Measure 18: Taking Stock off Wet Ground

Description of the measure

In many parts of the UK livestock are routinely allowed to graze pastures throughout the winter period. Such out-wintering management provides many advantages in terms of reduced demands for housing and lower feed costs. However, there are concerns about the potential environmental impacts associated with soil compaction, water pollution, and greenhouse gas emissions (in particular nitrous oxide). One potential solution to these problems is to move stock from wet ground during periods when soil water content exceed a threshold value. This can be achieved either by temporarily moving cattle to an indoor housing facility (Van der Weerden *et al.* 2017), or by relocating animals to specially designated stand-off pads (Buss *et al.* 2011), which are constructed areas of the field with a surface substrate placed above the soil (Smith *et al.* 2010). Early versions of this design were allowed to drain freely through the soil, but it is now recognised that these contribute to unacceptable pollution risk and it is now recommended that the surface substrate is isolated from the underlying soil, and waste deposited from livestock drained to a dedicated collection unit (Fig. 1). The construction of such standoff pads represents a considerable capital investments but it has been estimated to cost one tenth of the capital costs of a conventional built housing. The relocation of livestock in this way avoids inputs of dung and you run into the soil during wet periods which are known to be disproportionately important in terms of their contribution to nitrous oxide emissions. It has been demonstrated that such relocation of cattle can reduce nitrous oxide emissions and other negative environmental impacts of cattle grazing, particularly during periods of very wet soil conditions. A New Zealand study demonstrated a reduction of up to 12% of total greenhouse gas emissions could be achieved by removing cattle from wet ground. Similar estimates of a 9% emissions reduction were quoted by Weerden *et al.* (2017). These calculations was based on a full systems level assessment of greenhouse gas emissions, and compares cattle, that would be housed in a barn, with conventional manure management with those that would be left outdoors throughout the comparison period. It was also shown that the maximum emissions savings would be achieved with this management approach was applied to poorly drained soils.

Figure 1 Effluent collection from a stand off pad. From Buss et al 2011

Related measures and potential synergies

This measure has benefits in terms of reducing N_2O emissions associated with both waterlogged soils and compaction (MM16 and MM17).

Applicability

The measure would apply principally to beef herds which are currently being overwintered on a routine basis. It has also been demonstrated that the measure would be most applicable to poorly drained grasslands. It is estimated that 80% percent of the UK beef herd is currently out-wintered (Robert Logan Pers Comm). Approximately 30% of the grazed grassland is estimated to be poorly drained Alan Lilly, Pers Comm), and we assume that this relates to 30% of the beef herd across the UK. Therefore the applicability is 0.24.

Feasibility on farms

The feasibility of moving stock from wet ground depends partly on what alternative option is selected. The option of moving stock to a traditional barn would require that option to be permanently available. However, many farmers who manage cattle herds by out-wintering do so specifically because they have insufficient housing to accommodate the stock. In the circumstances modified pads would be more appropriate and offer a lower cost alternative.

Abatement rate

The N_2O emissions from grazing are reduced as a consequence of a decrease in the soil water content, which are known to have direct effects on nitrous oxide emissions. Furthermore the N_2O and CH_4 emissions from manure management change as there is less manure deposited at grazing.

The abatement is estimated via changing the proportion of manure in the different manure management systems and via decreasing the emission factor which describes the proportion of N converted to N_2O from urine and dung deposited during grazing. The time spent grazing is reduced by 8.3% of the total grazing time (e.g. by 4.17% if the cattle are grazing 50% of the time) – based on the assumption that those cattle which are not housed at all will spend 30 days of the year on the stand-off pads. The N_2O emission factor is an annual average, and we assume a 5% reduction in it from the 30 days on stand-off pads.

Table Data from literature on abatement by moving stock from wet ground

Abatement	Value	Country	Reference
N fertiliser use	Reduce by 10%, due to nutrient value in effluent returned to field	UK	(Merrilees & Donnelly 2007)
In field dung and urine emissions	Reduce to zero during periods on standoff pads. Assume this to represent a 10% reduction over a period of 1 year	New Zealand	(Van der Weerden *et al.* 2017)
Slurry emissions	Default emissions from slurry (effluent) spreading. The amount of slurry would correspond to 10% of the annual production per animal per year		

Abatement	Value	Country	Reference
Yield increase	10% increase in grass yields due to reduced compaction and fowling	UK	Paul Hargreaves, Pers Comm
Soil N_2O	-0.2 – -0.6 t CO_2e ha^{-1}	New Zealand	(Van der Weerden *et al.* 2017), (Luo *et al.* 2010)
Methane	Assume no change		

Current and additional future uptake

Current uptake of this measure is low. It was estimated that there were only around 600 woodchip corals in the UK in 2007 (Merrilees & Donnelly 2007), and recent uptake of this management approach has remained low (Bill Crooks, personal communication). There are around 40,000 beef holdings in the UK (Eurostat), i.e. 1.5% of them have stand-off pads. It is possible that the warmer and wetter winters that are predicted within the UK will make this management option more attractive by extending the period of grass growth, while also increasing the prevalence of wet soils during the winter period. However the low adoption rates to date indicate that an additional policy push would be required in order to have a significant impact on uptake.

Cost

Cost data from the literature is presented in Table 1. Based on the SRUC Technical Note TN595 £654 cow^{-1} construction cost was used (2018 value of £515 in 2007), assuming 15 years lifetime (Robert Logan, Pers Comm), with an additional £32 cow^{-1} annual maintenance cost.

Table 1 Costs and benefits of using stand off pads

Costs/savings	Value ('-' sign for savings)	Country	Year	Reference
Construction costs excluding on farm labour	£190-550 cow^{-1} Assuming 100 cow enterprise	UK	2011	Buss et al 2011
Construction costs excluding on farm labour	£185-515 cow^{-1} (higher cost if corral has scraped passage and effluent storage)	UK	2007	Merriles and Donnelly 2007
Ongoing maintenance	£25 cow^{-1} y^{-1}	UK	2007	Merriles and Donnelly 2007
Ongoing maintenance	£100 cow^{-1}	UK	2011	Buss et al 2011
Increased forage production	Assume a 10% increase in forage production	UK		Paul Hargreaves, Pers Comm
Reduced fertiliser costs	Assume a 10% reduction in fertiliser N applied	UK		Paul Hargreaves, Pers Comm

Assumptions used in the MACC

Parameter	Change in value	Notes
Time spent grazing	-8.3%	
Manure management system for stand-off pad	daily spreading	
EF_1	-5%	
Construction cost	£654 $head^{-1}$, lifetime 15 years	
Maintenance cost	£32 $head^{-1}$ $year^{-1}$	

Wider effects

The removal of stock from wet soils over winter offers a number of potential wider benefits in terms of reduced nutrient loss (nitrate and phosphate) in runoff and less soil compaction by grazing animals(Van der Weerden *et al.* 2017). It is unlikely that this measure would contribute to altered land use. Changes in water and energy use would be expected to be small.

Reference List

Buss, J., Chadwick, D., Davies, L., Smith, K., and Vickers, M. Improved design and management of woodchip pads for sustainable out-wintering of livestock. 2011. EBLEX. Better Returns Programme.

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Luo,J., de Klein,C.A.M., Ledgard,S.F. & Saggar,S. 2010. Management options to reduce nitrous oxide emissions from intensively grazed pastures: A review. *Agriculture, Ecosystems & Environment*, **136,** 282-291.

Merrilees, D. and Donnelly, S. Woodchip Corrals. TN595. 2007. SAC. Tecnical Note.

Ref Type: Report

Smith, K. A., Chadwick, D., Dumont, P. A., Grylls, J. P., and Sagoo, E. Woodchip pads for out-wintering cattle - technical review of environmental aspects. Defra LK0676, 1-44. 2010.

Ref Type: Report

Van der Weerden,T.J., Laurenson,S., Vogeler,I., Beukes,P.C., Thomas,S.M., Rees,R.M., CFE,T., Lanigan,G. & de Klein,C.A.M. 2017. Mitigating nitrous oxide and manure-derived methane emissions by removing cows in response to wet soil conditions. *Agricultural Systems*, **156,** 126-138.

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