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Effects of group housing and feed intake recording during performance test on expected selection response in pigs

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Abstract

Group testing of pigs may lower genotype × environment interaction (GEI) between test station and commercial farms. In a model study, selection of pigs for daily gain, feed intake and meat percentage in individual housing was compared with selection in group housing. If GEI is not caused by differences in housing, individual testing and feed intake recording appeared to be more profitable than group housing. However, if by group testing and group feed intake recording the genetic correlation between similar traits in different environments is about 0.1 units higher compared with individual testing, then group testing is more profitable.

Keywords: pigs, performance testing, selection, genotype × environment interaction

Introduction

Potential breeding boars are often tested in individual pens, whereas under commercial conditions the progeny of these boars is fattened in groups. Differences in housing can be a source of genotype × environment interaction (GEI), making selection less effective (Merks, 1988). Group testing of pigs may decrease this interaction.

The aim of this model study is to compare expected genetic benefits from selection of sire-line pigs in individual housing with selection in group housing. Special attention is paid to the quality and quantity of the information on ad libitum feed intake.

Methods

Out of several testing systems, two are compared here: six litter mates in individual pens or together in one pen. The breeding goal consisted of daily gain and feed intake under commercial conditions (DGC and FIC, respectively) and percentage of

Table 1. Sets of mutual genetic correlations between DGC, FIC, DGT and FIT.[1]

	DGT	FIT	DGT	FIT	DGT	FIT	DGT	FIT
DGC	1.0	0.85	0.8	0.6	0.6	0.4	0.4	0.2
FIC	0.85	1.0	0.6	0.8	0.4	0.6	0.2	0.4

[1] Abbreviations: see text.

lean parts in the carcass (feed conversion is a correlated trait). The selection index consisted of daily gain and feed intake under test conditions (DGT and FIT) and ultrasonically measured backfat thickness. DGC and FIC were assumed to be genetically different from DGT and FIT. Four alternative housing and feed intake recording systems were compared: (1) individual housing with individual FIT recording, (2) group housing, individual FIT, (3) group housing, FIT per pen, (4) group housing, no FIT recording.

Genetic and phenotypic parameters and economic values were mainly based on estimates by Ketelaars (1979) and Knap et al. (1985). Common-environment components (c^2) were taken as 0.15 for full sibs housed in the same pen and 0.08 for full sibs in different pens. These values are in the range where there is a negative relationship between c^2 and expected selection response.

GEI is inversely proportional to the genetic correlation between similar traits under test and commercial circumstances (r_{TC}). Merks (1988) found r_{TC} values for daily gain of −0.48 to 0.17 between central test and commercial fattening and of about 1.0 between on-farm test and commercial fattening. In this study, four sets of mutual genetic correlations between DGC, FIC, DGT and FIT were used (see Table 1).

Results and discussion

In Figure 1, correlations between selection index and breeding goal (r_{IH}, which is proportional to expected genetic change) are presented at varying r_{TC}. If $r_{TC} < 0.8$, the change in FIC is negative. This is undesirable and, therefore, results of a restricted selection index (no change in FIC, but lower r_{IH}) are also presented (Fig. 1b).

Each alternative shows a decreasing r_{IH} with decreasing r_{TC} (increasing GEI). Individual housing and feed intake registration gives the highest r_{IH}. Differences between alternative 1 and alternative 2 are caused by the higher c^2 in group housing. In alternative 3, r_{IH} is lower than in alternative 2 because only the total FIT per pen is measured. Differences between alternative 3 and alternative 4 represent the value of total FIT per pen compared with no feed intake recording. If the change in FIC is restricted to zero, r_{TC} in group housing with recording of group feed intake has to be about 0.1 units higher than in individual housing and individual feed intake recording to achieve a higher genetic improvement (alternative 3 vs alternative 1). However, this value is higher at high values of r_{TC} and if the change in FIC is not restricted to zero. With individual feed intake recording, an increase of r_{TC} by

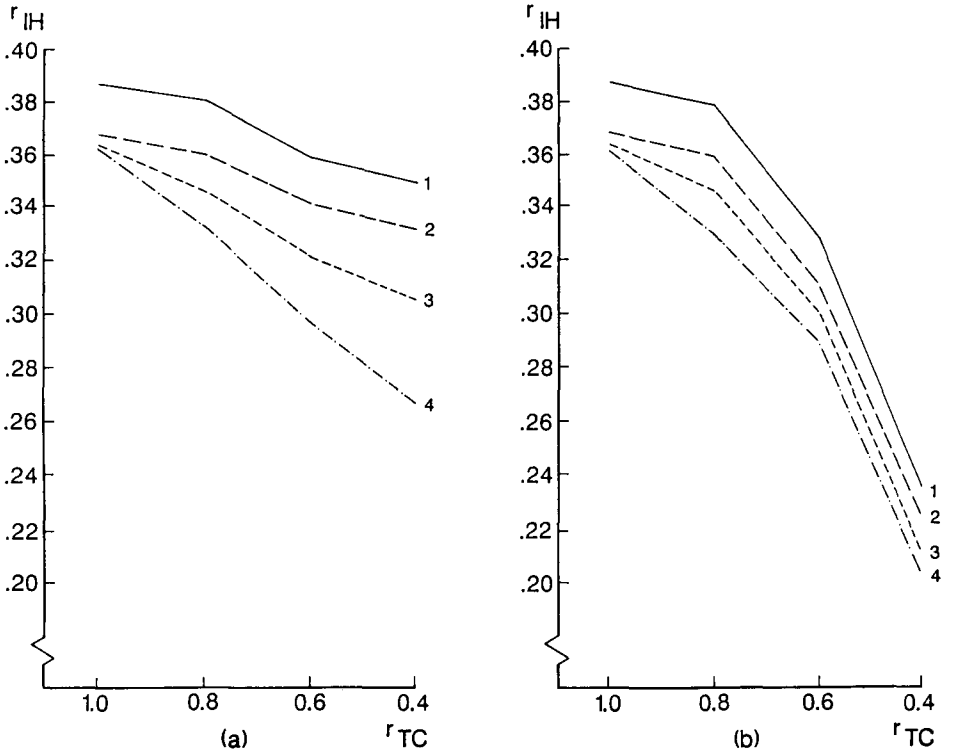

Fig. 1. Correlations between index and breeding goal (r_{IH}) for four sets of correlations between test station and commercial farms (r_{TC}), with change in feed intake unrestricted (a) or restricted to zero (b). —— 1: individual housing, individual feed intake, — — 2: group housing, individual feed intake, - - - - 3: group housing, group feed intake, - · - · - 4: group housing, no feed intake recording.

about 0.05 units is sufficient to let r_{IH} with group housing be greater than with individual housing (alternative 2 vs alternative 1), but this value depends solely on the assumptions for c^2.

Selection in sire lines has been economically evaluated by means of gene-flow techniques (Brascamp, 1978). It was assumed that the breeding programme is based on testing of 4500 animals (males and females) yearly and that one million slaughter pigs are produced per year. As expected, the small differences between the alternatives in Figure 1b gave large differences in financial returns for the entire breeding program. For r_{TC} = 0.4 to 0.8, individual housing and FIT recording resulted in 1.11 to 1.41 million Dfl. more per year than group housing with recording of group feed intake (alternative 1-alternative 3). Recording of group FIT may cost Dfl. 390,000 to Dfl. 710,000 per year (alternative 3-alternative 4). Finally, recording of individual FIT in group housing (electronic feeding gates) may cost Dfl. 530,000 to Dfl. 610,000 per year (alternative 2-alternative 3).

Conclusions

Group testing of potential breeding pigs can be an interesting alternative for individual testing if it reduces genotype × environment interaction between test station and commercial fattening. Individual feed intake, but also feed intake per pen (litter) is important information for selection.

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