

Agroecology update:

Research on low-input farming methods in UK (*July 2017*)

With support from the Marisla Foundation, facilitated via PAN North America, PAN UK is compiling information to inform colleagues in other PAN regions of relevant research, policy and practical experiences in agroecological farming and food provision in the European region.

As mentioned in PAN UK's update on UK activities in agroecology (Oct. 2016), there is now some encouraging field-level research underway in British farming to explore how to move towards less input-intensive and more sustainable systems, based on ecological principles. This *Agroecology Update* summarises some of the field trials taking place with farmer groups, notably by the Innovative Farmers network (from which most of this information is drawn). Most of the research is on arable systems or pasture, but also some in orchards and vegetables.

Participatory research in the Innovative Farmers network

Innovative Farmers <https://www.innovativefarmers.org> is an action-research network of farmers, agronomists and scientists, aiming to find lasting solutions to the financial and environmental challenges in UK agriculture, by finding new ways to grow better food and cut waste and pollution, all whilst boosting their profit margins. Innovative Farmers brings together groups of farmers with researchers in practical 'field labs' to deliver reliable results and practical solutions to the challenges facing many British farmers, large and small, conventional and organic. It is part of the Duchy Future Farming Programme, funded by the Prince of Wales's Charitable Foundation. The network is backed by a team from LEAF (Linking Environment and Farming), Innovation for Agriculture, the Organic Research Centre and the Soil Association, and supported by Waitrose supermarket.

Farmers meet in small groups to test and develop new tools and techniques in practical 'field labs', supported by a co-ordinator and a researcher to offer professional advice and help the group access funding. The co-ordinator shares the group's learning through the Innovative Farmers website where groups can track their progress and compare notes. Over the last three years, 750 farmers have been involved in field labs, covering 35 topics, from reducing antibiotic use in dairy to methods to control of blackgrass.

Research topic A: Managing weeds without herbicides

Weeds compete with crops for nutrients and light in arable fields, resulting in lower yields, reduced productivity and increased harvesting costs. Herbicides are costly and can have wide-ranging impacts on the environment, so any advances in improving production whilst reducing their use is of significant benefit. But what different methods of tackling weeds are available and how do they work in different situations? Under this topic, 'field lab' groups are testing and developing mechanical, cultural and historical methods of weed control.

Trial A.1 Finding alternatives to glyphosate for terminating cover crops

Many arable farmers practicing some form of conservation agriculture or reduced tillage for soil conservation aims make use of temporary cover crops to protect soil structure and health. Farmers in conventional systems often rely on glyphosate herbicide to destroy or 'terminate' these cover crops when they are no longer wanted at a specific point in the crop rotation sequence in different fields. Organic farmers have no option to use herbicides but

may benefit from new or improved ways to terminate cover crops in their organic rotations and successfully establish the following cash crop.

With the current debate over glyphosate hazards and risks and the possibility of EU-level restrictions or bans on certain uses from 2018, developing alternative methods to terminate cover crops has become critical. Approaches that are beneficial to farm profitability, soil structure and the environment are explored in this field lab, focussing on methods that do not rely on glyphosate or on other herbicides which might be withdrawn in the future. The key measurements outlined for assessing these trials are:

- Termination success (efficiency of ending/removing the particular cover crop)
- Cash crop establishment
- Cover crop establishment
- Crop profit margin

In November 2016, over 20 farmers met with crop advisors and researchers to discuss their ideas on alternative methods for cover crop management.

<https://www.innovativefarmers.org/news/2016/november/17/finding-alternatives-for-terminating-cover-crops/?count=19>

Trial A.2 Cultural methods to control black grass

Black grass *Alopecurus myosuroides* is an annual grass weed that has become increasingly problematic in British arable farms dominated by early sown winter cereals. This weed can pose serious problems for both conventional and organic farmers and may also be a consequence of the decline of mixed farming systems. Organic farming systems which focus more on mixed farming rely on the use of manures to maintain soil fertility and minimise costs of imported feed. Many farmers after converting to organic will be aspiring to return to mixed farming and may benefit from knowledge of how livestock fit into an arable rotation and approaches to managing weed problems. Many of these approaches will also be relevant to conventional farmers seeking alternative weed control options.

Grazing a crop with sheep used to be a traditional method of weed control but is rarely practised today. There is little research in the UK on its impact, although promising results were demonstrated in trials carried out in the early 1990s – since 2015, this field lab is investigating how effective it is, as well as testing a range of mechanical management techniques against black grass. The host farmer in Suffolk has incorporated livestock into his system, using sheep to graze a winter sown wheat crop for 7 days in the spring. The trials are studying the time of sowing following false seed bed cultivations, and the effectiveness of mechanical weed control, such as inter-row weeding with a harrow comb and using a weed surfer.

Trial A.3 Allelopathy in action: Buckwheat for couch control

This field lab is investigating the potential for buckwheat (and other crops) to reduce infestations of couch grass *Agropyron repens*, a vigorous, perennial weed common in fields and gardens. Allelopathy is a biological phenomenon by which an organism (in this case, the buckwheat plant) produces one or more biochemicals that can influence the germination,

growth, survival, and reproduction of other organisms (in this case, the target is couch grass).

Anecdotal evidence has shown buckwheat to work well as a cover crop or 'green manure' within the arable crop rotation at Abbey Home Farm in East Anglia. Apart from helping to control couch grass, there may be other benefits to farmers from adding buckwheat into rotations, such as: reducing use of mechanical cultivation passes (saving fossil fuel use and reducing plough damage to soil structure and beneficial soil life); reducing reliance on herbicides; improvement in soil health; mobilising phosphorus resources in the soil; and providing nectar for pollinators and natural enemies of insect pests. The field lab aims to provide answers to the following questions:

- Can buckwheat be built into rotations to reduce the couch grass burden on other farms?
- What are the costs and benefits of using buckwheat (as a potential crop or green manure) in the rotation?
- Can we compare it with other means of control (e.g. following)?

Trial A.4 Controlling creeping thistle

Creeping thistle *Cirsium arvense* is a common, broad-leaved and perennial weed of cultivated land. It is one of the most problematic weeds for low and zero input farmers due to its ability to grow from small root fragments, often created through mechanical control operations. Once established, it competes vigorously for light and nutrients with most crops, affecting yield.

For zero input producers, the routine use of herbicides is not possible, while the additional mechanical operations required in organic production can lead to chopped root fragments and further weed spread. For conventional farmers, finding ways to reduce their reliance on synthetic herbicides by having effective alternative control options is an ever more important aim.

This field lab is hosted on two fields on the Sandringham Estate in Norfolk, one field under cereals and fallow and another with a second year grass/clover ley (arable land put temporarily under grass, often for livestock grazing but also for building soil fertility). Eleven treatments are being tested:

- mechanical methods**, using: electrical weeder; comb cut; weed surfer; and Garford hoe on the cereal crop
- fallow cultivations**, with: sweep tines; thistle bar; and subsoiling
- biological interactions**, by sowing a buckwheat green manure
- mineral or botanical preparations**, applying; magnesium and manganese: biodynamic pepper; and Saltex (salts-based crop stimulant)

The aim of the trial is to evaluate the effect of these different treatments on the creeping thistle population and the crop.

Other research topics in Innovative Farmers' field labs

Crop varieties for low-input systems

The majority of crop varieties grown in organic and other low-input systems are bred for the situations where synthetic fertilisers and pesticides are used. Which varieties are most effective – on farm and at scale – in lower input systems?

Growing quinoa organically in the UK

Quinoa has been hailed as a 'superfood' thanks to its valuable nutritional qualities. It is high in dietary fibre, phosphorus, magnesium, and iron, contains all nine essential amino acids and is rich in protein. However, some ethical and environmental concerns associated with quinoa production and export from Bolivia have recently been highlighted and there is an increasing interest in growing it in the UK.

This field lab is evaluating a range of quinoa varieties in organic systems to assess some of the challenges with growing the novel crop in the UK under organic conditions. Some of the varieties which are currently commercially available from The British Quinoa Company are being trialled in large plots, while novel breeding lines developed by breeders at Washington State University are tested in smaller plots. The farmer group is also evaluating weed competitiveness, disease resistance, and earliness, with varieties being scored in the field for these desirable characteristics

Growing heritage wheat varieties for thatching

Wheat was traditionally grown as a dual purpose crop for grain, as well as straw for thatching. With modern day farming and synthetic fertilisers, many straw growers abandoned older wheat varieties hoping to produce thatching straw and milling wheat from the same crop. Large quantities of fertiliser were needed to maximise grain yield and quality which weakened the straw, leading to thatched roofs showing premature decay. Thatchers now look for heritage varieties for their length and quality of straw and dedicated straw producers are returning to growing older varieties in low input conditions. Many of these older varieties suit low-input growing, being more competitive and needing less nitrogen.

This field lab is evaluating 60 wheat varieties, some dating back to the 1840s, from the John Innes Centre heritage wheat collection as potential varieties to grow for thatching. The quality requirements of thatching straw from each variety are scored by group members against a set of identified criteria.