

**THE GENETIC DEVELOPMENT AND  
PHENOTYPIC EVALUATION OF A CROSS SIRE LINE  
FOR THE PRODUCTION OF QUALITY PORK**

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**Summary**

A product has been developed for the South African market, namely the new top cross sire line pig, registered as the ROBUSTER.

The differences between Landrace (1), Large White (2), Duroc (3) and the Robuster (4) were estimated by comparison of contemporary progeny of AI sires out of Large White x Landrace (Landrace x Large White) dams. The sires were selected according to AI standards.

The Robuster showed superiority in growth rate in males (617.0 g/day) as well as in females (613.32 g/day) and the Robuster sired progeny (12.57 mm backfat and 69.37 % lean) outperformed all the other sires in the production of high quality carcasses. The Duroc and the Robuster outperformed the other two breeds as far as reproduction figures were concerned.

Keywords: pigs, development, evaluation, sire line, production.

*Introduction*

Whilst there has been a considerable discussion over the last few years about meat sire lines as well as the development of new breeds, there is nothing particularly new in this concept. For many years breeders and those involved in breed improvement, have been concerned to improve both the efficiency and the leanness of pig meat. To this end, the best stock available has been used in a progressive selective breeding programme to make rapid

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strides in the industry. For the commercial producer, boars have been the main way in which genetic progress has been harnessed.

In general, pig production in South Africa has been structured to use an  $F_1$  crossbred sow to measure reproductive performance and then, in theory, a sire line is used on such a female to maximise the efficiency of lean production. In South African up to now the major sire lines in use have been the Large White, Landrace and to a much lesser extent the Duroc and Hampshire.

In order to develop a new breed for use as a meat line boar (top cross sire line) it is necessary to have clear objectives as to what attributes that boar should possess. Clearly a new composite breed should have advantages over present breeds or lines, ideally combining the best features of existing breeds and, if possible, improving upon them.

A sire line boar needs to have a high libido, and be capable of withstanding a wide variety of environmental conditions. It must produce progeny which have rapid growth, good feed efficiency and carcasses which attract a premium for the producer. Different countries have different marketing requirements. However, the world-wide trend is for carcasses with a high lean content, and good conformation.

Due to the combining ability in the founder population, several major properties were introduced in the Robuster. Firstly it has produced a pig with strong, well boned legs which may be used in sub-optimal and less intensive production units. Secondly it has added extra stress resistance to the Robuster which is particularly important in South African environmental conditions. The parameters used to identify the stress gene was the MH test and due to the intensive selection against the *mn* homozygous recessive, the Robuster sire line is *NN* dominant homozygous with a high yield of lean, thus stress free.

Clearly, the development of meat type sire lines of various sorts will continue and these are very likely to take an increasing share of the boar market. These sire lines use in principle allows for greater genetic combining of different attributes to provide the many sided requirements of the consumer.

### *Materials and methods*

*Genetic development.* The breeding programme (Fredeen & Stothard 1969) followed, may be generally described as one of producing  $F_1$  progeny, backcrossing the  $F_2$  females to a sire breed, followed by inter se matings among backcross progeny (Lauprecht 1961).

The progeny bred from the matings in each generation were performance tested and after completion of the testing phase the superior animals were selected as breeding stock for the next generation. All the boars and sows were replaced after one generation.

Selection of replacement breeding stock in each generation was based on a combination of a variety of traits considered to have economic importance. The specific requirements were that the breed be white in colour and that it compares favourably with the existing breeds in productive as well as reproductive traits in crosses with F1 females, producing fast growing pigs of a high quality carcass type.

Pigs, on performance testing, were separated according to gender and in group sizes of six per pen. The pigs were fed on a commercial growth diet on an *ad libitum* scale, using selffeeders. Pigs were weighed at the start of the test and again at the completion of the test after a 70 day period.

Statistical analyses were conducted using routine procedures programmed by the Statistical Analysis System Institute, Inc. (1989) and used by many other researchers in the field of pig production (Affentranger 1996; Leach 1996 and Hovenier 1993).

*Phenotypic evaluation.* The boars were all of Artificial Insemination Standard, based on a Performance Index, one and a half standard deviations better than the average performance of the breed. The boars were housed in two official AI Centres and semen was collected and diluted, on a regular basis, by trained personnel and when needed transported to the different farms as fresh semen in a temperature controlled semen cooler box at 17 degrees centigrade.

The insemination periods overlap during the winter and summer seasons in order to prevent any variation in performances caused by seasonal effects. All inseminations were done by trained inseminators and the method of heat detection and inseminations were done according to the method described by Bowman (1994).

The combinations of breeds in the different insemination groups were Landrace x Landrace, Landrace x Large White, Landrace x F1, Large White x Large White, Large White x Landrace, Large White x F1, Duroc x F1 and Robuster x F1.

The contribution from each breed of sire were: Landrace (233), Large White (219), Duroc (207) and Robuster (301) with a total of 960 individuals in this study.

### Results and discussion

In Table 1 a non significant difference in the average daily gain ( $P = 0.1577$ ) between the progeny of Landrace and Large White sires and highly significant differences in the Duroc and the Robuster and the other breeds of sire was found, indicating that the Robuster progeny grew at 614.06 g/day compared to the Landrace (544.44), the Large White (554.10) and the Duroc (591.18).

Table 1. - LEAST SQUARE MEANS AND EXCEEDANCE PROBABILITIES WITH PREDICTOR OF BREED OF SIRE AND MODEL OF AVERAGE DAILY GAIN

Breed	Adg (g/day)	Std Err Lsmean	Pr >  T  Lsmean	I/j	Exceedance probabilities			
					1	2	3	4
1	544.44817	0.00477723	0.0001	1	.	0.1577	0.0001	0.0001
2	554.10452	0.00486881	0.0001	2	0.1577	.	0.0001	0.0001
3	591.18959	0.00586980	0.0001	3	0.0001	0.0001	.	0.0006
4	614.06983	0.00438857	0.0001	4	0.0001	0.0001	0.0006	.

Highly significant differences in percentage lean in the carcass were found between the different breeds of sire as shown in Table 2 with the Robuster sires indicating the percentage lean in the carcasses of their progeny to be 69.64 percent, compared to the Landrace (67.83), the Large White (68.18) and the Duroc (68.62).

Table 2. - LEAST SQUARE MEANS AND EXCEEDANCE PROBABILITIES WITH PREDICTOR OF BREED OF SIRE AND MODEL OF PERCENTAGE LEAN IN THE CARCASS

Breed	Plean (%)	Std Err Lsmean	Pr >  T  Lsmean	I/j	Exceedance probabilities			
					1	2	3	4
1	67.8388360	0.1164428	0.0001	1	.	0.0384	0.0001	0.0001
2	68.1884764	0.1216627	0.0001	2	0.0384	.	0.0170	0.0001
3	68.6252276	0.1462118	0.0001	3	0.0001	0.0170	.	0.0001
4	69.6440676	0.0997282	0.0001	4	0.0001	0.0001	0.0001	.

A terminal crossbreeding system requires only one cross, the most profitable and productive terminal cross, instead of all three terminal crosses,

as used in the present study. The question facing producers is which terminal cross is the most profitable. In this study, it is the cross requiring the fewest days to 90 kg and fastest post weaning average daily gain. The leanest and most efficient cross in this study, using terminal sires, was the Robuster X F1 female cross.

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#### GENETSKI RAZVOJ I FENOTIPSKA OCJENA VRHUNSKE LINIJE KRIŽANJA RASPLODNAKA ZA PROIZVODNJU KVALITETNE SVINJETINE

##### Sažetak

Razvijen je proizvod za tržište Južne Afrike, nova linija svinja vrhunskog križanja rasplodnjaka, registriranog kao ROBUSTER.

Procijenjene su razlike između Landrasa (1), Velike bijele (2), Duroca (3) i Robustera (4), usporedbom potomka rasplodnjaka AI ženke Velikog bijelog X Landrasa (Landrasa X Velike bijele). Rasplodnjaci su izabrani prema standardima AI.

Robuster je pokazao superiornost u stopi rasta mužjaka (617.0 g/dan) kao i ženki (613.32 g/dan) i potomaka Robustera (12.57 ledne slanine i 69.37% mišića) i nadmašio druge dvije pasmine što se tiče reprodukcije.

Ključne riječi: svinje, razvoj, ocjena, linija rasplodnjaka, proizvodnja

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