Benchmarking Indicates Production Improvement

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There is little doubt that the pig industry has changed dramatically in the last two decades—from changes in herd structure to changes in ownership to changes in the genetic base. Each year, benchmarks serve as "state-of-the-industry" reports that provide both motivation for change and recognition of how far the industry has come.

PigCHAMP recently released its 2004 annual benchmark, reporting average production values as well as the upper and lower 10th percentile values for 225 participating sow farms. Compared to the 2003 Year-End Summary, the 2004 numbers reflect improvements in average farrowing rate, average total born per litter, average born alive per litter and pigs weaned/mated female/year. Likewise, culling and death rates were also increased. Over the last five years, the annual breeding herd summaries have been characterized by steady increases in pigs born alive, pigs weaned per litter, average female inventory and sow death rates.

Table 1 contains selected parameter values from the 2000-2004 summaries. (To view the complete summaries, visit www.pigchamp.com.) Despite the progress implied by the annual benchmarks, the ranges of production values remain wide. For example, the differences between upper and lower 10th percentiles of reporting farms are: 17.6 percentage points for farrowing rate, 1.7 and 1.8 for average total born and born alive, respectively, and 29.8 and 8.3 percentage points for culling and death rates, respectively. Similar upper-lower ranges exist in previous compilations, as well.

In addition to PigCHAMP's annual breeding herd benchmarks, the USDA's quarterly compilation of producer surveys has reported a gradual, upward trend of productivity measures. The specific sources of such improvement remain unclear. The Hogs and Pigs Reports consistently report higher pig crop values (pigs weaned per litter) with increased herd sizes. PigCHAMP's annual summaries describe similar patterns of improved productivity measures and increasing average herd inventories.

Along with the annual benchmarks comes the quest to identify factors associated with successful sow operations. Several investigations have looked to identify associations between high producing farms and key performance parameters (Wilson, Stein, King). Wilson reported that in 1981, herd size was positively correlated with productivity (pigs weaned/sow/year) and negatively correlated with pre-weaning mortality among herds ranging from 26-383 sows. In 1990, Stein et al reported no correlation between herd size and productivity (pigs weaned/female-year) among 1985-1986 users of PigCHAMP with herd sizes ranging from an average inventory of 49 to 852 females. Increased productivity was correlated with low numbers of non-productive female days, greater pigs born alive, lower pre-weaning mortality and higher proportions of older parity sows. Summarizing 1995 PigCHAMP data, King et al similarly reported no association between herd size and productivity (pigs weaned/mated female/year) in U.S. herds ranging in size from 85-1248 sows (10th and 90th percentiles, respectively).

In addition to Stein's observations, they concluded that increased mating frequency could improve born alive numbers and a reduced lactation length could increase sow productivity, as

shorter lactation lengths with fewer non-productive sow days permit more litters per sow per year. In 1997 PigCHAMP data, Koketsu found that among high-performing U.S. herds, increased herd size was associated with shorter lactation length and greater reproductive efficiency.

While regular collections and summations of production data provide the swine industry with benchmarks of productivity, the question remains: what does it all mean? Further exploration of relationships within the sow productivity data provides an opportunity for "ecological" benchmarking—large-scale exploration of factors associated with more and less productive operations. As previously described, many ecologic benchmarks have been done. However, the challenge with ecological benchmarking is ecologic fallacy. In other words, relationships observed at the group level may not be applicable at the individual [farm] level. Counter examples to reported associations are relatively easy to cite.

Additionally, in the case of PigCHAMP summaries, average production values represent averages across all customer farms. As herd sizes increase and more animals are represented by fewer farms, it may be more accurate to consider industry performance by weighting farm production values on the basis of animal inventory. Such weighted values calculated from 2003 and 2004 PigCHAMP Year-End Summaries imply that larger herds perform more efficiently. (See Table 2.) While the 2003 weighted statistics reveal lower average total born and pigs born alive, compensatory increases in farrowing rate and sow utilization contributed to increased sow productivity. 2004 weighted averages show better overall performance and sow productivity than the farm-averaged summary. Weighted averages from both years do support industry concerns about high replacement rates and sow mortality.

It remains possible that PigCHAMP benchmarks are a biased representation of the industry, since summarized data require producer willingness to participate. Producers with poor performance or poorly kept records may exclude their performance from consideration. Farm-level bonus systems may lead to emphasis of sow productivity in generated reports. And incomplete event recording can cause disparities between actual and paper performance.

Nevertheless, annual industry benchmarks continue to shape both producer and customer expectations. Seedstock suppliers are expected to offer both prolific and efficient animal lines. Nursery management, recognizing the risks associated with lightweight piglets, has increased weight standards for acceptable animals, which, in turn, translates to longer optimal lactation length at the sow unit. Offers of improved performance associated with "high" health have also provided producers opportunities to change their genetics to gain both health and productivity. And changes to industry structure have resulted in larger sow farms in addition to the exit of less productive, less competitive producers. Current benchmarks and observed improvements, then, may actually be a reflection of industry changes: new sow farm populations with healthier and more productive genetics, as opposed to individual improvement within several farms.

The annual PigCHAMP year-end summaries and the summaries calculated via weighted average raise questions about true performance trends in the industry. Is the improved productivity over time a reflection of productivity improvements of individual producers? Is the better production efficiency associated with larger herds a function of better procedures? Or does the improved

performance among larger herds reflect the use of a more productive, healthier sow base? If the latter is the case, then production benchmarks within different genetic bases or health statuses (i.e., Porcine Reproductive and Respiratory Syndrome positive versus naïve herds) could offer producers more relevant information about where they stand with respect to the competition, as well as provide a window into their opportunities for improvement. Alternatively, sow farm productivity is driven by the output product. Herds that sell weaned pigs have incentives to maximize the number of weaned piglets produced, while herds feeding into an existing system may be have incentives to optimize their output to system constraints.

If production averages are simply considered within size cohorts (Table 3), advantages of total born and pigs born alive fade away. Pigs weaned/mated female/year becomes largely a function of higher farrowing rates and better sow utilization. Size-associated performance differences, then, may not be the result of a health or genetics advantage. Rather, the size advantage may be a function of facilities built with the capacity to utilize more recent developments in reproductive technology, such as artificial insemination and sow housing that improves embryo implantation.

Although application of their content may be limited, quarterly and annual benchmarks continue to provide relevant "state-of-the-industry" reports. With their limited detail, current benchmarks serve primarily to set expectations, but offer little information on how to improve. To generate improvement through the process of benchmarking, producers need to be able to identify measurable differences between their units and those of productively superior, fiscally efficient performers. However, strong numerical performance does not equate fiscal efficiency. Non-financial comparisons could be made with respect to capital measures, such as farrowing crate capacity.

While it is possible that the industry's advances in the 1990's, including the widespread implementation of artificial insemination, improvements in the genetic base and health prioritization, have made further improvement increments increasingly small, it remains possible that keys to future improvement still lie buried within the data. Intra-cohort comparisons of parameters reflecting both production and fiscal efficiency may be one of those keys.

Parameter	2004	2003	2002	2001	2000
Farrowing rate (%)	77.72	75.62	72.98	69.0	76.4
Average totalborn	11.51	11.39	11.25	11.3	11.1
Average bornalive	10.34	10.25	10.12	10.2	10.1
Pigs weaned per litter	9.10	9.02	8.98	8.9	9
Pigs weaned per mated female per year	21.25	20.15	20.28	19.7	19.6
Pigs weaned per female per year	20.27	19.12	19.19	18.6	18
Culling rate (%)	43.82	41.17	41.6	39.0	44.6
Death rate (%)	7.87	7.81	7.8	6.8	6.9

Table 1. Mean values from annual PigCHAMP Breeding Herd Year-end Summaries.

Parameter	2004	2004-weighted	2003	2003-weighted
Farrowing rate (%)	77.72	78.92	75.62	76.75
Average totalborn	11.51	11.57	11.39	11.36

Average bornalive	10.34	10.37	10.25	10.15
Pigs weaned per litter	9.10	9.10	9.02	8.94
Pigs weaned per mated female per year	21.25	21.53	20.15	20.92
Pigs weaned per female per year	20.27	20.47	19.12	19.95
Culling rate (%)	43.82	44.61	41.17	41.67
Death rate (%)	7.87	8.74	7.81	9.33
Average female inventory			1095.21	2196.69
Average female inventory-average gilt pool inventory**	1296.28	2121.45		

Table 2. PigCHAMP Breeding Herd Year-end Summary values weighted by average female inventory in farm. **Average female inventory-average gilt pool inventory was reported in place of the Average female inventory for the year 2004.

Year	2004			2003		
Parameter	<500	500-1499	≥1500	<500	500-1499	≥1500
Farrowing rate (%)	74.03	77.94	79.63	73.97	76.10	77.01
Average totalborn	11.47	11.44	11.63	11.47	11.32	11.38
Average bornalive	10.29	10.31	10.42	10.40	10.21	10.12
Pigs weaned per litter	9.12	9.08	9.12	9.14	9.02	8.89
Pigs weaned per mated female per year	20.28	21.32	21.72	18.87	20.71	21.05
Pigs weaned per female per year	19.41	20.41	20.59	17.74	19.79	20.02
Culling rate (%)	38.24	45.45	44.77	35.54	47.96	39.29
Death rate (%)	7.23	7.21	9.25	6.26	7.52	10.23
Average female inventory				239.4	841.0	2569.0
Average female inventory-average gilt pool inventory**	313.8	891.5	2487.2			
N	44	108	73	71	74	54

Table 3. PigCHAMP Breeding Herd Year-end Summary means by average farm inventory cohort. **Average female inventory-average gilt pool inventory was reported in place of the Average female inventory for the year 2004.

References

Wilson MR, Friendship RM, McMillan I, Hacker RR, Pieper R, Swaminathan S. A survey of productivity and its component interrelationships in Canadian swine herds. *J Anim Sci* 1986. 62:576-582.

Stein TE, Duffy SJ, Wickstrom S. Differences in production values between high- and low-productivity swine breeding herds. *J Anim Sci* 1990. 68:3972-3979.

King VL, Koketsu Y, Reeves D, Xue J, Dial GD. Management factors associated with swine breeding-herd productivity in the United States. *Prev Vet Med* 1998. 35:255-264.

Koketsu Y. Productivity characteristics of high-performing commercial swine breeding farms. *J Am Vet Med Assoc* 2000. 216:376-379.

Main RG, Dritz SS, Tokach MD, Goodband RD, Nelssen JL. Increasing wean age improves pig performance in a multisite production system. *J Anim Sci* 2004. 82:1499-1507.