

# Factors Affecting The Cleanliness Of Cattle Housed In Buildings With Concrete Slatted Floors

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## Summary

- From a series of experiments at Grange Research Centre, cattle were cleanest at housing in the autumn, however, within 3 to 4 weeks of housing on concrete slats and fed with a diet of grass silage, cattle were dirtiest, with the majority of the cattle in category 4 or 5.
- Cattle tended to be cleaner in the late March, early April period as they shed their winter hair coat.
- Cattle fed concentrates plus straw were significantly cleaner at slaughter compared to similar cattle offered grass silage plus concentrates.
- Cattle housed indoor on slats during the summer were cleaner than cattle on similar diet and accommodation during the winter.
- High dry matter silage produced cleaner cattle than did low dry matter silages.
- Back and tail clipping of cattle at the commencement of the winter finishing period did not have any positive effect on cleanliness score or liveweight gain when the cattle were accommodated in well ventilated slatted floor houses.
- A survey of 19 farms specialising in finishing cattle failed to show any correlation between stocking density, solid floor area or level of concentrate feeding on the cleanliness of finishing cattle.
- A survey of 36 finishing units, designated as producers of "clean" or "dirty" cattle at slaughter, found that units with clean cattle had houses which were in general well ventilated, had A-type roofs with an open ridge outlet and in general the grass silage offered was a higher dry matter. In contrast, finishing units with dirty cattle tended to be poorly ventilated and the grass silage offered had a lower dry matter.
- Overall in the survey cattle cleanliness score was not affected by stocking density ( $2.0\text{m}^2$  -  $3.8\text{m}^2$ ) or the proportion of solid floor area in the pen.
- Cattle accommodated on gang slats were dirtier than those accommodated on single slats.

## Introduction

Regulations governing the level of cleanliness of animals presented for slaughter were introduced by the Department of Agriculture and Food in Ireland in February 1998. These regulations outline five different categories of cleanliness ranging from 1 (clean) to 5 (very dirty) by which cattle presented for slaughter are assessed. These categories are similar to those presented in the British Meat Hygiene Service Clean Livestock Policy (1997). Categories 1 to 4 are accepted for slaughter. Category 4 animals with heavy amounts of adherent dirt/faeces on the primary sites (Figure 1) are accepted for slaughter after some changes in dressing procedure are carried out. Category 5 animals are not accepted for slaughter.

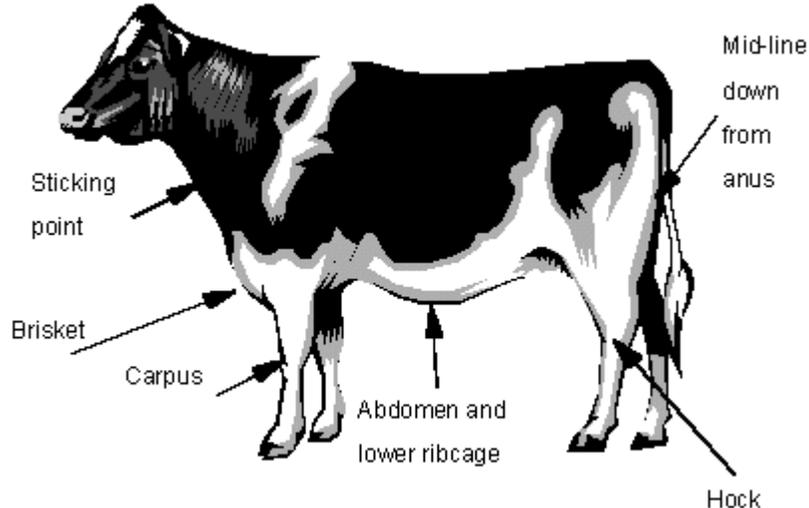


Figure 1 Primary sites for cleanliness measurements

There is contradictory evidence with respect to the effect of dirtiness of the hide of the animal on carcass microbial contamination. Ridell and Korkeala (1993) and Newton *et al.*, (1978) demonstrated that there was a direct correlation between the microbial load on the cattle hide and on the carcass surface. Irrespective of the experimental evidence on this issue, the presentation of clean animals at slaughter, is desirable in order to minimise the introduction of a reservoir of pathogenic bacteria into the meat processing plant (Hadley *et al.*, 1997).

There has been little experimental work carried out on factors affecting dirtiness of cattle. A survey by Scott and Kelly (1989) showed that cattle from any one of a number of housing systems can have dirty hides. They noted (contrary to popular opinion) that straw bedding systems were not necessarily the cleanest, neither were slatted floors the dirtiest. There was a general trend for animals to appear cleaner later in the season (March - April) and this was thought to be due to a combination of factors especially the loss of the winter coat.

This project was undertaken to determine what were the main factors affecting the cleanliness of cattle prior to slaughter and the following areas were investigated:-

1. Effect of time of year and type of diet on the cleanliness of finishing cattle.
2. Effect of tail clipping and back clipping at housing on cattle cleanliness score.
3. Survey of cattle cleanliness on 19 farms which specialise in finishing cattle.
4. Survey of farms producing finishing cattle which are designated to present "clean " or "dirty" cattle at slaughter.

## **Effect of time of year and diet on cleanliness of finishing cattle**

The objective of the study was to examine the effect of cattle housed on concrete slats on category of cleanliness in respect to time of year, type of diet fed and duration of housing. The cleanliness scores were

assessed, by a trained observer using photographic reference material provided by Department of Agriculture and Food, on cattle used in finishing experiments at Grange Research Centre.

## Results

*Experiment 1.* Twenty-eight charolais x Friesian steers (520 kg liveweight) were housed on single concrete slats on 4<sup>th</sup> November and introduced to an *ad libitum* concentrate feeding programme. Within 16 days of housing, 100% of animals were in Categories 4 and 5 compared to 93% of cattle in Category 1 and 2 at housing (Figure 2). At slaughter (5<sup>th</sup> February) 53% of cattle were Category 4 or 5 and required clipping.

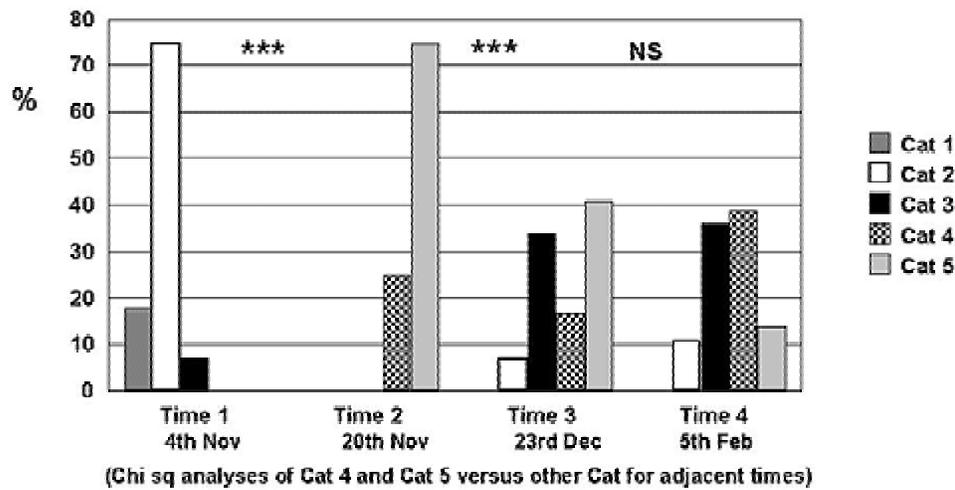


Figure 2. Percentage of animals, offered ad libitum concentrates, in each cleanliness category

*Experiment 2.* Sixty three-quarter continental steers (550kg liveweight) were housed on 17<sup>th</sup> November on concrete gang slats and introduced to an *ad libitum* grass silage diet plus 4 to 5 kg of concentrates/head/day. In December and January, approximately 30% of the cattle were in category 4 and 5 (Figure 3) compared to 98% of cattle in Category 1 and 2 at housing. The % in Category 4 and 5 increased to 57% in February and declined to 21% at slaughter on 4<sup>th</sup> March.

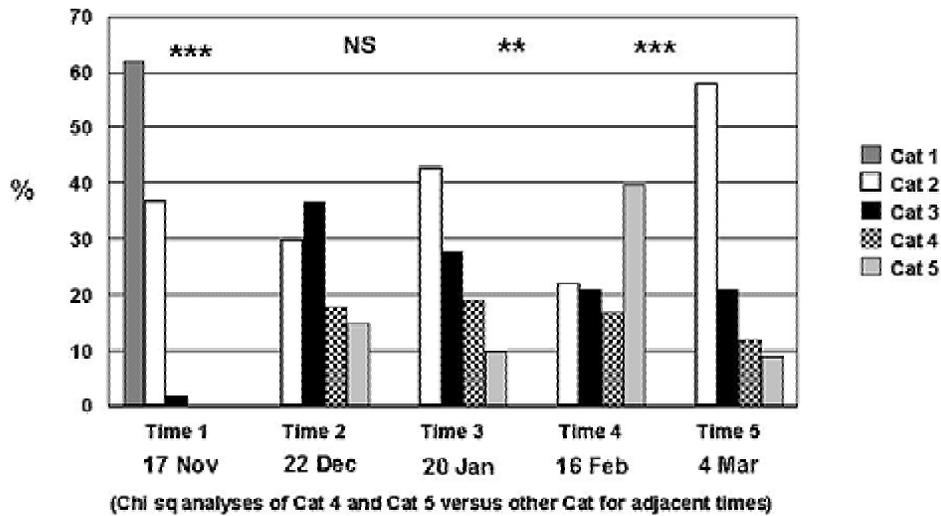


Figure 3. Percentage of animals, offered silage and concentrates, in each cleanliness category

*Experiment 3.* Thirty-eight three-quarter continental heifers (500kg liveweight) were housed on 12<sup>th</sup> September on concrete gang slats and introduced to either an *ad libitum* grass silage diet and concentrates which were gradually increased to 8 kg/head/day or to an *ad libitum* straw diet and concentrate which were gradually increased to 8 kg/head/day. At slaughter (17 November) 90% of cattle on the silage + concentrate diet were in Category 4 or 5; in contrast, 5% of cattle on the straw + concentrate diet were in Category 4 or 5 (Figure 4).

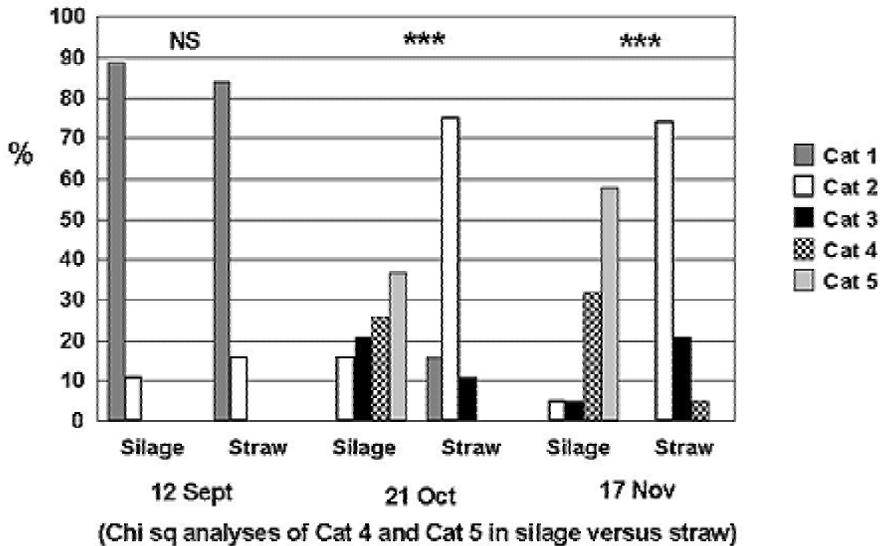


Figure 4. Percentage of animals, offered straw and concentrates or silage and concentrates in each cleanliness category

*Experiment 4.* Seventy continental cross heifers (500kg liveweight) were allocated to either a maize silage (M) diet or to a maize/grass (M+G) silage mixed diet on 28<sup>th</sup> April and continued to be housed on single

concrete slats. At the start, 34% of the M group and 54% of the M+G group were in Category 4 and 5 (Figure 5). In the period June to August there were no Category 4 or 5 in any of the treatment group (Figure 5). On 28<sup>th</sup> August, 94% of the M group and 76% of the M+G group were either Category 1 or 2. At slaughter on 13<sup>th</sup> October 0% of the M group and 24% of the M+S group were Category 4 or 5.

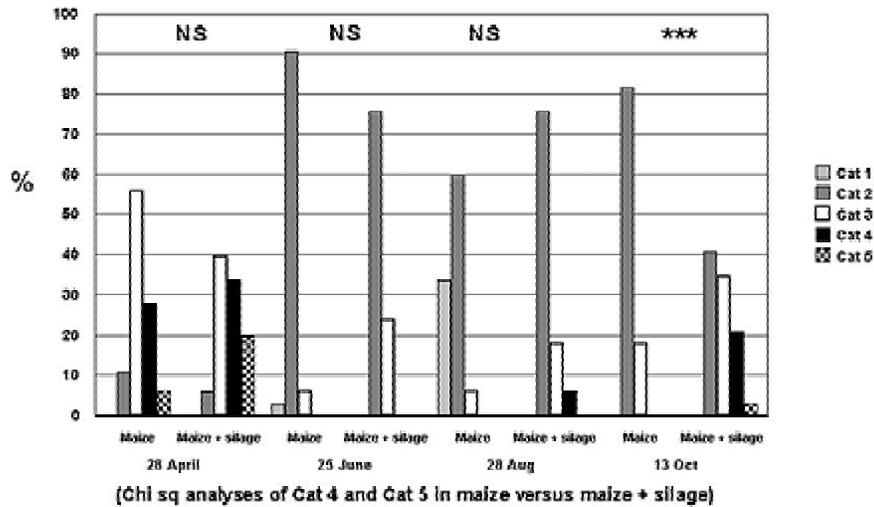


Figure 5. Percentage of animals, offered maize silage or on maize and grass silage, in each cleanliness category

*Experiment 5.* One hundred and eight continental cross heifers (510kg liveweight) on single concrete slats were allocated to wilted big baled grass silage *ad libitum* and three levels of concentrate (0, 2.5 or 5 kg/head/day). Thirty five days following the start of the experiment (21<sup>st</sup> January), the % of Category 5 animals was 53, 77 and 94 for 0, 2.5 and 5.0 kg of meal, respectively (Figure 6). However, at slaughter on the 5<sup>th</sup> May the level of meal fed did not affect the proportion of dirty cattle, with the % of Category 5 animals being 33, 34 and 32 for 0, 2.5 and 5.0 kg of meal, respectively (Figure 6)

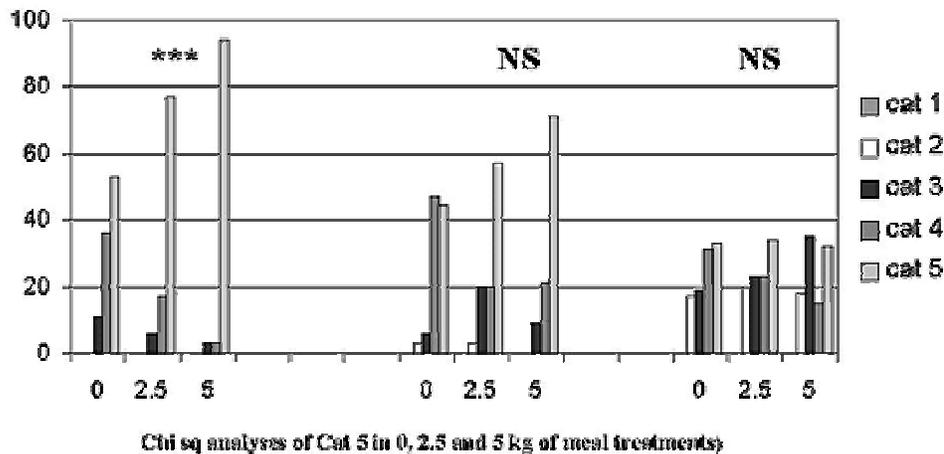


Figure 6. Percentage of animals offered different levels of meal in each cleanliness category

## Conclusions

- A group of cattle offered *ad libitum* concentrate (with no Cat 4 or 5 at housing off grass in early

November) were all Cat 4 or 5 by mid November and then gradually got less dirty thereafter until slaughter in February.

- A group of cattle offered grass silage and concentrates from November to March got dirtier during the first month of housing and were less dirty at slaughter in March.
- Cattle on a diet of straw plus concentrates remained cleaner throughout the 10 week Autumn finishing period compared to cattle fed grass silage plus concentrates.
- Cattle accommodated during the period April to October were dirtier in April and got cleaner throughout the period. In October cattle offered maize silage were cleaner than those offered a mixture of maize and grass silage.
- The level of supplemental meal fed to cattle offered wilted big baled silage did not effect cattle cleanliness score at slaughter in early May.

## Effect of back clipping and tail clipping on cleanliness score and performance of finishing cattle

Reports from Scotland indicate that back and tail clipping of finishing cattle at the start of the winter feeding period results in cleaner cattle and improved animal performance. Clipping the back of the animal allows the animal to dissipate heat and to sweat less, thereby, reducing the risk of dirt accumulation. In order to test the hypothesis that this had a positive effect on cleanliness and animal performance, finishing animals were assigned to either a control or a clip treatment.

*Experiment 1.* 72 Ch X Fr steers with a mean weight of 487 kg were accommodated on single concrete slats (6/pen) in an A type house which had good ventilation. Within each pen 3 animals were randomly selected for back (15 cm wide from withers to tail base) and tail clipping and the other 3 animals were assigned as controls.

*Experiment 2.* 28 three-quarter Continental steers with a mean weight of 560 kg were accommodated on concrete gang slats (5 to 7 per pen) in a A type house which had good ventilation. Within each pen animals were randomly selected for back and tail clipping and the remaining animals were assigned as controls. Data was analysed using ANOVA.

Both experiments commenced in the first week of November and were completed by the first week of March after a 120 day period indoors with the animal fed a diet of grass silage plus concentrates. The Department of Agriculture, Food and Rural Development Category 1 to 5 scores for cleanliness was used to monitor the animal at start and throughout the experimental period. Back and tail clipping at the commencement of the winter feeding period did not have any effect on cleanliness score or liveweight gain (Table 1).

Table 1. Effect of back and tail clipping on cleanliness score and liveweight gain of finishing Cattle

	Control	Clip	P value
<b>Experiment 1</b> (Clean Score)			
Day 1	1.22	1.19	0.87

Day 70	4.17	4.14	0.84
Day 120	3.08	3.15	0.83
Initial wt. (kg)	489	485	0.70
Mean daily gain (kg)	0.81	0.77	0.56
<b>Experiment 2 (Clean Score)</b>			
Day 1	1.15	1.08	0.61
Day 70	4.62	4.58	0.90
Day 120	4.54	4.67	0.59
Initial wt. (kg)	563	559	0.87
Mean daily gain (kg)	1.04	0.96	0.43

## **Conclusion**

It is concluded that back and tail clipping had no effect on the cleanliness score of finishing cattle when the cattle were accommodated in well ventilated slatted floor accommodation on a diet of grass silage plus concentrates.

## **Survey of cattle cleanliness on 19 selected farms specialising in finishing cattle**

A survey was undertaken on 19 commercial farms (437 cattle) specialising in finishing cattle to determine what on-farm factors affect the cleanliness of cattle. The farms were surveyed in late February and early March (1991). The survey compared number of animals per pen, space allowance per animal, amount of concentrate fed, void floor area and solid area at front and back of pen, with a cattle cleanliness score of Category 4 and 5.

## **Results**

There were no apparent relationships between any of the parameters measured on the cleanliness of cattle (Table 2). The data for the individual farms are presented according to different housing dates in the autumn (Tables 3 and 4). The use of straw bedding accommodation (Table 5) did not result in cleaner cattle and there was considerable difference in cleanliness between the two straw-bedded units. It was concluded that stocking density, % void area, % solid area or level of concentrate feeding did not correlate with the cleanliness of finishing cattle on slats at the end of the winter finishing period.

Table 2. Correlation between cleanliness (Cat 4 and 5) of finishing cattle and the various parameters measured.

<b>Parameter</b>	<b>R<sup>2</sup></b>
Space allowance (m <sup>2</sup> )	0.25

Concentrate fed (kg)	-0.04
Void area (%)	0.23
Solid area (%)	0.19
Period in house (days)	-0.24

Table 3. Effect of on-farm factors on cleanliness of animals housed in October

Farm	Start	Pen area (m <sup>2</sup> )	No. of animals/ pen	Space/ animal (m <sup>2</sup> )	Conc. Fed (kg)	Void Area (%)	Solid area (%)	Animals in Cat. 4+5 (%)
2	15/10/98	91	33	2.8	4	29	5	67
3	10/10/98	80	30	2.7	5.5	32	15	53
7	15/10/98	107	50	2.1	6.5	19	4	44
8	15/10/98	34	16	2.1	4.5	27	6	57
12	20/10/98	46	11	4.2	6.5	23	12	82
15	20/10/98	34	17	2.0	3	22	12	12

Table 4. Effect of on-farm factors on cleanliness of animals housed in November/December

Farm	Start	Pen area (m <sup>2</sup> )	No. of animals/ pen	Space/ animal (m <sup>2</sup> )	Conc. Fed (kg)	Void Area (%)	Solid area (%)	Animals in Cat. 4+5 (%)
4	28/10/98	34	15	2.2	5	32	17	40
1	1/11/98	35	12	2.9	4	31	12	67
10	1/11/98	67	19	3.5	6	34	1	41
13	4/11/98	27	8	3.4	4	15	25	63
14	5/11/98	50	16	3.1	6	26	0	25
9	10/26/98	32	12	3.7	4	23	4	73
6	15/11/98	88	45	2.0	8	26	10	73
11	15/11/98	76	29	2.6	6	33	7	62
18	4/12/98	64	19	3.4	4	17	12	32

19	4/12/98	55	19	2.9	4	24	15	84
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Table 5. Effect of on-farm factors on cleanliness of animals on farms using straw.

<b>Farm</b>	<b>Start</b>	<b>Pen area (m<sup>2</sup>)</b>	<b>No. animals/ pen</b>	<b>Space/ animal (m<sup>2</sup>)</b>	<b>Conc. Fed (kg)</b>	<b>Animals in Cat. 4+5 (%)</b>
16	11/15/98	122	20	6.1	4	75
17	11/4/98	244	26	9.4	4	62

## **Conclusions**

1. Stocking density, % void area, % solid area or level of concentrate did not appear to effect the cleanliness of finishing cattle on slats.
2. Time of introduction to slatted unit did not appear to influence the proportion of dirty cattle
3. (Category 4 and 5) present at the end of the winter finishing period.

## **Survey of Factors Affecting the Cleanliness of Cattle**

There is usually not a cleanliness problem with cattle sold off pasture, as they will normally be dirt score Category 1 or 2. Dirty cattle may come from indoor housing in the months of December through to March. However, after 4 to 6 weeks indoors a large proportion of cattle will be in Category 4 or 5. Thereafter the scores begin to decrease and this trend continues through late March/early April, being associated with the shedding of their winter coats. The production of clean cattle may be a problem as the accommodation used is mainly concrete slatted floors (loose straw bedded accommodation is not feasible on a wide scale) and the most common finishing diet is unwilted grass silage plus concentrates.

Different sources have suggested that the type of feed may affect the cleanliness of the animal e.g. it was stated that lower dry matter silage diets may cause wetter faeces and thus, dirtier animals. Anecdotal evidence for years suggests that the stocking rate of animals on slats affects the cleanliness of animals. In order to determine the actual level of dirt on cattle accommodated on concrete slatted floors a survey of 46 cattle finishing units was undertaken.

## **Materials and Methods**

A survey of 46 farms, which finished cattle on concrete slats, was undertaken during the first 2 weeks in February 2000 to determine the main housing and management factors which influence the presence of “clean” or “dirty” cattle.

Floor Type: Each house floor type was categorised, single (4m) or double (8m) slat, single or gang type slat and the proportion of solid area at both the back and front of the pen.

House Type: The type of structure, A- type roof or other and the level of ventilation (poor/fair or good) was determined by measuring inlet and outlet area.

Stocking Density: The number of finishing animals per pen and pen area was used to calculate the space allowance/animal.

Type of Diet Fed: Each farmer supplied details of the type of finishing diet offered. The grass silage was to characterised as dry, medium or wet.

## **Slatted floor house assessment**

Cattle in houses were designated as clean when less than 30% of animals were observed to be Category 4 or 5. Cattle in houses were designated as dirty when more than 70% of animals were observed to be Category 4 or 5. The clean and dirty designation provided a basis for the identification of differences in concrete slatted floor accommodation.

## **Results**

Ten farms were excluded from the analyses as they did not satisfy the "clean" or "dirty" criteria. Eighteen of the finishing farms were designated as "clean" (number of cattle = 1532) and a further 18 were designated as "dirty" (number of cattle = 1309).

## **House type**

Well ventilated conventional A-type buildings with open ridges tended to produce clean cattle in contrast poorly ventilated buildings which tended to produce dirty cattle (Table 6).

Table 6: Effect of house type on the cleanliness of cattle

<b>House Type</b>	<b>Dirty (n=18)</b>	<b>Clean (n=18)</b>	<b>Chi<sup>2</sup></b>
A-type	12	16	NS
Other	6	2	
Ventilation			
<i>Poor/Fair</i>	13	3	***

<i>Good</i>	5	15	
Ridge opening			
<i>No</i>	12	5	*
<i>Yes</i>	6	13	

### ***Slatted floor type***

Overall, there was a significant difference between slat type (single v gang), with single slats producing cleaner cattle (Table 7). The % of solid area in the pen was lower in the clean groups (Table 7). Pen depth (4m versus 8m) had no influence on the clean category animals.

Table 7: Effect of slatted floor type on the cleanliness of cattle

	Dirty	Clean	Chi <sup>2</sup>
Slat depth (m)			
4 m	6	9	NS
8m	12	9	
Slat			
<i>Single</i>	2	10	
<i>Gang</i>	16	8	***
Solid area			
<15%	9	12	NS
>15%	9	6	
% Solid	16.7	12.0	

### ***Animal density and diet***

The number of animals per pen and per area allowance was similar for both the clean and dirty groups (Table 8). The mean liveweight of the clean and dirty groups was similar. The main difference between the clean and dirty groups was the high proportion of wet (<18%) silage offered to the dirty groups, in contrast with a high proportion of dry (>24%) silage offered the clean groups (Table 8).

Table 8: Effect of animal density and diet on the cleanliness of cattle

	Dirty	Clean	Chi <sup>2</sup>
Number / pen	14	14	
Area / animal (m <sup>2</sup> )	2.8	2.7	
Mean weight (kg)	575	575	

Silage dry matter			
<i>Dry</i>	3	16	***
<i>Medium/Wet</i>	15	2	
Category 4/5%	88	15	

The data was also analysed to determine the effect of contrasting values for stocking density, solid area, number of animals per pen, pen depth and slat type on cleanliness score (n = number of cattle). Stocking density (3.8 v 2.0 m<sup>2</sup>) and, solid area % (5 v 26) or pen, depth had little effect cleanliness score. (Tables 9 and 10). Increasing the number of cattle per pen increasing pen depth and the use of gang slats compared to single slats increased the percentage of dirty cattle (Table 11, 12 and 13).

Table 9: Effect of stocking density on cleanliness score (n=1696)

	Low	High	Chi <sup>2</sup>
	Density	Density	
Number of farms	12	12	
m <sup>2</sup> /animal	3.8	2.0	
Solid area (%)	11	22	
Cat 4/5 (%)	66	62	NS

Table 10: Effect of solid area on cleanliness score (n=1959)

	Small Solid area	Large Solid area	Chi <sup>2</sup>
Number of farms	12	12	
Solid area (%)	5	26	
Animal/pen	25	17	
Cat 4/5 (%)	62	66	NS

Table 11: Effect of pen depth on cattle cleanliness score (n=2188)

	4m	8m	Chi <sup>2</sup>
Number of farms	12	12	
Animal/pen	9	20	
Stocking density (m <sup>2</sup> /animal)	2.8	3.4	
Cat 4/5 (%)	28	44	***

Table 12: Effect of numbers of cattle per pen on cleanliness score (n=2197)

	Small	Large	Chi <sup>2</sup>
Number of farms	12	12	
Number/pen	8	24	
Stocking density (m <sup>2</sup> /animal)	2.9	2.7	
Cat 4/5 (%)	36	51	***

Table 13: Effect of slat type on cattle cleanliness score (n=3645)

	Single	Gang	hi <sup>2</sup>
Number of farms	13	30	
Stocking Density m <sup>2</sup> /animal	2.7	2.7	
Animals/pen	13	15	
Solid area (%)	15	15	
Cat 4/5 (%)	36	61	**

### **Stocking density**

In the present study the pen area allowance was similar for both the dirty and clean groups. This finding would be supported by Fisher *et al.*, (1997) who reported no effect of space allowance on the cleanliness score of finishing beef heifers. O'Hagan and Steen (2000) reported that lowering stocking densities on slatted floors did not result in cattle being dirtier. It can be postulated that at low stocking densities there is more movement of cattle about the pen and therefore the potential to tread the dung through the slats would be similar at both low and high stocking densities.

### **Single V gang slats**

It has been anticipated that the newer gang slats with a reduced void to solid ratio would result in dirtier cattle compared to the older single slat with a higher void to solid ratio. Data from this survey indicates that differences in cattle cleanliness could be attributed to slat type.

### **Conclusion**

- On finishing units with clean cattle it was observed that the houses were in general well ventilated, had A-type roofs with an open ridge outlet and in general the grass silage offered was drier.
- In contrast finishing units with dirty cattle, were in general poorly ventilated and the grass silage offered was wetter.
- Overall in this survey cattle cleanliness score was not affected by stocking density (2.0m<sup>2</sup> v 3.8m<sup>2</sup>) or % solid area.
- Increasing the number of cattle per pen and depth of pen increased the proportion of dirty cattle.

- Cattle accommodated on gang slats were dirtier than those accommodated on single slats.

## Acknowledgements

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