DEFRA ORGANIC TECHNIQUES PRACTICE ABSTRACT NO. 7

INTEGRATING LEYS IN ARABLE ROTATIONS

Photo: Katie Bliss

PROBLEM

Shortening arable rotations and the specialisation of farming into live-stock and arable has contributed to an increase in persistent arable weeds such as blackgrass and a reduction in soil organic matter and overall soil health

SOLUTION

Reintegrating leys into arable rotations can have multiple benefits for weed control, soil health and diversifying the rotation. Combining with livestock could have further benefits.

OUTCOME

Grass, clover leys can be a beneficial addition to an arable rotation, particularly to manage weed problems such as black-grass and build soil fertility. Black-grass seed is relatively short lived in the soil, with seed numbers declining at around 70% each year. If black-grass is prevented from seeding by cutting or grazing a grass ley, the seed bank declines rapidly.

PRACTICAL RECOMMENDATIONS

APPLICABILITY

Applicable production types

Application time

Usually April - September

Required time

Variable depending on method used

Regulatory compliance

Applicable Countryside Stewardship Scheme (CSS) higher tier option

Reduced N fertiliser will allow compliance with Nitrogen Vulnerable Zone (NVZ) regulations

Equipment/resource required

No additional machinery required

Best in

Applicable to most soil types and for integrating grazing beef, sheep and dairy cattle and cutting for hay/silage

IMPLEMENTATION

Various options can ensure additional value is brought into the arable rotation, including integrating livestock into the farming business.

Options for collaborations with others include:

- Selling standing crops of grass, clover etc to make silage or hay; charged per cut or for the whole season and tend to be payments / ha
- Renting out grazing for the duration of the ley
- 'Flying livestock' - Short term grazing visits, such as over-winter grazing of leys by sheep
- Taking responsibility for others stock whilst grazing your ley on a liveweight gain / p/day contract
- Contract grown crops i.e. lucerne, sainfoin or silage for local farmers
- Stockless leys - can provide benefits if establishment costs are minimal and the ley is left long enough

- Selling standing crops of grass, clover etc to make silage or hay; charged per cut or for the whole season and tend to be payments / ha
- Renting out grazing for the duration of the ley
- 'Flying livestock' - Short term grazing visits, such as over-winter grazing of leys by sheep
- Taking responsibility for others stock whilst grazing your ley on a liveweight gain / p/day contract
- Contract grown crops i.e. lucerne, sainfoin or silage for local farmers
- Stockless leys - can provide benefits if establishment costs are minimal and the ley is left long enough.

Establishment

- Sowing late in the season can limit the window for good establishment and allow significant weed competition. Establishing leys in spring is preferable for more diverse mixtures containing clovers and herbs.
- Undersowing leys in a standing crop is an option particularly in more diverse mixtures containing clovers. This allows the crop to get started before harvest, and once the crop canopy is removed, the ley is already ahead. (See Practice Abstract 15 for more details on undersowing).
- Before establishing leys for grazing, it is important to check that the soil is suitable and the field drainage system is working correctly.
- Provide a good environment to enable seeds to germinate including a fine, weed-free seed bed with sufficient moisture and good soil to seed contact, at an even seed depth. Rolling to consolidate contact may be recommended depending on soil condition
- High seed rates may be used as an insurance policy to reduce the risk of weed infestation or to compensate for poor emergence rates
- Broadcasting grass seed can result in better ground cover, but mixtures containing clovers and herbs generally benefit from drilling
- In dry areas or on light soil, drilling into a prepared seedbed (i.e. with an air seeder in spring) can ensure the seed is placed in contact with soil moisture. In these conditions, seed rates can be reduced by one third.

Choosing ley species

- Select species based firstly on the purpose and duration of the ley and intended use for cutting or grazing.
- Longer term leys (4-6 years) can be based on simple or more diverse mixtures including grass, clovers and additional herbs such as chicory, offering high forage quality and additional animal health benefits
- Leys containing at least 30% legumes can eliminate the need for artificial N fertiliser
- Adding clovers improves livestock feed quality, supporting higher protein content in silage and total overall growth rates
- With leguminous species it is important to note that most of the nitrogen is held within the crop, which is released into the soil as the plant decays or through the effluent of grazing animals
- Increasing the number of species in the mix reduces the risk of the crop failing and enhances sward quality throughout the season
- Tools such as the AHDB Recommended Grass and Clover Lists, OSCAR Toolkit and data from the LegLink project can help with selecting appropriate species (see 'Further information')

Managing blackgrass

- Cutting or grazing leys before blackgrass seed becomes viable is an effective method of reducing weed burden in consequent crop
- Viable blackgrass seed in the seedbank reduces by approx 70% per year, therefore longer leys will have more impact (source: AHDB Blackgrass Solutions document – see Further Information below).
- If the preceding crop had a high blackgrass burden then ploughing is recommended to bury seeds below germination depth. Delaying drilling until after the peak blackgrass germination period in autumn can allow for false seed beds to further reduce the population.

EASE OF ADOPTION ON NON-ORGANIC FARMS

- No additional machinery required for crop establishment and management, but new knowledge required to treat the ley as a crop for maximum results
- If collaborating with others ease of adoption is relatively low

BENEFITS OF IMPLEMENTATION

- Grass and clover leys can help build soil organic matter through a combination of lack of tillage, root/residue returns and absence of crop biomass removal and as well as dung inputs from grazing animals
- More diverse ley mixtures can provide other ecological services

- Legumes are especially important as a food resource for pollinators and beneficial insects outside of major crop flowering times, while deep rooting species can increase water infiltration and reduce drought and flood risk
- Herbal leys may also provide anthelmintic properties
- Potential new markets/collaborations

DRAWBACKS OF IMPLEMENTATION

- Infrastructure has been regionalised - which creates barriers to setting up livestock enterprises in intensive arable areas due to limited access to services such as abattoirs, dairies and animal health professionals.
- Where taking on livestock, there is a need for reskilling and a change in labour routines.

BARRIERS AND RISKS

- Retailer brands require land to be out of horticulture production for 2 years following animals grazing. This reduces the use of grass leys
- Costs of having fields out of production (and not being able to graze animals on these due to food safety issue)
- Initial cost of establishing the leys versus the economic gains which have not been fully explained/confirmed

FINANCIAL ANALYSIS

The overall financial impact of this practice is likely to be minor (less than 10% margin increase), as the cost increase would be offset by an increase in yields.

Initial investment	Ongoing costs	Yields	Financial output	Expected effect on margin
~/↑	↓	↑	~	~

Rating approach used to describe the effect and direction of change (increase or decrease): Unknown = ? None = ~ Low = ↘ Moderate = ↘↘ High = ↘↘↘

The assumptions for the estimate of the financial implications were:

- Use of leys can potentially increase the yield of the following crop by approximately 5%
- Costs of introducing leys can be offset by renting the land for livestock at £275/ha/year, but there will be a requirement for an investment in on-farm infrastructure (e.g. fencing, water troughs) for hosting livestock

RELEVANT LEGISLATION AND CURRENT INCENTIVES

- Nutrient Management Guide (RB209), regulations for organic fertiliser handling, biosecurity, TB licenses.
- Support payments eligible under Countryside Stewardship options.

FURTHER INFORMATION

Videos

- Farmer Ian Boyd discussing herbal leys at the Agricology Field Day on integrating livestock in arable systems: https://www.youtube.com/watch?v=c_k2tuSvb2U
- Farmer Richard Smith discussing preparing a field to put it back into grass: https://www.agricology.co.uk/field/blog/establishing-grass-ley
- Example of undersown herbal ley in spring barley: https://www.youtube.com/watch?v=pFNvjQuF2xw

Further reading and weblinks

- Defra organic techniques Practice Abstract No 1 (2018) Mixed Farming Through Collaboration
- Defra organic techniques Practice Abstract No 11 (2018) Diverse Herbal Leys
- Dr Lizzie Sagoo (ADAS) shares her knowledge on the role of leys in arable rotations. Available at: https://www.agricology.co.uk/field/blog/rotational-benefits-leys-looking-future

- Cotswolds Seeds (2018) Herbal Leys. Available at: https://www.agricology.co.uk/resources/herbal-leys
- Cotswolds Seeds (2018) The Herbal Ley Farming System. Available at: https://goo.gl/Aq1zSa
- AHDB (2018) AHDB Recommended Grass and Clover Lists. Available at: https://goo.gl/ernrMo
- OSCAR Project (2015) Cover crop and living mulch wiki. Available at: https://goo.gl/y4n9p9
- Measures M (2014) Fertility building leys; IOTA Results of Organic Research: Technical Leaflet. Available at: www.agricology.co.uk/resources/fertility-building-leys
- Bliss K (2017) Diverse Fertility Building Leys in Arable Rotations: OK-Net Arable Practice Abstract 13. Available at: http://orgprints.org/31040/1/
- Diverse legume leys: Pollinator benefits. ORC (2015). Available at: https://goo.gl/yVrB59
- AHDB (2018) Livestock and the arable rotation. Available at: https://goo.gl/wpBoVF
- AHDB (2018) Guidelines for dealing with blackgrass: https://cereals.ahdb.org.uk/blackgrass

CASE STUDY FARMER APPLYING THE PRACTICE: KINGSCLERE ESTATES

Location: Hampshire

Size: 1012 hectares

Enterprises: Arable, breeding ewes, beef cattle

Tim May said:

"'We were struggling to improve yields year-on-year, in spite of growing expenditure on increasingly sophisticated inputs and technology. It was clear that the soil was becoming lifeless and lacking in organic matter and we needed to have a new approach, to get the soil back to maximising its potential and for the land to remain profitable.

"I am really interested in solar energy; capturing as much as I can and converting it into human usable energy as profitably as I can. The main engine in this exchange process is the green leaf, and in order to get the most from the green leaf, I need to have a readily available source of nutrients and water. I believe that the cheapest and most resilient way of doing this is naturally, through investing in soil health. I also need to maximise the amount of green cover I have on the land throughout the year.

"It was due to this realisation that I put half the farm down to a four year herb-rich and red clover ley that would maintain green cover 365 days a year, increase organic matter levels, and due to the diverse rooting characteristics, would help aerate the soil and make many more nutrients that are locked up in the soil profile available. As a result, I introduced true mixed farming back into the land holding, through adding four years of herb-rich leys into the rotation, and rotationally grazing these leys with a mix of animals including cattle and sheep (chickens and pigs will also be integrated in the future). Breeding ewes and beef cattle were brought in to help with soil improvement and to maintain an economic output from the leys. The animals are grazed in a way that ensures that the whole farm gets the benefits from the grass and livestock, by keeping everything mobile.

"The productivity and carbon-building capacity of the grass is improved by leaving long periods of rest between each grazing, allowing the plants to recover. The soil structure and colour has improved dramatically, and wildlife surveys conducted by the local wildlife trust show a lot of promise. While we have made the same sort of money as previously, we have added a whole new layer of resilience to our system by adding the leys."

https://www.agricology.co.uk/field/farmer-profiles/tim-may

ABOUT THIS PRACTICE ABSTRACT

Publishers: AGRICOLOGY

THE DAYLESFORD FOUNDATION, DAYLESFORD ORGANIC FARM, KINGHAM, GLOUCS GL56 0YG

Author: KATIE BLISS, THE ORGANIC RESEARCH CENTRE

Contact: KATIE.B(AT) ORGANICRESEARCHCENTRE(DOT)COM

Publication date: September 2018

Permalink: [WEB LINK TO AGRICOLOGY PAGE]

Contributing partners: The Organic Research Centre, Allerton Trust Game and Wildlife Conservation Trust, LEAF, Organic Farmers & Growers, Soil Association, Scotland's Rural College, Agricology

www.agricology.co.uk

Prepared as part of Defra Project OF03111 Organic Management Techniques