OIL SPRINKLING AND DIETARY MANIPULATION TO REDUCE ODOUR AND GAS EMISSIONS FROM GROWER / FINISHER BUILDINGS – LABORATORY SCALE EXPERIMENT

S. Godbout [1], S.P. Lemay [2], R. Joncas [1], J.P. Larouche [1], D.Y. Martin [1], J.F. Bernier [3], R.T. Zijlstra [2], L. Chénard [2], A. Marquis [3], E.M. Barber [4] and D. Massé [5]

Background

Odours emitted by the ventilation system of hog barns are significant contributors to the total farm odour emissions as this emission source is more continuous compared to odours emitted during storage or land application of manure.

Hypothesis and objectives

The hypothesis of this project is that a combined engineering and nutrition strategy consisting of canola oil sprinkling and a specific animal diet can result in a significant reduction of odour and gas emissions from swine buildings. This strategy is expected to significantly reduce the potential impact of pig barns on their surroundings. The first part of this three-year project was completed in Deschambault (Québec) and results on pig performance, ammonia and odour emissions are presented herein.

The specific objectives for this first phase of the study were:

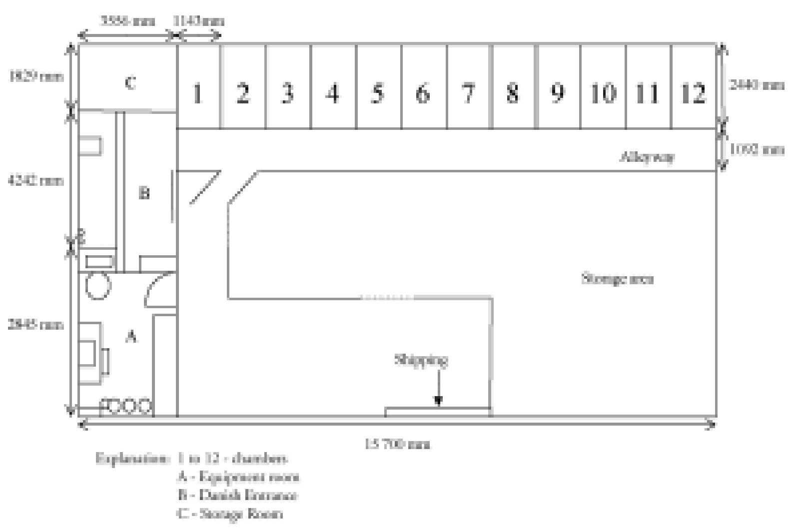
- To determine the interaction of four canola oil application rates (0, 10, 20 and 30 ml/m2 day) and three experimental diets (control diet (C) based on corn with an18% protein content; diet LP containing 16% protein; and diet LP-FC containing 16% protein and fermentable carbohydrates [15% soybean hulls]) on odour, dust and gas (CO_2, NH_3, H_2S) emissions from laboratory scale pig chambers.
- To select a combination of application rate and experimental diet that optimize odour, dust and gas emissions reduction.
- To determine the interaction of canola oil application rates and experimental diets on the chemical composition of the manure.

Experimental procedure

Twelve laboratory scale chambers were built to allow for each combination of experimental treatments (four oil application rates x three diets) to be tested during each replication of the experiment. Measurements were collected over three weeks for each of the four trials providing four replicates for each treatment combination. Each chamber housed four castrated males that had an initial weight of 56 ± 0.5 kg and a final weight of 80 ± 0.5 kg.

Temperature, relative humidity, total dust mass, CO_2, NH_3, and H_2S concentrations were monitored on a continuous basis. Air samples for odour analysis were collected once a week and sent to the olfactometry laboratory of the AAFC - Dairy and Swine Research and Development Centre at Lennoxville, QC.

Schematic of the experimental chamber set-up



[1] Institut de recherche et de développement en agroenvironnement (IRDA), Deschambault, Québec, Canada
[2] Prairie Swine Centre Inc. (PSCI), Saskatoon, Saskatchewan, Canada
[3] Université Laval, Québec, Québec, Canada
[4] University of Saskatchewan, Saskatoon, Saskatchewan, Canada
[5] Agriculture and Agri-food Canada, Lennoxville, Québec, Canada

Results and Discussion

Animal performance

Table 1 presents the experimental results on pig performance. Overall, the pig average daily gain and feed intake were 1.07 kg/day and 2.66 kg/day, respectively. The overall feed conversion (feed/gain) averaged 2.49 representing a better performance than what is typically achieved in commercial barns. No significant difference in pig performance among the three diets was observed (P>0.05).

Table 1 Average animal performance over the entire experiment (from 58 to 80 kg)

Oil application rate(ml/m^2-day)	Diet	Average daily gain (kg/day)	Average daily feed intake (kg/day)	Feed conversion (feed/gain)
0	C	0.96	2.59	2.34
	LP	0.97	2.43	2.51
	LP-FC	1.10	2.69	2.48
10	C	1.04	2.64	2.58
	LP	1.16	2.83	2.49
	LP-FC	1.09	2.61	2.43
20	C	1.10	2.76	2.55
	LP	1.11	2.71	2.47
	LP-FC	1.07	2.71	2.56
30	C	1.01	2.47	2.49
	LP	1.10	2.70	2.48
	LP-FC	1.16	2.74	2.39
Average		1.07	2.66	2.49

Ammonia emissions

Table 2 indicates that diet formulation significantly reduced NH_3 emission rates. In average, LP and LP-FC diets provided a 21 and 38% reduction in NH_3 emissions from the chambers compared to the control diet. Based on these results, manipulating pig diet appears to be an effective strategy for the reduction of NH_3 emission rates from swine buildings.

Table 2 Ammonia emission rates with the experimental diets and oil application rates

Diet	NH_3 emission rate (mg/s)			
	Oil application rate (ml/m^2-day)			
	0	10	20	30
C	0.40 a	0.36ae	0.32 de	0.36 ae
LP	0.28bd	0.28bd	0.28 bd	0,30 bd
LP-FC	0.22c	0.22cf	0.26 bf	0.20 c

Note: Averages followed by a different letter are significantly different (*P*<0.05).

Contrary to what was suggested in the initial working hypothesis, application of canola oil on the floor and the pigs did not decrease NH3 emission rates from the chambers (P>0.10).

Odour emissions

As presented in Table 3, the diet treatments without any oil application had no impact on odour emissions as no significant difference was observed. With the C diet, odour emissions were significantly reduced by 20 and 13% with oil applications of 10 and 30 ml/m2-day, respectively. The reductions in odour emissions between both application rates (10 and 30 ml/m2-day) for the C diet were not different.

Phase II of this project will involve the testing of the most promising combination of oil application rate and experimental diet and it will be completed at PSCI in commercial rooms over the year 2001.

Table 3 Odour emission rates with the experimental diets and oil application rates

Diet	Odour emission rate (OU/s)			
	Oil application rate (ml/m^2-day)			
	0	10	20	30
C	30acd	24be	28bde	26e
LP	27abde	38c	30abd	36d
LP-FC	23abde	30	33	30ae

Note: Averages followed by a different letter are significantly different (P<0.05).

Acknowledgments

The authors wish to acknowledge the funding provided for this project by the Canadian Pork Council and Agriculture and Agri-Food Canada through the HEMS program. Technical support was provided by the Centre de Développement du Porc du Québec, the Institut de Recherche et de Développement en Agro-Environnement (IRDA) and the Prairie Swine Centre Inc.