

# Intercrop Farm-scale trials experience to date of the EU ReMIX UK MAP

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# ReMIX Objectives

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- Overcome barriers to stimulate the adoption of **species mixtures** by farmers and in agri-food chains
- Unravel mechanisms of **plant-plant interactions** to maximize resource use efficiency
- Determine the role of species mixtures in controlling **diseases, pests and weeds** and alleviating yield damages
- Demonstrate the role of species mixtures in improving **ecosystem service** provision and development of **resilience** to biotic stress
- Identify key traits and create **novel breeding and phenotyping** methods. Generate novel breeding material to grain **legume / cereal** mixtures
- Develop generic rules for assembling species for efficient **cash crop** production using process-based simulation models
- Develop new **management techniques** to optimize species mixtures performance
- Optimize settings and specifications for **agricultural machinery** for harvesting and separating grains
- Develop a toolbox, a **serious game** and technical booklets for **farmers and advisors**

[www.remix-intercrops.eu](http://www.remix-intercrops.eu)



## Multi Actor Participation (MAP) – 11 “hubs” in 10 EU countries

- “Hub” and satellite farm approach

### The UK MAP context:

- **Current systems (generally):** *Input intensive, short term production orientated, potential soil damage, increasingly erratic weather events*
- **Targets or new expectations:** *Reliable yields but using lower inputs, especially cereals, seed potatoes and home grown protein production (grassland), improved soils - health & structure*
- **What are the main characteristics of the socioeconomic context?:** *Long-term sustainability of business, soils and agricultural productivity*
- **Planned activities on the UK MAP:** *Interaction between farmers (online discussion forum), MAP farm visits, open days / evenings*

# Approach @ “Hub site”



## Small plot trials based on known / suggested agronomy

- **Basic approach following from previous years RESAS trials**
  - Discussion with farmer group (EU ReMIX)
    - Sowing rate treatment - in mixtures
- **Yield / quality sampling regime**
  - **Multi-use options** aimed for
    - Biomass, Silage, Combinable grain
  - Feeding value
    - Analysis of micro-silage
    - Pulse use in animal feeding studies



# Recruitment of farms & communication lines

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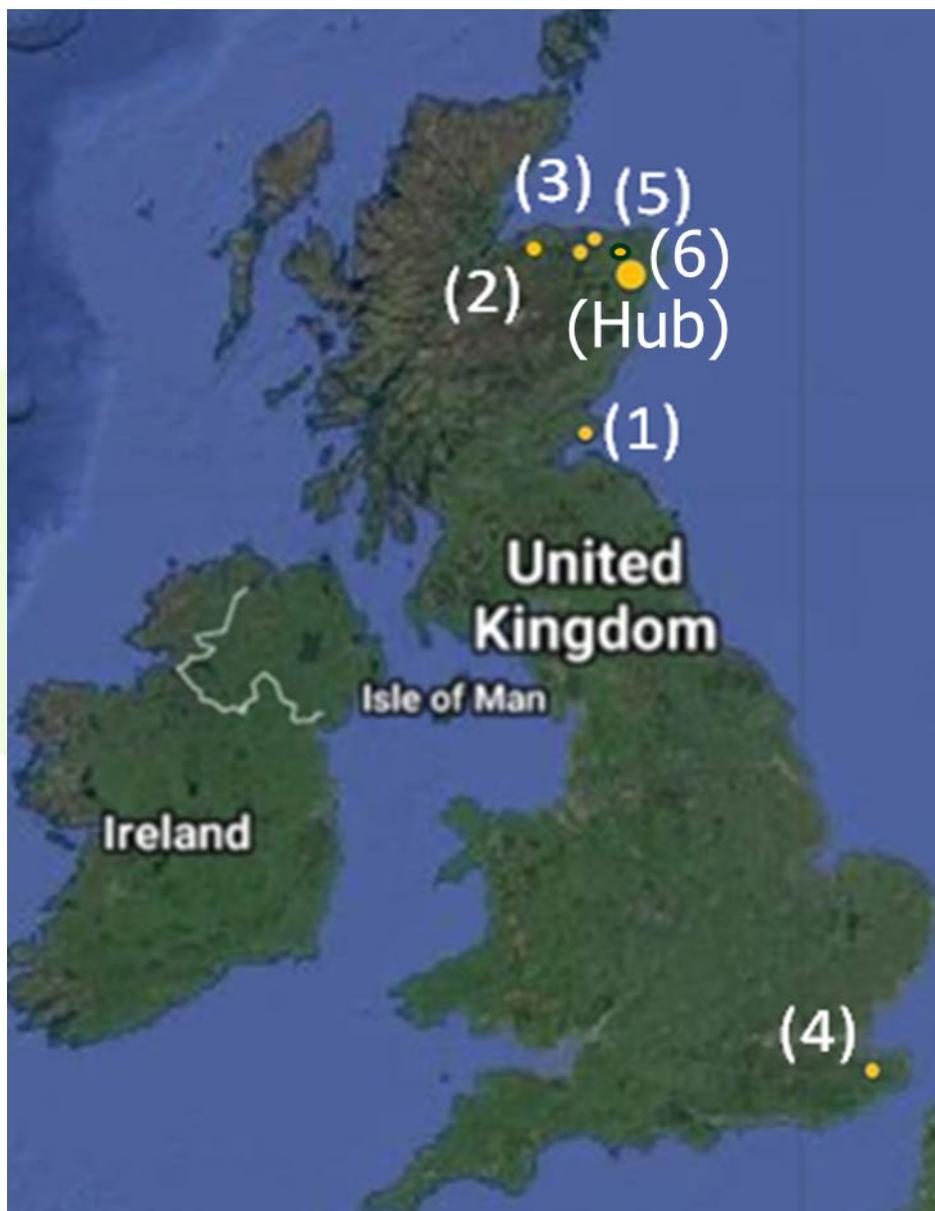


- **ReMIX presented:** by SRUC at several of their own and third party events (like this since May 2017)
  - E.g. demo at Cereals in Practice, Soil Association Innovative Farmers Field Labs, SOPA meetings, SRUC advisory service meetings
- Follow up **emails** and **phone exchanges** with farmers & other interested parties (e.g. processor)
  - Conventional and organic** - all have experience of intercropping – 2 farmers have intercrops on both organic and conventional land
  - **closed Facebook Group** - easier flow of information

# Location of ReMIX MAP Farms



SRUC



# How are the farms involved?

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- **How are crop mixtures chosen and who proposed them?**
  - *Farmer orientated with suggestions from other MAP participants*
- **What are your questions on the crop mixtures?**
  - *Different for each farm (based around targeted end use)*
- **Are they the same for each satellite farmers?**
  - *No, each farm chooses a crop mixture that fits in with their rotation and level of risk they are prepared to take, and which market is targeted*
- **What knowledge is available?**
  - *Some research available from SRUC and wider afield including other farmers (✓), alternative options for regional climate / soils (limited), herbicide options (limited), overcoming harvesting difficulties (limited)*

# Many intercroops in the MAP

## - currently all spring sown



### Central “Hub”

- Peas, beans, lupins, lentils - sole cropped (except lentil) and with spring cereal – different ratios (60/40 & 40/60) tested

### Satellite farms (**O = organic; C = conventional**)

- **(1)** Beans & oats (O and C); Peas, OSR & oats (C); Barley & OSR (O); Barley, strawberry clover, white clover, yellow trefoil (C).
- **(2)** Peas & barley (O & C) – with sole pea & barley crops
- **(3)** Peas & wheat (O)
- **(4)** Beans & OSR (C); Oats & clover (C); Lentils & flax (C)
- **(5)** Pea & barley (O); Pea & wheat (O), Barley & wheat (O); Barley, wheat & peas (O); Barley, wheat, peas & vetch (O) – with sole barley, wheat & pea crops
- **(6)** Oat, pea, vetch u/s high dual purpose grass mix, chicory & plantain; Wheat, vetch, lupin (& volunteer quinoa); Oats, vetch u/s grass & white clover

# EU-ReMIX UK MAP Closed Group - communication channels



EU-ReMIX UK MAP Closed Group

ReMIX UK MAP  
Species mixtures for redesigning European cropping systems  
www.remix-intercrops.eu

Joined Notifications Share More

Write Post Add Photo/Video Live Video More

Write something...

Photo/Video Get together Poll

RECENT ACTIVITY

**Robin Walker** 28 September at 18:31  
We've combined the peas, the barley and the two pea/barley intercrops - all went well 🌱. Still awaiting yield results and the split between the two species in the mixtures. I reckon we'll manage to get a combinable lentil crop this year 🌱 - although the lupins, beans and lentils as either sole crops or intercrops still need a week or two longer ...

ADD MEMBERS Embed invitation  
+ Enter name or email address...

DESCRIPTION Edit  
This group has been set up as a sub-group from the larger EU-ReM... See more

MEMBERS 8 members

GROUP TYPE  
Teams & projects

LOCATION  
Add Location

TAGS Add Tags  
Add a few descriptive keywords.

CREATE NEW GROUPS  
Groups make it easier than ever to share with friends, family and teammates. [Create Group](#)

RECENT GROUP PHOTOS See all

Suggested Groups See All

EU-ReMIX UK MAP Closed Group

Murray Cooper 20 June  
Hi guys thanks for the add here is some of my arable silage mixes this year drought has hampered germination combined with seed flowing slower in the drill due to playing about with dilution of seaweed extract to the cat seed I am less than happy with ground cover but on the plus side the undersown grass mix is getting a good start. We have oat/pea/vetch undersown with a high dual purpose grass mix with added plantain and chicory and wheat/vetch/lupin/(volentier quinoa) the plan is to follow this with a brassica forage crop to graze sheep post lambing in January or out winter dry cows. Also have one field currently in oats/vetch undersown with 6kg grass and white clover I may try direct drill/strip till w/ osr/w barley or wheat?

Robin Walker 1 Comment Seen by 5  
Like Comment

**Robin Walker** Thanks for the update Murray ... 🌱  
Like Reply 10w

Write a comment...

**Robin Walker** 13 June  
Hello, I would just like to welcome Murray to the group. He was at the NE Scotland Organic Discussion Group this afternoon at Craibstone when I gave a talk about some of our intercropping work including ReMIX. He farms up near Oldmeldrum and has been growing various intercrops for a number of years, mostly as wholecrop silage. Cheers Robin

Gordon James Whiteford Seen by 5  
Like Comment

ADD MEMBERS Embed invitation  
+ Enter name or email address...

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Suggested Groups See All

# Data sheets requested from farms

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- Time availability is a key resource so to keep things simple ...
  - Basic semi quantitative information on crops either intercrops, or sole crop components (in adjacent stands) -
    - Germination (1-9 scale)
    - General stand (1-9 scale)
    - Yield estimate (t/ha)
    - Protein content (%)
    - Pest issue (1-9 scale)
    - Disease (1-9 scale)
    - Flowering time (1-9 scale)
    - Ripening (1-9 scale)
    - Lodging risk (1-9 scale)
  - Still awaiting data from farms who are pooling it together

# Benchmark options



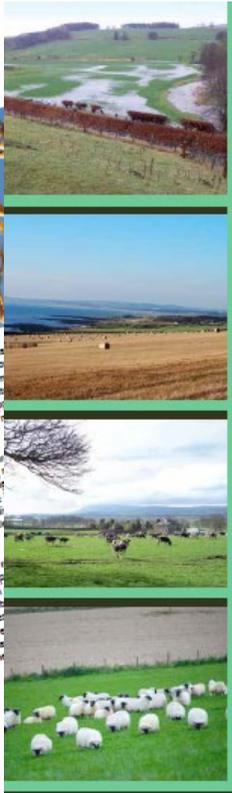
**TECHNICAL NOTE**

**FiBL**

## Examining root nodule activity on legumes

**In brief**  
The symbiotic partnership between bacteria and legumes is vital for the supply of biologically fixed nitrogen to soil and plants in organic cropping systems. Perennial clovers in a diverse grass-clover ley may contribute more than 300 kg nitrogen (N) per ha and year to the cropping system from the second year after sowing. This technical note aims at encouraging farmers to take a closer look at the roots of their legumes.

**isaralyon**  
The Soil Expertise Centre of the University of Applied Sciences



**FiBL**

## Earthworm sampling

**In brief**  
Earthworms are key organisms and indicators of soil quality, which also links to the productivity of an ecosystem. The higher the earthworm density and diversity, the better the soil. They are relatively easy to detect and determine into three ecological groups. The number and distribution of the three ecological categories and the numerous earthworm species depend on soil management, soil type, the vegetation and climate conditions. In this technical note, various methods how to sample, measure and interpret earthworms are shown.

**TECHNICAL NOTE**

## Three ecological categories

There are more than 4000 species of earthworms worldwide, around 400 in Europe and around 40 in our latitudes (Switzerland, Germany). Bouché (1971) in France and Lee (2009) in Australia defined the ecological categories according to morphological, demographic, ecological and anatomical characteristics and over the years, three categories simplified the identification of ecological groups. Some species, however, may have mixed properties and even a certain behavioural plasticity.

**Occurrence and ecological needs**  
Site-specific factors as soil pH, content of organic matter, soil texture, land use and farm practices influence the occurrence and abundance of earthworms. The different spatial way of life and preferences roughly determine the three ecological categories in the soil layer.

- Epicritic species** (leaf litter dwellers, 3-6cm long) decompose fresh organic matter close to the soil surface. They are small and mostly dark red. Preferred habitats: grassland, forest and compost, rarely found in cropland due to lack of permanent litter layers. They have a vigorous reproduction rate but a short lifespan.
- Endemic species** (shallow burrowers, small up to 10cm long) decompose organic substrates in soil and live in horizontal, unstable galleries in the root area of the upper soil layer. They are pale pigmented. Their reproduction rate is limited (2-5 cocoons/year) and lifespan is medium (15-20m years).
- Anecic species** (deep burrowers, 15-40cm long) plant parts from the soil surface into their cocoons (species diameter of 6-12mm), stable burrows (diameter of 6-12mm), which decrease partly and get newly for the cause of their behaviour, they are particularly active at night, when they are active. Reproduction rate is limited and lifespan long. Anecic species are large and red-brown. Adults partially place their faeces at the surface (worm casts). Anecic Lumbricid species are large and red brown. Adult animals deposit their faeces into the soil or above ground.

**Valuing Your Soils**  
Practical guidance for Scottish farmers

**TECHNICAL NOTE**

**FiBL**

## Decomposition study using tea bags

**In brief**  
Comparing the decomposition of green tea as a fast-decomposing material with rootbait, a material which is difficult to break down, allows for the calculation of the tea bag index. This provides information on the capability of the soil as a living organism to transform organic residues back into plant-available nutrients and contribute to the build-up of soil humus. This technique is easy to apply. Place the tea bag in the soil and take it out after three months to see how much is left. It is helpful to discover the result of our hardworking nitrogen-fixing root nodules.

**TECHNICAL NOTE**

**FiBL**

## Weeds as soil bioindicators: How to sample and use data

**In brief**  
This technical note shows how weed species can be used as indicators of soil conditions that are either favourable or unfavourable for crop production. It should be stressed that (i) this kind of analysis does not always provide consistent results, because the relationship between weed species and soil conditions is not always clear cut and that (ii) the bag-based sampling methodology requires some basic technical skills for weed identification.

**TECHNICAL NOTE**

**Wild plants as bioindicators**

The aim of this method is to gain information on soil conditions in an agroecosystem using wild plants. Many weeds can grow in different soils and environmental conditions, but each species has an optimum range of soil characteristics under which it can be found. According to Grime's plant strategy classification, weeds are very diverse and only a few have the capacity to adapt to any extreme conditions (stress-tolerant species). At the same time, some weed species can be typified by specific soil conditions. Knowledge of which species can be associated with which soil conditions is the basis for using them as bioindicators.

Wild plants as bioindicators allows farmers to track the soil conditions in their fields. The second step is to identify the weed species for which the same type of association or more different sources were derived as 'highly reliable' and 'medium reliable' indicators, which are listed in the 'Bioindicator species' appendix.

# Peas - spring barley

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**Pea sole cropped**



**Pea-barley intercrop**

# Lupins - spring barley

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**Lupin sole crop**



**Lupin-pea intercrop**

# Beans - spring barley



**Faba bean sole crop**



**Faba bean-barley intercrop**

# Lentils with spring oat scaffold

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**Anicia**



**Gotland**

# Thanks for your attention

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- Thanks to many colleagues CSS
- and thanks to Scottish Government (RESAS) and EU ReMIX for financially supporting this work

