

# IMPACT OF SIRE-SPECIFIC MORTALITY ON COMMERCIAL SWINE PROFITABILITY



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## INTRODUCTION

Mortality, both pre- and post-weaning, is one of the most important economic drivers in any commercial swine production system. Genetic improvement programs have been extremely adept at making genetic improvement for economically important post-weaning traits such as growth, feed efficiency, and carcass composition, and for maternally-oriented traits such as litter size, litter weight, and rebreed interval. However, most have no measure of an individual's offspring's ability to survive to market. USDA records indicate the number of pigs marketed

## MATERIALS AND METHODS

Data from the PureTek Genetics (Albion, Ind.) Commercial Test Herd (CTH) was utilized in this study. Commercial pedigreed Yorkshire x Landrace females were bred to pedigreed purebred Duroc boars via single-sire inseminations. Piglets were identified at birth and tracked through the system to market. Cross-fostering was performed to balance litters, but was not tracked for individual pigs. Removals were recorded and noted in on-farm herd management software. Pigs were reared in commercial facilities where weight, 10th rib off-midline backfat and loin muscle depth was collected and lean percentage was calculated. Groups were off-tested on a single day to minimize extra labor.

Test groups with incomplete removal records or missing performance test data, and sires with fewer than 50 pigs born were removed prior to analysis. A total of 39,939 piglet birth records, sired by 220 Duroc sires, from 2,568 dams and 3,603 litters were utilized in the study. Pigs were performance tested in 52 test groups under commercial finishing conditions, with 32,874 pigs marketed. Age at removal (AR) was calculated as days from birth to removal and averaged for each sire. Performance test measures for days to market (DAYS), backfat (BF), loin muscle depth (LD), and lean percentage (LP) were adjusted to 127 kg. Pigs born, pigs marketed, and percent marketed were calculated for each sire.

## RESULTS AND DISCUSSION

Descriptive statistics for survival to market are shown in **TABLE 1**. As the data shows, sires vary greatly in their progeny's ability to survive to market; almost 40% between the best and worst sires. The average age at removal appears to be shortly after weaning (24 d), which would indicate many of the pigs removed are lost prior to weaning. However, there is an almost 60 d difference between the best and worst sire for age at removal, indicating some sires' progeny are being removed much later in the growing period, when additional costs of feed, vaccine, and housing are accumulated. The least cost associated with a pig is at birth, so it would be more economically advantageous for pigs to be removed as early as possible.

These data would indicate a slight trend for sires of higher genetic merit to have commercial progeny with lower survival rate to market (**FIGURE 1**). Since the genetic estimates are current, and not from the time the sires were initially selected, this could be causing this phenomena. Investigating the initial CTSI value at selection versus percent marketed would shed light on this conclusion, but was not available in this study. Although, it stands to reason that high-performing animals would expend most of their energy to performance and may not have the needed reserves to fend off infection, disease, or adverse environmental factors.

as a percentage of the total born has steadily decreased over the last 25 years<sup>1</sup>. As regulations are introduced to reduce antibiotic usage in food animals and more systems venture into antibiotic-free programs, robustness and survival will be key to the profitability of commercial swine production.

The purpose of this analysis is to describe the variation that exists in survival across progeny of known sires in a commercial setting, and assess the economic impact of these differences.

Current genetic merit for each sire, in the form of Commercial Terminal Sire Index (CTSI), was utilized to determine economic impact of genetic differences for performance traits. The CTSI is a proprietary bioeconomic index derived from a combined purebred/crossbred evaluation that includes post-weaning performance measures from both purebred Duroc animals and Duroc-sired commercial progeny. Value per CTSI point is assumed at \$0.10 per pig produced, based on calculations from the Swine Testing and Genetic Evaluation System STAGES™ of the National Swine Registry (NSR). Value for mortality/removals was estimated under two scenarios: 1.) Fixed - assuming a cost of \$42.00 for an average pig removal (24 d), cost for each pig removed was fixed, regardless of age at removal, and 2.) Variable - assuming the cost of a pig at birth, weaning, and nursery of \$12.00, \$40.00, and \$65.00, respectively, cost by sire were adjusted based on the average age at removal of their commercial offspring. The total value per sire was calculated as the sum of the genetic value and mortality value. Two additional scenarios were investigated to determine the impact of removing the lower 16% of the sires, based on ranking the sires by either Percent Marketed or CTSI. Economic values are expressed as a deviation from the average of both CTSI and Percent Marketed across sire groups, for cohorts of 100 pigs born (approximately one week of semen production).

**FIGURES 2 & 3** illustrate the relationship of the total value per sire per 100 pigs born with genetic merit and percent marketed, respectively, based on cost of removals adjusted for age at removal described above. Similar results were found for the fixed cost of removal analysis, only varying for individual sires at both tails of the age at removal distribution. Investigating these graphs together leads the authors to believe there is a closer relationship between percent marketed and total value than there is between genetic merit and total value. This conclusion is further supported by **TABLE 2**. When removing the bottom 16% of the sires based on percent marketed, there is a four-fold improvement in total value compared to removing the bottom 16% of sires based on genetic merit (~\$0.80/pig versus ~\$0.20/pig).

These data would suggest there is a slight relationship between genetic merit and percent marketed, with animals of higher genetic merit tending to produce commercial progeny with a lower rate of survival to market. Results also indicate more improvement in profitability can be made by increasing the percent of pigs going to market than by selecting for genetic merit alone. While breeding stock companies and seedstock suppliers have made rapid progress in performance traits in terminal breeds/lines, this study illustrates the need to include some measure of survival/mortality/percent marketed in the breeding goal. This type of analysis is not trivial, and solid removal records are critical to the success of including survival in any genetic program.

**TABLE 1. DESCRIPTIVE STATISTICS FOR SIRE-GROUP AVERAGES (220 DUROC SIRES) FOR SURVIVAL TO MARKET**

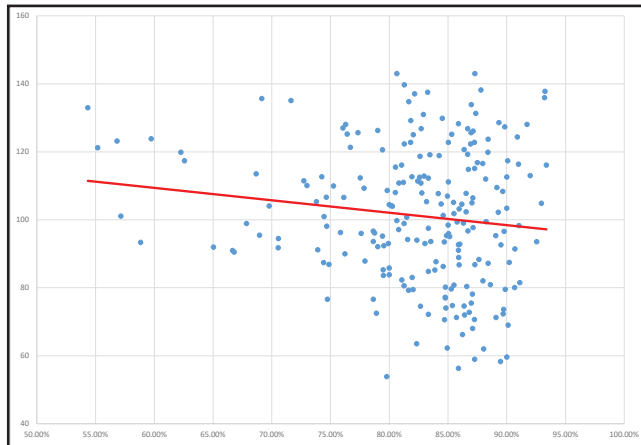
|                     | Average | St. Deviation | Minimum | Maximum |
|---------------------|---------|---------------|---------|---------|
| Pigs Born           | 181.5   | 75.2          | 52      | 528     |
| Pigs Marketed       | 149.4   | 63.2          | 33      | 436     |
| Percent Marketed, % | 82.4    | 7.3           | 54.3    | 93.4    |
| Removal Age, d      | 24.1    | 10.3          | 8.9     | 66.5    |

**TABLE 2. VALUE OF GENETIC MERIT & REMOVALS FROM COMMERCIAL PROGENY GROUPS OF 220 DUROC SIRES**

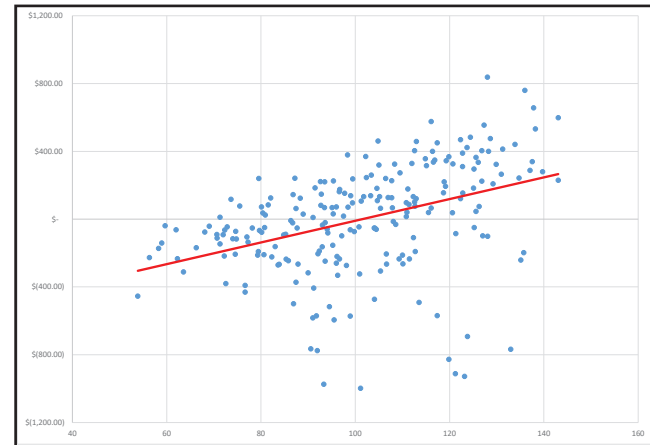
| Scenario <sup>1</sup> |          | CTSI <sup>2</sup> | Percent Marketed <sup>3</sup> | Value/100 pigs born – Fixed <sup>4</sup> | Value/100 pigs born – Variable <sup>5</sup> |
|-----------------------|----------|-------------------|-------------------------------|--|---|
| All Sires             | Mean     | 101.2             | 82.4%                         | (\$1.94)                                 | (\$1.76)                                    |
|                       | St. Dev. | 20.0              | 7.3%                          | \$334.31                                 | \$318.23                                    |
|                       | Minimum  | 53.9              | 54.3%                         | (\$1,059.48)                             | (\$997.46)                                  |
|                       | Maximum  | 143.0             | 93.4%                         | \$799.23                                 | \$838.37                                    |
| Mortality             | Mean     | 100.6             | 84.6%                         | \$89.53                                  | \$82.23                                     |
|                       | St. Dev. | 20.5              | 4.1%                          | \$239.91                                 | \$236.61                                    |
|                       | Minimum  | 53.9              | 75.2%                         | (\$485.49)                               | (\$453.61)                                  |
|                       | Maximum  | 143.0             | 93.4%                         | \$799.23                                 | \$838.37                                    |
| Genetic               | Mean     | 106.3             | 81.9%                         | \$20.69                                  | \$21.35                                     |
|                       | St. Dev. | 16.4              | 7.6%                          | \$350.16                                 | \$332.39                                    |
|                       | Minimum  | 78.2              | 54.3%                         | (\$1,059.48)                             | (\$997.46)                                  |
|                       | Maximum  | 143.0             | 93.4%                         | \$799.23                                 | \$838.37                                    |

1. Scenarios: All sires included; Mortality – bottom 16% of sires removed, ranked by Percent Marketed; Genetic - bottom 16% of sires removed, ranked by genetic merit (CTSI)
2. CTSI = Commercial Terminal Sire Index, proprietary index of genetic merit based on a combined purebred/crossbred genetic evaluation, value assumed as \$0.10/index point/pig produced
3. Progeny marketed per Duroc sire, as a percentage of the number born
4. Combined value of genetic merit and percent marketed for each sire group as a deviation from the group mean, based on a cohort of 100 commercial pigs born, and a fixed cost of \$42.00 per pig removed
5. Combined value of genetic merit and percent marketed for each sire group as a deviation from the group mean, based on a cohort of 100 commercial pigs born, and a variable cost of \$12.00, \$40.00, and \$65.00 for a pig at birth, weaning, and nursery, respectively, with cost per sire adjusted based on the average age at removal of their commercial offspring

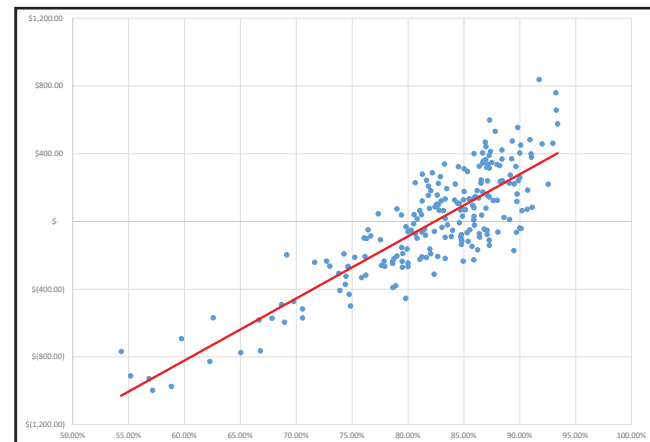
**FIGURE 1. GENETIC MERIT VERSUS PERCENT MARKETED FOR COMMERCIAL PROGENY OF 220 DUROC SIRES**



**FIGURE 2. GENETIC MERIT VERSUS TOTAL VALUE PER SIRE PER 100 PIGS BORN**



**FIGURE 3. PERCENT MARKETED VERSUS TOTAL VALUE PER SIRE PER 100 PIGS BORN**



**REFERENCES**

<sup>1</sup> Lemmon, M. *US swine industry structure and disease control: A "wicked" problem*. 2017. American Association of Swine Veterinarians Annual Meeting. Denver, CO.



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