SELECTION FOR LEAN TISSUE GROWTH IN PIGS

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SUMMARY

Selection of pigs for lean tissue growth in the ham (LTGRH) was carried out in two lines, one given ad libitum, the other given restricted feeding. In both lines the progeny of selected parents showed increased LTGRH over the progeny of unselected parents, the realised heritability averaging 0.28. These increases were associated with increased growth rate, a consequent reduction in age at slaughter, and a decrease in live animal fat measurement.

INTRODUCTION

Improvement of lean tissue growth rate has been suggested as the most important single method of improvement of lean tissue feed conversion in pigs (Fowler et al. 1976). However the feeding conditions under which pigs are grown may affect their response to selection and feed conversion efficiency. In mice the use of restricted and ad libitum feeding regimes during performance testing for growth rate has given similar increases in the rate and efficiency of growth (McPhee 1982). Unfortunately, increased fatness and appetite have occurred in mice selected under ad libitum feeding but this does not occur with restricted feeding (Hetzel and Nicholas 1978; McPhee 1982). These results have supported the use of restricted feeding when selecting pigs for genetic improvement of the efficiency of lean growth (McPhee 1982).

This paper presents early results from a selection experiment designed to study the effects of ad libitum and restricted feeding regimes during performance testing on selection for lean tissue growth in the pig.

MATERIALS AND METHODS

Lean tissue growth rate in the ham (LTGRH) was used as the selectioncriteria in this study, because of the strong relationship between muscle content of the ham and that of the carcass (Evans and Kempster 1979).

The Large White-Landrace cross herd of the University of Queensland piggery at Pinjarra Hills was used in the selection experiment. Two groups of 16 sows each were chosen at random, one being designated as 'Ad libitum', the other as 'Restricted.' To reduce initial inbreeding, two Large White-Landrace boars were purchased and used with other herd boars in both herds. The two groups of breeding animals were given the same management and nutrition. The first litters from each herd were born in March 1980 and with a growth period of approximately six months the first young pigs were available for selection in September 1980.

Offspring of the Ad libitum group were given unlimited feed throughout their entire growth period to the normal market weight (approximately 90 kg). Offspring in the Restricted group were fed ad libitum up to approximately 40 kg live weight. From 40 kg to market weight their feed was restricted to approximately 80% of ad libitum intake. Commercial pig feeds were used at all growth stages. At a preslaughter weighing at the piggery ultrasonic measurements were made of fat depth at the side and right P2 positions (6.5 cm from the midline of the back at the last rib).

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Using the following formulas which were estimated from earlier work with this herd, an estimate of LTGRH was calculated for each pig:

Restricted pigs: LTGRH (g/d) = 2.67 + 0.05 GR (g/d) - 0.16 P2 (mm)

Ad libitum pigs: LTGRH (g/d) = 6.25 + 0.05 GR (g/d) - 0.25 P2 (mm)

where: GR = Growth rate from birth to slaughter; P2 = Average P2 fat depth.

After the first young pigs were available for selection, the groups were closed and replacement breeding stock chosen from within each group. Over a six week period the female with the best LTGRH in each group was retained as a replacement gilt subject to conformational soundness. Similarly the best boar over a 12 week period was retained for each group. Boars were culled after six months use and sows after five litters to maintain a constant herd size of two boars and 16 sows in both selection groups.

Measurements of carcass weight and fat depth at the P2 site (assessed by intrascope) were received from the abattoirs for each pig sent to market.

Analyses have been carried out on measurements of pigs slaughtered to the end of 1982. These involved data from 589 pigs (299 males and 286 females) in the Ad libitum group and 589 (282 males and 307 females) in the Restricted group. Over this time, six boars had been selected for breeding in each group while 16 and 19 gilts had been chosen for the Ad libitum and Restricted groupsrespectively.

RESULTS

Growth performance

The offspring of selected boars in both lines had increased growth rates and LTGRH over the offspring of unselected boars (Table 1). All differences were significant except that for growth rate among female offspring in the Ad libitum line. The increased growth rates caused significant reductions in age at slaughter except for females in the Restricted line. In general the offspring of selected and unselected sows followed similar trends but the differences were similar and were not significant.

Carcass traits

In neither line were there any consistent or significant differences in dressing percentage between the offspring of selected and unselected animals.

Both male and female offspring of selected boars in each line showed significant decreases in average P2 fat depth at the preslaughter weighing. However these changes were not reflected in the intrascope P2 fat depth measurements taken on the carcasses at the abattoirs.

Selection differentials

The selection differentials for LTGRH that were achieved among the animals selected to be parents in each line are given in Table 2 together with the associated differences in growth rate and live P2 fat. In each case the values for selected boars were greater than those for selected sows and all were positive except for P2 fat among sows in the Ad libitum line.

Realized heritabilities

Realized heritabilities for LTGRH, calculated as the ratio of progeny

difference over selection differential, are given in Table 3. The values for each line cover a similar range except for the negative figure for female progeny of restricted sows.

TABLE 1 Weighted differences in growth performance characters of offspring of boars and sows selected for LTGRH compared to offspring from unselected parents. Figures in brackets are weighted differences expressed as percentage of mean performance of offspring of unselected parents

Feed regime	Ad libitum		Restricted	
Sex of offspring	Males	Females	Males	Females
LTGRH (g/d)				
Selected boars	1.5 * (5.5)	1.1 * (4.6)	1.9 * (8.5)	1.2 * (5.7)
Selected sows	0.2 (0.7)	0.4 (1.6)	0.2 (0.9)	-0.1 (-0.5)
GROWTH RATE (g/d)				
Selected boars	26.7 * (5.3)	13.1 (2.8)	35.0 * (7.8)	22.6 * (5.3)
Selected sows	-0.7 (-0.1)	10.2 (2.1)	1.5 (0.3)	1.6 (0.4)
SLAUGHTER AGE (d)				
Selected boars	-5.6 *(-3.3)	-5.4 *(-3.1)	-7.8 *(-4.2)	3.7 (1.9)
Selected sows	-3.0 (-1.7)	1.0 (0.6)	2.0 (1.1)	6.3 * (1.5)
DRESSING				
Selected boars	0 (0)	0.2 (0.3)	-0.3 (-0.4)	0.4 (0.5)
Selected sows	0 (0)	-0.7 (-0.9)	0.1 (0.1)	-1.2 *(-1.6)
P2 FAT PRESLAUGHTER (mm)				
Selected boars	-1.2 *(-6.0)	-1.4 *(-6.6)	-1.8 *(-11.2)	-1.8 *(-10.0)
Selected sows	-0.6 (-3.0)	0.3 (1.4)	-1.4 *(-8.7)	-0.9 (-5.0)
P2 FAT POSTSLAUGHTER (mm)				
Selected boars	1.5 * (8.7)	-0.1 (-0.5)	0 (0)	-0.3 (-2.0)
Selected sows	-0.3 (-1.7)	1.2 (6.5)	-1.4 *(-9.7)	-1.3 *(-9.0)

* Significant at $P < 0.05$.

TABLE 2 Weighted selection differentials for production characters of animals selected for LTGRH

Feed regime	Ad libitum		Restricted	
Sex of offspring	Males	Females	Males	Females
LTGRH (g/d)				
Selected boars	5.2	5.2	6.4	6.1
Selected sows	0.3	1.3	0.4	0.7
GROWTH RATE (g/d)				
Selected boars	143	142	121	115
Selected sows	29	41	32	37
P2 FAT PRESLAUGHTER (mm)				
Selected boars	1.5	1.5	0.6	0.6
Selected sows	-1.3	-0.8	1.3	1.1

TABLE 3 Realized heritabilities for LTGRH

Feed regime	Ad libitum		Restricted	
Sex of offspring	Males	Females	Males	Females
Selected boars	0.29	0.21	0.20	0.20
Selected sows	0.67	0.31	0.50	-0.14

DISCUSSION

The differences in LTGRH between offspring of selected and unselected parents represents the effects of one generation of selection. This analysis has shown large differences in such response between the offspring of selected boars and sows. However when the differences between sexes in selection intensity are taken into account by examining the realized heritabilities, it appears that effective responses are similar. The average of the realized heritabilities reported here (0.28) is almost the same as that estimated from variance analyses carried out by Ikin and Pattie (1980) using data for the base herd. Thus it is clear that lean tissue 'growth has a moderate heritability and it can be improved by selection using measurements on the live animal. At this stage there is no apparent effect of feeding regimen on overall selection response but a detailed analysis of any possible physiological differences will have to wait until larger selection changes have been produced.

The associated increase in growth rate, and consequent decrease in age at slaughter, that followed selection for increased LTGRH reflects the importance of growth rate in the index and indicates a high genetic correlation between them. In contrast, the fat measurement does not contribute greatly to the index and although it has a negative weighting coefficient, the animals selected for breeding tended to be fatter than average. Despite this, their progeny had lower fat measurements before slaughter indicating a strong negative genetic correlation between LTGRH and fatness.

There was a marked lack of agreement between the correlated differences in live animal and carcass fat measurements which cannot be explained at present. The animals represented in each measurement are not exactly the same as some were kept for breeding, however the small number retained would have made little difference. Both measurements are only indicators of total fatness but the carcass measurement is important as it determines the price paid to growers. It may be that more variables affect the carcass measurement and that larger differences between lines will be needed before consistent trends can be observed.

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