

Diverse Swards and Mob Grazing for Dairy Farm Productivity: A UK Case Study

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Key words: sward monitoring, stocking rates, grazing systems

Abstract

The paper presents first year results of one participatory case study carried out as part of EU FP7 funded SOLID project (Sustainable Organic and Low Input Dairying) on an organic dairy farm managed with diverse swards and mob grazing in Britain. Mob grazing is a livestock management strategy consisting of high stocking density for a short time to remove forage rapidly due to high grazing pressure and then removing livestock to allow grass recovery. On the farm this is combined with a diverse sward, paying particular consideration to soil fertility. First results indicate that there was more available herbage in front of the cows, especially in the summer months, than could be expected from rotational grazing with shorter rest periods. Differences between the diverse and standard mixture measure in one field were not as marked as expected. Further measurements during the coming grazing season will be carried out.

Introduction

Mob grazing is a livestock management strategy consisting of stocking density pressure for a short time to remove forage rapidly due to high grazing pressure and then removing livestock to allow grass recovery, paying particular consideration to soil quality. The basis for this approach is the grazing patterns of some species of wild herbivores roaming unrestricted over large rangelands. The animals spend a short time in a small area before moving on, leaving behind manure concentrated on a small area, and considerable plant residues, above and below ground, both of which contribute to Soil Organic Matter (SOM) and to soil nutrients (Savory and Butterfield, 1999). Published work on such grazing systems to date has mainly been carried out in arid areas (e.g. Weber and Gokhale, 2011). Interest in the approach has been developing in the UK, but there is some uncertainty about the levels of production that may be achieved. Diverse swards (with a range of grasses, legumes and herbs) may be well suited to this type of grazing management.

This paper presents first year results of one participatory case study carried out as part of EU FP7 funded SOLID project (Sustainable Organic and Low Input Dairying) on an organic dairy farm managed with diverse swards and mob grazing in Britain. The main aims of the case study were to explore the suitability of the system on this farm by determining the pasture herbage productivity, herbage dry matter (DM) utilisation by the animals. Measuring and estimating forage productivity on farms is time consuming. A second aim was therefore to explore the suitability of the plate meter method for estimating herbage yield of such diverse swards in the field.

Material and methods

The case study farm

Manor Farm is a 220 ha mixed dairy /arable farm in the Cotswolds (Gloucestershire, UK) at approx. 260 m above sea level. The thin limestone based soils are prone to drought. It has a long history of arable use in many fields and was converted to organic production in 2005. A mob grazing approach with diverse swards was introduced with the aim of increasing Soil Organic Matter (SOM). The farmer believes that this holds the key to improving and maintaining soil fertility and forage productivity in his organic system. Leys are reseeded as part of the rotation every five years with a diverse sward mixture that should be more suitable to the approach. The diverse sward mixture includes 10 different grass species (i.e. *Lolium multiflorum*, *Lolium perenne*, *Dactylis glomerata*, *Phleum pratense*, *Festuca pratensis*, *Festuca arundinacea*, *Poa pratensis*, *Cynosurus cristatus*, *Trisetum flavescens*, *Festuca rubra*) six legumes (*Trifolium pratense*, *Trifolium repens*, *Trifolium hybridum* L., *Lotus corniculatus*, *Melilotus*, *Onobrychis viciifolia*) and five herbs (*Cichorium intybus*, *Plantago lanceolata*, *Sanguisorba minor*, *Achillea millefolium*, *Petroselinum sativum*). The best method for establishing the long-term diverse ley is was found to be undersowing under a spring cereal crop.

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The herd of Friesian-Shorthorn cross dairy cows is spring calving, with a lactation period of 300 – 310 days. Full-time housing of the cows is limited to two months (Dec & Jan). Kale and fodder beet are grown for additional winter grazing. The mob grazing scheme uses high stocking densities of animals. During 2013, 48 heifers and a bull (equivalent to a body weight of 135 ton of livestock per hectare) and 186 milking cows (equivalent to 127 t/ha) were moved on twice a day after each milking. Typically 186 cows grazed 0.8 ha plots, delimited by electric fences. Following grazing pasture was allowed to recover for about 40 to 50 days. The case study used fields as established by the farmer with the above mixture.

Monitoring and sampling

Starting in March 2013, herbage yield and composition of the grazed swards were assessed on several fields representing the range of age of sward across the farm on a monthly basis. A one-square-metre quadrat was randomly placed in the un-grazed area just before the grazing cows and immediately after them on the grazed area. All the vegetation within the quadrat area was harvested to approximately 5 cm height and the herbage fresh weight was recorded. Samples were then separated into clover and legumes, broadleaves, grass and senescent material. This was used to determine percentage of grass, clover, broadleaved species and bare ground on the grazing plots and to estimate forage DM intake of the grazing cows. The dry matter (DM) content and forage proportion of each plant species within the sampled area were determined and forage yield (t DM/ha) was calculated for each sampled field before and after grazing. Additional herbage samples were analysed by wet chemistry for metabolisable energy (ME) content. Data on farm milk production were provided by the milk buyer.

Comparison of the productivity of two seed mixtures (i.e. perennial ryegrass/white clover mix *versus* the diverse sward (see mixture above) was determined in only one field ('Laines Estate') grazed by the heifers. On several sampling dates in August and September 2013, an Ashgrove Rising Plate Pasture Meter® (PM) was also use for estimating herbage yields. The quantity of herbage was estimated by PM based on 50 measures per plot of compressed sward height and by using the following equation: t of DM/ha = (mean compressed sward height x 125) + 650. Calculated values were compared with those derived from cutting. In line with commercial use of the PM, it was assumed that the material from the plots that could not be grazed by cows amounted to 1.4t DM/ha.

Student's t test for comparison of means for paired samples was used to compare a) DM yields of the two sward types, and b) DM yield estimated by cutting and plate meter.

Results

Figure 1 shows the productivity (t DM/ha) of the swards grazed by the cows and Table 1 shows the calculated estimates for dry matter intake and milk production per month for 2013.

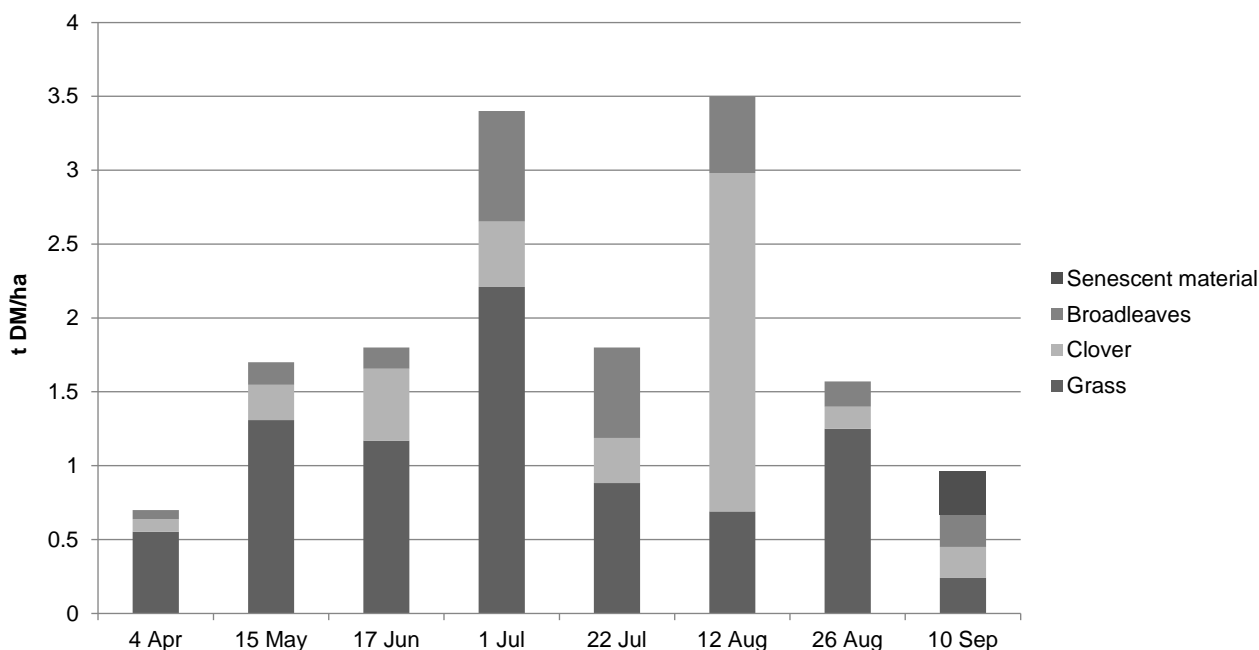


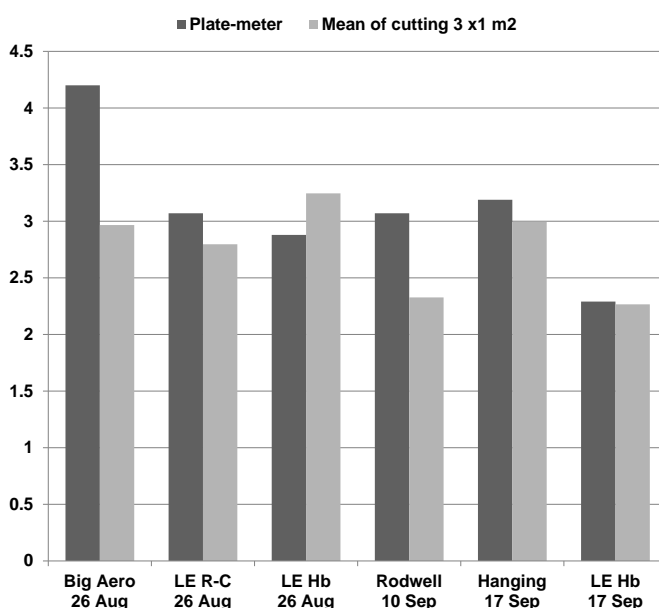
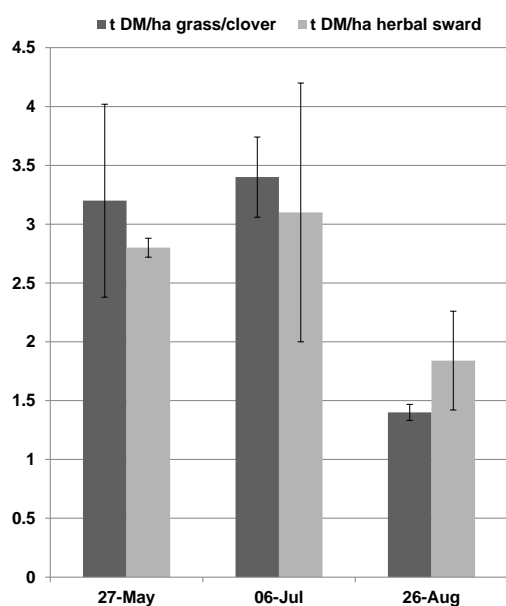
Figure 1: Productivity & herbal composition (DM) of diverse sward grazed by milking cows (2013)

In a search for useful predictors to allow more rapid assessment of herbage production, correlations between percentage cover and percentage of DM yield for the sward components were calculated. Among the relationships between percentage cover of each botanical group and the relative contribution to DM yield assessed on sample plots, only percentage clover cover and clover DM yield showed a statistically significant correlation ($r^2 = 0.724$, $p < 0.05$). The correlations for grass and broadleaves were not significant.

Table 1: Milking cows' feed consumption, feed composition and milk production

Month 2013	Estimated grazed intake cow/day		Supplementary feed per cow and day	Milk production litres per cow/day
	kg dry matter	Metabolisable Energy (MJ)		
March	4.25	No ME analysis	Silage+6 kg cake	16
April	7.45	87	Silage+6 kg cake	18.5
May	18	206	2 kg cake	24
June	14	141	1 kg cereal meal	20
July	18	184	1 kg cereal meal	15
August	10	99	1 kg cereal meal	14

No significant difference between the two sward mixtures was found (Figure 2). No significant relationship was found between herbage mass estimated by PM from compressed sward height and by cutting using the existing equation (Figure 3).



*1.4 t DM/ha has been added to the yield measured by cutting to allow for unharvested material

Figure 2. Comparison of the yields of grass/clover and herbal mixture sward (tDM/ha)

Figure 3. Comparison of herbage mass (tDM/ha) predicted from compressed sward height (PM) and measured by cutting*

Discussion and conclusions

Mob grazing allowed for higher forage availability for the grazing cows, especially in the summer months, compared with rotational grazing with shorter resting periods and with ryegrass (fertilised) or ryegrass/white clover (Leach et al. 2000).

The data illustrate that there was a large variation in herbage composition between dates and fields (Figure 1 and additional data not shown), but no significant difference in DM yield was found between the two mixtures compared (Figure 2).

Mob grazing with long pasture recovery periods can lead to better utilisation of mature swards by the grazing cows. It is well established that growth stage of sward influences digestibility, due to lignification. The effect of the increased proportion of senescent vegetation on milk yield should therefore be monitored carefully. It was noted that the proportion of senescent material was lower in the sward available to the cows than in the residual herbage, while the proportion of legumes and broadleaves was higher (data not shown). This suggests that the cows selected for the legumes and herbs and against the senescent herbage. Senescent material in the residual herbage is expected to make an important contribution to increasing SOM.

Monthly average milk yields (Table 1) were lower than those reported for British organic farms by Kingshay Dairy Costings (<http://www.dairyco.org.uk/market-information/farming-data/kingshay-dairy-costings/kingshay-dairy-costings-organic>) with the exception of the May lactation peak.

Regarding the use of the PM method to monitor diverse swards, the lack of good relationships between different sward parameters is likely to be due to the very heterogeneous nature of the diverse swards at different times.

Further measurements during an imminent grazing season are needed to evaluate the productivity of these swards and to fully validate the suitability of the plate meter for assessing varied swards and explore other predictive measures.

Acknowledgements

Support from Rob Richmond of Manor Farm, Chedworth in Gloucestershire is gratefully acknowledged.

This publication was generated as part of the SOLID Project (<http://www.solidairy.eu/>), with financial support from the European Community under the 7th Framework Programme (Agreement No. 266367). Gonzalo Palomo was supported placement at ORC was supported by the Erasmus Young Entrepreneur EU funded program and Extremadura Regional Government. The publication reflects the views of the authors and not those of the European Community, which is not to be held liable for any use that may be made of the information contained.

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