Title: Benchmarking performance in Ontario swine nursery barns

Introduction:

From a health standpoint the nursery is the most challenging stage of production. Passive immunity gained from colostrum at birth begins to disappear by 3 weeks of age and although pigs begin to create active immunity they are somewhat vulnerable to infection at the time of weaning, particularly because weaning involves a number of stressors. There are economically important diseases that are difficult to eliminate from a farm because they typically cycle within the nursery population, in other words older weanlings spread disease to newly weaned pigs week after week. In addition, because the nursery is a transition phase and a stage of pig vulnerability, antibiotics are commonly used, sometimes in response to sudden disease flare-ups. The impact of a poor nursery performance can negatively affect grower-finisher performance.

Some farms keep detailed production records and there are companies that provide benchmarking services. Unfortunately many of the farms that would benefit the most from this activity are not adequately recording nursery performance or are not using production records to guide management decisions. The advantage of participating in benchmarking is that it allows a farm manager to compare data with comparable operations and use this as an opportunity to set achievable goals. It helps prevent the blindness associated with being only focused on one’s own business and it may provide incentive to change procedures that have become outdated and inefficient.
Objectives:

1) Benchmarks for nursery rate of gain, mortality and morbidity in Ontario nurseries and the variation in these parameters between farms.

2) In addition, relevant management practices including vaccination strategies, antibiotic use, feed management, stocking density, pen design, etc. will be summarized.

3) Diseases resulting in morbidity or mortality in nursery pigs will be investigated and their significance established.

4) We will identify factors associated with high performance and strategies that minimize antibiotic use.

5) The research should identify opportunities that could reduce current antibiotic use that are practical and measurable for utilization by the Ontario pig industry, and should assess the economics and cost-effectiveness of these options.

Materials and Methods:

This project was approved by the University of Guelph Animal Care Committee and followed the guidelines of the Canadian Council on Animal Care. The work was also approved by the University of Guelph Research Ethics Board. Fifty swine nursery barns in Ontario representing a variety of farm types across a wide geographical area were recruited for the study and visited at least once. One farm dropped out before completion, leaving 49 farms where a second visit was completed. On each farm, a minimum of one batch of weaned pigs was identified for detailed sampling and monitoring as a way of measuring variability in growth within a batch and a way of obtaining samples for disease prevalence studies. The study batch of weaned pigs was
weighed in and out of the nursery. Twenty randomly selected pigs were individually ear tagged, and blood sampled at both weighing periods (entry and exit). In the original protocol the number of light weight pigs (<5 kg) at entry were to be noted as well as any abnormalities such as hernias, and likewise at exit the pigs too small to move on to the grower barn were to be accounted for but this aspect of the study was discontinued because it became too difficult and time consuming to record on most farms during the visit. Morbidity and mortality recording forms were provided for farms not using an existing farm-specific recording form. Producers were asked to record individual pig treatments including date, drug, dosage and reason. Compliance seemed to be a problem because few treatments were recorded although it is possible individual treatment may have been a rare occurrence on these farms. As an incentive to participate, producers were offered free diagnostic services up to $500. As a result individual pigs were sometimes submitted for postmortem examination and occasionally sera or fecal samples were tested. Serology was conducted for specific diseases on samples from a subset of 30 farms; testing for antibodies to *Mycoplasma hyopneumoniae* and influenza A virus and *Salmonella*. And PCR testing was performed for porcine reproductive and respiratory syndrome virus (PRRSv). These tests were performed in order to determine the prevalence of these common economically important disease agents and to determine if their presence was associated with poorer performance.

When a farm was enrolled on the project a survey was filled out to obtain information about the perceived nursery performance as well as management and housing details. Initially the herdsmen were asked to submit ongoing performance records including weekly mortality numbers but the usefulness of this exercise became questionable and it was generally not well received by many of the producers and therefore was abandoned. Instead farms were asked to
provide historical close-out data so that feed efficiency, growth rate, and mortality could be recorded.

Growth rate information was calculated using the 20 individual pigs that were weighed at the start and end of the nursery on each farm and the average and range of growth rate was calculated for all 49 farms. Farmers received their individual results and a copy of the summarized data without specific farm identification information to preserve the confidentiality of the enrolled herds. Where possible the association between certain husbandry practices and good performance was investigated. For example, nurseries using all-in/all-out pig flow by site were compared with barns operating as continuous flow to see if all-in/all-out is associated with better growth rate. Although it was difficult to obtain accurate individual pig medication data the feed medication used on many of these farms was recorded as well as feed use. An attempt was made to examine the relationship between antimicrobial use in feed and growth performance.

**Results and Discussion:**

The nurseries on this study were located in 12 counties and represented a variety of production types: 23 farrow-to-finish, 4 farrow-to-feeder, 4 wean-to-finish and 18 off-site nurseries. The nurseries were almost equally divided between operations that were continuous flow (all-in/all-out by room) and nurseries that were all-in/all-out by site. Initially we hoped to measure a number of different parameters on all farms but that was not always possible. For example feed efficiency proved to sometimes be inaccurate even for off-site nurseries using all-in/all-out pig flow. Growth rate was selected as the best objective measure to use in comparing nursery performance. Weighing a subset of 20 pigs appeared to be a useful measure of growth rate and an indicator of variation in the batch, and could be performed on all farms.
The average weights of 20 pigs from the 49 nurseries upon entry into and exit from the nursery were 7.3 kg and 24.8 kg, respectively. The mean average daily gain (ADG) was 451 g/day. There are many factors that need to be considered to accurately compare results from these farms. For example, there was a variation in weaning age (average: 23 days, range: 18 to 39 days). However, when weaning age was controlled for, mean ADG and variation around the ADG for farms weaning at 3-weeks of age were unchanged. Batch performance records were routinely kept on 24 farms with 22 farms providing records for the study. When comparing the entire batch performance to the subset of 20 pigs from each farm, ADG was not significantly different ($P=0.09$). On a farm that weighed all pigs in the batch individually ($n=236$) the mean ADG, weight at entry and exit were comparable with the 20 average pigs in the study group, thus reaffirming the usefulness of weighing a subset of 20 pigs to determine growth rate for a weaning batch of pigs.

There was a large range in growth rate from farm to farm of 300 to 600 g/d. The most obvious factor affecting nursery performance was age at weaning. On farms with pigs less than 21 days when first weighed the growth rate averaged 420 g/d compared to 455 g/d on farms where pigs were 21-28 days of age when first weighed. When pigs were over 28 days of age when they were first weighed the average growth rate was 491 g/d. Other factors such as pig flow, and stocking density were examined. No statistical difference was found when analyzing growth rate based on these factors but this was likely because the variation in growth rate among farms in each category was high and the number of farms relatively low. These factors may be quite important but larger numbers of farms would be required to show this by controlling for all the confounding variables.
Mortality rate for each batch on the study ranged from 0.1% to 7.5% with most batches recording mortality between 2 to 3%. When producers were asked which diseases were present and contributed to this death loss the most common responses were; post-weaning *E. coli* diarrhea (67% of farms), *Streptococcus suis* meningitis (50%), porcine reproductive and respiratory syndrome (25%), and influenza (10%). Of the 30 farms that were tested for the presence of PRRS virus with PCR, 10 farms tested positive.

Serology was used to test for antibodies to common diseases. For example, it was found that antibodies to *Salmonella* were present on all farms based on testing of newly weaned pigs. These results reflect the passive immunity (from colostrum) that the piglets have when they enter the nursery. Results revealed that 56% of nursery pigs were *Salmonella* seropositive at entry while this number was found to decline to 32% by the end of the nursery stage. *Salmonella* seropositivity decreased during the nursery phase on most farms indicating the disappearance of passive immunity, but on a few farms seropositivity increased indicating active infection during the nursery stage. Pigs were also tested for *Mycoplasma hyopneumoniae* antibodies. The majority of the farms (22/30) being tested, vaccinated piglets before or at the time of weaning with a *Mycoplasma* vaccine but surprisingly only 7 of 30 herds had pigs with positive titres to *Mycoplasma* at the end of the nursery period. There may be other explanations for this seeming lack of response to the vaccine but the results could indicate that the vaccine has not stimulated immunity and this should be further investigated. Serology for influenza was also investigated and antibodies to IAV H1N1 and H3N2 were commonly detected and there was evidence that pigs were becoming infected during the nursery period on some farms.

Medication use varied from no antibiotics used to multiple antibiotics used at a treatment level to the entire nursery. Compliance was an issue with regard to recording individual treatments. On
the whole farmers responded in the questionnaire that injection of individual pigs was relatively rare and in only one farm were all the pigs injected at entry as a routine precaution. On the other hand, 42/50 farms used medicated feed. However it was not always possible to obtain complete feed data in order to record what antibiotic was present in the feed, at what concentration and how much of the feed was consumed per pig. Complete feed data were obtained from 25 farms. Typically nursery pigs were fed between 3 and 5 phases with pigs consuming 5 or 6 kg of the first 2 or 3 phases and about 25 kg of the last phase. If medication was used, it was generally the first two or three phases that were medicated so total amount consumed of medicated feed was low but there were farms that used medicated feed for the entire nursery period. Water medication was used infrequently and based on the producer survey water medication was generally considered in response to a disease outbreak such as *Streptococcus* meningitis or *E.coli* diarrhea and not used routinely. Removing medication from the last nursery diet would greatly reduce the quantity of antibiotic used in a nursery and this practice would likely have the least impact on the health of the pigs.

**Conclusions**

Performance on Ontario nurseries is highly variable from farm to farm and therefore there is opportunity on many farms to increase performance and consistency. This research will help producers set achievable targets. In general, there is a need for better record keeping and increased health monitoring.

The nursery is the production stage when pigs are most vulnerable to disease challenge because it is a time when passive immunity declines and pigs are faced with challenge from endemic diseases, particularly on farms with continuous flow of pigs in the nursery or farms that mix pigs from multiple farrowing sources in all-in/all-out nurseries.
Acknowledgments

Additional funding was received to support this work OMAFRA-University of Guelph Research Partnership, and the Disease Surveillance Plan, which is a joint federal-provincial Growing Forward 2 project, as well as OMAFRA New Directions, Swine Innovation Porc, Merck Animal Health, and OVC graduate student fellowships

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