GROW/FINISH VARIATION: COST AND CONTROL STRATEGIES

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Variation in growth rate for grower/finisher pigs causes increased fixed costs of production and makes all-in all-out production management difficult or impossible. We conducted an observational study on 9 cooperating commercial farms between 1998-2000. All pigs born over a 1-6 week period were weighed onto the study at 1-2 days of age, to ensure a minimum of 250 pigs per farm. The pigs were then weighed at weaning and approximately 7, 14, and 20 weeks of age. Due to biosecurity concerns and the number of farms involved, after the pigs were weaned, the farms were not visited on a weekly basis. Therefore, the exact age of the pigs at the 7, 14, and 20 week weighing, within a farm, varied by 14 days.

The strength of this project is that data were collected on a wide variety of farms with no management intervention from the researchers. Therefore, we believe the data collected is a valid representation of the typical production found in Ontario farms. The farms selected for the study were those owned by cooperating producers whose units were within a 1 2 hour drive of the University of Guelph. The farms included one multi-site unit where the nursery pigs moved to three different finisher barns, two, 2 site, single-source off-site nursery units with the finisher barn on the sow site, one farrow to feeder barn, four single site farrow to finish units with commercial production, one farrow to finish, multiplier unit, and the University of Guelph research herd. The disease status on these farms ranged from those without porcine reproductive and respiratory syndrome virus (PRRSV) or *Mycoplasma hyopneumonia* to those with these diseases and swine dysentery and *A. pleuropneumonia.* The weakness of this project is that it is an observational study and as such, although the pigs were weighed as individuals, the management decisions and the disease status of the units were farm-level factors. With only 9 farms, we were unable to apply statistical tests to many of the factors of interest.

The purpose of this project was to describe: (1) the production found on commercial swine units in Ontario, (2) variation in the production as measured by the coefficient of variation (CV), (3) impact of the size of the young pig on the weight and weight gain of the older pig, and (4) impact of specific management factors on the growth rate and variation in weight at the grower finisher level.

The weight of a young pig has a large influence of the weight of that pig later in life (Table 1) (P=0.0001 for all relationships mentioned). A pig that weighs an extra 0.5 kg at birth will weigh an extra 0.8 kg at weaning and 1.2 kg at 7 weeks of life. A pig that weighs an extra 1 kg at weaning will weigh an extra 0.3 kg at 7 weeks and an extra 0.9 kg at 20 weeks of age. A pig that weighs an extra 5 kg at 7 weeks of age will weigh an extra 1.5 kg at 14 weeks and an extra 2.0 kg at 20 weeks of age. A pig that weighs an extra 10 kg at 14 weeks will weigh an extra 11 kg at 20 weeks of age.

Table 1. Additional weight of pig (kg, parameter estimate) for every 1 kg increase in weight at a previous stage of life.

	Weight			
Factor	Weaning	7 week	14 week	20 week
Birth weight	1.7	2.3	NS	NS
Wean weight		0.3	NS	0.9
7 week weight			0.3	0.4
14 week weight				1.1

WATER

We conducted a field trial to determine the association between water intake and nursery pig average daily gain (ADG). A total of 1932 pigs were weighed at weaning and placed in nursery pens holding approximately 30 pigs each. The pens had Crystal Springs wet-dry feeders, however, the water was not connected to the feeders. The control pens had one water nipple attached to the back wall of the pen (over the slats). The treatment pens had the water nipple at the back of the pen and the water in the wet-dry feeders was functional.

The pigs given the extra water gained significantly better than the pigs without the extra water (Table 2). Pigs without the extra water spent time lining up at the water nipple. Large pigs guarded the water nipple and did not allow other pigs access to the water without a fight. The water consumed by the pigs did not differ by treatment. We might have expected that the control pigs without access to water would consume less water rather than more water. However, previous research suggests that pigs using wet-dry feeders will consume less water than pigs eating from dry feeders.

Table 2. Change in weight gain of pigs by change in water access.

Growth Parameter	Pigs with extra water	Pigs in control pens	P-value
Weaning weight	6.29	6.29	>0.05
Weight at 8 weeks of age	17.34	15.70	0.01
ADG from 3 - 8 weeks	0.315	0.273	0.01
Weight gain from 3-8 weeks	11.04	9.41	0.01
Water consumed /pig/day	1.37 litres	1.57 litres	>0.05

We observed the same relationships in the observational study (Table 3). Drinker, feeder and space per pig are completely confounded with one another and with disease status and management system. Therefore, the numbers can only provide an indication but not a cause and effect relationship between productivity and access to feed and water. The weight of pigs at 7 weeks of age was numerically higher in farms where there was plenty of water. This is evident in the comparison in waterers per pen and in the number of pigs per pen. If pigs have limited access to water, their feed consumption will be reduced. The growth rate increased in both the grower and finisher phase when there were two drinkers per pen. By providing an

extra waterer, the variation in pig weight (CV) was reduced by more than half (from 48 to 13 or from 45 to 20).

Pigs need plenty of access to feeder space to grow to their genetic potential. If there were sufficient feeder spaces for one space per 5 pigs, the pigs grew better than if there were more pigs per feeder space. Similarly, pigs that were over-crowded had lower average daily gains than pigs given plenty of room. The amount of space provided to the pigs in the grower barn did not change the average daily gain in the grower barn but it did alter the CV. Pigs provided with more space grew more evenly than pigs given restricted space. In the finisher barn, the pigs given more space had a numerically higher ADG and grew more evenly than the pigs that had less space.

Table 3. Average weight of pigs at 7 weeks of age for various management factors.

Factor		Factor Level		
Drinkers per pen		1 drinker	2 drinkers	3 drinkers
	Average weight	14.1	14.4	18.5
	ADG 7-14 wks	0.70 (48)	0.74 (13)	
	ADG 14-20 wks	0.71 (45)	0.80 (20)	
Pigs per drinker		10 pigs	11-15 pigs	more than 15
	Average weight	19.9	14.3	14.2
Pigs per feeder		less than 5 pigs	5 or more pigs	
	Average weight	19.9	14.3	
Pigs per m^2		< 0.74 m^2/pig	≥ 0.74 m^2 / pig	
	Average weight	16.7	14.2	
	ADG 7-14 wks	0.07 (48)	0.70 (18.5)	
	ADG 14-20 wks	0.72 (37)	0.88 (19)	

WEIGHT AND VARIATION IN WEIGHT BY AGE OF PIG

The standard deviation and the CV are both measures of how variable the pig weight is at each age. The CVs do not change very much as the pig ages (Table 4). The standard deviation tends to be 24% of the average of the birth weight of the pig. The standard deviation is also 24% of the average weight of the pig when the pigs are 20 weeks old. This tells us that if we add and subtract 24% of the average weight of the pig, either at birth or at 20 weeks, these ranges will include 66% of all of the pigs that were weighed. For example, 66% of the pigs weighed between 1.3 and 2.1 kg at birth. Also, 66% of the pigs weighed between 63.9 and 104.3 kg at 20 weeks of life. Similarly, 95% of the pigs weigh between the average plus or minus 48% of the average pig weight. Thus 95% of the pigs at 20 weeks of age weighed between 43.7 and 124.3 kg. Other researchers have suggested that the variation in pig weights increases as the pigs get older. However, from our study we conclude that the CV does not increase as the pig ages. This tells us that proportionally the variation does not increase.

The variation appears to grow because the difference between the weights of the newborn pigs is 0.85 kg, whereas the difference between the weights of the 20 week old pigs is 42 kilograms. Unfortunately, this is still within the biological realm of 25% of the average pig.

Table 4. Average weight and variation in weights at various ages of life.

Age	Average Weight	Standard deviation	Coefficient of Variation	Smallest 25%[1]	Largest 25%[2]
Birth (1-4 days)	1.7	0.4	24	<1.45	>2.0
Weaning (17-24 days)	5.8	1.5	26	<4.9	>7.18
7 weeks (49-55 days)	15.5	4.8	31	<12.3	>19.0
14 weeks (96-105 days)	48.3	9.4	19	<42.3	>54.5
20 weeks (133-152 days)	84.1	17.5	20	<71.4	>97.0

[1]This shows that 25% of the pigs weighed less than 68.1 kg at 20 weeks of age.
[2]This shows that 25% of the pigs weighed more than 96.0 kg at 20 weeks of age.

FARM DISEASE STATUS AND PIG FLOW

Farms with more diseases and those using a continuous flow production system had lower ADG and a higher coefficient of variation than farms with fewer diseases or those that used an all-in all-out production flow. The disease status does not necessarily indicate that the farm had an active infection or clinically sick pigs, it just shows that the farm was not free of certain diseases.

Farms that were positive for more diseases had lower average daily gain in the grower and the finisher barn than farms that were free of diseases. This shows that for certain diseases that are easy to keep out of a barn, such as *Actinobacillus pleuropneumoniae* (APP), swine dysentery, and mange, it would be worth while to eradicate these diseases to improve average daily gain.

Diseases also have a very large impact on variation in weight gain. This can be seen by the CV. The herds with few diseases have a low CV. This means that the pigs are very close in weight to the other pigs of the same age. In the farms with diseases, the pigs do not grow in a uniform manner. This is because some pigs become chronically ill and are not able to gain weight. Other pigs in the same farm will not show clinical signs of disease, perhaps they have very strong immune systems and are able to fight the infection. This causes a wide variation in size of pig at the very same age.

There is also an obvious benefit to all in / all out production. Even though the first farm in the table has both PRRS virus and Mycoplasma, the pigs grow rapidly and in a uniformly because the pigs are managed all in all out by site. This means that the pigs coming into the barn are not exposed to the viruses and bacteria in the barn or in the air that older pigs carry. There is also a benefit to running the barn all in all out by room. As you can see from the table, the ADG is higher and the CV is lower in farms that use all in all out by room than in the farms

that run the facility on a continuous flow basis. Small farms that have insufficient weekly production to manage the farm this way can be encouraged to batch farrow, every two to three weeks.

NUMBER OF TIMES A PIG IS MOVED IN THE GROWER / FINISHER BARN

The pigs represented in the data in Table 5 were weighed at 13 weeks, 22 weeks, and 25 weeks of age. Please note that the pigs that were moved only once in the finisher barn were weighed at an older age than the pigs that were not moved at all or the pigs that were moved two or more times. Also, although the pigs that were moved two or more times were slightly lighter at the initial weighing, they were also 4 days younger than the pigs that were not moved at all.

Previous research has indicated that moving a pig in the grower/finisher barn adds 5 days to the days to market. This herd was chosen for this report because the producer moved some pigs a number of times during the growing phase. This allowed us to compare a sufficiently large group in each of the three categories: no-move, one move and two or more move.

At 25 weeks of age, the pigs that were not moved were 24 kilograms heavier than the pigs that were moved once. If the pigs grew at 0.75 kilograms per day, then the pigs moved once would need an extra 32 days to reach market weight. The pigs that were not moved were 44 kilograms heavier than the pigs that were moved two or more times. These pigs would need an extra 59 days to reach market weight. These numbers exaggerate the impact of the move because typically it is the slower growing pigs that are moved. If a pig is put in a pen and grows very rapidly, the pig tends to be shipped without being moved. However, if a pig does not grow well, then when its pen-mates are shipped, it is re-grouped with other pigs that are not growing well. Producers would be wise to minimize the number of moves for growing/finishing pigs to give them the optimum conditions for growth.

Table 5. Weights of finisher pigs based on the number of moves the pigs experienced. (Note, this data all comes from only one farm).

	Number of times the pigs were moved		
	0	1	2 or more times
Weight at 13 weeks of age	46	42	40
Age in days (approximately 13 weeks)	95	98	91
Weight at 22 weeks of age	68	62	51
Age in days (approximately 22 weeks)	151	165	159
Weight at 25 weeks	106	82	62
Age in days (approximately 25 weeks)	173	179	173

TRACKING PIGS FROM BIRTH TO MARKET

Table 6 describes the average carcass characteristics for pigs that grew quickly (25th percentile), slowly (75th percentile) or had average growth (50th percentile). The fast growing pigs reached market at 158 days, the average pigs at 169 days of age, and the slow growing at 181 days of age. The index, dress weight, and percent lean yield did not differ between these groups. There were more barrows in the fastest growing group than gilts. Only 34% of the slowest growing pigs were barrows. The fastest growing pigs had a larger fat depth than the slowest growing pigs. The slowest growing pigs had the smallest lean depth.

The lean yield was reduced by 1.2% in barrows compared to gilts, and was reduced by 5.7% for every extra 0.1 increase in average daily gain. Faster growing pigs had a lower lean yield. Fat depth was higher by 2.5 in barrows compared to gilts and increased by 7.2 for every increase in 0.1 of average daily gain. These factors only explained 9% of the variation in fat depth and 12% of the variation in lean yield.

These results suggest that producers may wish to feed fast growing barrows differently to reduce the level of fat and increase the lean yield. It could be that these producers are feeding to the average pig in the grower barn rather than the fastest growing pig. Producers in Ontario are working hard to phase feed nursery pigs, to the extent that large nursery pigs are given a different feed than small nursery pigs of the same age. Similarly, it may benefit Ontario swine producers to feed grower /finisher pigs different rations according to their size at a given age.

Table 6. Average growth and carcass characteristics for fast, medium and slow growing pigs.

	Percentile (by age)		
Parameter	25th	50th	75th
Age at slaughter (days)	158	169	181
Index	109	108.8	109.1
Dress weight (kg)	89.2	87.2	87.2
Fat depth (mm)	19.6	17.3	16.7
Lean depth (mm)	19.2	19.2	18.3
Estimated percent lean yield (%)	54.4	55.9	56.4
Weight at birth (kg)	1.8	1.6	1.5
Average daily gain 14 weeks to market	0.86	0.83	0.71
Number of pigs in sample	292	436	292
Percentage Barrows (%)	55%	46%	34%

IMPLICATIONS

1. Pigs that are provided access to extra water sources grow better in the nursery
2. Pigs with adequate access to water will not spend time fighting over the water source

3. Water is a relatively inexpensive resource and should not be the limiting factor in growth rate or variation in growth rate
4. Growth rate is improved and variation is reduced when pigs have more access to feeder space and more space per pig
5. Weight variation remains consistent (CV of 24%) throughout the pig's life
6. Weight variation is increased in disease positive farms and in farms that use continuous flow production compared to disease free farms and all-in all-out production

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