

LK09106: Using legume-based mixtures to enhance the nitrogen use efficiency and economic viability of cropping systems

Legume LINK began in December 2008, and is funded by Defra and industry partners under the Sustainable Arable LINK scheme. The project aims are to improve fertility building in organic rotations through use of a mixture of a wide range of leguminous species and to provide more efficient transfer of nitrogen to the subsequent crop. Species with a range of tolerances to different environmental conditions, and with differing growth characteristics, are being grown together, and the performance of the individuals and the ley assessed.

A successful fertility building crop is vital for a profitable rotation. Stability of establishment, nitrogen fixation and biomass production are all essential characteristics of the ley phase, providing weed control, fertility building and forage. In addition to these requirements, a ley must be resilient to different soil conditions between and within fields, increasingly variable weather, and pests and diseases. Currently in organic systems the most common approach to nitrogen fixation is to use ley mixtures of grasses with red or white clover. However, these simple mixtures can fail (e.g. under dry conditions) and furthermore there is a lack of synchrony between release of nitrogen after ploughing and nitrogen requirement of the following crop, leading to losses from the system.

The incorporation of leys by ploughing results in their decomposition and release of nitrogen. Decomposition rates of crop residues are partly the result of the action of microbes in the soil and the soil temperature, but the quality of the plant residues also has an influence. Woodier material, with a high carbon-to-nitrogen ratio, breaks down more slowly. The phenolic content (such as the presence of tannins) and lignin also affect breakdown rates.

The project is trialling a range of leguminous species at six research hubs throughout the UK, and a mixture of these species on 35 participatory farms from Aberdeen to Plymouth. Detailed assessments will study the range of performance in establishment, growth rate, biomass production, re-growth and the range of C:N ratios, lignins and polyphenols in the plant residues. A modelling approach will be taken to determine the most appropriate species to be grown in mixtures for a range of environmental conditions, and to estimate potential nitrogen losses from the system. The mixtures will also be incorporated into high-input rotations trials to evaluate their potential for cover cropping.

The consortium includes six research institutes and a range of industry bodies*. Trials will be carried out across the country by ORC and research partners SAC, IBERS (formally IGER Aberystwyth), Rothamsted Research, TAG, and Duchy College.

This project is sponsored by Defra through the Sustainable Arable LINK Programme.

* The project consortium is Abacus Organic Services Ltd, Duchy College, HGCA Ltd, IBERS, Institute of Organic Training and Advice (IOTA), Organic Farmers & Growers Ltd, The Organic Research Centre - Elm Farm, Progressive Farming Trust Ltd,

Rothamsted Research, SAC Commercial Ltd, SAC, Scottish Organic Producers Association (SOPA) Ltd., Soil Association Ltd., Soil Association Certification Ltd., TAG, Wakelyns Agroforestry, Organic Seed Producers Ltd.