

OUTSTANDING ACHIEVEMENTS ON PIG BREEDING AND GENETICS AT THE INSTITUTE OF AGRICULTURAL SCIENCES FOR SOUTHERN VIETNAM

Improvement of performances, quality of products and economic efficiency of pig production is always the aim of smallholders and farms owners. This is also a big concern of the government and pig scientists because pig production contributes to the economic development of the country in the integration period into the global economy. In order to develop high yielding pig breeds with high carcass quality and well-adapted to ecological condition and social demand, the Institute of Agricultural Sciences for Southern Vietnam has collaborated with organizations such as research institutes, agricultural Universities, provincial agricultural departments and breeding centers and pig farms to conduct applied researches on pig selections to produce breeding stocks nationwide.

Vietnamese Yorkshire was recognized as the breed according to the Decision No. 398 NN-KHKT/QĐ signed on 15th December 1990. From the base population of 409 Yorkshire at 29 pig farms (surveyed data, 1977), 2.000 Yorkshire sows were produced by pure breeding at state farms and the pig producing zone of Go Vap district, Ho Chi Minh city (the National Program 02-03 from 1981 to 1985 and the National Program 02B from 1986 to 1990). Vietnamese Yorkshire had the daily gain of 540g, back-fat thickness of 30mm, feed conversion ratio of 3.64, weaned piglets per sow per year of 14.5 and body weight of 95-100kg at 210 days of age.

From 1991 to 2000, the quality of pig population had continuously improved by research development and national projects on quality improvement and determination of crossing formulas, such as: the Project P from 1991 to 1992, the National Project KN 02-02 from 1992 to 1995 and KHCN 08-06 from 1996 to 2000.



Individual performance testing

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A good dam line selected

By supplementary import of breeding stocks through international collaboration projects with French, Australia, Belgium and Holland, thousands of breeding pigs, mainly Yorkshire, have been individually tested on performances and used in pig production at provincial pig farms and pig production zone in Bien Hoa-Dong Nai province. The genetic progress on reproductive and growth traits has been

increased. The Yorkshire population and their crossbreds have the growth rate of 670g/day, back-fat thickness decreased

to 25mm, feed conversion ratio reduced to 3.0, number of piglets per sow per year was 18-20, lean meat percentage was 56-58% and days at 90kg was 160 days of age.

Selection high-yielding lines of Yorkshire, Landrace, Duroc and Pietrain by applying BLUP procedure on estimation of breeding values of some important economic traits

The breeding value of a certain animal indicates its heritable ability to the next generation. Genetic improvement is the process of selecting animals of higher genetic merit than average to be parents for the next generation

Since 1990, Vietnamese government has focused on the task of improvement and upgrading breeding stocks through breeding programs. Exotic pigs of Yorkshire (Y), Landrace (L), Duroc (D) and Pietrain (P) have been imported from Cuba, the US, Australia, Belgium, Canada and Thailand through the National Breeding Programs (the Project P, the National Project KN 02-02 and the National Project KHCN 08-06) and international collaboration projects (the Pig Improvement Project collaborated with French from 1985 to 1992, the ACIAR-project "Pig Breeding and Feeding in Australia and Vietnam from 1995 to 2000).

In addition to the above-mentioned exotic breeds, Mong Cai (MC) breed should also be involved. It is a native breed with good characteristics, such as large litter size, good mothering ability but having some disadvantages of low growth rate (300-333g/day) and lean meat percentage (33-34%). Mong Cai and their crossbred between Mong Cai and exotic breeds have been widely raised in provinces of North to Central of Vietnam.

On the base of good genetic resources, applying technological progresses and software packages (MATLAB, SAS (1999), DFREML (1993), VCE, PIGBLUP and PEST) to estimate genetic parameters, breeding values, additive genetics, genetic correlations and heterosis in animal selection and breeding, the genetic merits of the national breeding stocks have been improved contributing to improvement of economic efficiency of the national pig production sector.



Individual performance tested boar

After 5 generations of selection, the litter size increased 0.1- 0.5 piglet per litter and the growth rate 30-50gs per day. The litter size of Yorkshire and Landrace increased 0.5-1.0 piglet per litter and the number of litters per sow per year augmented 1.9-2.1. The weaned piglets increased 1-2 piglets per sow per year. The liveweight at 60 days of age enhanced 5-7 kg per pig. The age at the first parity decreased 11%.

- For Yorkshire: Dams 4140, 780 (farm A), 242, 5072 (farm B), 565-5, 1008-4 (farm C) have the best breeding values on the litter trait: +1.267, +1.022, +0.857, +0.808, +0.887, +0.884 piglets per litter, respectively. Sires 9122, 827 (farm A), 323, 413B (farm B) and 1300-5, 812-8 (farm C) have the best breeding values on the litter trait: +0.841, +0.741, +0.648, +0.335, +0.491 and +0.483 piglets per litter, respectively.

- **For Landrace:** Dams 5004, 3534 (farm A), 4681, 6000 (farm B), 418-6, 197-3 (farm C) have the best breeding values on the litter trait: +1.009, +0.968, +1.072, +0.865, +0.712, +0.676 piglets per litter. Sires 80141, 970639 (farm A), 43B, 1457 (farm B) and 1130-4, 1185-7 (farm C) have the best breeding values on the litter trait: +0.876, +0.777, +0.317, +0.126, +0.419 and +0.404 piglets per litter, respectively.

Based on the estimated breeding values, coupling for mating dams and sires were done with the hope that the next generation has better breeding values compared with the parent generation. For example, the expected breeding value of the offspring between sire 9122 and dam 4140 was 1.044 piglets per litter and that of sire 827 and dam 780 was 0.882 piglets per litter.



A prolific local breed used in breeding program

Crossbred terminal sire between Pietrain and Duroc

Terminal boars play an important role in the performance improvement of the growth and meat quality traits and they partly determine the performance and economic efficiency of fatterer producers. Crossbred terminal boars are a component of the commercial production systems. The number of sperm cells per ejaculate of a crossbred P-D boar is 1 to 8 billion higher than that of pure Duroc and Pietrain one. Libido of crossbred P-D boars is generally stronger than that of pure Duroc or Pietrain boar. Crossbred boars (D.PD)

have the best growth rate of 700g per day and the number sperm cells of 28.2 billion per ejaculate.

Two groups of crossbred composite sows (exotic x exotic) and (exotic x local).

Crossbred sows are used to produce piglets for fattening to exploit heterosis.

- The interval from weaning to coming heat of crossbred sows YL/LY decreased 0.25-2.42 days. Heterosis of reproductive traits of number of born alive, birth weight, number of weaned piglets and weight at weaning was between 0.99-6.21%. The growth rate of these crossbred sows improved 2.03-3.48% (by performance testing from 90 to 150 days of age). The age at the first parity was 8 -27 days earlier. The litter weight at weaning of LY sows increased 1.11- 4.34kg.

- Crossbred sows Y.MC/L.MC/P.MC showed high heterosis on litter traits in F1 generation. The birth weight was 1kg per piglet. The number born alive was 11.33-12.02 piglets per litter. Especially crossbred sow P.MC had the best reproductive performances (0.47-0.69 piglets per litter and 0.045 kg per piglet at weaning higher than that of crossbred sows Y.MC and L.MC).

Crossing formulas

Three-way and four-way crossing become more and more popular in the pig commercial production. By crossing, heterosis on reproductive and growth traits is exploited. In the breeding system, we included two dam lines of Yorkshire and Landrace and two sire lines of Duroc and Pietrain. High yielding crossbred sows were developed from two dam lines and terminal boars from two sire lines. Three-way and four-way crossbred fatteners had high growth rate of 680-720g/day, leanmeat percentage from 56-58% increasing 2-4%. The leanmeat percentage of fatteners of 50% Mong Cai and 50% exotics was 2-7% higher than that of Mong Cai pigs. Pigs having $\frac{1}{4}$ Mong Cai and $\frac{3}{4}$ exotic have good adaptation to ecological conditions in the Central Region, good growth rate, less fat and rather high lean meat percentage (53 to 56%). The lean meat of crossbred pigs (P x Y.MC) can reach up to 56.87%.

Pig breeding systems

Among 99 surveyed pig farms (2002) including state farms, private farms and smallholders, only three farms had GGP, GP and PS stocks and 11 farms had GP and PS stocks. Other farms had only PS stock. Due to lacking of breeding value evaluation and pedigrees, pig farms were unable to do ranking their animals.

Some breeding systems have been formed based on selection results and practices of developing dam and sire lines such as pure breeding and commercial production systems at some pig farms although they are simple. The complete breeding system should include the nuclear stock, the breeding stock and production stock.

Economic efficiency

Economic efficiency in using terminal boars

- High heterosis and stronger libido than pure boars.
- High leanmeat yield: fatterers from terminal boars have high lean meat (56-59 %). The price per kg liveweight of these fatterers is 500-1,000 VND higher than that of ordinary fatterers. The fattener producers can get 45,000 to 90,000 VND more per fattener .

- The sperm cell numbers of crossbred boars P-D was 1 to 8 billion higher than that of pure boars Duroc or Pietrain. Money from selling semen of crossbred boars was 10,000 to 30,000VND per ejaculate higher than that of pure boars.

Economic efficiency in using crossbred composite sows Yorkshire-Landrace compared with using pure sows Yorkshire or Landrace.

A crossbred sow Yorkshire-Landrace can bring about 488,440VND per sow per year higher than that of pure sow, in which 317,500VND gained from the weaned piglets and 170,940VND gained from litter weight at weaning.

Seven protocols have been developed from theory and practices of pig production such as pig selection protocol, pig feeding protocol and pig health care protocol.

Improving reproductive and growth performances of the nuclear sire lines Duroc and Pietrain and dam lines Yorkshire, Landrace and Mong Cai by genetic improvement through breeding value evaluation and developing the regional and national breeding systems are regular and important tasks of pig breeders and managers.



A farm for nucleus herd multiplication