National Genetic Evaluation Programs in the USA

Tom Long

The American swine industry is similar to the Australian pig industry in that large sectors of the seedstock sector are still made up of smaller, independent breeders, although this situation may be changing for both industries. It differs from the Australian industry by slaughtering pigs at heavier weights, finishing barrows instead of boars, feeding more energy-dense diets, having different payment schemes for market pigs, and being more than 20 times the size of its Australian counterpart. In spite of these differences, it would still be useful for Australian breeders to examine the American swine industry and national genetic evaluation programs being initiated there to assess whether these programs contain directives the Australian industry might find beneficial to implement. The objective of this paper is to present those American initiatives.

As with the pig industries in other countries, the American swine industry realised in the 1980's that it needed to improve production efficiency and the genetic merit of its breeding stock to remain competitive with other meats domestically and in the international export market. In 1981 a team of US producers and scientists developed a standard of production efficiency called SYMBOL. The production attributes for SYMBOL were, a 109kg crossbred barrow from a litter of 10 pigs weaned, with 17.8mm of backfat at the last rib, a loin eye of 37.4cm2 and a feed efficiency of 2.5. This was a benchmark for breeders and producers to work toward.

When dealing with issues of improving genetic merit, commercial producers need to address two questions:

1. What breeds/lines are best to use?, and
2. What are the best animals in a breed/line?

To address the first question, in 1988 the National Pork Producers Council (NPPC), an organisation which performs similar functions for the US swine industry that the Pig Research and Development Corporation and the Australian Pork Corporation do for the Australian pig industry, initiated a program termed the Pork Challenge. This program was a commercial product evaluation of some of the breeding stock sources available. Samples of progeny from sires produced by different seedstock suppliers were tested together to determine production characteristics and carcase quality. Table 1 presents some of the results from the Pork Challenge from 1988-1990.

Table 1. Pork Challenge Results (1988 - 1990) (Source: R. Goodwill, Personal Communications)

		Loin Muscle Area (sq cm^2)			Tenth Rib Backfat
Breed of Sire	**Pigs Tested**	**Average**	**Minimum**	**Maximum**	**Average (mm)**
DeKalbL77	220	38.2	22.9	56.8	25.2
Duroc	297	36.1	22.0	52.3	24.9
Farmers Hybrid	274	37.7	24.8	58.7	26.2
Hampshire	308	37.6	26.1	58.1	23.4
PIC L26	197	37.5	21.9	58.1	21.6
Yorkshire	175	33.9	22.6	47.1	26.4

Since the majority of payment schemes for market pigs in the US have centred on backfat and degree of muscling, traits that reflected these schemes are considered important. Although this was a relatively small trial, this trial was important in being an objective comparison of swine seedstock.

This year the NPPC has carried this further in initiating a new program to aid producers in making genetic comparisons between breeds/lines, the Terminal Line Program. This program is designed to evaluate and benchmark the genetic merit of sire lines/breeds. Traits that will be evaluated include:

- average daily gain
- backfat
- feed efficiency
- leg soundness
- carcase length
- dressing percentage
- loin muscle area
- loin tenderness, flavour and juiciness
- loin intramuscular fat
- loin moisture content
- loin cooking loss
- meat firmness
- meat colour

A schematic of the Terminal Line Program is presented in Figure 1. Semen from young boars representing the breeds/lines to be evaluated is sent to one of the semen processing labs, where it is extended, labelled and sent to participating commercial producers. York-

Landrace F1s, PIC, DeKalb, Your-Hampshire F1s and Farmers Hybrid make up the majority of the genetics in the sow base. Cooperating commercial producers must meet specific health standards and use a computer-based management program such as Pig Champ. Sows are bred and from each resulting litter, NPPC purchases 1 – 2 pigs at 10 to 20 days of age. These pigs are then taken to medicated early weaning (MEW) stations and, using commingling procedures, pig health is standardised. At 40lbs, pigs are moved to a central testing facility where production traits, such as average daily gain, feed efficiency and leg soundness are measured. Animals are slaughtered and carcase measurements (eg. backfat, length, loin muscle are) taken. Loin chops are removed from each carcase and sent to a meat laboratory to assess meat quality, composition and eating quality. These data, along with information from other sites will be collected by NPPC and sent to a research university for analysis.

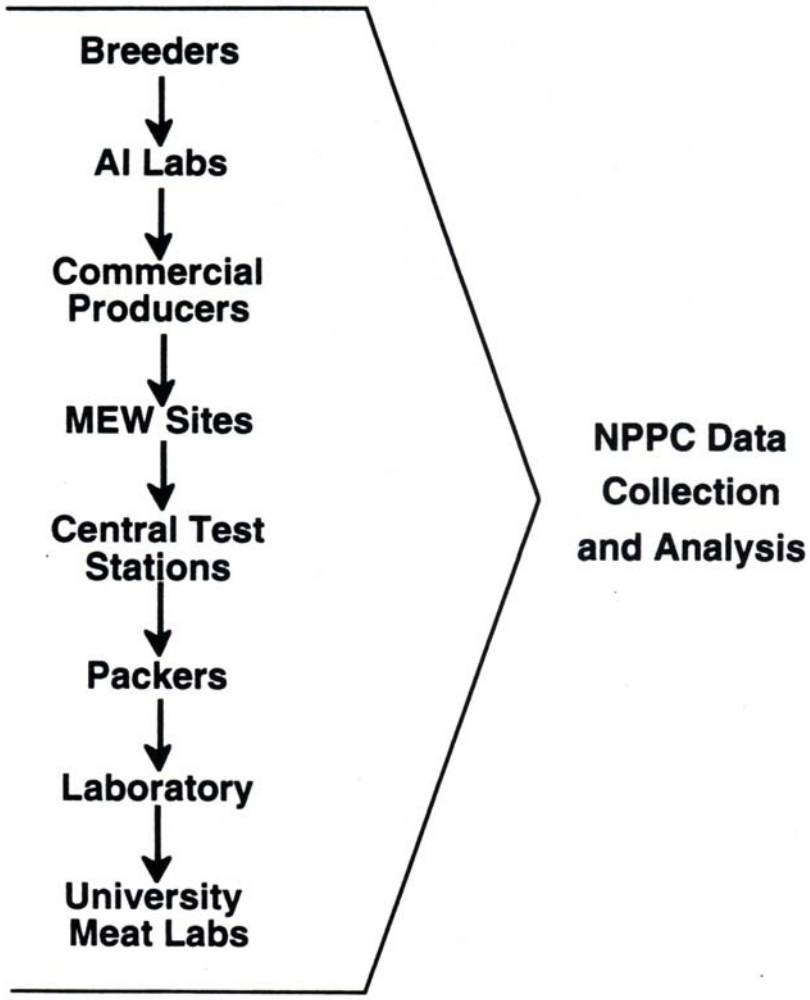


Figure 1. Schematic of the Terminal Line Program

The first round of matings began January, 1993 with semen from 130 boars used to breed 650 sows in 45 cooperating commercial herds. The second round of matings, in March, involved over 1000 sows. This program has a target, for each breed/line tested, to have 46-85 sires represented by 190-360 tested pigs. Results are expected by 1995, and the estimated cost of the program over the first three years is $1.2 million US. The program is being paid for using funds from the NPPC levy which is .3% of the market price charged on each pig slaughtered. For a 2501b market barrow this would be approximately 34c/head, depending on current market prices.

The Terminal Sire Program is an ambitious project and does require the cooperation of a number of sectors of the swine industry but does represent a serious attempt by the industry to benchmark the breeds/lines being used by commercial producers as terminal sires. A Maternal Line Program is also planned which will include sow reproductive performance as well as the production and meat quality traits included in the Terminal Sire Program. These two programs, when the data have been collated and analysed, will give US commercial producers excellent information regarding optimal breeds/lines to use in the crossbreeding programs they are implementing on-farm.

Segments of the US industry are addressing the second question of commercial producers ("What are the best animals in a breed/line?") through a genetic evaluation program called STAGES (Swine Testing and Genetic Evaluation System). This system has been a cooperative project of Purdue University, the US Department of Agriculture and several swine breed associations. The system uses BLUP technology and calculates Expected Progeny Differences (EPDs), which are predictions of performance for future offspring. The traits that STAGES analyses are number born alive (NBA), litter weight at 21 days (LW21), days to 230lb (DYS) and backfat depth (BF). Analyses are run at a central processing centre on a main frame computer at West Lafayette, IN.

Three indexes have been developed for breeders to use:

1. TSI - a terminal sire index
2. MLI - maternal line index, and
3. SPI - a sow productivity index.

The terminal sire index uses only information on DYS and BF, the maternal line index uses both growth and maternal data, and the sow productivity index uses only NBA and LW21. Correlations between the STAGES indexes and performance traits are given in Table 2.

Table 2. Correlations between STAGES Indexes and Performance Traits

	Index		
Trait	TSI	MLI	SPI
Days to 2301bs	-.81	-.60	.14
Backfat Depth	-.68	-.58	-.01
Number Bom Alive	-.07	.19	.83
Litter 21-day Weight	-.01	.31	.52

Analyses are performed for breeders routinely on a within-herd basis and EPDs and indexes are sent to them on-farm. Periodically, across-herd evaluations are performed for herds which have appropriate genetic linkages. The American Yorkshire Club has adopted the system to a much greater extent than other US breed associations, and current annual data submissions from Yorkshire breeders total 22,000 sow productivity records and 32,000 individual records for growth and backfat. Genetic trends from the Yorkshire across-herd analyses were presented by Lofgren et al. (1993) and Figures 2 and 3 present these trends for DYS, BF, NBA and LW21. Trends were presented for a 10 year period and compared EPDs for animals which became parents versus those which did not become parents. Note that for most traits substantial movement in the trends did not occur prior to 1988 (the STAGES program was initiated in 1985).

Although US breeders have yet to have the facility to do BLUP genetic evaluations on-farm as with PIGBLUP, they do have access to the BLUP technology through the STAGES program. They are able to have across-herd analyses run due to the increased use of AI by breeders such that genetic linkages between herds have been established. With the Terminal Line Program, producers will have increased information regarding the genetic characterisation of available breeds/lines, which will aid in establishing optimal crossbreeding programs. Whether initiatives such as these are applicable to the Australian pig industry are dependent on:

1. potential funding
2. the desire by involved parties to do some form of breed/line commercial product evaluation, and
3. increased uptake of AI technology.

However, they should be considered given the increased competitiveness of the pig industry world wide.

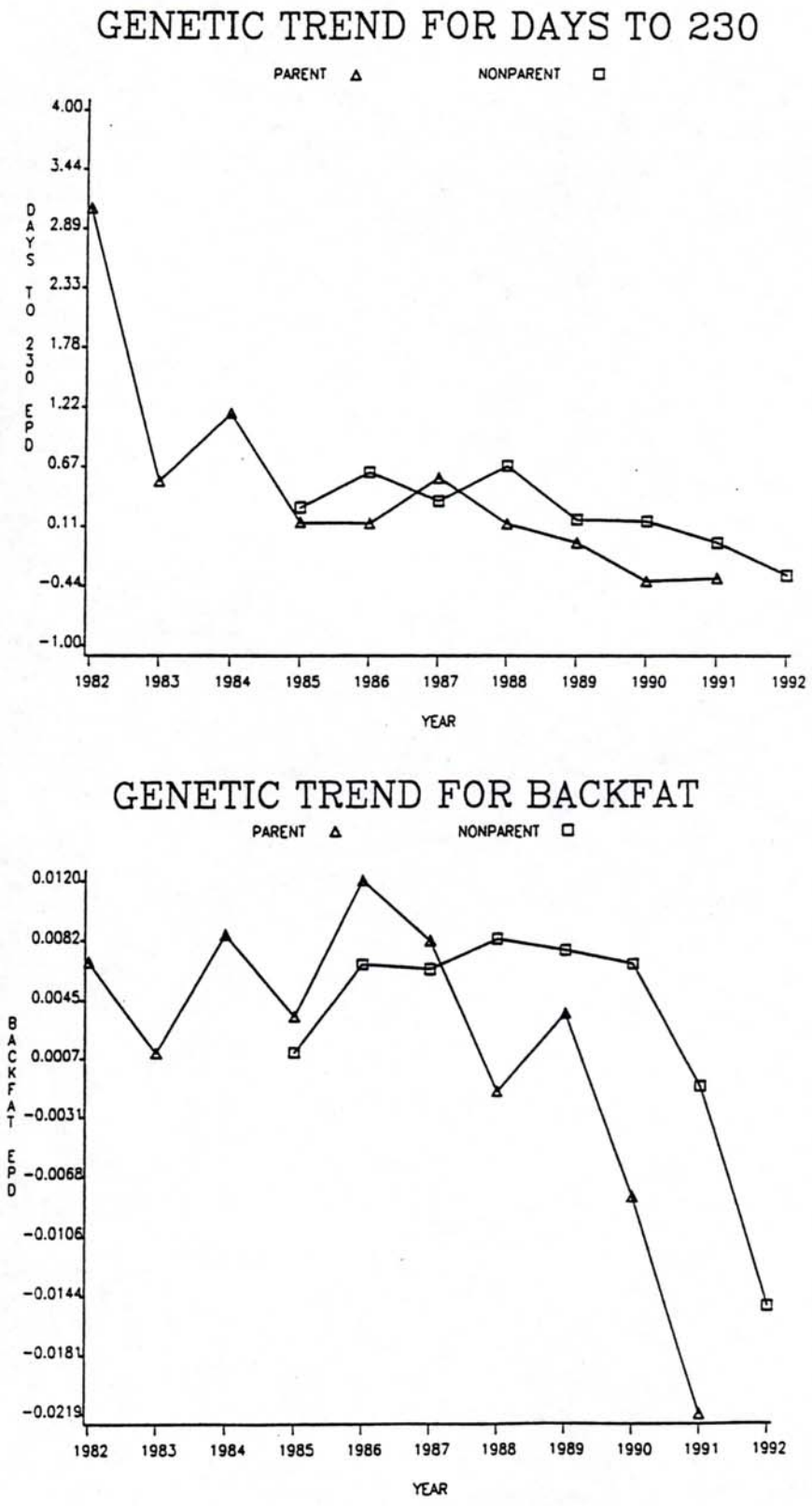
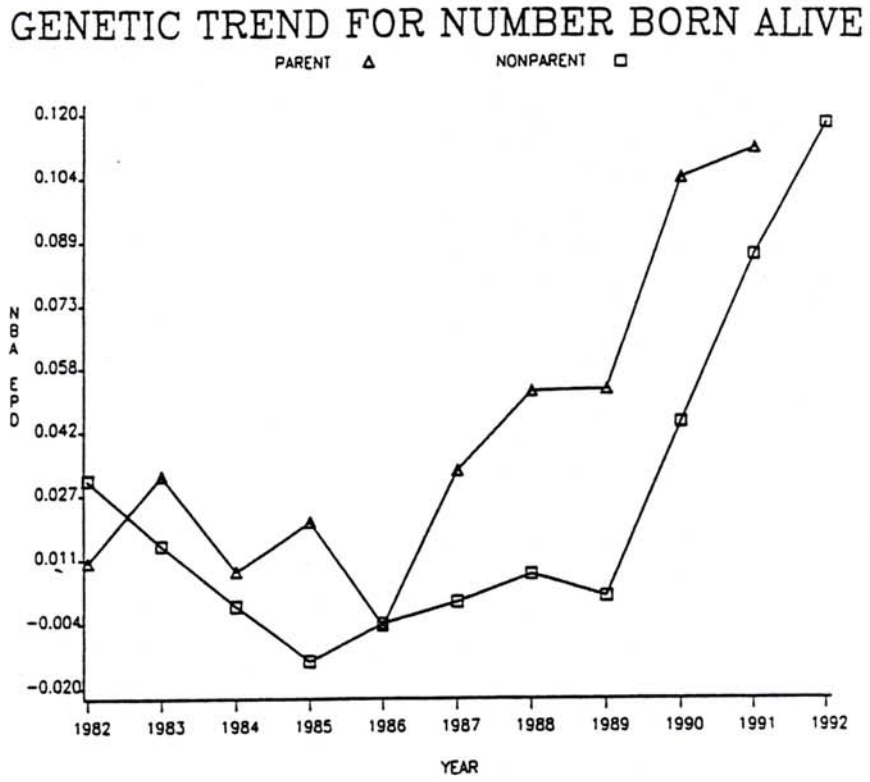


Figure 2. (Source: T. Stewart, Personal Communications)



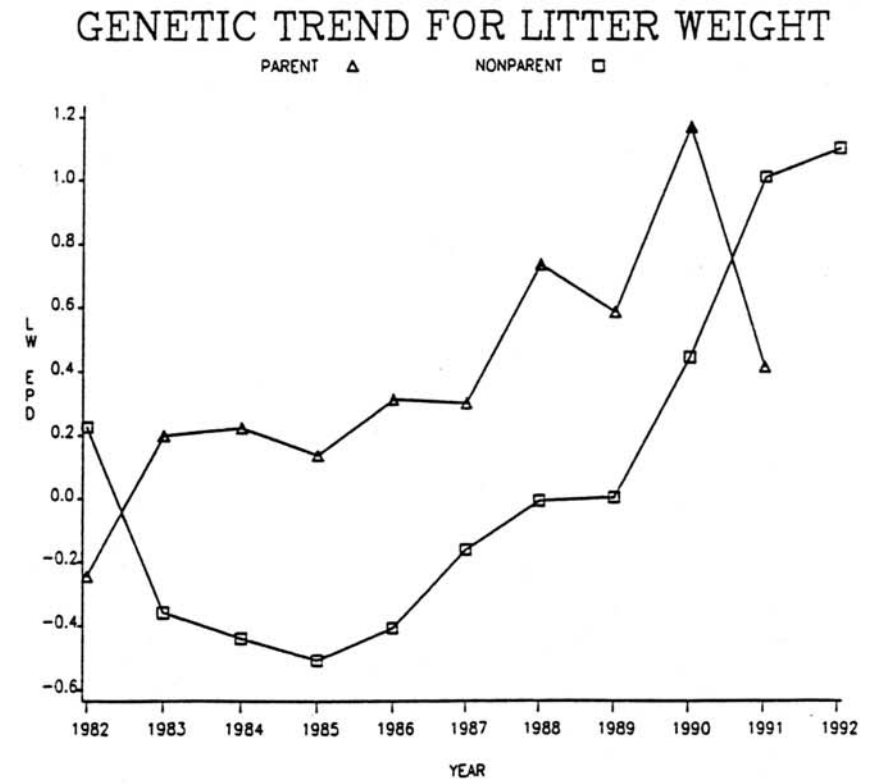


Figure 3. (Source: T. Stewart, Personal Communications)

NOTES