

MAJOR AND MINOR GENE EFFECTS ON PIG TRAITS AND PROFITABILITY

C. P. McPHEE

Animal Research Institute, 665 Fairfield Road, Yeerongpilly, Qld 4105

Two common objectives in genetic improvement programs for pigs are to increase growth rate and reduce carcass fat. Both major and minor genes affect these traits. Major genes are of large effect and often of known position on the genome. The best example in pigs is the halothane gene. This gene can easily be substituted into or removed from a population using a DNA probe. Minor genes are of unknown number and position on the genome. The frequency of these genes is changed in the population by selection using mathematically predicted breeding values for fat and growth.

As detailed by McPhee *et al.* (1988, 1994, 1995), a line of pigs was selected for high growth rate and low backfat and a line maintained without selection. The halothane gene was segregating in both lines. Estimates were obtained of changes in growth rate and backfat either by increasing the frequency of minor genes by 5 generations of selection, or by substituting either 1 or 2 halothane genes in place of normal genes. Tables 1 and 2 report the changes brought about by each process. In addition to growth rate and fat, the 2 traits under direct selection, changes in other traits of economic importance, which were not under direct selection, are also reported.

Table 1. Changes in performance, carcass, survival and lean quality traits with selection for minor genes and substitution of 1 or 2 halothane genes

Traits	Mean	Selection for minor genes	1 hal. gene	2 hal. genes
Carcass wt (kg)	73.7	+7.4	-1.7	-6.5
Backfat (mm)	16.9	-5.4	-0.9	-1.6
Food Conv. Ratio	2.9	-0.25	-0.12	-0.15
Food Intake (kg/d)	2.5	+0.18	-0.15	-0.36
Mortality (%)	0.9	+0.1	+2.5	+15.8
PSE (%)	9.0	-8.0	+10.1	+21.3

Table 2. Contributions to profit/sow/yr (\$) (Spencer, pers comm) from changes in economically important traits

Traits	Selection for minor genes	1 hal. gene	2 hal. genes
Carcass Weight	+252	-58	-221
Backfat	+140	+23	+42
Food eaten	-91	+70	+170
Mortality	-3	-83	-383
PSE	+6	-8	-74
Total (\$)	+304	-56	-466

Under the conditions of this study, selection of minor genes for increased growth rate and reduced backfat gave substantial economic gain resulting largely from heavier carcasses of increased leanness. Substitution of a single halothane gene had a small negative effect on profitability but 2 halothane genes substantially reduced profitability mainly through increased mortality and reduced carcass weight and lean quality (increased PSE).

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