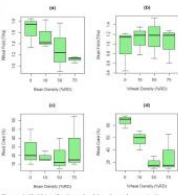
Nearly a decade ago and after several years of R&D, ORC researchers were convinced that intercropping of beans and wheat would be a valuable approach for organic farmers. Despite clear evidence of benefits few took it up. It is now being rediscovered by researchers in other countries. *Martin Wolfe*, one of the earliest proponents of the approach, has never doubted its value. Here he, *Nick Fradgley*, *Laure Winkler* and *Thomas Döhler* report on a trial last year, at Woburns AgriInstitute, intercropping spring wheat and beans.



Intercropping - weeds and yield

A trial was carried out at Woburns AgriInstitute in growing season 2012 to investigate the options of using a spring sown bio-crop of wheat and faba beans.

The wheat cultivar used was Pragma and the beans were Fuego. The replicated trial included plots of wheat, faba beans only and plots of wheat and beans intercropped at 75: 25, 50: 50 and 25: 75 of the Recommended Density (RD) for sole cropping.



Beans are an important crop, mainly used for high protein livestock feed, and wheat is a valuable cash crop. However, beans are often unreliable under organic conditions as yields can be depressed by British beetle attack, Chocolate Spot disease and weed competition. Intercropping wheat with field beans can be a practical approach to reduce these risks while making use of additional benefits.


Provided that the maturation time of the two crops is similar, they can be harvested together and either stored using a weed drier or used as a mixed livestock feed. Alternatively, the drier can be used for whole crop silage.¹ Depending on variety choice, there is the further possibility of using both crop components directly for human consumption.

There are several ways in which wheat and beans are complementary:

- Beans, being legumes, are able to fix and use atmospheric nitrogen while wheat only uses nitrogen already in the soil.
- When plants are at lower density (relative to their density in monoculture) in a mixed crop they have access to more nutrients per plant than they would in a dense monoculture.
- Light competition in the intercrop is lower than in the sole crops as the two species make use of light resources in different parts of the energy used at different times in the growing season.
- Disease incidence is also generally lower in diverse cropping systems as host plants are further apart from each other, delaying the spread of pathogens.² There are also several suggested mechanisms by which intercropping reduces pests, for example, beans may provide a habitat and source for beneficial insects, thus controlling cereal aphid populations.

Figure 2: Yield in t/ha (panel a, b) and weed cover in % ground cover (panel c, d) depending on the density of the beans (a, c) or the wheat partner (b, d). In panel (a) wheat yield responds to the density of the accompanying beans; to keep results comparable only those plots are included in panel (c) where wheat is more at 75% of the recommended density (RD). Conversely, panel (b) shows the response of the bean yield to the density of the wheat when the bean density is fixed at 75% RD. Similarly, weed cover (%) is shown for plots of wheat at 75% RD and varying bean density (c) and for plots of beans at 75% RD with the accompanying wheat at the variable % RD shown on the x-axis.

YouTube Search



Intercropping carlin peas and triticale @ Green Acres Farm

INNOVATIVE FARMERS

Home Field Labs Intercropping in arable systems

Field Lab Timeline

INTERDISCIPLINARY STATUS ACTIVE

Intercropping In Arable Systems

Interest in Intercropping has been growing amongst conventional and organic farmers for some time. This field lab will look at how farmers can use intercropping to make their arable systems more sustainable and productive.

Show More


Meet the Team

ORGANIC RESEARCH CENTRE ELM FARM 04488 658236

Research Institution Organic Research Centre

UK's leading independent research centre for the development of organic/agroecological food production and land management solutions.

DIVERSITY Intercropping Group Founded 13 September 2017




Field Beans and Lupins

Field Beans

View the website

RESOURCE EXPLAINED:

With purchased protein being expensive, home-produced protein in the form of crops such as field beans and lupins can be an attractive alternative. This technical summary of Scotland's Rural College (SRUC) provides practical information on growing field beans and lupins. Whilst aimed at farmers and growers in Scotland, it has a broader relevance.

AUTHOR(S): Boddley, J & Walker, R
 FUNDER(S): Scotland's Rural College (SRUC)
 ORGANISATION: Scotland's Rural College (SRUC)
 DATE: January 2014
 COPYRIGHT: 
 EVIDENCE: Applied research
 RELATED THEME:
 - Markets & food systems
 - Cereals, oil seeds & pulses
 - Grasslands & forage crops



Thank you! 😊

Hope to see you soon



<https://www.agricology.co.uk/join/events>

