

Legumes: building soil fertility



The Organic Research Centre is working on leguminous leys, which are the cornerstone of most organic systems. Our work has identified a number of benefits of using mixtures of legumes. As a result multi-species leys have been included as an option in Countryside Stewardship.

Legumes

The use of nitrogen-fixing legume-based leys, whether they are used for grazing, conservation or mulched to build soil fertility, is the basis of most organic systems. Their use is enshrined in the organic standards, which require the inclusion of legumes in rotations. The wider benefits of legumes, particularly in providing food for pollinators are also increasingly being recognised.

Using legume-based mixtures

There are positive correlations between diversity and stability and between diversity and productivity. The principle of diversity can be extended to legumes, where traditionally farmers have used only one or two key species.

ORC was part of a three-year study *Using legume-based mixtures to enhance the nitrogen use efficiency and economic viability of cropping systems* (LegLINK). Our approach was to use functionally diverse species-rich leys with nitrogen-fixing legumes in the rotation. There are a number of key conclusions from the project that can be used to help formulate seed mixtures, which should be adapted to suit the local conditions (pH, P, flooding/drought risk, soil type) and management (grazing, stock type, conservation, mulching) as well as other objectives such as increasing insect pollinators.

Advantages of mixtures

There are several advantages to more complex mixtures over simple two-way mixtures e.g. ryegrass/ red clover or monocultures:

- Stability - provide greater resilience to variable weather, climate and management conditions
- They combine early and late weed suppression characteristics
- Slower decomposition on incorporation and hence potentially better N utilisation by following crops
- Extends forage availability for key insect pollinators.

In the LegLINK project the “All species mixture” was more productive than the farmer’s own mixtures.

Above ground yield of the ley was found to be linked positively to subsequent crop yield.

There are a number of plant characteristics that have an impact on nitrogen release and mobilisation, namely high C:N ratio, lignin and possibly polyphenol content which result in slower N release and potentially lower N losses and better utilisation.

What species to include?

The following list identifies the principle fertility-building legume species and their characteristics.

- Red clover: high forage yield, high yield of subsequent crop
- White clover: high yield, high yield of subsequent crop
- Black medic: moderately high yield in second year, resistance to decomposition (lignin content and C:N ratio), high yield of subsequent crop
- Birdsfoot trefoil: good yield, high yield of subsequent crop
- Lucerne: high yield, resistance to decomposition, high yield of subsequent crop. Prefers high pH.
- Sainfoin: moderate yield, resistance to decomposition (high polyphenols)
- Crimson clover: an annual with high yield, high value for pollinators.

Other conclusions

In terms of forage yield including a 3rd or 4th legume in the seed mix is generally advantageous.

The best multifunctional mixtures contained Black Medic, Lucerne and Red clover.

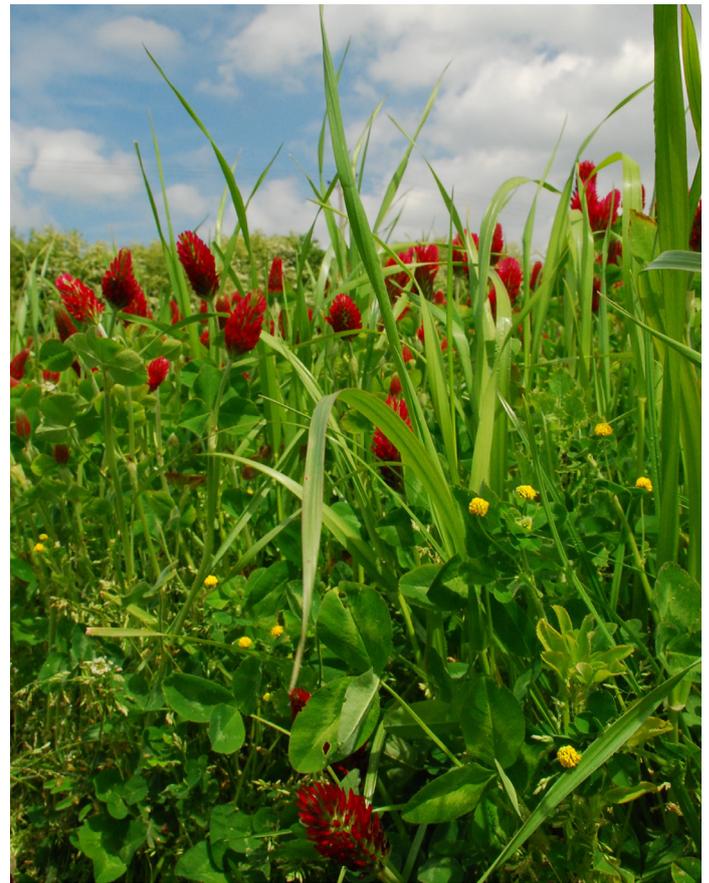
Black Medic, Red clover, Sainfoin, Lucerne and Crimson Clover all significantly benefit bee and butterfly species, Crimson Clover primarily in the first year. This advantage is regardless of management, except for sheep grazing, but changes in management can further enhance the benefits from these species. See the Countryside Stewardship Multi-species ley option OP4, paying £115/ha.

Note: Red clover is not suitable for tugging sheep, lucerne does not persist if grazed regularly. Trefoil, sainfoin and medic contain anti-bloating agents and help intestinal worm control. There is a risk that crimson clover will outgrow a cereal if undersown. Chicory could be included but is less suitable where the ley is to be used for hay or late cut big bale silage, due to the stalks. Lucerne may require additional cultivations to kill it effectively.

Please support our work! While much of what we do is funded as projects by the EU, governments and charitable foundations, many of our activities depend on voluntary donations from the public – *people like you!* **Donate online** or send your contribution to the address below.

There are benefits from the inclusion of grass species in the mix, whether for forage production or fertility-building. The grass takes up the N fixed by the legumes and reduces the free N in the soil, the legume rhizobia respond to the low soil N levels and fix more N, resulting in higher overall N fixation and hence greater biomass. In addition the grass raises the C:N ratio, prolonging the release of N to subsequent crops. The balance of grass and legumes is important.

The annual N accumulation of ley mixtures decreases after two years, although there may be other advantages from longer leys, such as weed control.



More information:

<http://tinyurl.com/ORC-LegLINK>

www.covercrops.eu

<http://tinyurl.com/ORC-OSCAR>

The Organic Research Centre,
Elm Farm, Hamstead Marshall, Newbury
Berkshire RG20 0HR UK
Tel: +44 (0)1488 658298
Email: elmfarm@organicresearchcentre.com
Charity no: 281276 Company no: 1513190

www.organicresearchcentre.com

