Determining the Optimum Stocking Density in Nursery Pigs

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SUMMARY

Significant effects of density were found for standing, sitting, feeding and lying recumbent (P <0.05). Both time spent feeding and percentage of pigs sitting was greatest with higher pig densities. Pigs spent more time overlying in week 1 than in weeks 3 or 5 , as well demonstrating more time standing and feeding in week 3 as compared to weeks 1 or 5. Initial results from Phase one indicate that temperatures were fairly consistent across seasons, and humidity was highest in the summer months. There were no consistent differences found in growth and immune responses were greater during the summer months

INTRODUCTION

Floor space allowance is a complex issue in swine production, and one that is critical for both economic and welfare reasons. There is currently a significant body of research on the effects of space allowances in grow-finish pigs The most widely accepted method to define floor space allowance (A) is to relate it to the size of pig by converting body weight (BW) into a two-dimensional concept yielding an expression of A = k * BW 0.667. Data from many studies on grow/finisher pigs was used to establish the critical k value at which crowding becomes detrimental to the growth of the pig. The critical k value established (by Gonyou et al., 2006) is used for the calculation of the current minimum required space allowance for nursery pigs in the Canadian Code of Practice for the care and handling of pigs (NFACC, 2014).

This study addresses concerns surrounding space allowance in nursery pigs to establish the critical cut-off points at which crowding occurs. To address the areas where uncertainty remains, this study examines average daily gain (ADG), pen group average daily feed intake (ADFI) and feed efficiency, health and pig behaviour at various space allowances, in both small and large groups, in controlled research and commercial settings across seasons. The resulting data will be entered into an economic model to determine the consequences of nursery space allowance on the cost of pig production and financial returns, and final conclusions regarding the optimum density for nursery pigs will combine welfare, economic and production outcomes.

MATERIALS AND METHODS

The study has been conducted in two phases, including: I) Controlled studies performed at the Prairie Swine Centre; and II) Commercial trials conducted at two sites (one in Saskatchewan and one in Manitoba).

Phase I Trial

Phase I trials took place at the Prairie Swine Centre's nursery barn. Pigs were housed in fully slatted pens, and fed ad-libitum via feed hoppers, with the availability of feeder space and drinkers (on a per pig basis) kept constant between treatments. Artificial lighting was provided to pigs from 07:30 - 16:00.

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Treatments, animal care and data collection

A total of 1,200 newly weaned pigs were studied over six density treatments, tested in two group sizes (10 and 40 pigs per group), over four replicates, one replicate per season to control for seasonal variation in weaning weight and growth due to variation in temperature and air quality. Density was determined using the allometric equation Area = k BW 0.667(where A=space/pig in m2, k = the constant under test and BW = body weight in kg), and the following k values tested: 0.0230, 0.0265, 0.0300, 0.0335, 0.0370 and 0.0390.

Phase II Trial

Farm selection and animal care

Two commercial operations with acceptable levels of nursery mortality levels (<3%, to minimize density changes) and with high heard health status were identified. One farm was selected in Manitoba and the second was selected in Saskatchewan. The same six density treatments from phase I were tested for a minimum of four replicates per farm over a span of two seasons (summer and winter). Unlike phase I, in which pen size is adjusted to ensure a specific nursery density, phase II pens remained static in size, and the number of pigs per pen was varied to achieve the required density based on the expected exit weight (25 kg - 30kg). Treatment groups were randomized and balanced for weaning weight and gender. Animals were fed and cared for following the standard management practices on each farm.

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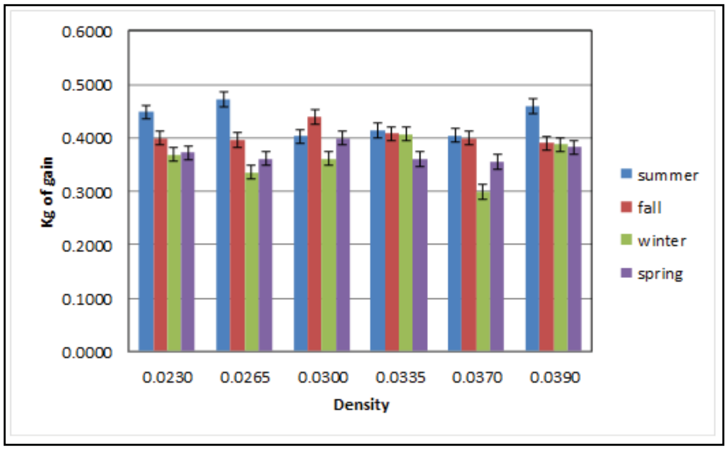

Figure 1. Average daily gain in Phase one trials.

Data collection

Information on pig diets, management protocols, pen and barn environment were collected for each facility. Information on temperature and humidity within the rooms and pens was collected using iButton data loggers. Both individual pig and group weights were collected at entry and exit, and group weights collected at mid-point in the nursery growth cycle to determine average daily gain. All feed inputs were recorded and feed returns taken on pig weigh days. Records of morbidity and mortality and any veterinary interventions were kept daily by barn staff. The date, weight and reason for removal of any pig removed from trial were also recorded.

Pig behaviour was recorded at three time points during the trial. On the second day after placement, the day before mid-point measurement of pig weights, and the day before nursery exit. Pig behaviour was recorded on cameras mounted above the pens to take pictures of pig behaviour.

RESULTS AND DISCUSSION

Phase I

Growth

Pigs on trial gained an average of 0.3924 Kg per day, with the best growth occurring during the summer months at densities 0.0265 and 0.0390 (Figure 1). There were no noticeable differences in ADG between densities, pigs given less space at a K value of 0.0230 did just as well on average as pigs given the most space (k=0.0390) however there were some seasonal interactions with density. Based on these descriptive statistics, there was no consistent pattern of improved or decreased performance.

Feed to gain ratios observed were fairly consistent across seasons and densities, with the summer months being the best for all densities. These preliminary results suggest that housing pigs at a tighter stocking density did not negatively affect the growth of animals.

Seasonal change in environment

There was very little change in temperature across the seasons. There was an increase in humidity levels during the summer months; likely due to the increased ambient humidity, while the rest of the seasons were fairly consistent.

Immune response

There was a seasonal effect on immune titers, with the highest titer values in summer. As this was only a minor immune challenge (inactivated m. hyopneumoniae vaccine) , it is possible that the increased titer, and best growth rates indicates the pigs were healthiest during the summer months, possibly partially due to the improved ventilation and air flow through the barn. The low titer levels and poor growth response during the cooler months may indicate that animals are facing other immune challenges at this time. There were no apparent effects of density treatment, indicating that the tighter densities did not affect immunity.

Behavioural Responses

There was a significant effects of density found for standing, sitting, feeding and lying recumbent ($P < 0.05$). When separated by density, there were significant differences in the percentage of pigs sitting and feeding. Pigs in the lower space allowances spent more time sitting and feeding when compared to the greater space allowance. All pigs demonstrated more time standing and feeding in week 3 as compared to weeks 1 or 5.

CONCLUSION

Initial results from Phase one indicate there were no consistent differences found in growth and immune responses were greater during the summer months. Significant effects of density were found for standing, sitting, feeding and lying recumbent ($P < 0.05$). The percentage of pigs sitting was greatest at lower space allowances (k= 0.023: 1.36 ±0.12 vs k= 0.039: 0.77 ±0.15% of time sitting, mean ±SEM). Similarly, pigs at lower space allowances spent more time feeding (k= 0.023: 1.91 ±0.07 vs k= 0.039: 1.74 ±0.07% of time feeding, mean ±SEM). Pigs spent more time overlying in week 1 than in weeks 3 or 5 ($P < 0.05$). Pigs also demonstrated more time standing and feeding in week 3 as compared to weeks 1 or 5. Further analysis including correlations with growth and physiological measures will help to interpret the importance of these changes for piglet health and welfare.

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