Moisture Production of Grower-Finisher Pigs: Field Measurements Compared With Theoretical Values

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Summary

Moisture levels in intensive swine operations (ISOs) are a concern in cold climates, as excess moisture may lead to condensation and bacterial growth inside the rooms. The moisture production (MP) of two grower-finisher rooms were measured and compared to predicted values to determine the validity of moisture production equations currently used for design purposes. The CIGR (1984) equations provided the best average MP values, with an 8% difference, and for all the prediction equations used in this study, diurnal MP patterns were not predicted. Further research needs to be done to update the MP equations and to provide engineers with appropriate values for designing ventilation systems.

Introduction

When the engineer designs ventilation systems for an ISO, the MP within the room is used to select the minimum ventilation rate to control for humidity in cold conditions. Over-ventilation would increase heating costs in winter conditions, and under-ventilation would foster undesirable high humidity levels in the room. The objective of this study was to verify that the MP equations currently used in designing ventilation systems for an ISO are suitable for Canadian climates, which would help ensure the optimal minimum ventilation rate is chosen.

Experimental Procedures

The MP of four grower-finisher cycles was measured on 15-min intervals, and the measurements were compared with predicted values. The predicted values were determined using equations provided by the International Commission of Agricultural Engineering (CIGR), which has two sets of MP equations (CIGR 1984, CIGR 2002) and from the American Society of Agricultural Engineers (ASAE 2002) handbook, which is based on equations provided by Bond et al. (1959).

Results and Discussion

Figure 1 presents a summary of the average MP over three different weight ranges in g water/15 min-kg. The MP equations from CIGR (1984) yielded the best estimates for MP, but underestimated the average MP by 8% for all cycles. The MP equations provided by CIGR (2002) and Bond et al. (1959) also underestimated the average MP by 13 and 31%, respectively. As shown in Figure 2, diurnal MP patterns were not predicted by the MP equations used in this study, and the maximum daily MP was underestimated by as much as 56%. These equations are not suitable for dynamic modeling of MP.

Implications

If the current MP is actually higher than predicted in swine barns, the minimum ventilation rate to control the humidity level of the room needs to be higher than the current design criteria. If the minimum ventilation rate increases, the current heater capacity may not be sufficient to compensate for the additional heat loss in cold conditions. The CIGR (1984) equations may be used to predict average MP values for design purposes, but additional work needs to be done to update the MP equations to better reflect the actual MP conditions in swine grower-finisher rooms. This will help to ensure the engineer selects the proper minimum ventilation rate design for the ISO.

Acknowledgements

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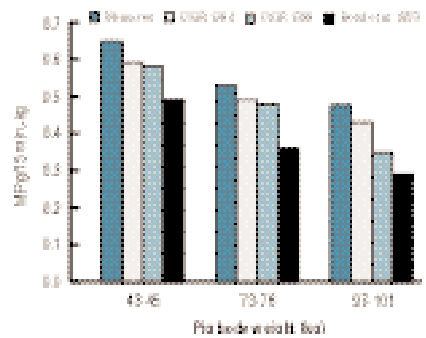

Figure 1: *Comparison of average moisture production (MP) in g/15 min·kg values for pigs on dry feeders: current study, CIGR (1984), CIGR (2002), and Bond et al. (1959) for three different weight ranges.*

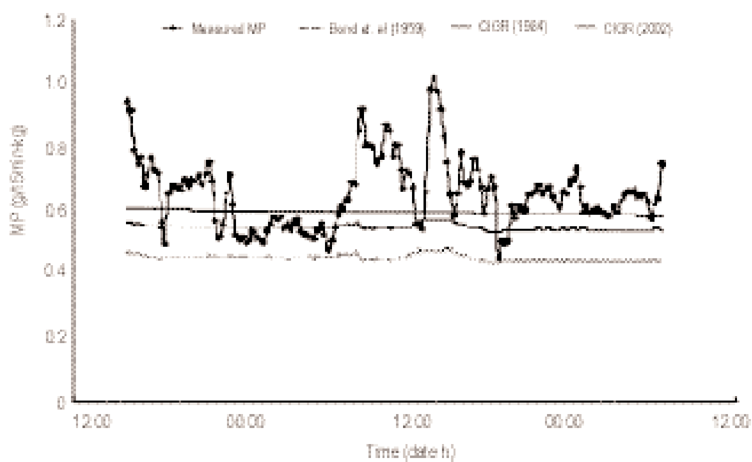

Figure 2: *Measured moisture production (MP) and calculated MP for grower pigs (43-45 kg) on dry feeders in the second experiment in g/15 min⁻¹/kg⁻¹.*

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