Government of Nepal
MINISTRY OF LIVESTOCK DEVELOPMENT
DEPARTMENT OF LIVESTOCK SERVICES

Pig Breeding Strategy

CENTRAL PIG AND POULTRY PROMOTION OFFICE

CENTER FOR ENVIRONMENTAL AND AGRICULTURAL, POLICY, RESEARCH AND EXTENSION DEVELOPMENT (CEAPRED)

SAMARTH-NEPAL MARKET DEVELOPMENT PROGRAMME

PIG ENTREPRENEUR'S ASSOCIATION, NEPAL

SWINE AND AVIAN RESEARCH PROGRAMME/ANIMAL BREEDING DIVISION, NARC

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1 BACKGROUND

Livestock is an important and integral major component of mixed farming system in Nepal contributing around 27% to the Agricultural Gross Domestic Products (AGDP). Pig farming has tremendous potential on employment and income generation thus significantly contributing for food and nutrition security at household level. Historically, pigs had held an important place in providing food for households, all around the world. However, in Nepal pig production and pork consumption was limited to certain ethnic community. Recently, the tradition is being gradually fading out, and all communities are being involved in pig production without any restriction on consumption of pork. The traditional system of scavenging pig production of native pig breeds is gradually moving towards semi-intensive and commercial production of more productive exotic pig breeds. The estimated population of pig in the country is about 1.2 million with annual increment of 2.3% contributing about 7% of the national meat production at present. The haphazard establishments, however has to be regularized utilizing conducive policy environment for improvement in the system with increased production and productivity.

The productivity and thus the profitability of pig farming is greatly determined by the genetic potential of pigs being raised with proper breeding, feeding, health care and other management practices. Among others, adopting proper recording system, genetic evaluation and breeding practices for continuous genetic improvement and hybrid piglet production for improved productivity and higher profitability is crucial. However the pig breeding practices being adopted in the country at present both at backyard farming and commercial set up is haphazard without considering for potential genetic improvement that can be obtained for higher productivity. In this context, developing appropriate **Pig Breeding Strategies** aligned with the **National Livestock Breeding Policy** and its effective implementation at national level through consolidated efforts of government and private sector has been felt essential for pig productivity improvement and thus benefit of pig farmers at large.

2 PAST AND RECENT EFFORTS

The exotic pig breeds were introduced in Nepal in 1957 for the first time by Heifer International. The major tangible efforts that have been put forward from the government sector for overall development of pig sector in the country is importation of exotic pig breeds that have higher growth potential, superior reproductive effeciencies, better feed conversion and meat quality. The government maintained nucleus stock of imported exotic pig breeds in different development and research farms that produce purebred and crossbred piglets for distributing to the 'breeder farmers' and 'fattener farmers' respectively. With this government initiatives, many private breeder farmers have emmerged in the country that cater the need of piglets within the country. More recently, some International Non Governmental Organization (INGO) particularly Samarth-NMDP, a DfiD supported programme has facilitated to work in piggery sector adopting market-led private sector development approach in an integrated way for overall productivity improvement of pigs and betterment of the farmers. The research and development organization have worked on characterization of native breeds, identification of production potential of native pigs, comparative performance evaluation of imported pure and crossbred pigs

and artificial insemination with fresh and frozen semen. Recently with the support of DfiD, the Samarth-NMDP has facilitated public private partnership with high emphasis on pig genetic improvement.

3 CURRENT STATUS

3.1 AVAILABLE PIG BREEDS

Nepal has four indigenous pig breeds, one synthetic breed, wild pig and several imported exotic pig breeds along with various crosses between different exotic breeds and exotic and indigenous breeds.

3.1.1 Indigenous breeds

a. Chwanche

Chwanche pigs are found in low to mid hills and are good scavenging animals. This pig breed is mostly found in eastern, western and mid-western hills and raised by certain ethnic communities like Magar, Tharu, Rai and Dalit. Though, the population status at present is not known, it was in the past estimated that the Chwanche constitutes 58% of the native pig population. Generally, they are black in color, hardy and well suited to local environments. They reach puberty at an average age of 7 months, first farrow at 10 months with average litter of 7 piglets at birth and 6 piglets at weaning. The average birth weight is 0.7kg and adult weight is 35kg (30-40kg). They have been characterized at phenotypic level and chromosomal level.

b. Hurrah

Hurrah pigs are distributed in southern Terai belt of Nepal from east to west. Again the population of Hurrah pig is not known at present, but it was estimated that it constituted 23% of the total native pig population. They are rust brown in color, hardy and suitable for scavenging conditions. They reach puberty at the average age of 11 months, first farrow at 14 months with average litter of 7 piglets at birth and 6 piglets at weaning. The average birth weight is 0.8 kg and adult weight is 45kg (40-55kg). They have been characterized at phenotypic and chromosomal level. Their population is declining and need conservation measures.

c. Bampudke

Bampudke or *Sanu Badel* is a domesticated wild species, which is known to be the smallest of all hogs in the world. They are called "Pigmy hog" (Epstein 1977). They are rusty brown to black in color, rarely found and are about to be extinct. They reach puberty at the average age of 6 months, first farrow at 11.5 months with average litter of 5 piglets at birth and 3 piglets at weaning. The average birth weight is 0.6 kg and adult weight is 20kg (18-25kg).

d. Nagpuri or Pundi

The breed is found in eastern hills and Terai districts of Nepal. They are black in color, short snout, wrinkled face and pendulous belly that resembles Chinese Mehisan breed. Some believe that the breed is crosses between the Chinese Mehisan and local pig breeds which have been well established since long before. They are prolific with average weight of 40-50kg. Under good management condition, the breed has potential to reach adult weight of about 70kg.

3.1.2 Synthetic pig breed

a. Pakhribas Black

Pakhribas pigs are black in color and are mainly found in eastern hills. They have been developed by crossing Fayuen, Tamworth and Saddleback (Triple crossing). Some literature also mentioned that it has been developed by crossing 4 different pig breeds. They are prolific and have good mothering ability with high popularity in the Eastern hills. Mature boar weighs about 350 kg and the sow 250-300 kg.

3.1.3 Exotic Breeds

a. Large White /Yorkshire

Large white/Yorkshire popularly known as Yorkshire is an English bacon breed with excellent mothering quality with higher milk yield potential and higher number of piglet weaned per farrowing. The pig is white in color with moderately long head, face slightly dished, snout broad and identical erect ears. Mature boar weighs about 300-450 kg while the sow weighs 250-350 kg.

b. Landrace

Landrace is a Danish pig bred for producing high quality bacon in the world. Landrace is white in color and characterized by long deep side, square ham; short legs with heavy lop ears inclined to the front above the eyes. The carcass is leaner with less back fat and lard. The breed is popular for high prolificacy and better feed conversion efficiency. Mature boar weighs about 310-400 kg while the sow weighs 250-330 kg.

c. Duroc

Duroc is an American breed, brown to red in color with shades varying from a golden to cherry red color. It is popular for its excellent growth rate and feed efficiency. It is an early maturing breed with high reproductive efficiency and good mothering ability. Mature boar weighs about 400 kg and sow 350 kg. The carcass is considered as a good meat type.

d. Hampshire

Hampshire is English breed popular for pork production. The coat color is black with white strip around the back. It is well known for excellent growth rate and feed efficiency. It matures early, farrows 8-10 litters and is a good mother. Mature boar weighs about 400 kg and sow 350 kg.

3.2 EXISTING PIG BREEDING PRACTICES

3.2.1 Indigenous Backyard Pig Farming

- No systematic breeding program being adopted so far
- No government intervention (DLS, NARC) for improvement
- Generally natural mating during scavenging
- Probably very high level of inbreeding
- A sort of negative selection happening due to better male being castrated for meat production and the poor performers being left for further breeding
- Performance recording do not exist at all

3.2.2 Exotic Commercial Pig Farming

- No breed improvement plan in place
- Haphazard cross breeding of Yorkshire, Landrace, Duroc and Hampshire
- Available exotic breeds mostly crossed with blood level
- Haphazard way crosses of Yorkshire, Landrace and Duroc being common practice for fattener piglet production
- Most farmers generally breeder- selling piglets for fattening
- Government and NARC farms providing purebred/ crossbred exotic pigs to the breeder farmers/ fatteners
- Primary recording system in place in government and private farm but the records rarely used for genetic improvement program.
- Artificial Insemination with imported frozen semen started in government farms and recently in private farms. Fresh semen production and AI in pig being recently tried.

3.3 PIG PRODUCTION SYSTEM

The pig production system prevalent in Nepal can be broadly divided into subsistence (traditional) production in scavenging management and recently emerging commercial piggeries. Under the traditional subsistence production system, mostly indigenous pigs are found to be reared under scavenging management near the villages. Both, input and output under this system are low, but have significant contribution in the household level food and nutrition security as well as for the fulfillment of the religious requirement.

The recently emerging and fast growing is the commercial pig production system, under which mostly exotic breeds and their various crosses are reared in the confinement with commercial feed supplement, which has been adopted by the people belonging to all ethnicity. Under commercial pig production system, following sub systems are most prevalent in the country.

- Breeding farms- Farmers are only producing piglets and selling to the fatteners
- Fattening farms- The farmers purchase piglets from the breeder farms and fatten the piglets for slaughter/ market. The fattening period varies between 6-12 months depending on feeding management.
- Both breeding and fattening farms- The farms produce piglets both for selling to the fatteners and for fattening and marketing by themselves

Under this system, farmers are found to be rearing from few breeding sows to as large as 200 breeding sows with more than 1000 fatteners with the concept of factory farm production. Beside these systems, pig production has also been found to be integrated with fish farming in the country.

3.4 LIVESTOCK BREEDING POLICY

The Livestock Breeding Policy has been drafted during the year 1999 (2056 B.S.) and is still awaiting for its approval from the concerned authorities. The major elements of Livestock Breeding Policy are:

- Identification of different breeds of livestock species suitable for different agro ecology and resource availability.
- Improve livestock productivity through genetic improvement
- Conservation, promotion and proper utilization of livestock biodiversity
- Develop private livestock resource centre on public private partnership and cooperative model
- Promotion of high value livestock commodities such as deer, musk deer, wild pig, wild fowl, wild rabbit through research and human resource development

The 'Pig Breeding Policy and Strategy' has been developed based on the livestock breeding policy of the country.

3.5 ARTIFICIAL INSEMENINATION IN PIG:

Recent development of A.I. in pig using both frozen semen and fresh boar semen undertaken by both the public and private sector can be used for faster Genetic Improvement and for faster dessemination of improved genetics to the comercial pig seed stock producer to meet the demand market for quality lean pork.

4 MAJOR PIG BREEDING ISSUES

- Lack of breed improvement plan and strategy to enhance productivity and to meet the demand of consumer for quality pork
- Rudimentary recording system and the records not being utilized for genetic improvement program
- Haphazard breeding practices leading to poorer performance and inability to tap the genetic potential
- Negative selection due to good quality male pig being castrated for meat production and poorer one left for breeding
- High degree of inbreeding leading to performance decline in the absence of proper record keeping system

5 THE NEED FOR PIG BREEDING POLICY AND STRATEGY

Pig farming is fastly growing with tremendous empolyment and income generation potential. There has been tendency of every farmer to become breeder farmer due to comparative advantage in piglet sale. Some smallholder farmers even buying pair of male and female piglets from the same litter and bred them and produce piglets for sale with high level of inbreeding. High desire of farmers for piglet sale in one hand and lack of proper market development for pork in pace on the other has also created market glut. In the absence of proper pig breeding strategy and poor breeding kowledge of most of the farmers, the existing pig breeding practice is very haphazard leading to deterioration in the performance. Farmers are not getting the potential benefit that could be obtained from pig farming if proper breeding management were adopted. Nor the breeding practice has been directed towards production of quality pork as led by the market demand and consumer choice. In this context, it has been strongly felt to develop proper pig breeding strategy and adopt it throughout the country for

improving the pig productivity, income of pig farmers and entrepreneurs and meeting the demand of the consumers.

6 PIG BREEDING POLICY

- Maintain and improve the existing exotic and promising native breeds of pig and produce suitable commercial pig
- Conserve and improve existing native breeds of pig improving their productivity through upgradation and pig farmers group breeding approach

7 PIG BREEDING STRATEGY

7.1 OBJECTIVES

The overall objective of the pig breeding strategy is to produce fast growing commercial pig through its proper implementation to meet the following specific objectives

- To maintain the purity of a particular breed to be used further for breeding purpose
- To improve productivity of existing native pig breeds through genetic upgradation of the existing pig population
- To conserve indigenous germplasm of Nepalese pig breeds and enhance their productivity
- To maintain and improve the exotic breeds like Yorkshire, Landrace, Duroc and Hampshire at nucleus herds.
- To improve the productivity of commercial pig adopting three breed crosses utilizing maternal and paternal heterosis
- To direct the breeding programme towards lean pork production as per the market demand
- To check the inbreeding to enhance the productivity of the pig
- To maintain proper recording system for genetic evaluation of the different pig breeds especially at the nucleus pig breeding farms.

7.2 STRATEGY

The following are the desirable pig breeding traits that will lead to overall higher profitability from pig farming.

- Higher litter size at weaning
- Better daily growth rate with lower market/ slaughter age
- Better feed conversion efficiency
- Low back fat thickness- lean meat production
- Low frequency of disease occurence and higher level of disease reistance
- Absence of genetic disorders and genetic defects

The pig breeding stragey is conceptualized in the following multi-tired breeding pyramind.

The nucleus farms are placed at the top of the pyramid with emphasis on pure lines of breeds which undergo intense selection and introduce the improved genetics from abroad especially through the use of frozen semen. The imported quality frozen semen (Boar of specific breed) and intensively selected gilts of respective breed will be the Great Grand Parent Stock for production of grand parent stock of specizlized breeds or lines for supplying to the multiplier pig herds.

The multipliers farms occupies middle tier of the pyramid and is an indicative of large number of pig herd for multiplication and expansion of superior lines of breeds, multiple crossing of pure lines or breeds from nucleus herds.

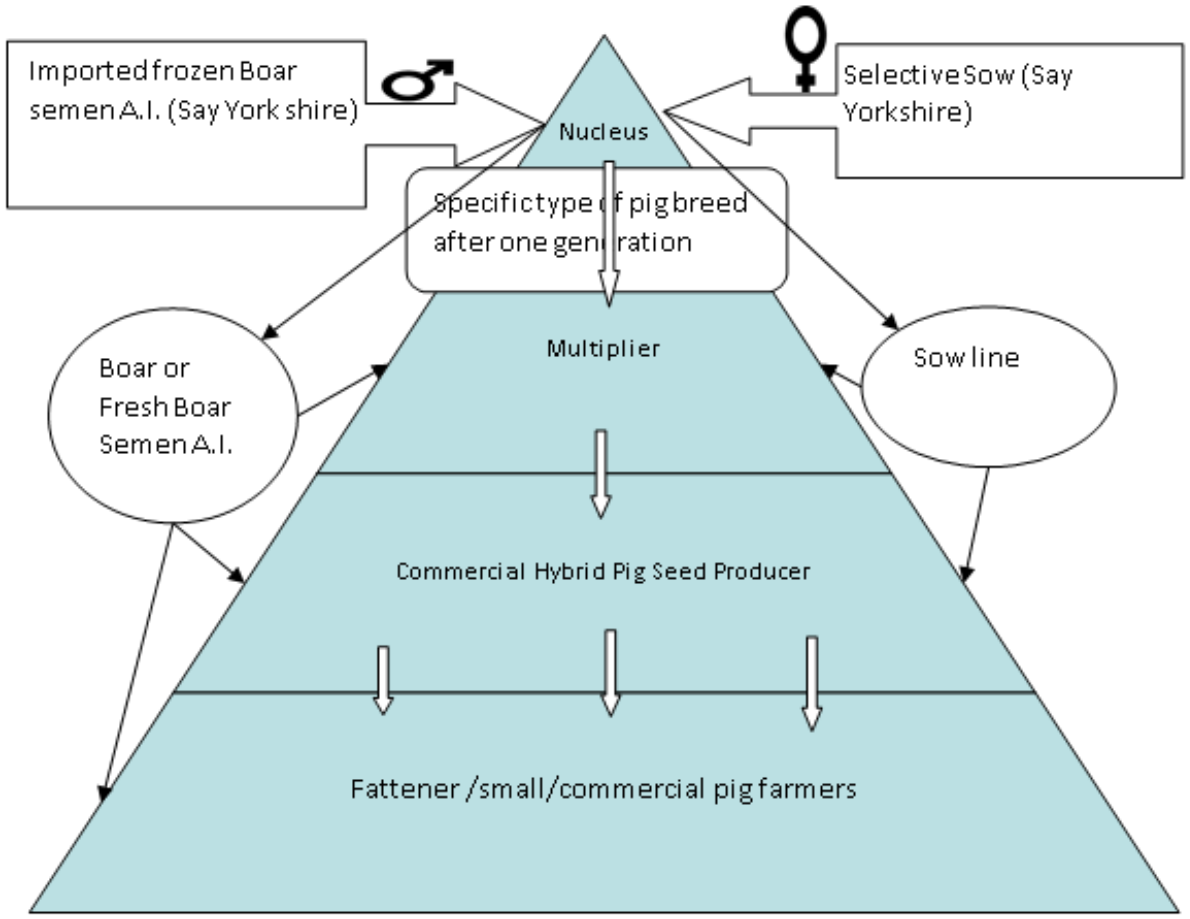


Figure 7.1 Multiplier Pig Breeding Pyramid

The base tier of the pyramid represents commercial pig seed stock producers where large number of parents animals produced at the multipliers are mated using specific crossbreeding schemes to produce a pig and pork that meet the specific market demand.

A very cheap and practical way to carry out genetic improvement is through use of artificial insemination using quality frozen semen from abroad. The dissemination of improved genetics to commercial pig seed stock producer can further be enhanced by the use of fresh boar semen. The strength of A.I. in pig is generally depended on the genetic superiority of the boar produced at the nucleus herds.

7.2.1 Breeding strategy for backyard and indigenous pig farming

a. The indigenous pig production pockets, their population status and production performance should be confirmed and well documented.
b. If any of the native breeds are confirmed as endangered status, immediate measures (government or public private partnership) should be taken for their conservation linked with improvement programme.
c. Genetic characterization of all native pig breeds should be performed and positive attributes (if any) should be documented to be used in the pig breeding programme.
d. Selective breeding for genetic improvement- Any individual or communities willingness for pure breeding should go for selective breeding program for productivity enhancement of native pig breeds. For selective breeding, the following points need to be considered and should be supported by the government adopting public private mode.

- Clusters identification and native pig breeding group formation
- Farmers trainings on selective breeding concept and breeding management
- Breeding goal identification by community consensus
- Development of simple recording system and its implementation
- Identification of superior male for further breeding and culling of poor performer sows
- Control of inbreeding in the village native pig herds through the use of unrelated male animals.

e. Cross breeding with wild boars for value addition: native pig breeds (Hurrah, Nagpuri, Chwanche) could be crossed with wild boars (tamed) for value addition as the price fetch by wild pig meat is 3-5 folds higher than the domestic pigs. This could further enhanced with wider scaling up of fresh boar semen A.I.
f. Black pig production- For the community preferring only black color pigs can either go for selective breeding within black color native pig breeds (Chwanche, Nagpuri) or choose alternative strategy of cross breeding with Duroc boar. However, all such piglets which are all black resulting from crossbreeding should be fattened and slaughtered as further breeding results into segregation and all progenies are not black and also the heterosis are lost to some extent. For this, maintaining purebred black color native pig breeds, raising Duroc boar in the community, regular replacement of Duroc boar should be ensured for better productivity.

In addition, NARC should continue its work on productive black color pig development by utilizing existing pig breeds and introduction of new breeds (Large Black and Berkshire semen have been already brought) if necessary.

7.2.2 Breeding strategy for semi intensive pig farming:

Cross-breeding (village hybrid pig breeding scheme)

Cross-breeding the existing breed of sow group with boar of other breed types for exploiting heterosis and productivity improvement shall follow rotational cross breeding with two or three boar breed types. The village hybrid pig breeding scheme has been further elaborated with pictorial diagram in Annex 1. The reliable breeding farms shall be able to supply good quality breeding boar of farmers' choice for cross-breeding. However,

crossing Hurrah sows with Hampshire boar and Nagpuri sows with either Hampshire or Duroc boars would be appropriate.

Table 7.1 Choice of boar for village hybrid pig breeding scheme

Breeding strategy	Recomended breeds	Remarks
Village Hybrid Pig Programme (Adopting identification of esisting breed types of sows groups and intervening getting boar from other breed type to produce crossbred piglets with changing the breed of boar at third year following two or three breed rotational crossing in subsquent generation)	**White breeds:** York shire, Landrace **Black breeds:** Hampshire Berkshire cross Large black crosses Nagpuri/Meihshan Wild boar	The male boar keepers should manage the type of boar used at subsequent generation

7.2.3 Breeding strategy for commercial pig farming

For commercial pig farming, a triple way cross-breeding strategy has been proposed that will ensure higher heterosis for litter size (estimated 10% higher litter size at weaning), higher growth rate and lower back fat thickness. The commercial pig breeding hierarchy with facility and activities to be performed by pig farms at different tiers is further elaborated and well described in Annex 1. The existing pig breeds (Yorkshire, Landrace, Duroc and Hampshire) need to be used while other exotic breeds can be introduced if found promising (review and research). The proposed strategy emphasizes crossing between Yorkshire and Landrace (reciprocal) for production of breeding sows and using either Duroc or Hampshire as terminal sire breed for production of triple cross fattener piglets. The following steps are essential for implementing the proposed breeding strategy.

Breeding structure for Nepali white pig breeds:

The breeding structure for commercial three way cross-breeding of white pig breeds has been described in the following diagram.

Level	Breding Strategy (White pig breeds)		
	Nepali Yorkshire(gilts from imported frozen semen)	**Nepali Landrace (Gilts from impported frozen semen)**	**Nepali Duroc (Boarling from imported frozen semen)**
Nucleus herds Selective breeding of Nepalese breed	♂ X ♀	♂ X ♀	♂ X ♀
Pure line pig breed production at nucleus herds	♂ X ♀	♂ X ♀	♂ X ♀
Multiplier pig herds	LY (Male) slaughter LY female piglet dam line	LY (Male) slaughter LY female piglet dam line	
Piglet producer	LY female ⇩	YL female ⇩	
	Three way crosses for fatteners/finishers (YLD)		

Figure 7.2 Breeding design for Nepali white pig breeds

The breeding structure for commercial Nepali black pig breeds

The breeding strategy to be followed for commercial three way crossing for black pig breeds is described pictorially in the following table.

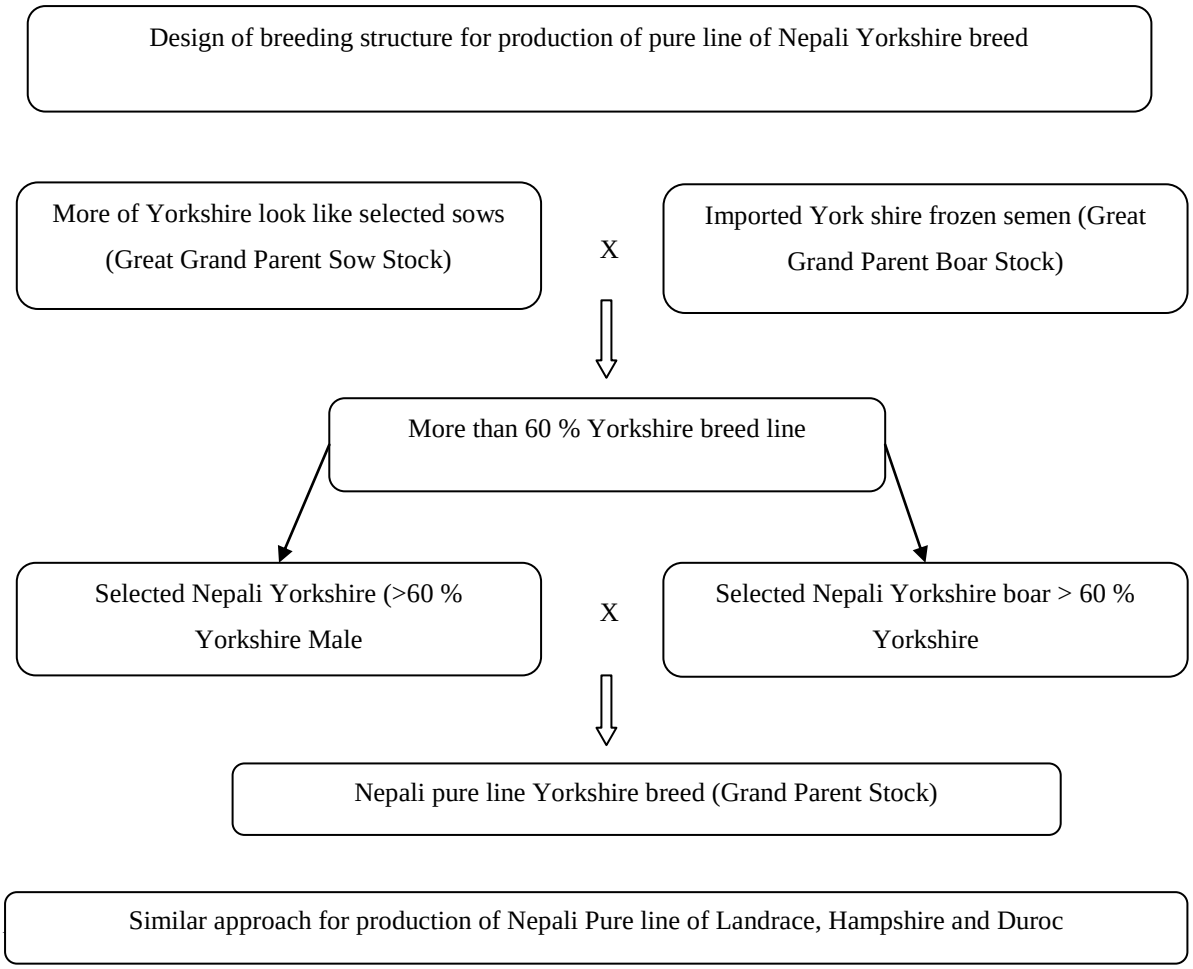
Level	Breeding Strategy (Black pig breeds)		
	Nepali Wrinkle face black pig breeds Nagpuri or Mehshan	**None-wrinkle face black pig breeds (PAC black pig, Dharane, other black pig breeds)**	**Nepali Hampshire (Boarling from imported frozen semen) or berkshire derivatives or large black derivatives**
Nucleus herds Selective breeding of Nepalese breed	♂ X ♀	♂ X ♀	♂ X ♀
Pure bred production at nucleus herds	♂ X ♀	♂ X ♀	♂ X ♀
Multiplier pig herds	**WN (Male) slaughter WN female piglet dam line**	**LY (Male) slaughter NW female piglet dam line**	
Piglet producer	**WN female**	**NW female**	
	Three way crosses for fatteners/finishers (NWH)		

Figure 7.3 Breeding design for commercial Nepali black pig breeds

7.2.4 Nucleus Flock Development

Maintaining nucleus stock of pure line breeds (Yorkshire, Landrace, Hampshire and Duroc): The government and NARC farms along with some private pig farms willing to become pure breeding nucleus farms should keep these exotic pig breeds. The number of each breed that need to be kept at nucleus flock depends on the annual market demand of slaughter pigs (also for export if there is opportunity), however, the purebred nucleus stock of each breed should not be less than 100 breeding sows for implementing genetic improvement program. The available breeds in Nepal are mostly the crossbred of these four exotic breeds resulting from haphazard crossbreeding, thus need purity maintenance. For this, initial 1-2 years need to be devoted for genetic purity development for which the following approach has been proposed.

The breeding structure to be adopted for pure line pig breed production in Nepal for commercial farming has been described pictorially in the following diagram.



Thus developed Nepali Yorkshire, Landrace, Hampshire and Duroc pigs should be maintained at nucleus herds in which the genetic improvement program should be initiated. The nucleus herd should be able to provide all necessary purebred sows and boars (after keeping best individuals as replacement in the nucleus stock) to the multiplier herds. The nucleus flocks need to be free from vertically transmitted diseases such as PRRS, TB and Brucellosis.

7.2.5 Genetic improvement in nucleus herd:

All pigs in the nucleus herds need to be appropriately identified with unique identification numbers. Appropriate record keeping system should be followed and the records should be periodically analyzed for identifying best breeding sows and boars based on their breeding values estimated for the set breeding goal. Only pure breeding should be adopted in this nucleus herds (however, private farms might have separate multiplication herd isolated from the nucleus herd).

The following should be the selection criteria in the nucleus herds:

A. Initial stage of selection at weaning individual without any physical deformities,

- From litter of 10 or more pigs farrowed
- From litter of 8 or more pig weaned
- Have 12 or more fully developed well placed normal teats

B. Later at six month of age based on performances

a. Selection criteria for young boar, sire lines (terminal and pure breeding)

- Growth rate
- Feed conversion efficiency
- Backfat thickness
- Days to 90 kg body weight
- Free from some reproductive diseases
- Physical attributes with strong hind legs, normal and proper structure of hind legs,
- True to type of breed characteristics
- Normal penis and uniformly well-developed testes,

b. Selection criteria for gilts, Maternal line based on dam performance

- Number of piglet born alive
- Litter weight at birth
- Litter weight at weaning
- Feed efficiency
- Back fat thickness
- From the sows having good longevity with minimum of two farrowing a year without assistance

In the nucleus flock, all males and 40% of the poor performing sows need to be replaced from the superior replacement stock each year.

Once the genetic parameters are estimated from our own herds, then gradually selection index as attached in the annex 6 would be adopted for selection of breeding animals in the future. The Nucleus flock should/ could adopt the following data recording system (details in Annex 2).

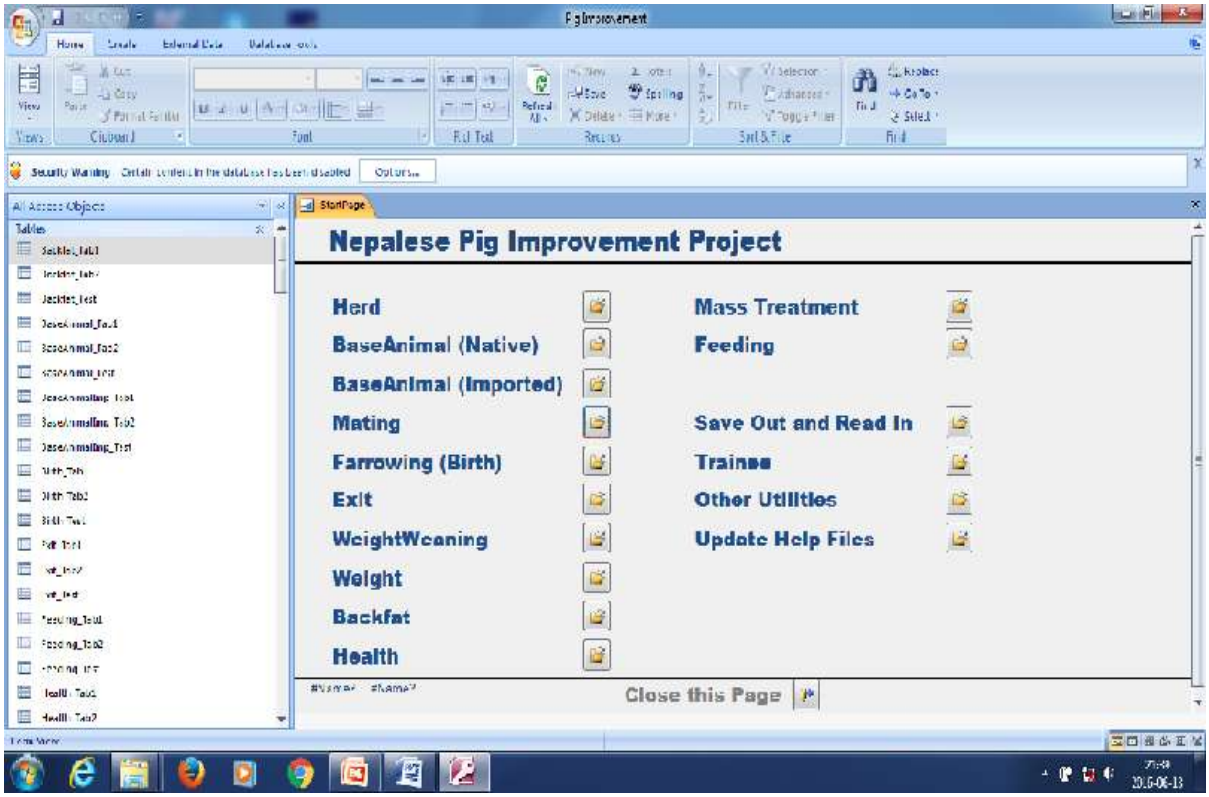


Figure 7.5 Outlook of software for date recording and evaluation

7.2.6 Development of 'Multiplier Herds'

The commercial farmers with willingness to produce dam line, by crossing sows (crossing between Yorkshire and Landrace either way) should be assigned as the multiplier herds. Recording should also be done at multiplier herds so that best crossbred breeding sows are provided to the piglet production herds where the farmers cross crossbred sows obtained from multiplier herds with terminal sire obtained from nucleus herd. Multiplier and piglet production herd can also be combined together depending upon the annual slaughter pigs required and farmers' willingness to perform both tasks.

7.2.7 Hybrid piglet production herds

The crossbreeding system to be adopted by hybrid piglet producer is principally of three way crossing utilizing terminal sire line and cross bred dam line to utilize more of heterosis and is further elaborated in Annex 4.

8 HEALTH PROGRAM

The following items are herd health should be adopted by pig seed stock producers:

- All seed stock producers' herds should be validated and certified and brucellosis, Tuberculosis and PRRS free.
- All pigs offered for sale should be vaccinated against swine fever, FMD, and should be free of external and internal parasites.
- Strict bio-security measures should be followed for all visitors and incoming traffic, such as scanning equipment, feed truck, stock truck, boar buyers, etc. Each farm should have its own scales.

9 NUTRITION PROGRAM

The breeding animals in the nucleus and multiplier flocks should have standard feeding regimes.

Table 9.1 Suggested crude protein and lysine levels for growing-finishing pigs

Weight (kg)	Pig type/ sex	CP%	Lys %
5-10	all	20	1.2
10-20	all	18	1.1
20-50	all	17	0.85
50-80	gilts and boars	16	0.8
50-80	barrows	14	0.65
80-105	gilts and boars	14	0.65
90-105	barraows	13	0.55

10 MANAGEMENT PRACTICES

- All breeding animals in nucleus and multiplier herds should be appropriately housed considering confort and economics
- The different age groups animals and male female should be kept separately
- Strictly bio-security measure should be followed in farm premises
- Appropriate feeding and watering facilities should be in place in the pig shed.

11 IMPLEMENTATION ARRANGEMENT AND INSTITUTIONS INVOLVEMENT

- For the implementation of Pig Breeding Strategy after its endorsement from the Department of Livestock Services, the steering commitee comprising of follwing officials should be formed.

Table 11.1 Steering Committee on Pig Breeding Strategy Development and its Implementation in Nepal

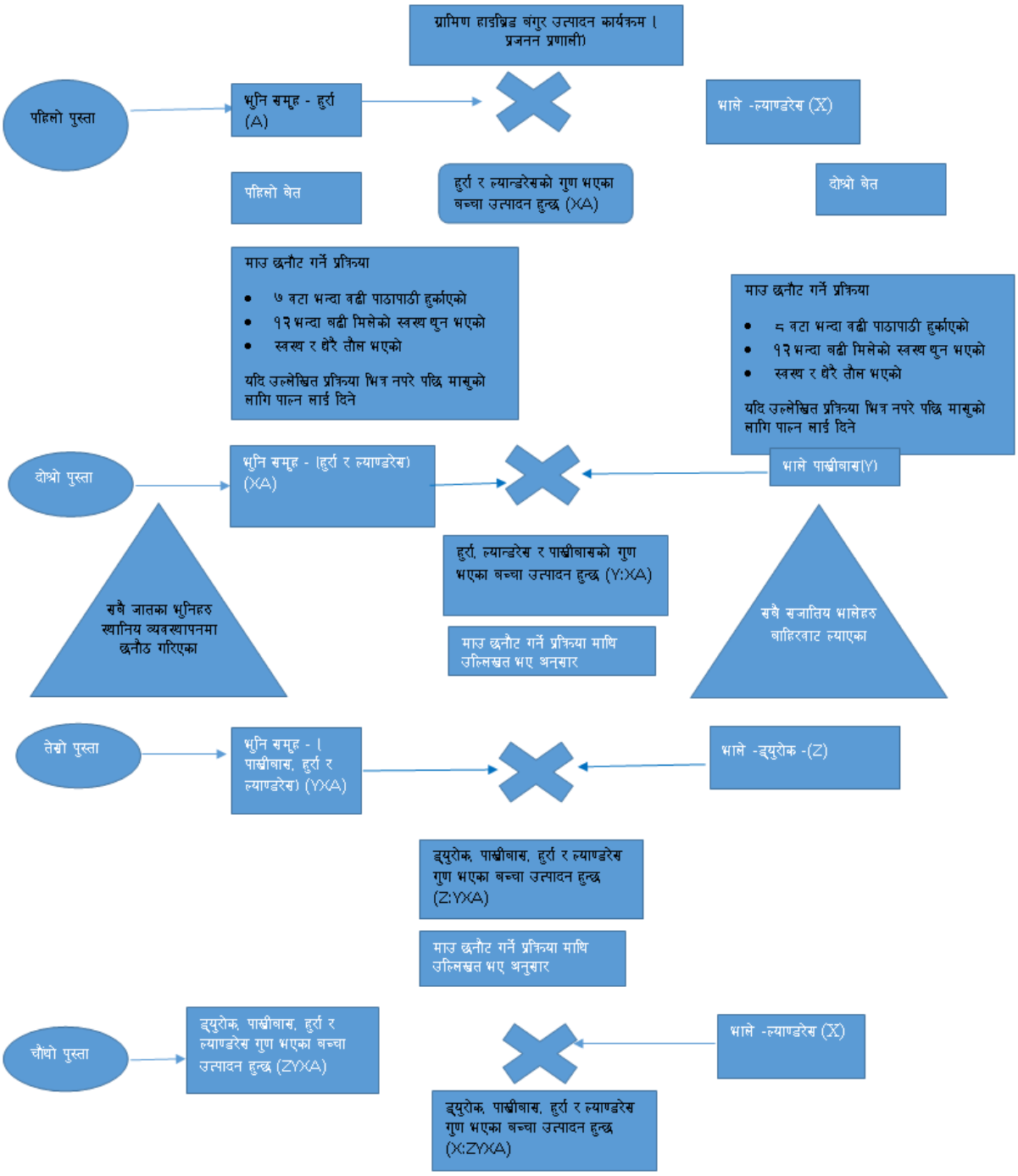
1	DG, Department of Livestock Services	Chairperson
2	Chief, Animal Breeding Division, NARC	Member
3	Coordinator, Swine and Avian Research Program, Nepal Agriculture Research Council	Member
4	Professor from Animal Breeding Department, Agriculture and Forestry University	Member
5	Member secretary, National Animal Breeding & genetic improvement advisory Committee, MOLD	Member
6	Director, Directorate of Animal Health DLS	Member
7	Director, Directorate of Animal Production, DLS	Member
8	Chief, National Livestock Breeding Center, Lampatan	Member
9	Chairperson, Pig Entrepreneurs Association Nepal (PEAN)	Member
11	Chief, Central Pig and Poultry Promotion Office, DLS	Member Secretary

- The committee will develop plan for implementation based on this strategy
- The committee wil review the implemntation of the breeding strategy six monthly intervals
- The pig breeding strategy steering committee will guide, help and will assign respective task to each member institution and will be responsible for monitoring and resolving any issues arises while implementing the strategy.
- The committee will review the breeding strategy every five year and make the implemetation plan accordingly

- Required budget for implementation of the Pig Breeding Strategy will be built in annual programme of Livestock Production Directorate and Central Pig and Poultry Promotion Office under DLS, Swine and Avian Research Programme and Animal Breeding Division under NARC.
- Animal Breeding Division will take lead role in genetic improvement work in Nucleus flocks whereas DLS farms and NARC farm along with some praviate pig entrepreneurs will maintain Nucleus stock.
- NARC and DLS Pig Farms- Maintain Nucleus stock of Yorkshire, Landrace, Duroc, Hampshire
- Private pig farms- Some farms to maintain nucleus stock, others to work as multiplier herds
- NGO/INGO like Samarth/NMDP/ CEAPRED- pig breeding scheme implementation partner
- PEAN will coordinate among stakeholders for strategy implementation.

12 ANNEXES

12.1 ANNEX-1: VILLAGE HYBRID PIG BREEDING SCHEME



12.2 ANNEX-2: COMMERCIAL PIG BREEDING HIERARCHY

Level	Present Status of breeding farms	Facility needed	Activities to be performed
Nucleus Pig Breeding Farms	• LDF, Lampatan pig unit (White breeds) • SARP, Khumaltar (white breeds) • PLPL, Rithepani (white breeds) • Kulung Bangur Farm, topgachhi (White pig breeds) • RARS, Pig umit Tarahara (Black pig breeds) • Other farms in future	• Laboratory facility for frozen boar semen A.I. -Maintainance of pure line sow herds • Maitainance of Recording system for genetic evaluation • Practicing selective pig breeding system • Testing for PRRS, Tuberculosis, Bruscellosis • Bio-security measure under taken • Facility to measure back fat thickness in live pig and weighing machines for growth and feed efficiency measuremnt • Capacity to detect any genetic defects and recognition of the ancestry of the affected animals. • Adoption of recording system as directed by Department of Livestock Services	• Maintain Great Grand Parent/Grand Paretn Stock from frozen boar semen A.I. • Adopt breeding system to produce and maintain pure line of specific breeds • Adopt performance recording, evaluation, testing and selection of gilts and for boars for using fresh boar semen collection and processing • Maintainance of disease free especially PRRS, bruscellosis, TB) pig herds • Should provide the pedigree information of the breeding seed stock provided
Multiplier Pig Farms	• CPPPO identify potential pig herds at different districts • AFU/Academic institutional pig herds • Other government pig herds • Other NARC pig herds • Pig herds maitained at CTEVT farms	• Capacity to do A.I. from Fresh boar semen • Should maintain pedigree records of breeding animals • Maintenanace of pure line of pig breeds • Capacity to Produce dam line of pig breeds • Bio-security measure undertaken • Stock obtained from Nucleus farms	• Produce cross-bred dam lines with superiority in litter size mothering ability • Maintain parent stock to produce dam lines • Maintain pureline to produce terminal sire lines • Pure line pig seed stock production from pureline of Nucleus stock farms • Provide pedigree information of the piglet provided to commercial pig seed stock producer
Piglet producer farms	• Commercial pig breeder Farm (CPBF) use parent stock of dam line from Multiplier herds with reminal sire line either from nucleus farms or from Multipliers or from fresh boar semen A.I.	• Work closely with multiplier pig herds • Focuses on production of three breed crosses	

12.3 ANNEX 3: SAMPLE PIG BREEDING PLAN (AS PER PROPOSED STRATEGY FOR COMMERCIAL FARM)

The following assumption have been made in the proposed breeding scheme

- 500000 slaughter pigs annually
- Two farrowing per sow per year
- 20 piglets (10 male and 10 female) weaned per sow per year
- 1 Boar to serve 10 sows
- 40% female replacement at all nucleus, multiplier and fatteners production unit annually-culling after 5 farrowing on an average
- All males are replaced annually in Nucleus herd

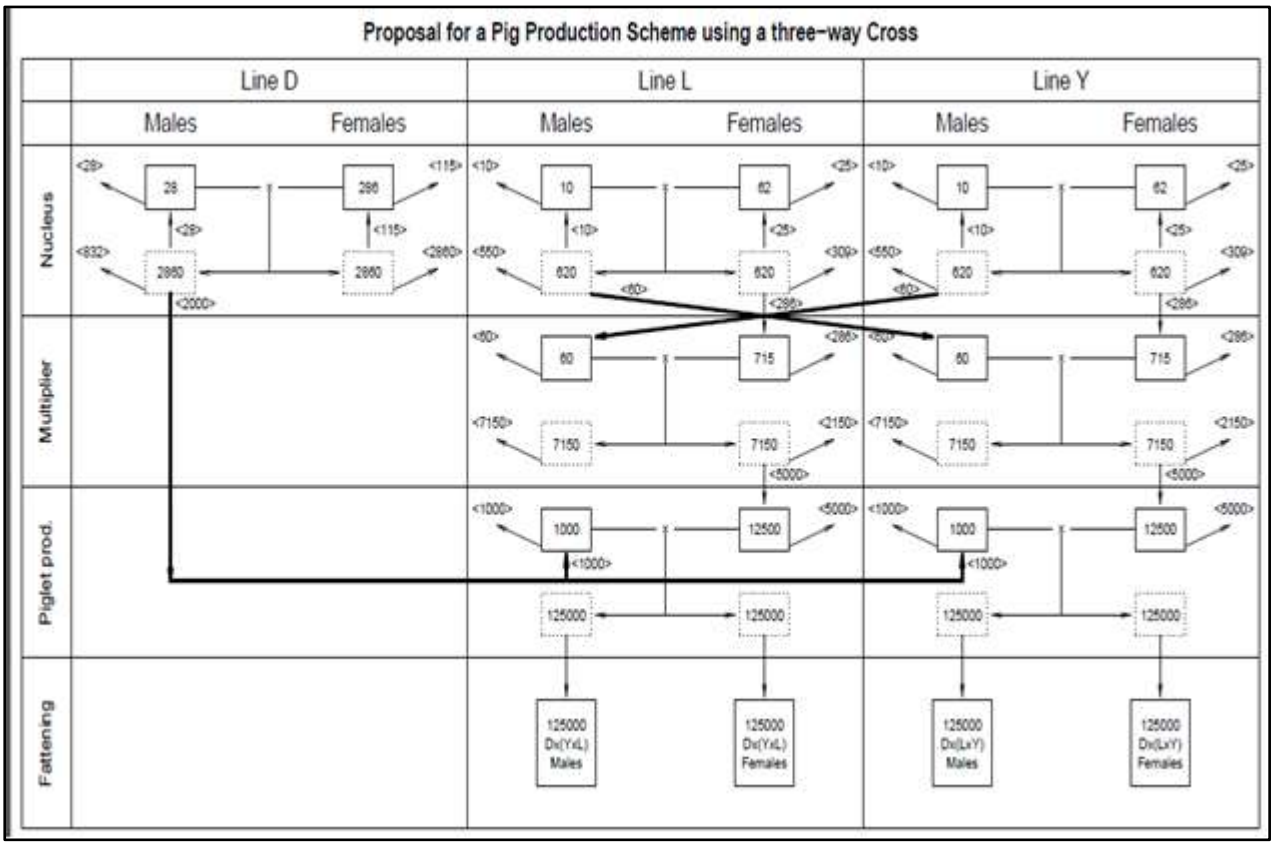


Figure 12.1 An example of Pig production scheme for white pig breed

12.4 ANNEX-4: PEDIGREE PERFORMANCE RECORDING SCHEME AT NUCLEUS AND MULTIPLIER HERDS

The following data table should be maintained

Table 12.1 Herd Registration – Master Herd

Col.	Name	Meaning	Kind	Size	Comment
1	ID_Herd	seq. number	Text	2	Unique number for each herd in the nucleus and in the multiplier
2	Date_EntryHerd	starting Date	Date short		Date (YYYY-MM-DD) when herd joint the scheme
3	District		Text	15	District Administrative
4	VDC		Text	15	VDC Administrative
5	Ward		Text	15	Ward Administrative
6	Name_Family	Family	Text	20	Family Name
7	Name_Given	Given	Text	20	Given Name (Forename)
8	Name_Herd	Name	Text	20	Name of Herd if different from Family Name
9	E_Mail	E-Mail Address	Text	25	E-Mail Address
10	Phone		Text	15	Phone Number
11	Active	Still active	Text	1	Indicator if herd is still active 1=active, 0=inactive

Table 12.2 Base Animal Registration (natives - non-imported) - Master_BaseAnimal

Col	Name	Meaning	Kind	Size	Comment
	#	seq. number	Integer		sequential number on the sheet
1	ID_Herd	Herd	Text	2	ID of registering Herd
2	Date_Regist	Date of reg.	Date short	10	Date of Registering
3	ID_Breed	Breed	Text	2	1=Landrase; 2=Yorkshire/Large White 3=Duroc; 4=Hampshire, 5=?
4	ID	ID of animal	Text	9	unique Identi cation of animal
5	Date_Birth	Date of Birth	Date short	10	Birth Date YYMMDD
6	Sex	Sex	Text	1	1=male; 2=female
7	Colour	Colour	Text	2	1=white, 2=red, 3=black, 4=?
8	Teats_No	No of Teats	Integer		number of Teats (8-16?)
9	ID_Sire	ID of Sire	Text	8	ID of sire if known
10	ID_Dam	ID of Dam	Text	8	ID of dam if known
11	[Comment]	Whatever!	Text	25	

Data Table 3.3 Similar to Data table 3.2 for explicitly those of imported animals

Table 12.3 Mating Recording - Master Mating

Col.	Name	Meaning	Kind	Size	Comment
	#	seq. number			sequential number on the sheet
1	ID_Herd	Herd	Text	2	ID of Herd
2	Date_Mating	Date of mating	Date Short	10	Mating Date
3	ID_Sow	ID of Sow	Text	8	ID of sow mated
4	ID_Boar	ID of Boar	Text	8	ID of mating boar
5	Double	once/twice	Text	1	blank or 1=once, 2=twice inseminated
6	AI	AI used?	Text	1	blank or 0=NS; 1=AI
7	Frozen	kind of AI	Text	1	blank or 0=no; 1=Yes
8	Comment	whatever!	Text	25	Any Comment

Table 12.4 Farrowing Recording - Master Birth

Col.	Name	Meaning	Kind	Size	Comment
	#	seq. number	Integer		sequential number on the sheet
1	ID_Herd	Herd	Text	2	ID of Herd
2	Date_Birth	Date of farrowing	Date	10	Farrowing Date
3	ID_Sow	ID of Sow	Text	8	ID of farrowing sow
4	Born_Dead		Numeric	2	number of still-born piglets
5	Born_Alive		Numeric	2	number of piglets born alive
6	Date_BirthW	Date of weighing	Date	10	Date of piglet weighing
7	ID_Piglet	ID of Piglet	Text	8	ID of piglet weighed
8	Sex	Sex of piglet	Text	1	Sex of piglet: 1=male; 2=female
9	Weight	Weight of piglet	Numeric	x.x	x.x kg Weight of piglet
10	[Comment]	whatever!	Text	25	Any Comment

Table 12.5 Exit Recording - Master Exit

Col.	Name	Meaning	Kind	Size	Comment
	#	seq. number			sequential number on the sheet
1	ID_Herd	Herd	Text	2	ID of Herd
2	Date_Exit	Date of Exit	Date, short	10	Date of Exit
3	ID	ID of pig	Text	8	ID of leaving pig
4	ExitCategory	why gone	Text	1	Nucleus? Multiplier? Grand Parent? Culled? or Died?
5	ExitReason1	reason	Text	15	if Died or Culled most important reason
6	ExitReason2	reason	Text	15	if Died or Culled second most important reason
7	ID_HerdNew	Where gone	Text	8	if gone to nucleus or multiplier Herd: to which Herd?
8	Comment	whatever!	Text	25	Comment whatsoever

Table 12.6 Weaning Weight Recording - Master Weight

Col.	Name	Meaning	Kind	Size	Comment
	#	seq. number	Integer		sequential number on the sheet
1	ID_Herd	Herd	Text	2	ID of Herd
2	Date_WeightW	Date of weighing	Date short	10	Date of piglet weighing
3	ID	ID of piglet	Text	8	ID of piglet (4 weeks old?)
4	Weight	Weight of piglet	Numeric	xx.x	xx.x kg Weight at 4 (?) weeks
5	Comment	whatever!	Text	25	Any Comment

Table 12.7 Weight Recording - Master Weight

Col.	Name	Meaning	Kind	Size	Comment
	#	seq. number	Integer		sequential number on the sheet
1	ID_Herd	Herd	Text	2	ID of Herd
2	Date_Weight	Date of weighing	Date short	10	Date of weighing
3	ID	ID of 'fattener'	Text	8	ID of young pig
4	Weight	Weight of pig	Numeric	xxx	xxx kg Weight at age ???
5	Comment	whatever!	Text	25	Any Comment

Table 12.8 Back-fat Thickness Recording - Master Back fat

Col.	Name	Meaning	Kind	Size	Comment
	#	seq. number	Integer		sequential number on the sheet
1	ID_Herd	Herd	Numeric	2	ID of Herd
2	Date_Fat	Date of measurement	Date	10	Date of scanning of pigs of about 6 month
3	ID	ID of pig	Text	8	ID of pig
4	Thickness1	Thickness of back fat	Numeric	xx	xx mm Thickness
5	Thickness2	Thickness of back fat	Numeric	xx	xx mm Thickness
6	Thickness3	Thickness of back fat	Numeric	xx	xx mm Thickness
7	Comment	whatever!	Text	25	Any Comment

Table 12.9 Health Recording - Master Health

Col.	Name	Meaning	Kind	Size	Comment
	#	seq. number			sequential number on the sheet
1	ID_Herd	Herd	Text	2	ID of Herd
2	Date_Sick	Start of sickness	Date	10	Date of rst observing
3	ID	ID of pig	Text	8	ID of pig
4	Symptoms	what's wrong	Text	25	what is observed, why sick?
5	Diagnosis	diagnosis	Text	25	Diagnosis reasonable sure?
6	Treatment 1	what was done	Text	25	What drug is used, what was done
7	Treatment 2	what was done	Text	25	What was additionally done?
8	Comments	whatever!	Text	25	Additional observation?

Table 12.10 Mass Treatment Recording - Master Mass Treatment

Col.	Name	Meaning	Kind	Size	Comment
	#	seq. number			sequential number on the sheet
1	ID_Herd	Herd	Text	2	ID of Herd
2	Date_MassT	Date of Treatment	Date	10	Date of 1st observing
3	Category	what animals	Text	20	What kind of animals eg piglets, etc.
4	Kind	what treatment	Text	20	vaccination, deworming, etc.
5	Against	against what	Text	20	vaccination against what?
6	Brand	what drug used	Text	20	What vaccine, what drug?
7	Comments	whatever!	Text	25	Additional observation?

12.5 ANNEX-5: CHOOSING A CROSSBREEDING SYSTEM

CROSSBREEDING SYSTEMS

1. Heterosis

A. Crossbreeding systems & maximum heterosis (%):

Table 12.11 Maximum heterosis expected in offspring and maternal sow in various cross-breeding system

System	Offspring	Maternal
F_1 (A x B)	100	0
Backcross (A x (AXB))	50	100
2- breed rotation	67	67
3- breed rotation	86	86
4- breed rotation	93	93
Terminal with F_1 sows	100	100
Rotaterminal with 2-breed rotation	100	67
Rotaterminal with 3-breed rotation	100	86

B. To maximize individual heterosis, should use sows and boars of different breeds, and to maximize maternal heterosis, should use crossbred females.

2. Terminal System

A. Used for both individual and maternal heterosis, and three- or four-breed terminal is the most commonly used system - See an example of the three-breed terminal in a box.

B. Very simple & market pigs have 100% heterosis.

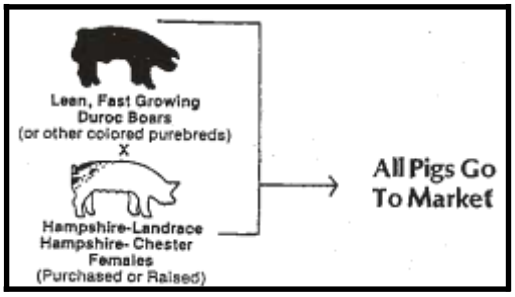


Figure 12.2 Piglet production with 100% heterosis

3. Rotational Systems

A. Maximum heterosis over a long term: Two- breed, 67%; Three-breed, 86%; Four-breed, 93%, etc.

B. Can produce replacement females, reducing chance of disease introduction, and also can reduce costs of replacement.

C. Proper mating is essential to maintain expected levels of heterosis, i.e., mate each sow to the least related breed of boar. A color coded ear-tagging system may be very useful for this purpose!

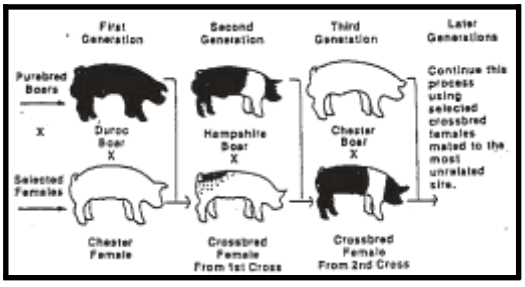


Figure 12.3 Piglet production from rotational crossing system with 67% heterosis

4. Rota-terminal System

A. Simply a combination:

1) Use a rotational system (15-20% of herd) to produce gilts - Usually use white breeds.

2) Use lean, fast growing boars to produce market pigs.

B. Taking advantages of the two systems:

1) Excellent system for producers who want to raise own replacement females.

2) At the same time, market hogs will have 100% heterosis.

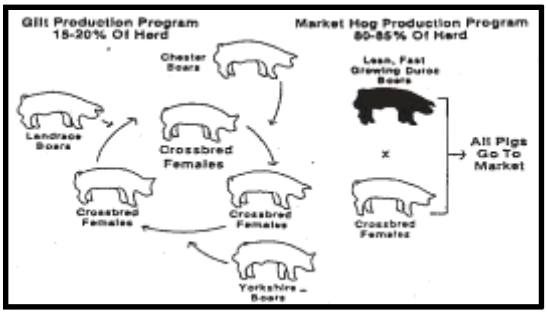


Figure 12.4 Piglet production from rota-terminal system with maximum heterosis

12.6 ANNEX 6: ON FARM TESTING PROGRAMME USING SELECTION INDEXES

(Based on Guidelines for Uniform swine Improvement programmes)

On farm testing programs are designed to assist seed stock producers both Nucleus and Multiplier farm in evaluating their animals in a systematic manner. The programs will assist nucleus breeding farms and multiplier farms in: 1) selecting of boars and gilts for use in their breeding programs; 2) providing procedures for identifying superior individuals within strains, lines, or breeds; 3) supplying high quality performance tested seed stock; and 4) communicating unified terminology and breeding stock selection guidelines to the pork industry.

Procedures

The objectives of on-farm testing programs are best achieved through whole herd testing. Testing only a selected sample of the herd yields limited and biased information. Expected Progeny Differences (EPD) that describe the genetic merit of each animal as a parent can be estimated most accurately by combining all of the available information on a pig and its relatives.

Pigs should be evaluated within *contemporary test groups*. A contemporary group is a group of pigs of the same breed or breed-cross, born in a short period of time, fed the same diet, and raised in the same facilities under the same management. These test groups should be managed uniformly, and all pigs within the test group should be given an equal opportunity to perform. Contemporary groups should consist of at least 10 pigs from at least three litters and at least two sires. Testing smaller groups will lead to inadequate comparisons and less reliable EPDs.

Base Program

When ranking animals, selection indexes should be used to assign appropriate emphasis to each of the various traits. The nucleus breeding farms should meet the following minimum recommendations.

1. ***Identification:*** of all pigs in the herd. All the participating nucleus breeding farms (Grand Parent Seed Stock Farms) should use ear notching system that identifies the litter in the right ear and the individual pig in the left ear.
2. ***Birth Record:*** Within 3 days of birth all pigs must be individually identified and the following recorded in an appropriate record book or file kept by the breeder: gender, birth date, identification and breed of parents. These records are essential.
3. ***Sow Productivity:*** The number of pigs farrowed alive and dead should be recorded. The number of pigs born alive should be adjusted to a mature sow equivalent by adding the following numbers to the record based on the parity of the female:

Table 12.12 Parity adjustment factors for number born alive.

Parity	Number born alive (L)
1	1.2
2	0.9
3	0.2
4, 5	0.0
6	0.2

7	0.5
8	0.9
9+	1.1

An individual breeder may wean at any time, but litter weight should be recorded before weaning and as near to 28days of age as possible for the most accurate assessment of sow milking ability. It recommends weighing pigs between 25 and 35 days and adjusting to a 30 day basis.

Post-farrowing litter weights may be adjusted to a 30-day basis by using the following multiplicative factors:

Table 12.13 Factors for adjusting litter weight to a 21-day basis

Age Weighed	Factor		Age Weighed	Factor
10(19)	1.50		(29)20	1.03
11(20)	1.46		21(30)	1.00
12(21)	1.40		22(31)	0.97
13(22)	1.35		23(32)	0.94
14(23)	1.30		24(33)	0.91
15(24)	1.25		25(34)	0.88
16(25)	1.20		26(35)	0.86
17(26)	1.15		27(36)	0.84
18(27)	1.11		28(38)	0.82
19(28)	1.07		(40)	0.80

The following equation was used to compute the tabular values and can be used to directly adjust litter weight to a 30-day basis:

Adjusted 30-day litter weight = wt[2.218 - .0811(age) + .0011(age^2)].

The closer to 30 days of age pigs are weaned, the more accurate the adjustment will be.

Standardization of the post-farrowing weight record will prevent discrimination against a good milking sow or gilt that has a lesser opportunity because of smaller than optimum litter size. The litter weight (already adjusted to a 30 day basis) should be standardized to 10 pigs by adding the appropriate value from the following table:

Table 12.14 Factors for adjusting 30 day litter weight for number of pigs after transfer (number allowed to nurse)

Number of pigs after transfer(weaned)	Adjustment factor for 30 day litter weight (W)
1-2	104
3	76
4	61
5	51
6	41
7	30
8	21

9	17
>=10	0

Post-farrowing litter weights should also be adjusted to a mature sow equivalent by adding the following numbers to the record based on the parity of the female:

Table 12.15 Parity adjustment factors for 30 day litter weight

Parity	Adjustment factor for 30 day litter weight (W)
1	6.2
2	0.0
3	1.0
4	3.8
5	6.2
6	9.5
7	11.6
8	15.2
>=9	21.5

4. ***Growth.*** Growth rates must be measured on all intact males and/or all gilts by one of two procedures.

   A. ***Age at a constant weight.*** If pigs are not weighed on test but only a final weight is taken, weights should be taken at or near 90 kg constant weight. The equation for adjusting days to a constant weight is:

   where a = 50 for boars and barrows, and 40 for gilts.

5. ***Backfat.*** Backfat depth should be measured at the midpoint of the loin, and should include the skin and all fat layers. All measurements should be adjusted to a constant basis using the formula below:

   where b = -20 for boars, +30 for barrows, and +5 for gilts.

6. ***Live Evaluation.*** Breeding animals must be structurally correct and mobile to carry out their normal functions and sows must have functional nipples to raise pigs.

   Additional traits that may be considered in the base program are:

7. ***Birth weight.*** Weights should be recorded within 3 days of birth.
8. ***Feed Efficiency.*** Feed consumption should be measured on an individual basis if possible. If group fed, pigs should be tested in progeny groups. With group feeding, the number of pigs per pen, sex and relationship among pigs in the pen should be noted.
9. ***Predicted Percent Lean.*** This trait can be used in place of backfat in a selection index. Use the following equation to calculate Predicted Percent Lean (PPL) if pigs are weighed off-test at 90 kg.

Within-Herd EPD Programs

Calculation of EPDs on all pigs in a herd using all available information is a requirement for these programs. In addition to data on the individual, information should include full-sib, half-sib, parental, and progeny data updated regularly. Computer programs are commercially available for the calculation of within-herd EPDs.

Across-Herd EPD Programs

Across-herd breeding value estimation should use multiple trait animal model procedures and genetic parameters derived from the data. An accuracy value that reflects the amount of information used in the genetic evaluation should also be made available. Purebred breeders (Nucleus and Multiplier herds) can participate in across-herd genetic evaluation programs through the Pig Pedigree Performance Recording Scheme by CPPPO and ABD, NARC.

Commercial Program

To make accurate selection decisions, commercial producers who select replacement animals from their own herd should measure the performance level of their animals. The records that commercial producers should keep and the traits chosen for genetic improvement are dependent on the economic value of the traits and the extent to which producers plan to utilize the records in decision making. These essential records should provide the basis for a diagnosis of the program's weaknesses as related to the producer's goals, and serve as an early warning tool to monitor potential program problems. All commercial producers should utilize records on sow productivity and boar performance to evaluate and monitor herd production.

For commercial farms, maximum hybrid vigor is essential in the female. Therefore, planning and implementing a crossbreeding program and keeping a record of female breed composition are important. A sow productivity program should aid in selecting replacement gilts from the most productive sows in the herd and serve as a basis for culling the least productive females. To achieve high production standards, sows need to be prolific, have good milking ability, and rebreed within 7 days post-weaning. Sows that fail to settle in two estrous cycles following weaning should be culled. Computer programs and sow record cards can help as systematic tools to record production activities and performance records. For producers who select replacement females from within their own herds, performance information on individual gilts and their dams is important, and use of a selection index is recommended.

Boars purchased from seed stock producers should come from the top 50% of their test group in test station and on-farm programs. Whenever data are available, commercial producers are strongly encouraged to use EPDs when purchasing animals or semen. Boars selected for use in an A.I. program should meet higher standards and be in the top 10 percent of the population evaluated.

Selection Indexes

Environmental influences make it difficult to compare pigs tested at different locations, at different times, or under different management. Using selection indexes based on contemporary group comparisons will allow comparisons of animals in the same test group. Keep in mind, indexes are not appropriate for comparing different groups of animals.

The traits used in the calculation selection indexes based on (National Swine Improvement Federation) are defined as follows:

L =	the adjusted number born alive record on the dam minus the average of the adjusted number born alive records of her contemporary group.
W =	the adjusted 30-day litter weight record on the dam minus the average of the adjusted 30-day litter weight records of her contemporary group.
D =	adjusted days to 90 kgs 200 pounds measured on the individual minus the average of the adjusted days to 90 kgs or 200 pounds of the test group.
B =	backfat measured on the individual, adjusted to 90 Kgs (200 pounds), minus the average of the adjusted backfat of the test group.
M =	predicted percent lean calculated for the individual minus the average predicted percent lean of the test group.

RECOMMENDED INDEXES[a]

SPI = 100 +6.5(L) + W

EWSPI = 100 + 10(L)

MI = 100 + 6(L) + .4(W) - 1.6(D) - 81(B)

TIA = 100 -1.7(D) - 168(B)

TIB = 100 - 1.4(D) -106(B)

TIM = 100 - 1.4(D) +12(M)

———————

[a] Details about the indexes are given

Sow Productivity Index (SPI). This index provides a measure of sow productivity and is especially useful when culling sows. Prolificacy is measured by the adjusted number of pigs born alive in a litter. Milking ability is measured by the adjusted weight of the litter at 30 days of age.

Early Weaning Sow Productivity Index (EWSPI). This index is designed for use in culling sows when 30-day litter weights are not available. Litter weight at 30 days is used as a correlated trait when the index is constructed, allowing some selection emphasis to be placed on milking ability even when weights are not collected.

Maternal Index (MI). The maternal index is intended to put emphasis on maternal characteristics and is useful for selecting boars to produce replacement gilts and in selecting replacement gilts. Because barrows, and gilts that are unacceptable for replacements, are residuals of this type of mating, there is some emphasis on growth rate, backfat and feed efficiency. Feed efficiency is included as a correlated trait, although it is not measured directly.

Terminal Indexes (TI). The terminal indexes put emphasis on growth, efficiency, and backfat. The terminal indexes should be used for selecting animals to be used in terminal crosses. If backfat is measured using A-

mode ultrasound, the TIA should be used. If backfat is measured with B-mode ultrasound or metal probe, the TIB is the appropriate index. The TIM is for use if PPL has been calculated.

These indexes will average 100 for each test group and should have a standard deviation of about 25. A test group should have approximately the following distribution of index values:

Table 12.16 Distribution of pigs based on criteria selected on index value

Index Value	Percent of Animals
More than 150	2
125 to 150	14
100 to 125	34
75 to 100	34
50 to 75	14
Less than 50	2

If EPDs are reported, animals may be evaluated with similar indexes. The simplest index consists of all the EPDs added together. For example, if a producer is interested in litter size, growth and backfat, the index would be:

$$I = 100 + EPD_L + EPD_D + EPD_B$$

Use of economic values for each trait will weigh the genetic information for the relative economic importance of each trait. Index with economic weighting would be:

$$I = 100 + 13.5 * EPD_L - .17 * EPD_D - 15 * EPD_B$$