Progeny test for AI-sires based on Held results regarding growth and carcase traits using electronic identification systems in pigs

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1 Introduction

In Germany the estimation of breeding values of young boars and sows is based on their own data for daily gain and backfat as well as full- and/or half-sib information on carcase traits. In breeding companies young boars are often tested under test station conditions using individual pens to get information on feed conversion while gilts are raised in groups and tested at 90 kg of weight for lifetime average daily gain and backfat thickness. Pedigree breeders in Germany use central test station results of full-and/or half-sibs regarding carcase traits including meat quality in connection with on-farm test results for gilts and auction test results for young boars to evaluate potential breeding stock. Within breeding companies full- and/or half-sibs are tested on production farms using group housing and feeding. Some authors (Brascamp et al. 1985, Merks 1988, Meier 1990) have shown there is the potential for some genotype-environment interaction to occur in pig breeding, which could reduce the efficiency of breeding programmes. The conclusion of these authors is to test animals in the production environments where progeny will be performing. Therefore the efficiency of estimation of breeding values could be increased by using field test results of progeny in conjunction with the testing schemes described above. In all German abattoirs slaughter pigs are automatically recorded on an individual animal basis. This information could be of great value for optimising the estimation of breeding values for boars and sows in breeding programmes, but there is still an unsolved identification problem. To use the abattoir information for breeding purposes information such as identification of parents and date of birth have to be known. On weaner production farms in modem breeding programmes this information is known but the transfer of information and identification between weaner production farm, fattening farm and abattoir is poor or non-existent. Therefore, an approach to link information between the weaner production farm, fattening farm and abattoir using electronic identification systems will be discussed in this paper. The potential for using this information collected at abattoirs, as a progeny test for terminal sires in a breeding program will be shown.

2 Data flow using electronic identification for pigs

The development of electronic identification systems (chips) for slaughter pigs has been described by Van der Weghe (1988 and 1990) and Weltz et al. (1992). An experiment with nearly 5000 pigs (Niggemeier, 1991) showed that only one to two percent of chips implanted in the base of the ear of piglets between 6 and 25 kg were lost within the first week after implantation, while further losses after the first week of implantation and damaged chips were not reported in that trial. After slaughter 90 to 95 percent of all chips were found immediately and the rest after a short search. With more accurate implantation of chips the number of losses could be reduced, and the number of recovered chips at slaughter could be increased.

The AI stations of Ascheberg, Bethen and Oldenstadt in connection with regional organisations of the 'Bundeshybridzuchtprogramm' (BHZP=Federal Hybrid Breeding Programme) have started a project to estimate breeding values for their terminal sires on the basis of progeny results obtained from normal fattening farms. The selection criteria for young boars to become AI sire are based on own test results including backfat thickness and daily gain measured on boar multiplier farms. The selected boars are normally used in AI between 1.5 and 2 years, so there is time enough to use the information from the first slaughtered progeny for further selection. Because these AI sires are only used for production of final crosses this selection will not increase the generation interval in a breeding program but it could improve production levels for the commercial sector.

The data flow between AI stations, weaner production farms, fattening farms and abattoirs is shown in Figure 1. All piglets produced on weaner production farms are implanted with chips and using the sow management recording program of BHZP, there is the possibility of recording these chip numbers of piglets within their litter record. The contracted weaner production farms are using about 60 to 70 percent artificial insemination. Mainly the semen of young boars selected for AI is used on these farms to obtain 15 to 20 litters born per boar within a short period. After weaning all piglets born are transferred to normal fattening farms. These farms take only fattening piglets with chips from one or two weaner production farms. The market animals are slaughtered at a single abattoir within a region. At the abattoir carcase traits (carcase weight, meat percentage, muscle depth, backfat thickness and meat quality) and chip number are recorded automatically. At the AI station the information from the abattoir is combined with the data stored in the sow management program. Information about further relationships between sires and sows is also available.

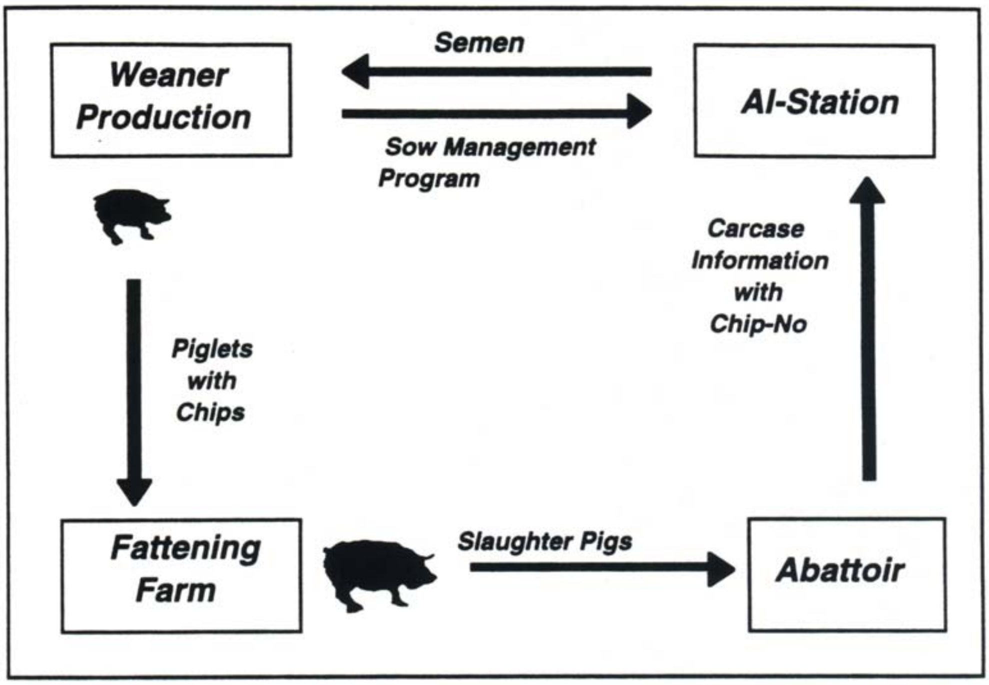

Figure 1. Data flow using electronic identification in pigs

3 Estimation of breeding values

Although the slaughter pigs are crossbred pigs the estimation of breeding values of boars and sows is realised by using a mixed model that doesn't include dominance effects. This has been done for practicality of computing. The main justification for ignoring nonadditive effects in the model is the fact that these sires are terminal sires and the ability to produce slaughter pigs should be the selection criteria. Thus it is not necessary to estimate additive and nonadditive effects separately. Breeding values are estimated for meat percentage and net lifetime average daily gain (only carcase weight is available).

The estimation of breeding values is done within the regional organisation of the BHZP (eg. for AI boars at the AI stations of Ascheberg and Bethen/Oldenstadt, respectively). Breeding values for meat percentage and net lifetime daily gain are combined into an index using the approach described by Schneeberger et al. (1991) with weighting factors of .12 DM per gram of daily gain and 4.50 DM per percent meat.

4 Results

The AI station of Ascheberg started this progeny test in 1990. In May 1991 the method of measuring meat percentage was changed, so that only data from June 1991 are included in this analysis. The AI stations of Bethen and Oldenstadt started to slaughter the first animals in June 1992. A detailed description of the data available is summarised in Tables 1 and 2.

Table 1. Description of data sets analysed

	Ascheberg	Bethen/Oldenstadt
Pigs slaughtered	9185	3058
Sires	98	35
Dams	910	323
Litters	1504	429
Fattening farms	14	8
Weaner production farms	5	5

Table 2. Means and standard deviations for net lifetime average daily gain (grams per day) and meat percentage (in %)

	Ascheberg		Bethen/Oldenstadt	
	mean	standard deviation	mean	standard deviation
Net daily gain	446	54.9	454	53.5
Meat percentage	54.7	3.19	54.9	3.05

The estimated breeding values for sires are based on an average of 87 progenies for the data set of the AI stations of Bethen/Oldenstadt and on an average of 95 progenies for the data of the AI-station of Ascheberg. For sows, on average, 10 progenies are tested per sow for both data sets. The results of the estimated breeding values are shown in Table 3. The differences of breeding values between sows are somewhat smaller than between boars. The difference between the best and the poorest boar at Bethen/Oldenstadt is about 25 DM in the index, 6 percent in meat percentage and 58 grams in net lifetime average daily gain. The differences between the best and the poorest boar at Ascheberg are 40 DM in the index, 7 percent in meat percentage and 104 grams in net lifetime average daily gain and, thus, much higher than those at Bethen/Oldenstadt. Comparing the average of the top genetic boars within each region there are only very small differences in all traits observed. All top genetic boars are about 6 DM in the index above the average of all tested boars.

Table 3. Standard deviations (std), maximum (max), minimum (min) of breeding values for sires and dams and average of top genetic boars (30% best ranked by index)

		Trait	Min	Max	Std	Top genetic
Bethen/ Oldenstad	Sires n=35	Net daily gain	-26	+32	16.2	+3.3
		Meat Percentage	-3.8	+2.3	1.40	+ 1.27
		Index	- 14	+11	6.1	+6.1
	Dams n=323	Net daily gain	-28	+23	8.8	-0.5
		Meat percentage	-2.6	+2.3	0.88	+0.97
		Index	-12	+12	3.8	+4.3
Ascheberg	Sires n=98	Net daily gain	-44	+60	19.1	+ 12.7
		Meat percentage	-4.8	+2.9	1.19	+0.93
		Index	-24	+16	5.6	+5.7
	Dams n=910	Net daily gain	-36	+87	10.7	+2.7
		Meat percentage	-3.2	+2.9	0.90	+ .96
		Index	-13	+12	3.9	+4.7

5 Costs of progeny tests

The AI station of Ascheberg is testing 40 boars per year with about 10 litters per boar. Assuming between 60 and 70 percent artificial insemination on the weaner production farms, 300 to 350 sows would be required per year, so 4 weaner production farms will be needed to be involved in the testing. Taking into account a price of 7 DM for each chip and an average of 8 piglets per litter, the costs of microchips for the 40 boars sum up to 22400 DM per year. With some additional costs of equipment for implantation and antenna to read the chips this progeny test will cost about 600 DM per boar (24000 DM per year). The identification of all piglets does not involve additional labour costs since other identification systems require similar amount of time. The price of chips will probably reduce in the near future.

The AI station will select the 30 percent best boars, the so called 'Top Genetic Boars', and will charge the farmer an extra 2 DM for a dose of semen from a top genetic boar. 12 top genetic boars (30 percent out of 40 tested) each giving 20 doses per boar of semen per week will provide about 1000 doses per boar per year. So the AI station is getting an extra income for top genetic boars of 24000 DM each year which will cover their testing costs.

6 Discussion

With the use of this electronic identification system it seems to be possible to use testing schemes under normal production environments to overcome the discussion of possible genotype environment interactions. The results show expected differences between boars and between sows. Although the advantage of top genetic boars will not increase the cumulative genetic gain for further generations it will increase the production level in meat percentage by 1 percent which is one third of a phenotypic standard deviation. The economic advantage from using only top genetic boars of 6 DM per slaughter pig justify the high testing costs per boar. To reduce the testing costs per boar a reduction in number of progeny per boar is possible without losing too much accuracy of estimated breeding values. Within these data some boars have more than 150 progeny tested which does increase the accuracy but with very high costs.

Within the abattoir the problem still exists of finding the chip without additional time requirements. At the moment there is no possibility of an automatic detection and removal of the chips. An ear tag with an integrated chip has been developed to solve the problem of detection. The chip in this ear tag is programmable for multiple use which could reduce the costs to 2 DM per pig.

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