

Including diverse leys in arable rotations

Problem

Leguminous leys are a cornerstone of organic arable systems to support soil quality and fertility, and weed, pest and disease management. However, a typical ley of one or two legume and grass species can fail to deliver expected services under unfavourable conditions. Good establishment, weed suppression potential and controlling the quantity and timing of nitrogen (N) release can be especially challenging.

Solution

Different legume species have different growth characteristics and nutrient use profiles. A number of on-farm and field trials conducted in the UK have evaluated the role of functionally species-rich leys in arable rotations.

Outcome

Results of various studies in the UK suggest that there are several advantages to more complex mixtures (Figure 1), including:

- Greater **resilience** to variable conditions caused by extreme weather such as drought and flooding.
- A **reduction in overall weed biomass** and suppression of both early and late weeds.
- Opportunities for **improving the synchrony between nitrogen release and demand** due to mixing species with different lignin and phenolic profiles. The release of N can also be spread out over time due to mixing species with different decomposition rates, which can allow for a higher proportion of N to be taken up by the following crop.
- Extended flowering / foraging period and resource availability for key **insect pollinators**.
- Increased ground cover and an increase in yield which persists over time - generally achieving **higher forage yields and potentially higher subsequent crop yields** (an increase in ley biomass is likely to translate in to higher yields of a following winter cereal).
- Improved **soil structure** (particularly through boosting soil organic matter).
- Providing livestock with **micronutrients** necessary for good health and production.
- Herbal ley seed mixtures are **more costly** than ryegrass/clover leys but this initial **cost is balanced out by reductions in N fertiliser and protein expenditure** and improved health in livestock and soil. The cost is also compensated for by the decrease of establishment failure risks, yield increase, and by the fact that leys can be self sufficient once established (requiring no additional N), and produce high protein forage for stock.

Applicability box

Theme

Rotation, organic, cropping system, ecosystem services

Geographical focus

The method was tested across the UK on a number of farms as part of the LegLINK project

Application time

Sowing in spring or late summer as a 2 to 5 year break in the rotation before nitrogen demanding crops.

Required time

Sowing, cutting

Period of impact

Within ley, in succeeding crop and the following year

Equipment

No specific equipment needed



Figure 1: 'All species mix' including 14 legumes species

Practical recommendation

- Including grass species in a mix is important as it enables uptake of the N delivered by legume residuals and root decomposition and reduces the free N in the soil; the rhizobium bacteria that live symbiotically in the legume root nodules respond to the low soil N, resulting in higher N fixation and greater biomass. Moreover, the higher C:N ratio occurring in such mixtures prolongs the release of N to subsequent crops, although at lower rates.
- The balance of grass and legumes is also important. For example, within the LegLINK project it was found that when 27% perennial ryegrass (PR) was included in a legume mix, there was 2.8% N in the cut grass and 2.1% in the stubble and roots. When 75% PR was included, the percentages were 1.8 and 1.3 respectively.
- Choose a mixture of species that have different decomposition rates, so that the release of nitrogen can be spread out over time, potentially allowing for a higher proportion of nitrogen to be taken up by the following crop.
- Annual N accumulation of ley mixtures decreases after two years, although there may be other advantages from longer leys such as weed control. Ensure that you select species with contrasting patterns of growth over the whole season to allow for optimum weed control.
- When selecting forage species, it is important to focus on increasing the diversity of flowers and to select legume species that have different flowering times. This will ensure continuous flowering and extend the availability of nectar for key pollinator species such as bumblebees. Additional income from appropriate environmental schemes could provide financial support to cover any additional costs.
- Previous research has found that black medic, lucerne, clover and birdsfoot trefoil (alongside other legumes according to farm requirements) are the most successful multifunctional mixtures. It is recommended you consider including some or all of the legume species.

Further information

Video

- [Herbal Leys with Alex Joynson](#) (English), Cotswolds Seeds First Hand: A farmer from Wiltshire, UK, describes his experience of planting herbal leys on his farm.

Further readings

- IOTA Technical Leaflet 7: [Fertility building leys](#)
- IOTA Technical Leaflet 10: [Sowing and management of multispecies leys to encourage pollinators](#)
- [Cotswolds Seeds: Herbal Leys](#)
- HGCA/LegLINK (2013) Project Report No. 513 [Using legume-based mixtures to enhance the nitrogen use efficiency and economic viability of cropping systems](#)
- [Grass-clover ley in organic rotations \(IBERS\)](#)
- [Modelling the ability of legumes to suppress weeds](#) (Storkey et al. 2011)
- [A win-win for legume mixtures](#) (Doring et al. 2011)

About this practice abstract and DiverIMPACTS

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DiverIMPACTS: The project is running from June 2017 to May 2022. The overall goal of DiverIMPACTS - Diversification through Rotation, Intercropping, Multiple Cropping, Promoted with Actors and value-Chains towards Sustainability - is to achieve the full potential of diversification of cropping systems for improved productivity, delivery of ecosystem services and resource-efficient and sustainable value chains.

Project website: www.diverimpacts.net

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