GENETIC PROGRESS OF THE U.S. YORKSHIRE BREED[1]

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SUMMARY

Across-herd Expected Progeny Differences for Yorkshire pigs born since 1982 were analyzed to determine the amount of genetic trend which has taken place in the breed. Five traits and three indexes were examined. Four traits and all indexes have shown a trend in the desired direction since 1987-1988; at that time, genetic evaluations were first calculated using animal model technology and used by a substantial number of breeders. Means for animals which became parents have been consistently superior to nonparent means. The fifth trait, which is not reported to breeders, has shown no change. The improvement in performance reflected by the maternal line index is worth more than $10 for each litter produced by a daughter of a Yorkshire animal, relative to the beginning of the program.

INTRODUCTION

For the past eight years, Purdue University, USDA-ARS, USDA-ES, and the U.S. swine breed associations have collaborated in the development, implementation, and facilitation of use by breeders of STAGES, the Swine Testing and Genetic Evaluation System (Schinckel et al., 1986; Harris et al., 1989; Stewart et al., 1991). This system is based upon a set of computer software to process, in a timely manner, the performance records from individual breeders, and return EPDs (Expected Progeny Difference; .5 Expected Breeding Value) and selection indexes. Postweaning and maternal traits are analyzed separately. Within-herd analyses, using a multitrait reduced animal model, are run on a daily basis on the breed association computers. Periodic across-herd multitrait animal model analyses are made for the same traits and indexes. Information from the across-herd analyses is used to adjust subsequent within-herd analyses to an across-herd basis.

The American Yorkshire Club has been progressive in implementing and using this genetic methodology. Currently, annual submissions total 23,000 reproductive records and 48,000 postweaning records. Across-herd analyses are made twice a year for Yorkshires. For these analyses, the genetic base is the animals in the first across-herd animal model analysis, which was run in May 1992. Results from the latest across-herd analysis, in October 1993, were used to determine genetic trends in the breed.

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MATERIALS AND METHODS

Postweaning EPDs are obtained for days to 105 kg (DAYS) and backfat thickness adjusted to 105 kg (BACK); an EPD for feed conversion (kg feed/kg gain) is calculated from its correlation to DAYS and BACK. Reproductive EPDs are obtained for number born alive (NBA), number weaned (NW; litter size at 21 days), and litter weight at 21 days (LW). Both NW and LW are adjusted to 10 pigs after transfer, and all three traits are adjusted for sow parity. Three indexes are calculated: Terminal Sire Index (TSI), including only postweaning EPDs; Sow Productivity Index (SPI), including only reproductive EPDs; and Maternal Line Index (MLI), including all EPDs (Stewart et al., 1986; Stewart et al., 1990).

The postweaning across-herd analysis included records for 97,586 pigs in 69 herds. The reproductive analysis included 130,583 records for 58,802 sows in 745 herds. Resulting EPDs for animals with records and their parents were averaged by the year of birth of the animal. Animals were classified as 'parents' or 'nonparents'. Parents were defined as sires and dams of animals with performance records. The EPDs were weighted by the number of progeny records for the animal when obtaining the means. Nonparents were defined as animals with performance records (young pigs or sows) which did not yet have progeny with performance records. The difference between animals born in a given year which became parents and those which did not is a measure of the selection differential.

Regressions of mean EPD on year were calculated to quantify the change that has occurred over time. Most traits showed a nonlinear trend: there was little overall trend during the first years, followed by an improvement in EPD in the later years. The point where the trend changed was 1987 or 1988 for all traits. Because of this, linear regressions were calculated separately for years 1982-1987 and 1987-1992.

RESULTS

Table 1 contains the mean EPDs for each birth year for the individual traits, with linear regressions for years 1987-1992; regressions for the earlier time period were not significantly different from zero, and are not listed. For the postweaning traits (DAYS and BACK), the first pig records were collected in 1985, and only a limited number of pigs from a few herds were tested prior to 1988. Mean EPD fluctuated during the first few years, but have been decreasing (moving in the desired direction) since 1988. During this time period, parent means have been consistently superior to nonparent means, indicating the selection pressure for these traits. Average EPDs for DAYS have improved by 1 day. For BACK, nonparents have improved over .5 mm, while selected parents have improved by 1.3 mm.

The maternal traits of NBA and LW showed little change in EPD for the first few years; STAGES EPDs were first calculated in 1987. Parent EPDs for NBA have been superior to nonparents since 1987, while parents have been superior for LW in all years except 1982. Thus there has been selection pressure placed on these traits. As a result, mean EPDs have increased (moved in the desired direction) since 1987 for these two traits. The improvement has been approximately .1 pig born alive and .5 kg litter weight The third maternal trait is NW. This is not reported to breeders. It is the number of pigs at 21 days, adjusted to 10 pigs after transfer, and gives a measure of pig survival to weaning. Its EPDs have shown no change.

Table 2 contains the means for the three economic indexes calculated by STAGES, for parents and nonparents from 1982 until 1992, with linear regressions for years 1987-1992. Indexes are scaled so that an animal with EPD of 0 will have an index of 100. These are economic indexes with an improvement of 1 index point indicating a $1 increase in value of each litter produced by the animal's progeny.

Table 1. Mean EPD[1] by birth year for Parents (PAR) and Nonparents (NON).

Birth	DAYS		BACK(mm)		NBA		NW		LW(kg)	
Year	PAR	NON	PAR	NON	PAR	NON	PAR	NON	PAR	NON
1982	3.23	—	.16	—	.02	.03	.01	.03	-.09	.13
1983	.60	—	.02	—	.04	.02	.01	.01	.11	-.14
1984	1.32	—	.27	—	.01	.01	.01	.01	.12	-.18
1985	.22	.42	.08	.09	.03	-.01	.01	.01	.07	-.21
1986	.22	.71	.34	.19	-.01	.00	-.00	.00	.14	-.16
1987	.67	.47	.20	.18	.03	.00	-.01	.01	.14	-.06
1988	.09	.80	-.07	.25	.06	.01	-.00	.00	.36	.01
1989	-.02	.21	.10	.21	.05	-.00	-.01	-.01	.28	-.01
1990	-.42	.16	-.26	.19	.11	.04	-.01	-.01	.54	.15
1991	-.49	-.02	-.76	-.03	.08	.08	.00	-.01	.49	.42
1992	-.45	-.29	-1.12	-.44	—	.12	—	-.01	—	.61
Reg[2]	-.22	-.18	-.26	-.11	.02	.02	.00	-.00	.09	.14

[1] DAYS = Days to 105 kg; BACK = Backfat thickness; NBA = Number Born Alive; NW = Number Weaned; LW = Litter Weight at 21 days.
[2] Linear regression of EPD on year, for years 1987-1992.

Table 2. Mean indexes[1] by birth year for Parents (PAR) and Nonparents (NON).

Birth	TSI		SPI		MLI	
Year	PAR	NON	PAR	NON	PAR	NON
1982	85.11	—	100.25	101.01	95.44	—
1983	97.31	—	100.75	100.26	98.20	—
1984	91.80	—	100.43	99.97	96.83	—
1985	98.27	97.30	100.48	99.76	99.48	97.83
1986	95.51	95.11	99.94	99.91	97.13	97.39
1987	95.10	96.11	100.38	100.11	98.88	98.32
1988	100.31	94.07	101.09	100.08	102.54	98.65
1989	99.00	96.91	100.77	99.80	100.69	99.32
1990	104.43	97.22	101.88	100.55	104.41	99.32
1991	109.93	100.09	101.77	101.43	106.38	101.23
1992	113.56	105.46	—	102.19	110.88	104.88
Reg[2]	3.62	1.86	.36	.43	2.15	1.16

[1] TSI = Terminal Sire Index; SPI = Sow Productivity Index; MLI = Maternal Line Index.
[2] Linear regression of index on year, for years 1987-1992.

The TSI includes only postweaning EPDs. There has been a positive change since 1987, when the individual traits began to show a consistent improvement. Parents have been superior to nonparents during this time. The overall change has been 9.3 index points for nonparents, and over 18 index points for selected parents.

The SPI includes the three maternal EPDs. Although there were small selection differentials, there was not much change until about 1987, at which time the parent average started to increase, with the nonparents following two years later. Parents were superior to nonparents in most years. The overall change has been approximately 2 index points.

The MLI includes all EPDs, with twice as much emphasis placed on the maternal traits as on the postweaning traits. The MLI have been generally increasing since 1987 for parents, with nonparents following a few years later. Parents have been superior to nonparents during this time. The increase in MLI has been 6 index points for nonparents, and more than 10 index points for selected parents.

DISCUSSION

There was little change in EPD prior to 1987-1988, but there have been substantial selection differentials and a nonlinear change in the means in the desirable direction for all reported traits and the three indexes since that time. The non-reported trait analyzed (NW) has not exhibited any change in mean EPD. The change in trend beginning in 1987-1988 coincides with the availability and substantial usage of STAGES evaluations by breeders.

The genetic change seen in Yorkshires is commercially relevant. The improvement in performance reflected by the Maternal Line Index is worth more than $10 for each litter produced by a daughter of a Yorkshire animal, relative to the beginning of the program.

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