The effect of different paddock rotation strategies for organic sows on behaviour, welfare and the environment

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ABSTRACT

Two alternative paddock rotations for dry sows were established on an organic farm: Rotational (40 x 40m moved three times per year) and Set Stocked (120 x 40m in place for one year). Sows showed distinct preferences in the location of dunging and urination within the paddocks ($p<0.001$), but no differences between the paddocks. Vegetation cover under the sows was similar overall in the two paddock systems, but showed differences over the year. Work to model the potential for nutrient leaching in the two paddock systems is ongoing.

Keywords: organic farming; pigs; behaviour; excretion; paddock rotation

INTRODUCTION

Under UK organic standards, sows are managed outdoors throughout the production cycle. Access to pasture allows expression of a wide range of behaviours, and may provide additional nutrients and foraging materials. However, rooting behaviour may quickly destroy plant cover, as some sector bodies prohibit nose ringing (Edwards *et al.*, 1998). Without green cover, the potential for nutrient leaching is increased, especially if certain areas of the paddock are favoured for excretory behaviour and receive high nutrient loading. Farmers have traditionally maintained dry sow pastures for one year to fit in with annual crop rotations. Alternatively, some organic farmers have developed a paddock rotation strategy where the sows are moved to fresh pasture three times per year, when the existing cover has been destroyed, in an attempt to maintain vegetation cover in the area occupied by pigs.

MATERIALS AND METHODS

Pigs and paddocks

Two alternative dry sow systems were established on a second year grass-clover ley on the same commercial organic pig unit, managed to Soil Association standards. In the “Rotational” system, up to six sows occupied a 40m x 40m paddock, which was moved

to fresh pasture approximately every four months, thus utilising 120m x 40m over the whole year. In the "Set Stocked" system, up to six sows occupied one 120m x 40m paddock for the whole year. Sows were allocated to one of the two types of paddock at the start of their first parity, and remained in the same treatment until the third parity was completed, thus the two types of paddock were assessed over two years (1999 - 2001). Replicates 4 and 5 utilised only two rotational paddocks as all sows completed their third parity in less than one year. Thirty-five sows were allocated to Rotational paddocks and 25 to Set Stocked paddocks.

Observations

Sow behaviour was recorded at the start, middle and end of gestation. On these occasions, the paddocks were notionally divided into 10m x 10m grid squares (16 in the Rotational paddocks, 48 in the Set Stocked paddocks), and the location of any dunging or urination was recorded.

Vegetation cover was assessed at each behaviour session, using a regular pattern of 0.5m x 0.5m quadrats in a W-formation across each paddock. The Rotational paddocks were assessed using one W-formation of 20 quadrats; the Set Stocked paddocks were assessed using two W-formations (40 quadrats). At 25 fixed points within each quadrat, the presence or absence of vegetation was noted, and the totals used to calculate % vegetation cover for the whole paddock.

Data analysis

Grid squares were combined for statistical analysis, into functional areas as follows: squares where the sows were routinely fed ("feeding"); squares containing water trough and wallow ("water"); squares containing the hut, bedded with straw ("hut"); squares with fenceline contact with other pigs ("Border 1"), with fenceline separated from other pigs by trackway only ("Border 2"), with fenceline separated from other pigs by large distances ("Border 3"); corner squares where two different categories of border met ("Border Mixed"); other squares ("Central").

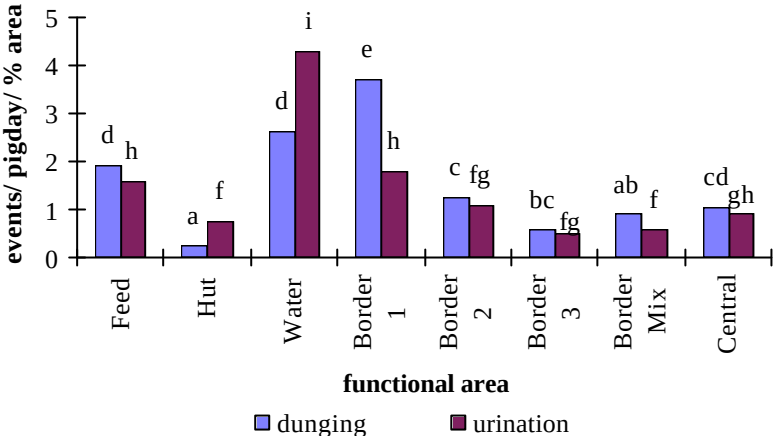
The number of excretory events in each functional area, expressed as number of observations in each group per pig-day observed per % paddock area, was analysed by analysis of variance, using the GLM function which fits a general linear model (Minitab 13.0). The data were transformed to the cube root to attain a normal distribution of residuals; significant differences between locations were investigated using Tukey's test. Where data were transformed no standard errors can be reported. Mean % vegetation cover was compared between paddock systems using the t-test.

RESULTS

Behaviour

There was no significant difference between paddock types in relative use of functional areas. The distributions of dunging and urination in the different functional areas were significantly non-random ($p<0.001$; Figure 1).

Figure 1. Dunging and urination events recorded in different functional areas (events/ pig day observed/ % area). Within each data set, means with the same letter are not significantly different ($p<0.05$); no statistical comparison was made between dunging and urination.



Vegetation cover

A summary of the vegetation cover in each paddock type is shown in Table 1. % occupancy is relative to occupation by six sows throughout the study period.

Table 1. Vegetation cover in the different paddock types (data for the Rotational system include the 2-3 paddocks occupied during the stated period). *analysed using t-test.

Paddock	Date		Days in	%	Vegetation cover			daily
	Start	End	use	occupancy	mean %*	max %	min %	rainfall mm
Set 1	Aug-99	Sep-00	374	38.7	64.0	97.3	25.4	2.5
Set 2	Nov-99	Oct-00	352	40.1	58.3	90.7	17.0	2.6
Set 3	Jan-00	Oct-00	287	42.7	83.6	85.4	66.0	2.6
Set 4	Oct-00	Apr-01	202	55.6	34.0	98.7	7.9	4.3
Set 5	Dec-00	Jun-01	182	27.0	38.4	95.7	25.6	2.9
mean			***262***	***41***	***55***	***94***	***28***	
Rotat 1	Aug-99	Jun-00	326	41.8	57.0	96.2	10.6	2.7
Rotat 2	Oct-99	Oct-00	385	40.1	65.5	97.6	9.8	2.8
Rotat 3	Nov-99	Oct-00	356	51.5	54.9	97.2	13.0	2.7
Rotat 4	Sep-00	Apr-01	229	22.8	55.3	97.4	19.4	3.9
Rotat 5	Nov-00	Jul-01	237	27.8	42.6	88.6	20.2	2.8
mean			***307***	***37***	***55***	***95***	***15***	

Table 2. Number of days for vegetation cover to fall below 50% (> indicates that cover remained above 50% throughout paddock occupancy)

Paddock	1			2			3			4			5		
Set Stocked	134			41			>318			50			24		
Rotational	48	32	>74	39	>102	>74	61	77	41	19	16	16	18		

There was no significant difference between the paddocks in mean vegetation cover over the study period, although the pattern of pasture loss over the season was different. In the Rotational paddocks, vegetation cover was lost quickly, and then restored as the pigs were moved to a new paddock. In the Set Stocked paddock, vegetation cover was lost and then usually regrew later in the season. Table 2 shows the time taken for the paddocks initially to fall below 50% vegetation cover.

DISCUSSION

The pigs showed distinct preferences in the location of excretory behaviour. The choice of Border 1 suggests a territorial motivation, as well as the motivation to dung and urinate away from the hut. Lactating sows showed a similar pig fenceline preference (Marcellis *et al*, in press).

The feed area was also a relatively highly used excretory location, which is of concern for the transmission of parasites and other pathogens. Although sows appeared to leave that day's feeding site to dung and urinate (data not shown), they did not subsequently appear to distinguish an area where they were regularly fed. The preferred use of the water and wallow area, is also of concern for transmission of pathogens.

The localisation of excretory behaviour will lead to increased nutrient loading in these areas. These results suggest that it might be possible to alter the pigs' use of space by moving the hut and water periodically, creating a more even spread of nutrients. A shorter period of paddock occupancy would limit nutrient loading at fencelines. The current data suggests that altering the feeding area is unlikely to change excretory behaviour, however it may improve nutrient loading by spreading wasted feed more widely. Further analysis is ongoing to investigate excretory behaviour in those parts of the feeding area with and without fenceline contact with other paddocks, the implications for feeding practice, and the influence of feeding location on foraging behaviour.

There was little difference between the paddock types in overall vegetation cover under the sows. However, the results for paddocks 4 and 5 suggest that during a very wet period, followed by a late spring (2000 - 2001), the Rotational paddocks may be advantageous because the pigs are moved off damaged pasture, while the Set Stocked pens appeared slow to recover. Further work is ongoing to describe the differences between the paddocks, and also to model the level of vegetation required to retain nutrients under these conditions.

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