Autumn sown herbal ley comprising 16 species (Kate Still)

Herbal leys in an organic dairy rotational grazing system (United Kingdom)

**DESCRIPTION**

Use of diverse herbal leys in dairy production. Provides resilient forage that improves soil health and provides a habitat for biodiversity within a rotational grazing system

Perridge and Old Burford Farm is a 182 ha organic dairy and beef farm in Somerset. They established 43 ha of diverse herbal leys on their grazing platform between 2018 and spring 2021. There are a further 16 ha to be sown in autumn 2021 with further developments planned thereafter.

The system initially established a mix of chicory, plantain, ryegrass and clover in Autumn 2018, with further fields including a more complex mix of cocksfoot, Festulolium sp (a natural hybrid of ryegrass and fescue), ryegrass, timothy, tall and meadow fescue, sainfoin; red, white, alsike and sweet clovers, sainfoin, lucerne, birdsfoot trefoil, burnet, chicory, ribgrass forage herb, yarrow and sheep's parsley.

The most successful establishment has been from autumn sowing, following ryegrass, into a well prepared seed bed with shallow cultivation. This has led to three to four times more effective germination. To prepare the seed bed, a Cambridge roller was used to form a firm seed-bed and stop seeds going too deep, then seed was sown using a grass harrow and air seeder in August. Soil was rolled again with the Cambridge roller to break up clods of soil and then given a flat-roll to give tight soil-to-seed contact and to conserve moisture. The field is then left untouched until the following spring.

Once established by the following spring, the leys are grazed with 140 organic dairy cows, calves and beef animals. They are grazed using a strip rotation approach where they are moved daily at a target of 4,000kg dry matter (DM)/ha, and graze the herbage down to a residual of 1,800kg DM/ha (minimum residual of 10cm). The minimum full rotation is 35 days but this is often longer.

No artificial inputs are used with these diverse herbal leys, thus adhering to organic standards. The legumes (clover, lucerne, sainfoin and birdsfoot trefoil) are used to fix nitrogen, and with the grazing approach of “a third eaten, a third trampled and a third remaining as residual feed” soil organic matter is built up. In addition, the deep rooting species draw up minerals, improve soil structure and infiltration, and increase soil organic matter (SOM). Increasing SOM can also increase soil bacteria and microbe activity. Furthermore, managing the system with a rotational, cell grazing approach prevents selective grazing and increases species diversity and longevity of the sward.

Benefits:

- Soil health – deep rooting species improve soil structure and infiltration, and through building up organic matter this improves soil carbon sequestration and leads to greater soil microbial activity and improved nutrient cycling. This is particularly important for this site due to mineral deficiency.
- Resilient and persistent forage – deep rooting species bring up moisture from deep in the soil.
- Mineral-rich forage – there is a high mineral content in ribwort plantain, chicory, sheep’s parsley, yarrow and burnet. Again, root structure helps, mining more minerals from deeper in the soil profile.
- Biodiversity improvements - a wider species diversity of flowing plants is beneficial for biodiversity.

**LOCATION**

Location: Shepton Mallet, Somerset, United Kingdom

No. of Technology sites analysed: single site

Geo-reference of selected sites

- -2.58772, 51.17382

Spread of the Technology: applied at specific points/ concentrated on a small area

In a permanently protected area?: No

Date of implementation: 2018

Type of introduction

- ✓ through land users’ innovation
- ✓ as part of a traditional system (> 50 years)
- during experiments/ research
- through projects/ external interventions
Animal health benefits – Anthelmintic properties of some species with a high tannin content, such as chicory, sainfoin and birdsfoot trefoil, reduce the parasitic worm burden. Also, the way livestock are grazed, with a good residual of forage, reduces soil contact and, therefore, worm risk.

There are many positives to herbal leys and these have all been experienced to date, particularly resilient forage production in dry conditions. It currently is too early to see changes in soil structure and health.

The challenge with herbal leys are ensuring successful establishment and selecting the right seed mix. Establishment is reliant on conditions and preparations, with the lifespan of the ley managed through careful grazing by having long rotations and preventing selective grazing. Ensuring you have the correct mix of grasses, herbs and legumes to get the balance of energy and protein is key; there has been some anecdotal experience at this farm of cows not seeming “full” coming off herbal ley, this is thought due to dominance of chicory over grasses.

**CLASSIFICATION OF THE TECHNOLOGY**

| Main purpose | ✓ improve production |
| ✓ reduce, prevent, restore land degradation |
| ✓ conserve ecosystem |
| ✓ protect a watershed/ downstream areas – in combination with other Technologies |
| ✓ preserve/ improve biodiversity |
| ✓ reduce risk of disasters |
| ✓ adapt to climate change/ extremes and its impacts |
| ✓ mitigate climate change and its impacts |
| ✓ create beneficial economic impact |
| ✓ create beneficial social impact |

| Land use | Land use mixed within the same land unit: No |

**Grazing land**

- Improved pastures
- Animal type: cattle - dairy, cattle - non-dairy beef
- Is integrated crop-livestock management practiced? No
- Products and services: meat, milk

<table>
<thead>
<tr>
<th>Species</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>cattle - dairy and beef (e.g. zebu)</td>
<td>140</td>
</tr>
</tbody>
</table>

**Water supply**

- ✓ rainfed
- mixed rainfed-irrigated
- full irrigation

**Degradation addressed**

- chemical soil deterioration - Cn: fertility decline and reduced organic matter content (not caused by erosion)
- physical soil deterioration - Pc: compaction
- biological degradation - Bh: loss of habitats, Bs: quality and species composition/ diversity decline, Bl: loss of soil life

**SLM group**

- pastoralism and grazing land management

**SLM measures**

- agronomic measures - A1: Vegetation/ soil cover
- vegetative measures - V2: Grasses and perennial herbaceous plants
**TECHNICAL DRAWING**

Technical specifications

**ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS**

**Calculation of inputs and costs**
- Costs are calculated: per Technology area (size and area unit: ha; conversion factor to one hectare: 1 ha = 1 ha = 2.47 acres)
- Currency used for cost calculation: GBP
- Exchange rate (to USD): 1 USD = 0.75 GBP
- Average wage cost of hired labour per day: 150

**Most important factors affecting the costs**
Seed cost, success of establishment. If establishment fails or is patchy then reseeding or over seeding will be required. Additionally longevity of sward is an important factor in cost – how many years will the sward last before reseeding is required. Aim minimum 4 -5, but can be up to 9 years

**Establishment activities**
1. Shallow cultivator x 4 passes (Timing/ frequency: August)
2. Cambridge Roller (Timing/ frequency: August)
3. Sow seed with grass harrow and air seeder (Timing/ frequency: August)
4. Cambridge Roller (Timing/ frequency: August)
5. Flat Roller (Timing/ frequency: August)
6. Cows let into graze (Timing/ frequency: April)

**Establishment inputs and costs (per ha)**

<table>
<thead>
<tr>
<th>Specify input</th>
<th>Unit</th>
<th>Quantity</th>
<th>Costs per Unit (GBP)</th>
<th>Total costs per input (GBP)</th>
<th>% of costs borne by land users</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equipment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shallow cultivator (up to 4 passes)</td>
<td>Ha</td>
<td>1.0</td>
<td>35.0</td>
<td>35.0</td>
<td>50.0</td>
</tr>
<tr>
<td>Cambridge Roller</td>
<td>Ha</td>
<td>1.0</td>
<td>20.0</td>
<td>20.0</td>
<td>50.0</td>
</tr>
<tr>
<td>Grass harrow and air seeder</td>
<td>Ha</td>
<td>1.0</td>
<td>31.0</td>
<td>31.0</td>
<td>50.0</td>
</tr>
<tr>
<td>Flat Roller</td>
<td>Ha</td>
<td>1.0</td>
<td>26.0</td>
<td>26.0</td>
<td>50.0</td>
</tr>
<tr>
<td><strong>Plant material</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Herbal ley seed mix</td>
<td>Ha</td>
<td>1.0</td>
<td>218.0</td>
<td>218.0</td>
<td>50.0</td>
</tr>
</tbody>
</table>

**Total costs for establishment of the Technology**

<table>
<thead>
<tr>
<th>Total costs for establishment of the Technology in USD</th>
<th>330.0</th>
</tr>
</thead>
</table>

**Total costs for establishment of the Technology per input**

<table>
<thead>
<tr>
<th>Total costs</th>
<th>440.0</th>
</tr>
</thead>
</table>

**Maintenance activities**
1. Rotational Strip Grazing (Timing/ frequency: 1 day in >35 days April to November)

**NATURAL ENVIRONMENT**

**Average annual rainfall**

- < 250 mm
- 251-500 mm
- 501-750 mm
- 751-1,000 mm
- 1,001-1,500 mm
- 1,501-2,000 mm
- 2,001-3,000 mm
- 3,001-4,000 mm
- > 4,000 mm

**Agro-climatic zone**

- humid
- sub-humid
- semi-arid
- arid

**Specifications on climate**
Average annual rainfall in mm: 1300.0

**Slope**

- flat (0-2%)
- gentle (3-5%)
- moderate (6-10%)
- rolling (11-15%)
- hilly (16-30%)
- steep (31-60%)
- very steep (>60%)

**Landforms**

- plateau/plains
- ridges
- mountain slopes
- hill slopes
- footslopes
- valley floors

**Altitude**

- 0-100 m a.s.l.
- 101-1500 m a.s.l.
- 1501-1,000 m a.s.l.
- 1,501-2,000 m a.s.l.
- 2,001-2,500 m a.s.l.
- 2,501-3,000 m a.s.l.
- 3,001-4,000 m a.s.l.
- > 4,000 m a.s.l.

**Technology is applied in**

- convex situations
- concave situations
- not relevant

**Soil depth**

- very shallow (0-20 cm)
- shallow (21-50 cm)
- moderately deep (51-80 cm)
- deep (81-120 cm)
- very deep (> 120 cm)

**Soil texture (topsoil)**

- coarse/ light (sandy)
- medium (loamy, silty)
- fine/ heavy (clay)

**Soil texture (> 20 cm below surface)**

- coarse/ light (sandy)
- medium (loamy, silty)
- fine/ heavy (clay)

**Topsoil organic matter content**

- high (>3%)
- medium (1-3%)
- low (<1%)

**Groundwater table**

- on surface
- < 5 m
- 5-50 m
- > 50 m

**Availability of surface water**

- excess
- good
- medium
- poor/ none

**Water quality (untreated)**

- good drinking water
- poor drinking water
- treatment required

**Water quality refers to: surface water**

**Is salinity a problem?**

- Yes
- No

**Occurrence of flooding**

- Yes
- No

Wocat SLM Technologies
Herbal ley seed mix
Establisment inputs and costs per ha
Species diversity
- high
- medium
- ✓ low

Habitat diversity
- high
- medium
- ✓ low

**CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY**

**Market orientation**
- subsistence (self-supply)
- mixed (subsistence/commercial)
- ✓ commercial/market

**Off-farm income**
- less than 10% of all income
- 10-50% of all income
- > 50% of all income

**Relative level of wealth**
- very poor
- poor
- average
- rich
- ✓ very rich

**Level of mechanization**
- manual work
- animal traction
- ✓ mechanized/motorized

**Sedentary or nomadic**
- ✓ Sedentary
- Semi-nomadic
- Nomadic

**Individuals or groups**
- individual/household
- groups/community
- cooperative
- employee (company, government)

**Gender**
- women
- ✓ men

**Age**
- children
- youth
- ✓ middle-aged
- elderly

**Area used per household**
- < 0.5 ha
- 0.5-1 ha
- 1-2 ha
- 2.5-5 ha
- 5-15 ha
- 15-50 ha
- 50-100 ha
- ✓ 100-500 ha
- 500-1,000 ha
- 1,000-10,000 ha
- > 10,000 ha

**Scale**
- small-scale
- ✓ medium-scale
- large-scale

**Land ownership**
- state
- company
- communal/village
- group
- ✓ individual, not titled
- individual, titled

**Land use rights**
- open access (unorganized)
- communal (organized)
- leased
- ✓ individual

**Access to services and infrastructure**
- health
- poor ✓ good
- education
- poor ✓ good
- technical assistance
- poor ✓ good
- employment (e.g. off-farm)
- poor ✓ good
- markets
- poor ✓ good
- energy
- poor ✓ good
- roads and transport
- poor ✓ good
- drinking water and sanitation
- poor ✓ good
- financial services
- poor ✓ good

**SCALE**

**IMPACTS**

**Socio-economic impacts**
- fodder production
- decreased
- ✓ increased

- fodder quality
- decreased
- ✓ increased

- animal production
- decreased
- ✓ increased

- risk of production failure
- increased
- ✓ decreased

- product diversity
- decreased
- ✓ increased

**Socio-cultural impacts**
- SLM/land degradation knowledge
- reduced
- ✓ improved

**Ecological impacts**
- soil moisture
- decreased
- ✓ increased

- soil compaction
- increased
- ✓ reduced

- nutrient cycling/recharge
- decreased
- ✓ increased

- plant diversity
- decreased
- ✓ increased

Good quality and diversity of fodder for grazing cattle. Similar production to grass ley achieved.

Good quality and diversity of fodder for grazing cattle

Cattle remained healthy and well fed on herbal ley

More resilient and diverse forage

Up to 16 species have been sown as a very diverse seed mix

Training and SLM expert support has transferred knowledge to land users

Deeper rooting and broader leaves have helped maintain soil moisture

No heavy machinery used after sowing in August through to grazing in May.

Deep rooting varieties can recharge nutrients from depth, while nitrogen fixers can support nutrient cycling

Up to 16 species have been sown as a very diverse
**Plant diversity has attracted a greater abundance of beneficial species.**

Deeper rooting and broader leaves have helped maintain soil moisture and recycle from deeper soil water.

**COST-BENEFIT ANALYSIS**

**Benefits compared with establishment costs**
- Short-term returns: very negative and very positive
- Long-term returns: very negative and very positive

**Benefits compared with maintenance costs**
- Short-term returns: very negative and very positive
- Long-term returns: very negative and very positive

**CLIMATE CHANGE**

**Gradual climate change**
- Annual temperature increase: not well at all and very well
- Seasonal rainfall decrease: not well at all and very well

**ADOPTION AND ADAPTATION**

**Percentage of land users in the area who have adopted the Technology**
- Single cases/ experimental
- 1-10%
- 11-50%
- > 50%

Of all those who have adopted the Technology, how many have done so without receiving material incentives?
- 0-10%
- 11-50%
- 51-90%
- 91-100%

Has the Technology been modified recently to adapt to changing conditions?
- Yes: No

To which changing conditions?
- Climatic change/ extremes
- Changing markets
- Labour availability (e.g. due to migration)

**CONCLUSIONS AND LESSONS LEARNT**

**Strengths: land user's view**
- Improving soil health and structure, building soil organic matter and improving mineral balance
- Resilient forage crop that can cope with longer periods of low rainfall
- Nutritious, high mineral content forage that has additional anthelmintic benefits

**Strengths: compiler's or other key resource person's view**
- Diverse herbal leys have multiple benefits to soil, also perform well in periods of low rainfall – more evidence of soil benefits is required regarding structure and biological cycling
- Delivers for biodiversity - through providing flowering plants for pollinators and allowing diverse plants like chicory to go to seed provides important feed for birds
- More research is required on health impact and production in relation to dairy. Research by Reading University has demonstrated no significant different in growth rate for steers

**Weaknesses/ disadvantages/ risks: land user's view → how to overcome**
- Cost and challenge of establishment due to frequent dry springs → Careful timing and flexibility
- Maintaining species diversity and sward longevity → Rotational grazing and long rotations, allowing plants to seed on a rotational basis

**Weaknesses/ disadvantages/ risks: compiler's or other key resource person's view → how to overcome**
- Have realistic expectations of what plants will thrive on different soil types and select bespoke mixes accordingly → Improved knowledge and support
- In many cases having to establish a seed bed through ploughing – linked to longevity of sward, want to minimise cultivations and re seeding to reduce soil damage and cost → Improved knowledge and support

**REFERENCES**

**Compiler**
- Alan Radbourne

**Reviewer**
- Rima Mekdaschi Studer
- William Critchley

**Date of documentation:** Sept. 3, 2021

**Last update:** Sept. 9, 2021
Resource persons
Kate Still - SLM specialist
Stephen Turner - land user
Nathan Hutchings - land user

Full description in the WOCAT database

Linked SLM data
n.a.

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Institution
• Soil Association (Soil Association) - United Kingdom
Project
• European Interreg project FABulous Farmers