



The Detection of Dysbacteriosis — Iain Mortimer, M.R.C.V.S. “Biography”

*Senior Veterinary Advisor, Elanco Animal Health
U.K. And Ireland*

Iain qualified as a veterinarian from Melbourne University in 1989, and after a short period in General practice, moved to Ireland where he spent 3 years working as a specialist production animal veterinarian . In 1997 he joined Elanco Animal Health as a veterinary adviser, supporting Elanco's Pig and Poultry team in the UK and Ireland.

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The Detection of Dysbacteriosis

“Abstract”

Iain Mortimer, Elanco Animal Health

Introduction

Increasingly, wet litter has been reported as a problem of the intensive broiler industry.

Many environmental, management and bird factors contribute to litter quality. Recently, wet litter has been directly linked to a poorly described digestive condition of poultry known as ‘dysbacteriosis’.

Enterome based analytical methods have demonstrate that birds affected by this condition have an increase in the size and change in the composition of the normal duodenal bacterial flora (Panneman 2000). It is hypothesised that this change in the microbial flora leads to malabsorption and a deterioration in litter quality due to a higher moisture content in the droppings of affected birds.

Well-managed litter will have some absorptive capacity, consequently the moisture content of affected birds is likely to be abnormally high for a period of time before litter quality deteriorates visibly. For that reason, a means of monitoring the moisture content of the birds’ droppings, on a daily basis, would be helpful in the early diagnosis of dysbacteriosis and in the differentiation of this disease from management associated problems.

The Litter Box – materials and methods

The litter box is a simple device designed to allow the moisture content of bird droppings to be measured. The droppings of birds, perched on top of the box, pass through the grid on the top and fall onto absorptive paper below. A moisture ring then spreads out from this dropping, the extent of which would be directly proportional to the moisture content of the dropping. (See Figures D-1 and D-2 on next page).

Figure D-1. Litter Box.

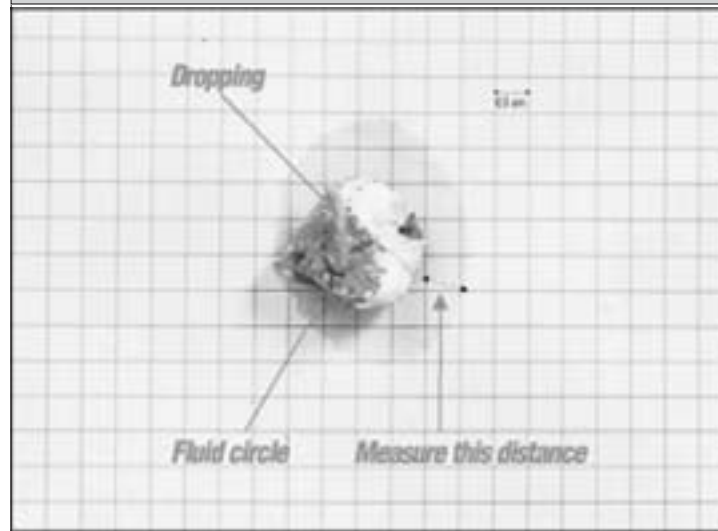
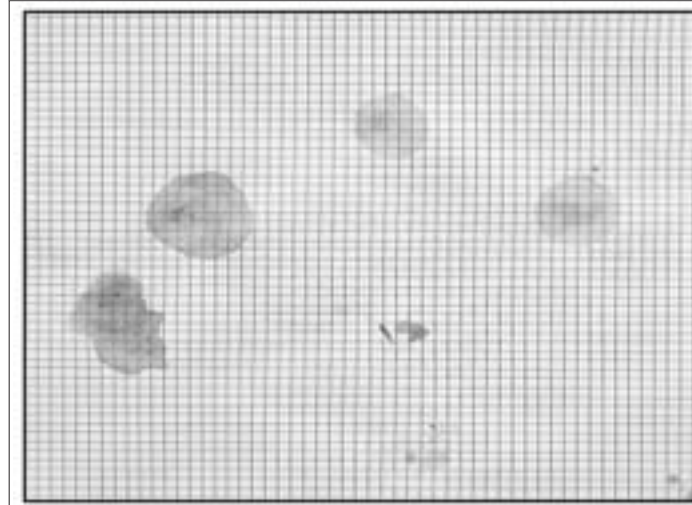


Figure D-2.



If droppings are classified as ‘wet’ or ‘dry’, according to the extent of the moisture ring, ($> 0.5\text{cm}$ ‘wet’; $< 0.5\text{cm}$ ‘dry’) then the proportion of wet dropping over a given time period can be assessed on a daily basis. The greater the proportion of wet droppings, the greater the likelihood of the birds having dysbacteriosis and subsequently, the litter becoming wet. The litter box can be used thus as a diagnostic tool:

- If the proportion of wet droppings is below a lower cut off mark, then the birds are unaffected and the litter will not become wet.
- If the proportion of wet droppings is above an upper cut off mark, then the birds are affected and the litter will become wet.
- If the proportion of wet droppings is between the two cut off marks, the test is inconclusive.

Computer programmes are available to determine these cut off marks and ensure that the number of false positives and false negatives are acceptably low.

Results

The diagnostic ability of the litter box was assessed over 150 farms in the UK. Upper and lower cut off marks were determined, with their corresponding positive and negative predictive values.

For the purposes of this assessment, each farm was given a score, rounded to the nearest first decimal point, equal to the highest proportion of wet droppings over two consecutive days. Farms were classified as ‘affected’ (litter assessed as wet by the farm manager for two or more consecutive days) or ‘unaffected’. Farm managers were given specific guidelines on how to assess the litter quality. For each score, the number of affected and unaffected farms was recorded. Results are shown in Figure D-3.

Figure D-3.

Score	Affected	Unaffected
0.0	0	18
0.1	0	22
0.2	5	29
0.3	26	19
0.4	22	3
0.5	11	0
0.6	4	0
0.7	6	0
0.8	3	0
0.9	2	0
1.0	0	0

This information was analysed using Win Episcope2.0[®] software (See Figures D-4 & D-5).

A lower cut off of 0.2 gave a 95% negative predictive value and an upper cut off of 0.5 gave a 100% positive predictive value.

Figure D-4.

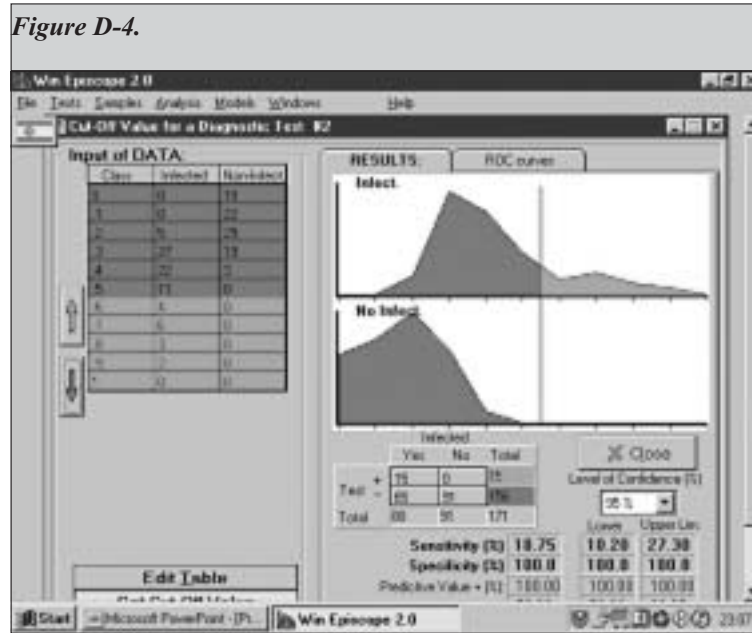
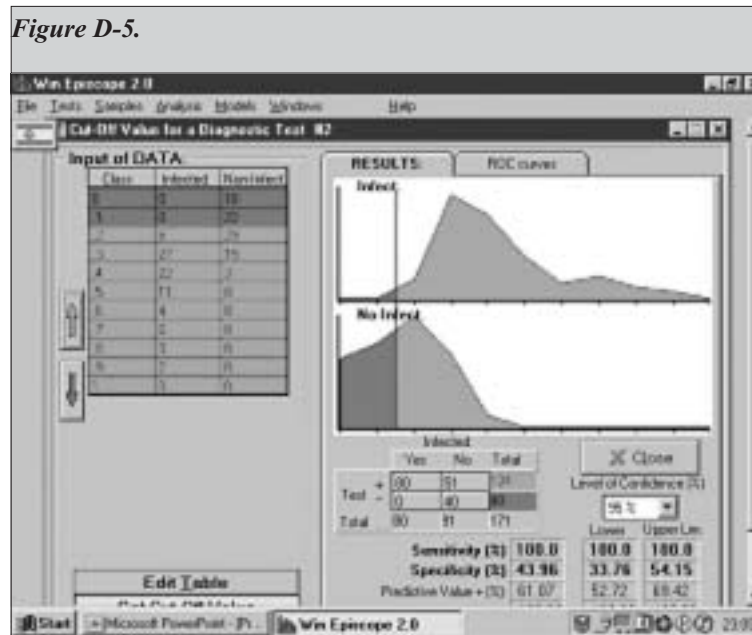


Figure D-5.



Discussion and conclusions

The following guidelines were then recommended for use with the litter box:

1. Calculate the proportion of wet droppings, daily, over a two to three hour period.
2. If the value of the litter box score is less than 20%, wet litter should not be a problem.
3. If the litter box score rises above 20%, for two or more consecutive days, then the farm is at risk of wet litter due to dysbacteriosis.
4. If the litter box score rises above 50%, for two or more days, then the litter is highly likely to become wet and immediate action is required.

Conclusion

The presence of a qualitatively and/or quantitatively abnormal flora in the small intestine (dysbacteriosis) can cause a diarrhoea, malabsorption and wet droppings. This in turn leads to wet litter.

Current knowledge shows that litterboxes can be used as an indication of increased likelihood of wet litter occurring during a crop and can confirm wet droppings as the causal factor.

References

1. Van der Stroom, J. Geelen J and Pipers A, Mal-digested feces in relation to intestinal aspecific bacterial overgrowth in broilers. In press.
2. Panneman, H. Clostridial enteritis/dysbacteriosis. Fast diagnosis by T-RFLP, a novel diagnostic tool. Proceedings of Elanco Symposium, Montreal 2000.

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The Detection of Dysbacteriosis

“Slide Presentation”

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Figure D-1.

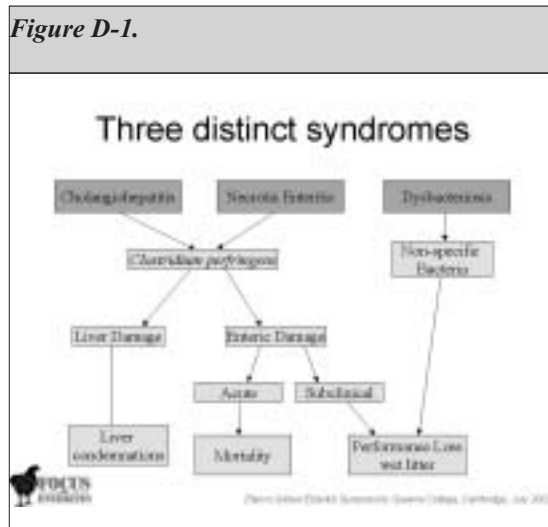


Figure D-2.

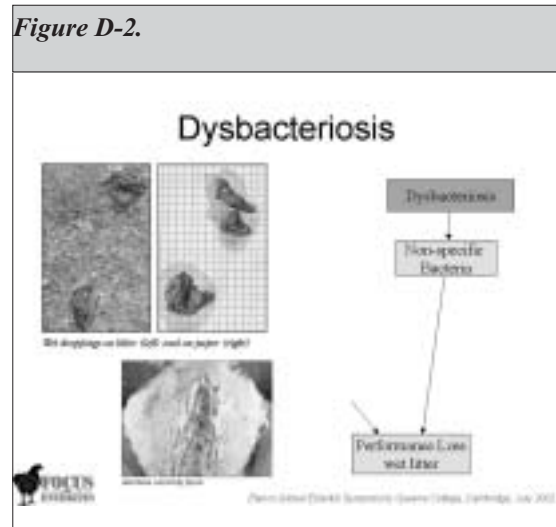


Figure D-3.

Dysbacteriosis

The presence of a qualitatively and/or quantitatively abnormal flora in the small intestine and this causes a diarrhoea and/or malabsorption.

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Figure D-4.

Dysbacteriosis

- A change in the 'Normal flora'
- The initiating factor is unknown
- The initiating factor is likely to be a combination of many factors
- Incidence has increased in Northern Europe over the last few years

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Figure D-5.

The use the Litter box to detect dysbacteriosis



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Figure D-6.

Why is a diagnostic tool needed

- Early detection
- More objective
- Differentiate from purely management associated problems
- Detect sub clinical problems



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Figure D-7.

The Litter box

- Allows estimate of the moisture content of droppings
- Box placed over paper
 - Paper changed daily
- Birds perch on top of box, droppings pass through grid and land on paper below
- Moisture ring spreads out from droppings
 - Extent of ring proportional to moisture content of droppings




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Figure D-8.

Relating litter box findings to occurrence of wet litter

- If the proportion of birds with wet droppings is low then problems of wet litter/poor performance should not occur
 - Lower cut off
- As the proportion of birds with wet droppings increases the probability of wet litter increases
 - Upper cut off

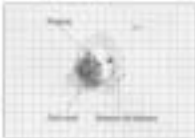




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Figure D-9.

Relating litter box findings to occurrence of wet litter

- The litter box can be used to estimate the proportion of birds with wet droppings
 - Droppings with a moisture ring extending beyond 2 bars are classified as wet
- The number of wet and dry droppings are counted on daily basis, 2-3 hours after fresh paper is placed in the box
 - The proportion of wet droppings is calculated and recorded

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Figure D-10.

Relating litter box findings to occurrence of wet litter

- If the proportion of wet droppings is low then problems of wet litter/poor performance should not occur
 - Lower cut off
- As the proportion of wet droppings increases the probability of wet litter increases
 - Upper cut off
- The Litter box can thus be used as a diagnostic tool
 - The accuracy of the test can be assessed by examining the results from known affected and unaffected flocks



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Figure D-11.

Determining the cut off marks

- Over 150 farms in the UK took part in the assessment
- A protocol for measuring the moisture ring and assessing the litter quality was written
- All farm managers were visited to ensure interpretation of the protocol was the same




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Figure D-12.

Protocol

- Place box daily from day 10 to day 35
 - Do not place near drinker liners, the door or other areas of condensation
- Record % wet droppings daily
 - Do not record caecal droppings
 - Ignore all droppings that lie too close together to allow them to be distinguished
- Assess litter quality and record daily
 - Guide on recording sheet
- After depopulation farm is classified as affected or unaffected
 - If the farm had wet litter ≥ 2 days then affected otherwise unaffected




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Figure D-13.

Determining the cut off marks

- Results entered into data base

Farm	Highest score	Affected
1	0.0	No
2	0.3	Yes
3	0.1	No
4	0.0	No
5	0.4	Yes
6	0.2	Yes
7	0.5	Yes




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Figure D-14.

Determining the cut off marks

- Filtered to count number of unaffected and affected farms for each score

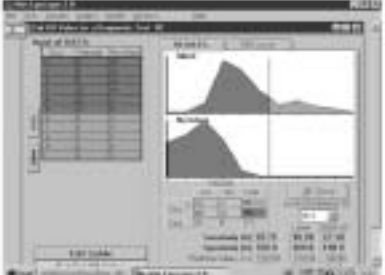

Score	Number Affected	Number Unaffected
0.0	0	40
0.1	0	30
0.2	3	35
0.3	10	30
0.4	20	10
0.5	37	0
0.6	0.5	0



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Figure D-15.

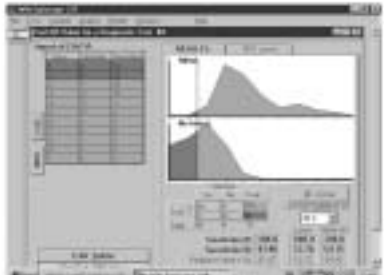

Upper Cut Off

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Figure D-16.

Lower Cut Off





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Figure D-17.

Results

- <20%, negative predictive value 98%
 - If percentage of wet droppings < 20% at least 98% certain that the birds do not have dysbacteriosis
- >50% for 2 consecutive, positive predictive value 100%
 - If percentage wet droppings >50% for 2 or more consecutive, 100% certain that wet litter will develop
- If between 20% and 50% for 2 consecutive days, then it is inconclusive




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Figure D-18.

Accuracy

- <20%, negative predictive value 98%
 - If percentage of wet droppings < 20% at least 98% certain that the birds do not have dysbacteriosis
- >50% for 2 consecutive, positive predictive value 100%
 - If percentage wet droppings >50% for 2 or more consecutive, 100% certain that wet litter will develop
- If between 20% and 50% for 2 consecutive days, then it is inconclusive




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Figure D-19.

Inconclusive results

- There is large band of inconclusive results
 - Small sample size
 - Misclassifications
 - Farm to farm variation in litter management
 - Seasonal variation
- Cut off marks can be fine tuned at farm or company level




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Figure D-20.

Reliability in the field

- 5 companies are using the litter box
 - Results so far are consistent with recommendations
- A number of farm managers have been able to fine tune the cut off marks to reduce the number of inconclusive results




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Figure D-21.

Reliability in the field

- 5 companies are using the litter box
 - Results so far are consistent with recommendations
- A number of farm managers have been able to fine tune the cut off marks to reduce the number of inconclusive results




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Figure D-22.

Conclusions

- The litter box is a user friendly system for visualising the level of moisture in bird droppings
- When used as directed can predict the likelihood of wet litter developing
 - Recommended cut off marks of 20% and 50% are accurate and reliable in the field
 - The amount of inconclusive results can be reduced by adjusting cut off marks to individual farm or company conditions



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