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.

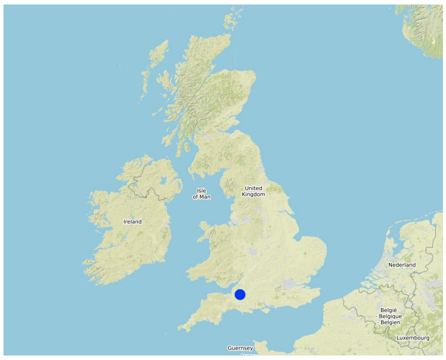
The most successful establishment has been from autumn sowing, following ryegrass, into a well prepared seed bed with shallow cultivation. This has led to three to four times more effective germination. To prepare the seed bed, a Cambridge roller was used to form a firm seed-bed and stop seeds going 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: Shepon 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.

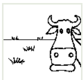

Spring 2020 sown herbal ley (Kate Still)


"Simple mix" herbal ley establishing before grazing (Kate Still)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose
- [x] improve production
- [x] reduce, prevent, restore land degradation
- [ ] conserve ecosystem
- [ ] protect a watershed/ downstream areas – in combination with other Technologies
- [x] preserve/ improve biodiversity
- [ ] reduce risk of disasters
- [x] adapt to climate change/ extremes and its impacts
- [x] 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

Species	Count
cattle - dairy and beef (e.g. zebu)	140

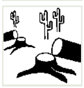
Water supply
- [x] rainfed
- [ ] mixed rainfed-irrigated
- [ ] full irrigation

Purpose related to land degradation
- [ ] prevent land degradation
- [x] reduce land degradation
- [ ] restore/ rehabilitate severely degraded land
- [ ] adapt to land degradation
- [ ] not applicable

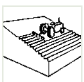
Degradation addressed

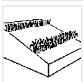
chemical soil deterioration - Cn: fertility decline and reduced organic matter content (not caused by erosion


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 = 1ha = 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)

Specify input	Unit	Quantity	Costs per Unit (GBP)	Total costs per input (GBP)	% of costs borne by land users
Equipment					
Shallow cultivator (up to 4 passes)	Ha	1.0	35.0	35.0	50.0
Cambridge Roller	Ha	1.0	20.0	20.0	50.0
Grass harrow and air seeder	Ha	1.0	31.0	31.0	50.0
Flat roller	Ha	1.0	26.0	26.0	50.0
Plant material					
Herbal ley seed mix	Ha	1.0	218.0	218.0	50.0
Total costs for establishment of the Technology				**330.0**	
Total costs for establishment of the Technology in USD				*440.0*	

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.
- ✓ 101-500 m a.s.l.
- 501-1,000 m a.s.l.
- 1,001-1,500 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)
- for agricultural use only (irrigation)
- unusable

Water quality refers to: surface water

Is salinity a problem?

- Yes
- ✓ No

Occurrence of flooding

- Yes
- ✓ No

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 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

Water 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	

IMPACTS

Socio-economic impacts

fodder production	decreased ☐ ☐ ☐ ☑ ☐ ☐ ☐ increased	Good quality and diversity of fodder for grazing cattle. Similar production to grass ley achieved.
fodder quality	decreased ☐ ☐ ☐ ☐ ☑ ☐ ☐ increased	Good quality and diversity of fodder for grazing cattle
animal production	decreased ☐ ☐ ☐ ☑ ☐ ☐ ☐ increased	Cattle remained healthy and well fed on herbal ley
risk of production failure	increased ☐ ☐ ☐ ☐ ☑ ☐ ☐ decreased	More resilient and diverse forage
product diversity	decreased ☐ ☐ ☐ ☐ ☐ ☑ ☐ increased	Up to 16 species have been sown as a very diverse seed mix

Socio-cultural impacts

SLM/ land degradation knowledge	reduced ☐ ☐ ☐ ☐ ☑ ☐ ☐ improved	Training and SLM expert support has transferred knowledge to land users

Ecological impacts

soil moisture	decreased ☐ ☐ ☐ ☐ ☑ ☐ ☐ increased	Deeper rooting and broader leaves have helped maintain soil moisture
soil compaction	increased ☐ ☐ ☐ ☐ ☑ ☐ ☐ reduced	No heavy machinery used after sowing in August through to grazing in May.
nutrient cycling/ recharge	decreased ☐ ☐ ☐ ☐ ☑ ☐ ☐ increased	Deep rooting varieties can recharge nurtients from depth, while nitrogen fixers can support nutrient cycling
plant diversity	decreased ☐ ☐ ☐ ☐ ☐ ☑ ☐ increased	Up to 16 species have been sown as a very diverse

			seed mix
beneficial species (predators, earthworms, pollinators)	decreased	✓	increased	Plant diversity has attracted a greater abundance of beneficial species
drought impacts	increased	✓	decreased	Deeper rooting and broader leaves have helped maintain soil moisture and recycle from deeper soil water

Off-site impacts

buffering/ filtering capacity (by soil, vegetation, wetlands)	reduced	✓	improved

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Short-term returns	very negative	✓	very positive
Long-term returns	very negative	✓	very positive

Benefits compared with maintenance costs

Short-term returns	very negative	✓	very positive
Long-term returns	very negative	✓	very positive

CLIMATE CHANGE

Gradual climate change

annual temperature increase	not well at all	✓	very well	
seasonal rainfall decrease	not well at all	✓	very well	Season: summer

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- [x] 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?

- [x] 0-10%
- [ ] 11-50%
- [ ] 51-90%
- [ ] 91-100%

Has the Technology been modified recently to adapt to changing conditions?

- [ ] Yes
- [x] 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 heath 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
https://qcat.wocat.net/en/wocat/technologies/view/technologies_5982/

Linked SLM data
n.a.

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Institution
- Soil Association (Soil Association) - United Kingdom

Project
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