



Matchmaking for legumes

Mixing the right species for multifunctional leys

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ABSTRACT

Forage legumes are indispensable components of organic rotations. White and red clover are the most widely used, however there are many different legume species available. Two ideas came together in a series of research projects at ORC: (i) to expand the range of species used by organic farmers, showing which species grow best under which conditions, and (ii) using multiple species in mixtures to combine the different properties and advantages that these species offer.

Field trials were set up at six sites across the UK, including English, Welsh and Scottish locations, to test different legume species with a range of traits. In addition, a mixture of nearly all of these species was grown on more than 30 organic farms alongside a farmer-chosen control ley.

Results showed that some not so well-known species, such as black medic (*Medicago lupulina*) have a strong multifunctional performance under various environmental conditions and may have been underrated by farmers and growers. Also, the optimal species composition of mixtures was dependent on the site.

The OSCAR project went on to show that several rarer legume species have good potential to be grown in organic rotations.

INTRODUCTION

Building soil fertility is one of the central tenets of organic agriculture and improving soil fertility is almost unthinkable without legumes. Apart from their unique property to fix atmospheric nitrogen, they provide several further important services to the soil, e.g., by building up organic carbon, supporting a diverse soil fauna, and suppressing weeds and diseases. Their additional ability of providing ample resources of nectar to pollinators makes legumes true champions of multifunctionality. Starting in 2008, ORC brought together a large consortium of farmers, researchers and seed producers to ask which forage legume species are best suited to various organic growing conditions. The LegLINK project aimed to find multifunctional mixtures of multiple legume species to optimise the fertility building capacity of organic leys¹.



Figure 1 A legume species mix undersown in barley

MANY SITES AND A MODEL

A set of twenty different legume species was pre-screened for their general suitability to organic conditions. Following this initial analysis, a subset of 12 of these legumes plus an additional set of four grasses (**Table 1**) were selected for trialling at six sites across the UK, namely Wakelyns Agroforestry in Suffolk, Barrington Park in Gloucestershire, Rothamsted in Hertfordshire, Duchy College Cornwall, IBERS Ceredigion and SRUC in Aberdeenshire.

At these locations, individual species were grown in monocultures to learn more about their various growth characteristics. A mixture compiled of 10 of the legumes and all of the grasses was tested alongside the monocultures. In addition, seed of this mixture or ASM (All Species Mix) as it was known, was sent to more than 30 farmers across the UK to be grown in a strip alongside their individual, farmer-chosen ley.

Data was collected on the establishment, growth and biomass of the legumes; on a subset of sites, the occurrence of weeds and insects was studied (**Figure 2**), and in a final year we studied the performance of the cereal crop following the incorporation of the ley. Further, data collected in the field was used to calibrate a model that simulated the growth of all possible mixtures of the legume species – something that would have been impossible to test in the field, because of the astronomical number of mixtures.

Results from the LegLINK project showed clearly the large potential to diversify organic leys in the UK, e.g., by including lesser known species such as black medic, alsike clover or crimson clover in the ley¹, but also by expanding the geographical range of other species, e.g., lucerne grew surprisingly well up in Scotland. Work from the modelling then showed that the species composition of optimal multifunctional mixtures would be site-dependent², highlighting the need to develop mixtures adapted to specific conditions found on the farm. Somewhat surprisingly, the model also showed that even with multifunctionality as a target, some optimal mixtures contained only one species, i.e., were in fact monocultures of a high-performing all-rounder species.

ORC's experience with the diversity of forage legumes then led to its participation in OSCAR: a collaborative European research project to develop more sustainable systems of conservation agriculture and increase the diversity of cover crops and living mulches. This work considered legumes' role as so-called subsidiary crops, e.g., as cover crops between cash crops or undersown into main crops. Here, the research combined the screening of further diverse legume mixes and included the development of specialised machinery to enable reduced tillage³. Also see: [Factsheet 5 "Reduced tillage in organic farming"](#).

Table 1 The list of the species selected for on-farm trials

Species	Latin name
Alsike clover	<i>Trifolium hybridum</i>
Birdsfoot trefoil	<i>Lotus corniculatus</i>
Black medic	<i>Medicago lupulina</i>
Crimson clover	<i>Trifolium incarnatum</i>
Italian ryegrass	<i>Lolium multiflorum</i>
Large birdsfoot trefoil	<i>Lotus pedunculatus</i>
Lucerne	<i>Medicago sativa</i>
Meadow fescue	<i>Festuca pratensis</i>
Meadow pea	<i>Lathyrus pratensis</i>
Perennial ryegrass	<i>Lolium perenne</i>
Red clover	<i>Trifolium pratense</i>
Sainfoin	<i>Onobrychis viciifolia</i>
Timothy	<i>Phleum pratense</i>
White clover	<i>Trifolium repens</i>
White sweet clover	<i>Melilotus alba</i>
Winter vetch	<i>Vicia sativa</i>

CONCLUSION

Many of the results produced by the LegLINK project were complex and not easy to translate into robust advice for the choice of the right legume species in an individual growing situation. However, the project and its participatory nature with large-scale farmer involvement meant that many farmers were able to become more engaged in their forage legume selection.

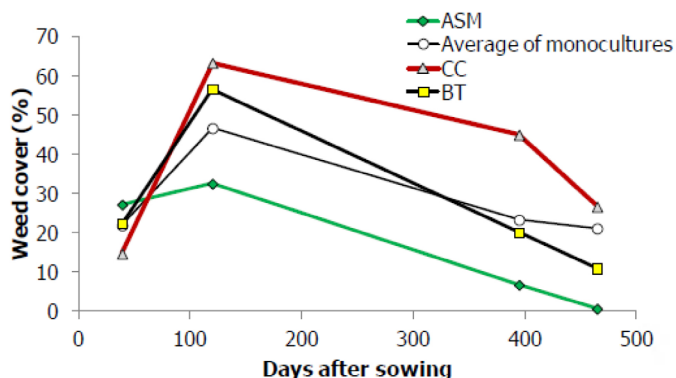


Figure 2 Weed cover for two selected legume species, the all species mix and the average of the monocultures. CC - Crimson Clover, BT - Birdsfoot Trefoil, ASM - All Species Mix

REFERENCES

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