Monitoring productivity of a UK dairy system aiming to increase soil carbon, based on diverse swards and incorporating mob grazing

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Introduction

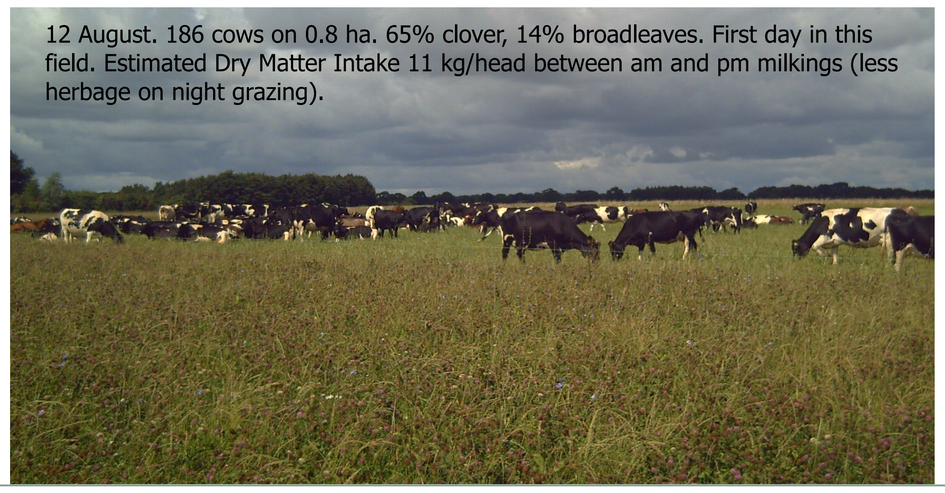
Benefits of increasing soil carbon include: better water retention, increased carbon sequestration, better soil structure, and improved plant productivity. An organic Cotswold farm has been managed for the past 7 years with this in mind.
Two key features have been introduced: diverse swards and "mob grazing". Soil organic matter levels of 3.8 to 4.2% were recorded in 2006.
The farm is being used as a Case Study to address two questions**:**
Immediate: What is the current productivity on these swards?
Long-term: What are the effects on soil carbon?

The System: Manor Farm Chedworth

- Soil—Cotswold brash prone to drought
- Long history of arable in many fields
- 188 dairy cows and followers: Friesian, Shorthorn and crosses
- Spring calving from 2013
- Grazing area for milkers 74 ha plus 20 ha after first cut
- Aim to graze grass Feb to Nov, and winter cover crops

Mob grazing approach used at Manor Farm compared with traditional UK rotational grazing:

- High stocking density for a short period of time (typically 188 cows on 0.8 ha moved twice a day)
- Longer recovery times between grazings (40—50 day rotation)
- Grazing more mature swards, leaving higher cover to increase organic matter returns to soil



12 August. 186 cows on 0.8 ha. 65% clover, 14% broadleaves. First day in this field. Estimated Dry Matter Intake 11 kg/head between am and pm milkings (less herbage on night grazing).

Diverse sward benefits:

- N fixation by legumes
- Mineral supply increased by deep rooting herbs
- Resilience in adverse conditions
- A less seasonally fixed decline in digestibility
- More opportunity for cows to select

Monthly monitoring

- Herbage DM available to cows and residual in 3 x 1 m^2 quadrats in paddock ahead of and behind cows respectively
- Grass, clover and broadleaf components of sward
- Metabolisable energy (ME) and crude protein (CP) of available and residual herbage by wet chemistry.
- Comparisons with a ryegrass/clover plot

Herbal sward 2 July

Residual 2 July

Sampled to approx. 6 cm

Ryegrass/clover sward 2 July.

Species included in 2013 seed mix

(those in brackets not recorded in plots surveyed in established swards)

Grasses	**Legumes**	**Herbs**
Italian ryegrass	Red clover	Chicory
Perennial ryegrass	White clover	Ribwort plantain
Cocksfoot	Birdsfoot trefoil	Burnet
Timothy	(Alsike clover)	Yarrow
Meadow fescue	(Sweet clover)	(Sheep's Parsley)
Tall fescue	(Sainfoin)	
Smooth stalked meadow grass		
Crested dogstail		
Yellow oatgrass		
Creeping red fescue		

Results: Cow performance

Month 2013	Estimated grazed intake / cow/day: kg DM and (ME)	Supplementary feed/cow/day	Milk sales (l/cow/day)
March	4.25 No ME analysis	Silage + 6 kg cake	18
April	7.45 (87 MJ)	Silage + 4 kg cake	22
May (14th onwards)	18.0 (206 MJ)	2 kg cake	22
June	14.0 (141 MJ)	1 kg cereal meal	21
July	18.0 (184 MJ)	1 kg cereal meal	16

Results: Herbage production

Figure 1 Amount and botanical composition of available and residual herbage in field where cows were grazing on day of sampling

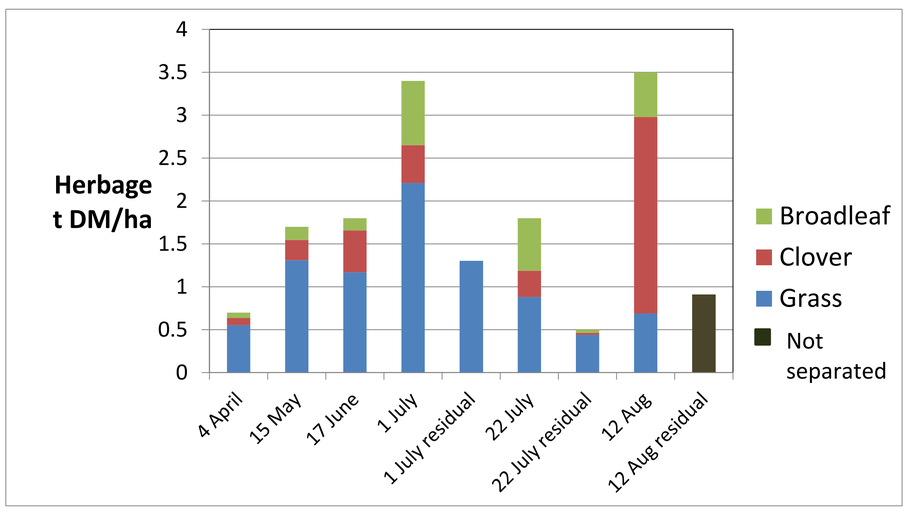


Table 2 Nutritional value of available herbage assessed by wet chemistry

Date and sward type	**ME (MJ/kg DM)**	**CP (% of DM)**
May 27th Herbal	11.5	9.3
July 6th Herbal	10.5	13.6
July 6th Ryegrass/white clover	10.9	14.2

Discussion

Cold spring conditions resulted in slow herbage growth and more supplementary feeding than anticipated. Grazing allocations resulted in measurable residual herbage from late June onwards. The proportion of non-grass species increased over the summer. By late July, cows were selectively grazing legumes and broadleaves, rejecting stalks of grasses, chicory and plantains. The estimation of herbage and energy intakes from such variable swards presents a large challenge. Continued monitoring is needed to evaluate the effect on soil carbon.

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