MALAYSIAN LIVESTOCK BREEDING POLICY
2013

1. VISION

A leader in tropical livestock breeding.

2. MISSION

Enabling the breeding of quality livestock through sound genetic principles and practices that satisfy the need for economic and sustainable livestock industry, and fulfill the market requirements.

3. BACKGROUND

Domestic animals were probably first introduced into the Malay Peninsular by early human migrants, as they journeyed from Southern China into the Malay Archipelago. It is likely that these early Malays initially brought with them poultry, pigs, goats and sheep, and later buffaloes and cattle (Mustaffa-Babjee, 1994). Some credence to this theory is afforded by the similarities found between indigenous livestock and livestock currently existing in Southern China and Indo-China. For example, the Kedah-Kelantan cattle of Malaysia have been found to closely resemble the Yellow Cattle of Southern China (Epstein, 1969). Reference to livestock is found in numerous Malay poems and in Malay folklore, which have been passed down through the generations. The earliest written record on the presence of cattle and buffaloes in Peninsular Malaysia is found in the 15th century "Melaka Code" of Sultan Mahmud Shah. In describing the country of Man-la-chia (Melaka), the Chinese interpreter Ma Huan (1433) referred to the presence of several species of farm animals, including oxen, goats, fowls and ducks. Modern day Malaysia has a variety of livestock species and breeds. These include indigenous breeds, adapted breeds and continuously imported breeds. Livestock production based on these commodities is described below.

3.1 Livestock Production by Commodity

3.1.1 Beef Cattle

The indigenous breed of cattle is the Kedah-Kelantan, found predominantly in the northern states of Peninsular Malaysia. It is mainly used for beef production and is

considered by many to be the breed of choice for subsistence farming and integration with oil palm. The Department of Veterinary Services (DVS) has about 1,000 head of purebred Kedah-Kelantan cattle at its Tanah Merah nucleus and conservation farm.

Since the 1970s, DVS has imported several exotic breeds for use as purebreds and for crossbreeding. Earlier imports included the Angus, Hereford, Santa Gertrudis, Shorthorn, Simbrah and Droughtmaster breeds. These breeds did not perform well under range conditions (extensive production system) and were not sustainable.

Some of the larger European continental beef breeds were sourced in the form of frozen semen, including the Charolais, Limousin and Chianina. The Charolais and Limousin remain the breeds of choice for crossbreeding in Kelantan and Terengganu, where the production system and micro-climate may be more suited to these types of breeds.

Brahman has been imported since the 1970's as breeder animals in the cattle oil palm integration projects. Brahman crosses from Australia have been used as feeder cattle for the feedlot industry. From 2005 to 2010, a total of 25,843 head of Brahman cattle were imported from Australia into Malaysia as breeder animals, which were distributed to TAC (Target Area Concentration) projects located throughout the country. Most of these animals were kept under oil palm plantations. In 2008, Sabah had embarked on the Brahman Breedplan project in collaboration with the Australian Brahman Breeders' Association. Under the Brahman Breedplan, 5 stud bulls and 18 pedigree heifers were imported, together with about 160 heads of commercial Brahman cows that were already available to form the nucleus breeding unit. In 2009, 120 heads of Brahman pedigree animals were imported from Australia and are kept at the Ulu Lepar Livestock Breeding Center in Pahang.

Bali cattle exist in small herds in several parts of Malaysia. In 1981, a small herd of Bali cattle from the Agriculture Institute of Johor was relocated to Institut Haiwan Kluang (now known as Institut Veterinar Malaysia). In 2003, Felda Farm Products managed to import 987 head of Bali cattle breeders from Lombok, Indonesia and currently there are approximately 2,000 head in Felda farms. These animals are very hardy and prolific and are a success story in their own right. Bali cattle were introduced to Sabah in 1956. In the 1960's, a Bali cattle breeding project was established in Tawau. The breeding project was aimed at multiplication and conservation of the breed. In 1989, a crossbreeding program between Bali cattle and Brahman crosses was introduced and as of today, the progenies from that crossbreeding program were raised mainly under integration with oil palm plantations.

In the mid 1970's, Droughtmaster cattle from Australia were imported by Pahang Bif and later by MAJUTERNAK at the Jelai Gemas Livestock Breeding Center. The Droughtmaster is a composite breed consisting of 5/8 Shorthorn and 3/8 Brahman inheritance. The early experience with these animals in smallholder conditions was not encouraging. However, these animals were found to be more suited for feedlotting with average daily gains in excess of 0.78 kg.

In the early 1990's, Nelore cattle were imported from Brazil by the DVS, and kept at the Ulu Lepar Livestock Breeding Center in Pahang and currently there are about 400 head. The Nelore is a suitable beef production breed in the tropics being hardy, heat tolerant, exhibiting high growth rates and reasonably good carcass quality. This breed is suitable in the extensive system but not favored by local farmers due to their poor temperament.

Up to 2007, 3,000 head of Yellow Cattle were imported from China and kept in Jelai Gemas, Negeri Sembilan and Muadzam, Pahang. From the Jelai Gemas farm, a total of 980 head were selected and relocated to Tersat Livestock Breeding Center, Terengganu to form a nucleus breeding herd. These cattle have adapted well to our local climatic conditions. From 2005 to 2010, a total of 10,550 head of Zebu crossbred cattle were imported from Thailand and Myanmar and distributed to farmers under the Farmers Transformation Program (TRUST Scheme).

Since the 1990's, MARDI has developed two composite breeds, namely the Brakmas and Charoke. Brakmas is derived from crossing Kedah-Kelantan cattle with Brahman and the Charoke is a cross between Charolais and Kedah-Kelantan. The Brakmas are found to be suitable for integration projects whereas the Charoke are recommended for feedlot production.

The importance of dairy cattle such as the Sahiwal-Friesian as a secondary supplier of meat to the beef industry cannot be overlooked. Mafriwal cattle (derived from Sahiwal-Friesian crossbreds) were developed as a dual purpose breed, both for milk and beef production. Mafriwal contributes significantly to the domestic beef production.

The performance of major breeds of beef cattle in Malaysia, under various management systems is given in Table 1.

Table 1. Performance of Major Breeds of Beef Cattle

Breed	Production System	Parameter			
		Birth Weight (kg)	ADG* (kg/day)	2 Years Weight (kg)	Calving Interval (days)
Kedah-Kelantan	Extensive	16	0.18	188	367
KK crosses	Integration	21	0.27	220	401
Brahman	Integration	27	0.34	300	537
Brahman crosses	Feedlot	22	0.79	218	559
Nelore	Extensive	25	0.29	245	542
Droughtmaster	Extensive	35	0.29	320	460
Brakmas	Extensive	23	0.31	316	780
Charoke	Feedlot	24	0.82	325	---
Sahiwal-Friesian	Feedlot	23	0.65	272	424
Bali Cattle	Extensive	Male: 15 Female: 14	Male: 0.29 Female: 0.26	At 36 mths: Male: 320 Female: 260	439

To address the issue of the lack of breeding strata in the beef industry, the state of Pahang under its Makmurbif Accreditation Scheme embarked on a breeding program to create structure within Pahang's beef industry. A 3-tier strata was formed namely a nucleus tier, pedigree breeding tier and a commercial tier. This is illustrated in Figure 1.

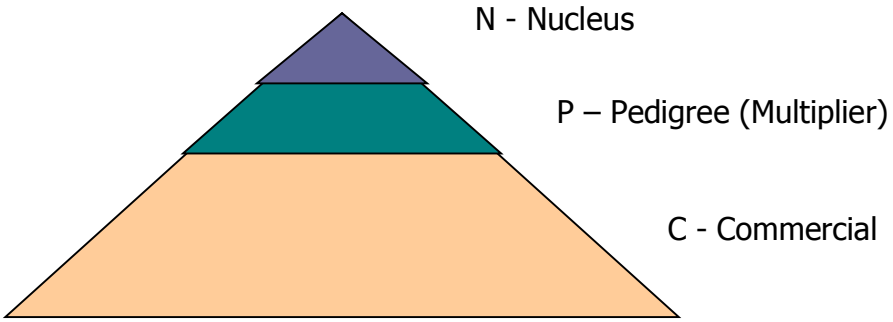

Figure 1. Breeding Structure Under Makmurbif Accreditation Scheme

The nucleus consisted of the Brahman Nucleus Breeding Center in Tebing Tinggi, the Kedah-Kelantan Nucleus Breeding Center in Bukit Katjang and the Nelore Nucleus Breeding Center in Ulu Lepar. Around each of the nucleus breeding centers, farmers were being developed into pedigree farmers. Around Tebing Tinggi for example, farmers were breeding Brahman-based breeding stock. The pedigree farmers obtained breeding stock from the nucleus breeding center close to their farms and their main function was to supply male studs to the commercial tier. The

commercial tier practiced a form of rotational crossbreeding using Kedah-Kelantan based sires, Brahman sires and Nelore sires. This project, although well designed, has been discontinued due to manpower and financial constraints.

3.1.2 Dairy Cattle

Migrants from India imported several non-descript mixtures of Indian cattle breeds (given the name 'Local Indian Dairy' cattle, LID) since the early part of the twentieth century and introduced dairying as an agricultural activity. Introduction of pure dairy breeds from temperate regions was undertaken by European agriculturalists. Amongst the earliest breeds introduced was the English Shorthorn from Australia, which was used to crossbreed with the Local Indian Dairy at the Government Dairy Farm in Taiping, Perak (Main, 1908). In 1926, the Department of Agriculture established a dairy breeding facility at the Serdang Government Farm. The farm was stocked with imported purebred Montgomery (Sahiwal breed) cattle from India, where upgrading and continuous selection were undertaken to produce high-grade dairy cattle (Bunting and Marsh, 1934). These Montgomery cattle were also crossed with Holsteins, Ayshires and Jerseys. In 1931, the Department of Agriculture established another dairy farm in Jeriau, Fraser's Hill to supply fresh milk to the European community there.

In the 1950's, to increase the productivity of local dairy cattle at the Institute Haiwan farm in Kluang, Johor, Sindhi and Sahiwal bulls were used to crossbreed with the LID. This crossbreeding program was able to slightly improve the performance of dairy cows from about 800 liters to 1,200 liters of milk per cow per lactation. More systematic crossbreeding of local zebu animals with European dairy breeds was attempted in the early 1970's, producing crossbreds exhibiting excellent hybrid vigor and giving in the region of 1,500-2,000 liters of milk per lactation. The Department of Veterinary Services capitalized on this successful breeding of dairy cattle by distributing relatively superior crossbred bulls and by providing an artificial insemination service.

The Dairy Development Programme of the Department of Veterinary Services was initiated in 1974. Under this program Milk Collection Centers were established in several strategic locations in Peninsular Malaysia, to service local dairy farms. Through contract breeding with Australia and New Zealand, Sahiwal x Friesian dairy cattle were imported by the government and sold to farmers at subsidized prices. During the period 1975-1991, the government imported 14,708 head of these crossbred dairy heifers.

In the period 1983-1984, MAJUTERNAK imported 500 head of AMZ (Australian Milking Zebu) cattle from Australia. AMZ cattle had 50-65% Jersey and 35-50% Sahiwal-Sindhi inheritance. These AMZ cattle and their descendants were used in a

progeny testing program with CSIRO in Australia and were kept at government farms until 1991-1992, but the program was discontinued due to poor dairy performance. Also in 1992, 200 head of Girlando dairy cattle (Gir x Friesian) were imported from Brazil. However, this program was discontinued after a few years due to poor milking performance under a machine milking system.

Parallel to the importation of Sahiwal x Friesian crossbreds, the DVS embarked on a breeding program to develop the Malaysian Sahiwal-Friesian breed, called the MAFRIWAL. The foundation breeds for the MAFRIWAL were the Holstein-Friesian breed, Kenyan Sahiwal breed, Brazilian Gir breed and the Sahiwal-Friesian. The foundation breeds were carefully selected so as to be from the best of genetic material. The MAFRIWAL has 60-75 percent Holstein-Friesian inheritance and 25-40 percent zebu inheritance and is developed for both milk and meat production. The development of the MAFRIWAL is an ongoing DVS project. However, the number of MAFRIWAL animals owned by the government has dropped considerably from a population of 6,000 head to about 800 head due to the scaling down or closure of DVS dairy breeding farms. This has affected the breeding program in that selection intensity has dropped and the project cannot distribute sufficient animals to the dairy industry. However, frozen semen of top MAFRIWAL dairy sires is available for the dairy industry.

In 2007, approximately 400 head of Jersey cattle were imported from Australia and placed at the Air Hitam Livestock Breeding Center. A small batch of Jersey-Friesian dairy heifers were imported from Australia in 2009 and followed by another 300 head in 2010. In 2012, 1,000 head of Friesian crosses were brought in from Thailand under the Entry Point Project 13 (EPP13) Dairy Cluster Development with the objective to increase the dairy cattle population in Malaysia, thus increasing local milk production at the same time.

In Sabah, the dairy industry development project was started in the early 1970's with the crossbreeding program between local Zebu cattle and imported Friesian using the artificial insemination technique. In 1976, dairy breeding herds were established at Sebrang Livestock Breeding Station, Keningau and Tawau Livestock Breeding Station. In 1980, the initial importation of Sahiwal-Friesian heifers from New Zealand was made. Around the same time, Koperasi Pembangunan Desa (KPD) ventured into highland dairy farming at Mesilau Plateau, Ranau using the pure Friesian breed. Currently, this project is managed by Desa Cattle with 500 dairy cattle.

The status of the dairy industry in Peninsular Malaysia and Sabah since 1990 is shown in Table 2 and Table 3.

Table 2. Status of the Dairy Industry in Peninsular Malaysia (1990 – 2010)

Parameter	Year				
	1990	1995	2000	2005	2010
Total Dairy Animals	N/A	N/A	37,854	25,843	34,386
No. of Milking Cows	N/A	N/A	14,635	9,617	12,646
Milk Production (mil. liters)	26.20	31.87	24.42	34.06	67.00
Milk Yield per Cow per lactation (liters)	N/A	N/A	1,669	2,631	2,658
Lactation Length (days)	N/A	N/A	N/A	300	270
Calving Interval (days)	N/A	N/A	N/A	487	475

Table 3. Status of the Dairy Industry in Sabah (1990 – 2010)

Parameter	Year				
	1990	1995	2000	2005	2010
Total Dairy Animals	1,870	3,140	2,360	3,632	7,180
No. of Milking Cows	1,140	1,740	1,830	2,725	4,204
Milk Production (mil. liters)	2.0	4.89	4.99	7.48	10.4
Milk Yield per Cow per lactation (liters)	1,758	1,905	2,009	2,325	2,470
Lactation Length (days)	272	279	275	282	267
Calving Interval (days)	386	389	402	381	398

3.1.3 Buffalo

The indigenous breed of buffalo in Malaysia is the Swamp Buffalo or Kerbau Sawah. In the 15th and 16th century the Swamp Buffalo was the most significant rural animal, and was used for ploughing paddy fields, transportation and as a supply of meat. The Malays have been known to occasionally milk their swamp buffaloes, the milk being used to produce *dadih*, a dairy product similar to yoghurt. Today the buffalo has lost its prominence due mainly to farm mechanization and urbanization. It is farmed mainly for meat production under an extensive production system. Some oil palm estates are using Swamp Buffalo as draught animals for pulling carts carrying oil palm bunches.

River buffaloes were imported from the Indian subcontinent in the 1920s and are mostly found in Selangor, Perak and Kedah and raised for milk production. New genetic material in the form of live river buffaloes were introduced by DVS with the importation of 150 Murrah buffaloes from India in 2010 and 170 Nilli Ravi buffaloes from Pakistan in 2011.

River buffaloes are not indigenous to Sabah. The early Chinese traders brought the river buffaloes to Sabah during the pre-World War II period. In 1976, a Buffalo

Multiplication and Research Centre was established at Sook and the centre was relocated to the present site at Telupid in 1979. In 1995, a crossbreeding program between the swamp buffalo at the centre with the river buffalo through artificial insemination was initiated. The frozen semen was donated by the then Universiti Pertanian Malaysia. In 2005, the Northern Territory Government of Australia donated 5 head of crossbreed river buffalo bulls as part of the "TenderBuff" breeding program in Sabah.

The buffalo breed found in Sarawak is the swamp type *(Bubalis carabenesis).* In the 1960s the buffaloes were used in paddy land preparation for cropping rice under the Assistance to Paddy Planters Scheme. Buffaloes were actively imported in 1965 to 1968 where some 1,100 were imported annually. They are used in many rituals, ceremonies and festivals of the Bisaya, Kedayan, Malay and Lun Bawang communities of Limbang Division, such as in the Babulang Water Buffalo Racing Festival and the Ratu Babulang competition (buffalo beauty contest). In 1994, the Agriculture Department brought in 60 head of Murrah buffalo *(Bubalis bubalis)* and these were kept at the Batu Danau Buffalo Station in Limbang.

3.1.4 Goat

The indigenous goat reared is the Katjang (or Kacang) breed. It is a small-sized, meat-type, hardy animal with good fertility, found in small clusters reared by smallholders. Due to the Katjang's small build, it has been crossbred with larger exotic breeds. The crossbreeding has been successful to such an extent that the Katjang breed itself is now under threat. Several breeds of goats have been imported into Peninsular Malaysia over the years to be bred pure or for crossbreeding. Meat goat breeds imported include the Australian Feral Goat and the Boer. During the period 2005 to 2010, a total of 64,658 head of commercial grade Boer goats were brought in for the breeding program. Commercial meat goat production in Sabah started in the 1960's by upgrading and crossbreeding local goats with the imported Anglo-Nubian bucks. In 1978, Australian Feral Goats was introduced in Sabah as breeding goats. Boer and Kalahari Red goats were introduced recently. Boer Breeding Centre at Papar and Kalahari Red Breeding Centre at Kunak were established as part of the breeding nucleus for Sabah.

Dairy goat breeds imported include the Saanen, Alpine, Toggenberg and more recently the Shami (Damascus) goat. The Anglo-Nubian and Jamnapari are among the dual-purpose breeds that have been imported. A total of 2,200 head of Jamnapari goats were imported by DVS into the country in 2010. In Sarawak, a total of 115 dairy goats have been imported by the Agriculture Department in 2009, comprising of the Saanen, Anglo Nubian, British Alpine, Toggenberg and the Australian Brown breeds to meet the request of the local dairy goat producers.

In the 1980's, the University of Malaya embarked on a breeding program to develop a synthetic goat breed called Jermasia, using German Fawn and Katjang as foundation breeds. This breed is in demand, but the breeding stock is limited. This breed was developed for both milk and meat production. Numbers of animals in the foundation herd at the University of Malaya are limited (200-250 head). The DVS assisted the University of Malaya to multiply its Jermasia breed at its Kampung Kuala Pah Livestock Breeding Centre, which now has been relocated to Jeram Pasu Livestock Breeding Centre, Pasir Putih, Kelantan.

More recently there is great interest to harness the superior qualities of the Boer breed, which has undergone about 100 years of systematic genetic selection in South Africa. The DVS set up a National Boer Breeding Center (NBBC) in Pondok Tanjung, Perak to capitalize on the attributes of the Boer breed. The NBBC will act as a catalyst for the transformation of the goat industry in Malaysia. The center will consist of a nucleus farm, multiplier farm, service center and sales center. There will be stratified production of the Boer breed through the nucleus and multiplier farms. There will be application of breeding technology. Goat and goat products produced by satellite farms will be of consistent quality. It will have an integrated production system, which is well organized from farm production to marketing. Under the NBBC, training and incubators would be established for commercial goat entrepreneurs. A Goat Data Center is being planned, to provide genetic improvement services to goat breeders and farmers. In addition, 1,300 head of Boer goats are being reared at Telaga Papan, Terengganu under the East Coast Economic Region (ECER) initiative.

The comparative performance of Boer, Jermasia and Kambing Katjang breeds of goats is shown in Table 4.

Table 4. Comparative Performance of Boer, Jermasia and Katjang Goat Breeds

PARAMETER	BREED		
	BOER	JERMASIA	KAMBING KATJANG
Mature Weight (kg):			
Male	80	35	25
Female	60	25	20
Mature Height at Withers (cm):			
Male	75	72	63
Female	65	63	56
Age at First Breeding (months)	13	12	10
Litter Size	1.7	1.4	1.8
Average Daily Gain (g)	150	135	55
Carcass Weight (kg)	35	NA	12
Dressing Percentage	45	NA	50

Source: DVS Malaysia

3.1.5 Sheep

It is known that sheep were raised especially in Kedah, Kelantan, Terengganu and Negeri Sembilan. Sheep were kept for the production of mutton. The indigenous sheep breed of Malaysia is a small-sized wool-hair-type animal, known as Malin (Malaysian Indigenous). Malin sheep are being conserved at the National Institute of Veterinary Biodiversity (NIVB).

Many exotic breeds have been imported for crossbreeding, including the Dorset Horn, Wiltshire Horn, Polled Dorset, Suffolk, Romney and Dorper. In 1926, a sheep

farm was established in Panor, but in 1930 due to high mortality, the animals were relocated to Padang Jeram in Kuantan, Pahang. In Sabah, Sulu sheep were imported from the Philippines in 1932. In 1987, DVS imported a large consignment of Commercial Merino-Border Leicester crosses from Australia to stimulate sheep breeding in Malaysia. Guthrie Estates at about the same time embarked on a program to produce synthetic breeds of sheep for commercial production, namely the Dorsimal (a Dorset Horn and Malin synthetic) and Sufrimal (a Suffolk and Malin synthetic). These synthetic breeds were not popular at that time and the project was subsequently abandoned.

In 1990, Siamese Long-Tailed (SLT) sheep, a wool breed, was imported from Thailand, and was valued for its hardiness. In 1993, the government imported several breeds of hair sheep for trial purposes, including Barbados Blackbelly (from Barbados Island), Santa Inês (from Brazil), Morada Nova (from Brazil) and St. Croix (from the Caribbean). The hair breeds were found to be hardier than the wool breeds and much easier to manage as they did not need shearing. The DVS maintains a Barbados Blackbelly nucleus herd at the Chalok Livestock Breeding Center in Terengganu. The performance of Barbados Blackbelly sheep at the Chalok Livestock Breeding Center is shown in Table 5.

Table 5. Weight and Conformation Measurements of Barbados Blackbelly Sheep*

Parameter	Male	Female
Birth Weight (kg)	2.30 ± 0.28	2.30 ± 0.34
Adult Weight (kg)	43.0 ± 5.8	32.0 ± 5.8
Average Daily Gain (g/d)	34.3 ± 14.0	21.0 ± 10.8
Height at Withers (cm)	71.2 ± 0.3	65.0 ± 4.2
Body Length (cm)	97.5 ± 4.6	90.0 ± 7.8

* Data given is mean ± standard error

Between year 2006 and 2010, a total number of 7,489 heads of Damara hair sheep was brought in by DVS and distributed to farmers throughout the country under the TRUST Scheme.

In the late 1980s, sheep rearing by small holder farmers in Sarawak was introduced as part of the Agriculture Department under Sheep Development Program through the implementation of "halaman" or grazing land development and the distribution of breeder sheep through a loan scheme under the Sheep Farm Flock (SFF) program whereby 50 ewes and 5 rams per farm flock unit were implemented, with the farmers returning the same number loaned to them within the six year period. During the period 1994 to 1998, a total of 12,322 heads of Malin cross sheep were brought in from Peninsular Malaysia for the program.

Recently, a large scale sheep production program is being implemented by the East Coast Economic Region Development Council (ECERDC) in the agropolitan areas of the states of Kelantan, Terengganu and Pahang under their poverty eradication program. In 2009, Pekan Agropolitan Sheep Project was launched in Pahang with the disbursement of Dorper sheep, the first batch of 3,000 head at Runchang and followed by 4,800 head in 2011 at Batu 8, Mukim Lepar.

3.1.6 Swine

The rearing of pigs is closely associated with Chinese settlement in Malaysia. In the early days, it was common for Chinese vegetable farmers in Peninsular Malaysia to keep a few Local Chinese Pig (LCP) which are also known as South China Pig. There were two types of South China Pig, namely the South China (Hainan) which resembles the baconer type and the South China Black (Canton) which resembles the porker type. These pigs were scavengers as well as swill feeders, with a slow growth rate and soft-lardy carcass. They were however very hardy, resistant to disease and parasites, very prolific, had both superior litter size at birth and at weaning, and exhibited good mothering ability. Steps to improve the genetic quality of pigs were initiated in 1926 by the crossbreeding of local pigs with exotic breeds such as the Middle White, Large Black and Poland China. Commercial pig farms were established in the 1950's. Since then a multitude of pig breeds have been imported and tested by pig breeders, including Large White (Yorkshire), Landrace, Duroc, Spot, Hampshire, Tamworth, Chester White, Pietrain and Berkshire. During this time also, the benefits of heterosis through crossbreeding of various breeds had been realized and exploited by pig farmers. Today, the main breeds being utilized are the Large White Yorkshire (LWY), Landrace and Duroc. The performance of these three breeds of pigs in Malaysia is shown in Table 6.

Table 6. Performance of Major Pig Breeds and Their Crosses

Parameter	Breed or Breed Cross*					
	D	L	LWY	D x L	D x LWY	D x (L x LWY)
Birth Weight (g)	1,800	1,650	1,700	1,600	1,600	1,500
Litter Size (at birth)	9.5	10	10	9.5	9.5	9.0
Litter Size Weaned	8.5	9	9	8.5	8.7	8.25
Age at first farrowing (days)	365	365	365	365	365	365
Farrowing Interval (days)	165	160	160	165	165	162
Post Wean ADG (g/d)	850	800	830	800	800	760
FCR (unit)	2.9	3.0	3.1	3.0	3.0	3.2
Slaughter Age (months)	5.5	6.0	6.1	6.0	6.0	6.5
Slaughter Weight (kg)	100	102	107	102	102	110
Carcass Weight (kg)	75	76.5	80.3	76.5	76.5	83
Dressing %	75	75	75	75	75	75
Carcass Lean (%)	60	57	57	56	56	55
Fat Depth (cm)	1.2	1.5	1.5	1.6	1.6	1.8
Loin Eye Area (sq. cm)	40	38	36	35	35	32

* LWY = Large White Yorkshire; L = Landrace; D = Duroc; Post wean ADG is from 30 kg to slaughter weight; FCR is the FCR for porker production (not whole farm); Loin eye area is used

Before the 1960's, there were two breeds of pig found in Sabah: the "Chinese-sway-back" brought in from China at the turn of the 19th century, and the indigenous kampong pig that had existed since time immemorial. Berkshire was the first exotic breed imported to Sabah in 1960 from the United Kingdom. In 1967, Large White, Landrace and Duroc were introduced to Sabah. Kiansam Pig Unit was established in 1976 as the breeding unit for selection of good genetic stock.

In Sarawak, pig rearing had remained free range and back yard and mainly for home consumption. Pig rearing was given much encouragement by the Department in the 1960s and improved breeds like the Tamworth and Berkshire were imported from Australia in 1963 under the Colombo Plan Aid Project to inject new genetic material. In the seventies, breeds such as the Duroc, Large White and Landrace were also brought in and these breeds have contributed significantly to the porker production. Prior to 2005, the local pig production system can be described as a "one-site" production system where all the stages of rearing from mating, gestation, farrowing, weaning and porker production were on a single site and under continuous production. This system of production has been noted to result in poor disease control, lowered productivity and high reliance on antibiotic usage. A restructuring of the pig industry was recognized to be beneficial to transform and modernize the swine industry in Sarawak as well as to control pig waste pollution. The State Planning Authority approved the master plan for the country's first centralized pig farming area (PFA) on an 804 hectares site at Pasir Puteh in Samarahan Division. This PFA is designed to accommodate 250,000 standing pig

population (SPP) and all the 72 licensed pig farms in Kuching and Samarahan Divisions will be relocated to the PFA. The central PFA will adopt a stratified production system consisting of a Grand Parent Stock unit, Multiplication Breeding unit and Porker Production Unit. Biosecurity measures include perimeter fencing for the whole farm, biosecurity centre, vehicles dips and sprays, veterinary centre and an administration block. An EU standard abattoir with capacity to slaughter 120 pigs per hour and cold room facilities was also built. Other facilities and amenities include a state of the art waste treatment and biogas plant, portable water treatment plant, sale house, staff accommodation and feedmills. Productivity in the current Anchor farm in the PFA has increased tremendously from 16 to 21 piglets per sow per year. The 250,000 SPP is expected to be realized in 2018. Pollution from the PFA is expected to be minimal as all farm wastes are treated in the Biogas Plant and the final waste water will be further treated in the surrounding wet lands.

3.1.7 Poultry

From archeological findings, chickens are amongst the earliest of domesticated animals, dating back to 2,000 B.C. With agriculture becoming well established after the 14th century, the indigenous Ayam Kampong (or village chicken) was reared by most households but in small numbers. The Ayam Kampong was probably domesticated from the wild jungle fowl. In earlier times, chickens were more important for use in cockfighting than for food. They were raised naturally (organically), were left to tend to themselves and received little attention other than being given household scraps and leftovers. Mustaffa-Babjee (1994) suggests that exotic chickens could have been introduced into the country during the Portuguese and Dutch colonial periods, implying that crossbreeding of local chicken with European breeds could have already taken place by the 15th century. In more modern times, steps to improve local chicken by crossbreeding were initiated by the Agriculture Department in 1932, through the use of heavy breeds such as Rhode Island Red, Light Sussex, White Wyandottes and White Leghorns. In Sabah, White Leghorns and Rhode Island Red chicken were introduced in 1929.

The control of Ranikhet disease and the availability of balanced rations from large feedmills allowed large scale poultry production to flourish in the 1960's. During this period also, the Department of Veterinary Services undertook scientific poultry breeding programs. For example, through the Poultry Breeding and Research Station in Johor Bahru, the local "Ayam Baka Johor" was developed for egg production. However, these programs were abandoned when superior commercial hybrids became available through importation. Breeds (trade marks) of layer parent stock imported into Malaysia include Golden Comets, Hisex, Isa Brown, Babcock, Tetra, Dekalb, Lohmann Brown, Hyline and Shaver. Breeds of imported broiler parent stock include Arbor Acres, Avian, Cobb, Lohmann, Ross, Hybro, Shaver and Hubbard. Local breeders have moved upstream to import grand-parent and parent stocks to

facilitate local production of hybrid broiler and layer chicks. Today most commercial layer chicks are produced locally. In Sarawak, poultry rearing had remained free range and back yard and mainly for home consumption. The post colonial Sarawak saw tremendous change in poultry keeping from back yard farming to large scale commercial farms. The adoption of intensive poultry rearing using genetically improved breeds, well formulated compounded feeds and backed by the government veterinary support services had revolutionized poultry farming. This had resulted in the reduction in live broiler imports and thus the evolvement of the commercial poultry sector.

The general performance of broiler and layer chickens is shown in Table 7.

Table 7. Performance of Broiler and Layer Chickens

Type	Parameter	Performance
Broiler	Body weight at 5 weeks (kg)	2.019
	Average Daily Weight Gain (g/d)	57.10
	Feed Conversion Rate	1.61
	Dressing carcass weight (kg)	1.43
	Dressing Percentage (%)	71
Layer	Age at first egg (days)	126 - 130
	Egg production (52 weeks)	290
	Egg weight (g)	65
	Feed Conversion Rate	2.23

Some ducks and geese were most likely to have been introduced by Chinese traders from the 5th century onwards but the bulk of these animals could have been brought in when Chinese migrant workers began to arrive in the early 18th century. Most Chinese and some Malays kept ducks. The "itek jawa" and "itek nila" were the popular breeds kept by the Malays whilst the "Poa Chi" hybrid was preferred by the Chinese. Commercial duck rearing was undertaken by the Chinese community in the 1950's. Progress in the development of duck breeding is slower as compared to chicken breeding. Currently the duck breeds used are Peking, Muscovy, Aylesbury, Cherry Valley and the local Itik Jawa Crosses. The DVS has a Muscovy and Khaki Campbell duck breeding facility at Paya Jaras Livestock Breeding Center. Duck meat and egg is mainly consumed by the Chinese community, duck eggs being consumed mainly as salted or preserved eggs.

Some work on quail breeding and production was done at the Poultry Breeding and Research Station in Johor Bahru in the 1960's and 1970's. Breeding objectives were more on quail egg production with little emphasis on meat production. In the late 1980's breeding work on quails were revived and geared towards meat production.

Local and imported quails were evaluated and used as foundation breeds in the breeding programs. A meat type quail, called "Puyuh IKTA", was eventually produced that is fast growing and efficient. Selection work has stagnated due to limited expertise. New work will be undertaken in the near future to expand further the breeding program for quails, aimed at improving productivity. It is hoped that a layer type of quail can also be developed.

3.1.8 Deer

Breeding deer in captivity for conservation purposes was initiated by the Department Of Wildlife in 1977 at Sungkai, Perak. In 1980, the DVS imported 34 head of Red deer (*Cervus elaphus*) from New Zealand for a pilot project in Ijok, Kuala Selangor to study the possibility of commercial deer farming in Peninsular Malaysia. This pilot project obtained valuable information and it stimulated much interest in deer farming for recreation and meat purposes (Babjee, 1994). In 1992, 200 head of Timorensis (*Cervus timorensis*), 18 head of Sambar and 18 head of Chittal (*Axis-axis*) deer were imported from Mauritius, Sabah and Sulawesi Island in Indonesia into the Behrang Hulu Livestock Breeding Center in Perak. Following the development of a new township, the selected deer in Behrang Hulu Livestock Breeding Center were relocated to a new dedicated deer farm, Lenggong Livestock Breeding Center in Perak. Currently, the deer population of this farm has increased to 1,298 head consisting of 1,100, 50 and 148 head of Timorensis, Sambar and Chital deer respectively. Between 1980 and 2010, the number of farmed deer in Malaysia increased significantly from less than 100 heads to over 13,000 heads.

In Sabah, deer farming was initiated in 1977 with the gift of 11 head of Chital (*Axis axis*) deer from the Indonesian government. Sambar deer was obtained from local farmers, and farmed at Sebrang Livestock Breeding Station, Keningau in 1978. In 1981, a deer project was established at Telupid with the importation of Timorensis deer from Australia. In addition, Red deer imported from New Zealand was introduced in 1989.

In Sarawak, the Sarawak Economic Development Corporation (SEDC) farm at Karabungan, Miri first started the commercial deer farm in 1993 with their initial purchase of 396 hinds and 31 stags from Australia. In 1996 another 20 stags were brought in. The deer herd was doing extremely well and between 1993 and 1998, the fawning records showed that 1,293 deer were born. In 1997, the Agriculture Department acquired 100 breeders from this farm and are now maintaining this herd at around 700 heads and selling some 200 heads per year to breeders and the meat market.

3.2 Current Trend of Livestock Population

The livestock described earlier in the text have gone through several stages of growth. From a small population at the turn of the 20th century, the number of livestock has increased dramatically over the decades. The population of major livestock classes in Malaysia under the Ninth Malaysia Plan (2006 – 2010) is shown in Table 9.

Table 8. Population of Major Classes of Livestock under Ninth Malaysia Plan

Class of Livestock	Year				
	2006	2007	2008	2009	2010
Cattle	786,201	842,186	851,227	860,491	837,543
Buffalo	128,938	130,775	131,229	127,152	125,175
Goats	349,427	428,263	477,480	514,233	494,499
Sheep	116,387	125,988	131,278	136,285	123,349
Deer	16,033	12,659	14,894	14,612	13,862
Swine	2,029,119	2,020,117	1,988,889	1,831,308	1,880,309
Chicken	179,226,276	188,383,841	192,693,703	208,332,522	225,789,624
Duck	8,640,628	8,261,647	7,120,994	7,521,819	7,927,857

- Source: Annual Livestock Statistics, Department of Veterinary Services Malaysia

3.3 Development of Breeding Infrastructure

Initially, government farms were set up to function as breeding stations, to disseminate genetic material in the form of live animals to farmers. A good example of this is the Veterinary Institute Malaysia (IVM) in Kluang, Johor. The main breeding practices in these farms involved natural mating. Due to the many advantages of artificial insemination, and not to be left out in the stream of time and technology development, the country decided to adopt this technology. During this time, artificial insemination works were carried out at limited scale and coverage.

The need to intensify artificial breeding of livestock using state of the art technology for producing quality semen was realized in the 1970's. Initially this role was undertaken by the National Animal Breeding Center (NABC), which was located at Pantai, Negeri Sembilan, then relocated to the Air Hitam Livestock Breeding Center in Johor. To further enhance the needs for genetic improvement in the country, new facilities were required. Thus, in 1989, the National Institute of Animal Biotechnology (NIAB) complex in Jerantut, Pahang was finally established for operation. Besides producing frozen semen, the Institute is also involved in multiple ovulation and embryo transfer program (MOET). It was formally opened by the Hon. Minister of Agriculture on August 30th 1997. With the establishment of the NIAB, the NABC ceased operations and all its staff were relocated to the NIAB complex. The institute has recently been renamed in 2010 as the National Institute of Veterinary Biodiversity (NIVB). The scope of the institute has been further widened to include conservation and sustainable development of livestock genetic resources. MARDI is also involved in breeding work through their National Embryo Center in Kluang, Johor.

In Sabah, pureline breeding of Brahman and Bali is carried out at Livestock Breeding Station in Tawau. A Biotechnology Center in Keningau has been established to produce cattle frozen semen to meet the local demand.

3.4 Breeding Policy Development

In Port Dickson in April 1980, under the auspices of the DVS, the First Meeting of the Committee on Cattle Breeding Policy was convened. This meeting was attended by experts from the University of Malaya, University Pertanian Malaysia, MARDI, MAJUTERNAK and the Department of Veterinary Services. The committee came up with recommendations on the breeding of dairy cattle, beef cattle and buffaloes. This was followed by a second meeting of the same committee in July 1986. This committee played an instrumental role in addressing issues on the breeding of cattle and buffaloes at that time. The solutions proposed could not be fully implemented at that time due to limited resources which did not support a comprehensive policy.

3.5 Challenges in Livestock Breeding

The livestock industry is currently facing challenges that are new and multifaceted. Firstly, Malaysia together with other developing countries is undergoing what is now termed as *The Livestock Revolution* (Delgado *et al*., 1999), in which demand for livestock products is increasing at an incremental rate and hence the animal industry is challenged to reinvent itself to meet the needs of the nation. Secondly, with globalization and the liberalization of international trade, there is rising competition for market share as far as livestock products are concerned. The ability to increase quality and productivity, and become competitive vis-à-vis other countries has also taken on a new dimension. Given this scenario, the production of quality breeding stock from a structured breeding system is being given high priority by the Ministry of Agriculture and Agro-Based Industry (MOA). In the light of these developments, MOA perceives the imperative need to have a comprehensive policy document on livestock breeding, covering all the major commodities including dairy cattle, beef cattle, meat goats, dairy goats, sheep, deer, poultry and pigs. This endeavor will also be in line with Strategic Priority 3 (Establish and strengthen national sustainable use policies) and Strategic Priority 4 (Establish national species and breed development strategies and programs) of the Food & Agriculture Organization's Global Plan of Action for Animal Genetic Resources (FAO, 2007).

4. CURRENT BREEDING PRACTICES

Current breeding practices are outlined for beef cattle, dairy cattle, buffaloes, meat goats, dairy goats, sheep, pigs, chicken, ducks, quails and deer.

4.1 Beef Cattle

Beef cattle are primarily bred for efficient and economic meat production. In 1980, The Committee on Cattle Breeding Policy stipulated that pure-line breeding of indigenous Kedah-Kelantan cattle be continued for long-term selection and as a base for future crossbreeding programs. Crossbreeding of beef animals was also recommended for commercial beef production using imported exotic breeds such as Angus and Hereford. Both *inter se* mating and criss-cross breeding was advocated and continued to be in practice.

There is no well structured breeding program for beef cattle, which are currently farmed under 3 types of production systems:

- Traditional farming
- Integration with tree-crops
- Feedlot

Under traditional farming, most farmers use natural mating of purebred indigenous Kedah-Kelantan cattle. Purebred Kedah-Kelantan cattle and its crosses are also crossed with other breeds such as Brahman, Charolais, Limousin and Belgium Blue. Most farmers in Kelantan and Terengganu prefer the Charolais and Limousin breeds for crossbreeding with their Kedah-Kelantan based animal. Beef cattle crossbreeding with exotic breeds are mainly undertaken using artificial insemination. Traditional farms do supply feeder animals to the tree-crop integration areas and to feedlot.

Under integration with tree-crops, three dominant types of herds can be seen, which are pure Kedah-Kelantan, Pure Brahman, commercial grade Brahman and KK-Brahman crosses. Farmers prefer Kedah-Kelantan or their crossbreds as these animals are very hardy and can easily be reared with minimal problems under tree-crops. Also found under this production system is a small population of Bali cattle. Natural mating is widely practiced in this system while a small percentage used AI using semen produced locally or imported. Integration projects do supply crossbred feeder animals to feedlotters.

Feedlotters obtain feeders mainly by importing Brahman and Shorthorn crosses from Australia and Brahman crosses from Thailand. They also do obtain their stock of feeders from traditional and integration farms. Minimum breeding activity is carried out here. If there is any, both natural mating and AI are practiced.

The government has established a National Feedlot Program. The program is an integrated approach along the beef value chain. Under this program is the National Feedlot Corporation as the umbrella company with its Satellite Farms as their contract farmers. Associated with the National Feedlot Corporation are companies involved in animal feed and fodder production, livestock suppliers, abattoir and meat processors and fertilizer producers. The *modus operandi* is for NFC to have a multiplier breeder farm to produce feeder cattle for the satellite farms. Natural mating will be the main breeding practice. No breeding is allowed in the satellite farms.

4.2 Dairy Cattle

The dairy production system in the country can be classified as one of 2 types namely a medium-input system or a high-input system. It is estimated that 90% of farms employ a medium-input system and the rest a high-input system. Under the medium-input system, breeding animals utilized are mainly Sahiwal x Friesian based crossbreds and Jersey x Friesian. Due to the recommendation from DVS, farmers also produce offspring having 60-75% Friesian and 25-40% Zebu inheritance. The MAFRIWAL breed developed by DVS is also used in this medium-input system.

These animals are generally adapted to the tropical environment and can be maintained using local feedstuffs. Some farmers also use the pure Jersey breed.

Under the high-input production system, dairy farmers use mainly Friesian, Jersey and Jersey-Friesian crossbreds as breeders. Breeders are mated to preserve the temperate inheritance. Hence, these dairy farmers depend heavily on imported genetic materials. Animals under a high-input production system are normally well-housed, and in some instances closed-house facilities with temperature control are employed. Animals are stall fed with high quality feed, formulated using a high proportion of imported grains.

In general, about 60-70% of the farmers practice natural mating while the rest use AI as compared to almost 100% AI for dairy cattle in developed countries.

4.3 Buffaloes

There is not much emphasis on genetic improvement for buffaloes in Malaysia. In general, since a Swamp Buffalo herd never mixes with a River Buffalo herd, both are bred pure. For dairy buffalo, the farmers use river buffaloes such as the Murrah. The DVS has Murrah and Nili Ravi as dairy buffaloes. The State of Kedah is currently breeding Swamp Buffalo with imported semen from Italian Mediterranean Water Buffalo on the island of Langkawi, to produce a crossbred animal that can be used for both milk and beef.

Similarly in Sabah, government and private farms also breed buffaloes. In 2004, Sabahmas Plantations in Lahad Datu embarked on a Swamp Buffalo breeding project with the aim to produce more draft buffaloes for pulling carts in the plantations. The Swamp buffaloes were imported from Northern Territory, Australia. The State Government of Sabah has a Buffalo Breeding and Research Center at Telupid. Swamp and Murrah buffaloes and their crossbreds are reared at the Center.

Almost all buffaloes in Malaysia are bred through natural mating. Only a small percentage of them are bred through AI particularly in Buffalo Park, Pulau Langkawi.

4.4 Meat Goats

Goats are bred mainly for meat (chevon) production. In the rural areas breeding is by natural means using Katjang crossbreds. DVS through NIVB has initiated efforts to conserve indigenous Katjang goats through both *in situ* and *ex* situ methods. Other government goat breeding farms (GBC) keep Boer and Jermasia breeds. Continuous purebreeding work using AI and natural mating to improve the genetic quality is carried out. Breeder farmers over the years have also resorted to

importing Boer, Kalahari Red, Australian Feral, and Jamnapari-based breeds for purebreeding and crossbreeding. Breeding methods include natural mating and AI. In the past, there were farms that used a specific crossbreeding system to produce terminal crosses for meat production.

4.5 Dairy Goats

There is a niche market for goat milk. Dairy goat breeds used are the Saanen, Alpine, Anglo Nubian, Toggenburg and Jamnapari, with the Saanen breed being most popular due to its high milk yield. Saanen, Alpine, Anglo Nubian and Toggenburg breeds are kept at the DVS Infoternak Farm in Sungai Siput, Perak. Dairy goat farmers rear Saanen, Alpine, Anglo Nubian, Jamnapari, Shami and Toggenburg and their crosses. Mating is mainly through natural means although some artificial insemination is practiced.

4.6 Sheep

Sheep are reared for meat production. In the rural areas, sheep rearing is mainly based on the Malin and its crosses. Breeding is by natural means. The wool when produced does not have much economical value to the industry. The hair-type breeds such as Barbados Blackbelly (BBB), Santa Ines and Morada Nova are more suitable for meat production in Malaysia. They are hardy, have good productivity and do not need shearing. Government Livestock Breeding Centre at Chalok, Terengganu has BBB and Morada Nova and IVM Kluang, Johor has Santa Ines and BBB. Meanwhile, wool-type sheep such as Damara are kept at Livestock Breeding Center Gajah Mati in Kedah and Malin at NIVB Jerantut in Pahang. Mating is mainly through natural means although some artificial insemination is practiced. MARDI Research Station in Kluang breeds the Dorper breed for research purposes. At the commercial level, farmers mostly use crossbreds having a mixture of 2 or more breeds such as Barbados Blackbelly, Damara, Malin and Dorper. Large scale sheep farming using mainly crossbred sheep has been established in the Modern Agricultural Project in Kluang, Johor and the Agropolitan Project of East-Coast Economic Region (ECER) in Pekan, Pahang.

4.7 Pigs

All pig breeding stock are imported from overseas. Local breeding companies multiply purebred imported stock and sell them to commercial farms. Typically a pig farm will have either Large White or Landrace or both breeds. These breeds are bred pure or crossbred to produce farm replacements. To overcome the problems of inbreeding, the farmer may from time to time infuse purebred Landrace or Large

White genetic material into his herd. To produce animals for market (terminal cross), the farmer will make one of the following crosses where Duroc, a meaty breed, is used as the Terminal Sire.

i) Duroc ♂ x Large White ♀
ii) Duroc ♂ x Landrace ♀
iii) Duroc ♂ x (Large White x Landrace) ♀

Commercial pig farms do keep records of animal type, birth weight, litter size, weaning weight, numbers weaned and adult weight. Some farms use computerized software packages such as PigCHAMP.

Use of artificial insemination to produce porkers to be marketed at 6 months of age is also being practiced. Most of the larger farms (above 5,000 SPP) do practice AI. These farms have their own parent boars from which the semen is collected. The farms also have their own AI laboratory. Frozen semen imported from USA and Canada is also being used. The smaller farms which practice AI depend on larger farms for their supply of boar semen. The AI services in these smaller farms are provided by private individuals as and when their services are required.

4.8 Chicken

The Malaysian Poultry Industry (comprising chicken and ducks) adopts a policy of continuous importation of germplasm, where grandparent stock are imported and managed under an integrated system. Local breeding companies multiply imported breeding stock and use them for commercial production. In the international scenario, the number of breeders is limited and the competition to produce the most efficient chicken is intense. At present there are 4 companies having broiler grandparent stock (GPS). All the GPS are imported. Parent Stock (PS) farms use mainly PS produced by local GPS farms. Some PS are also imported mainly from Europe and the United States. No breeding work is done here except crossing for production of PS and commercial broilers. For the layer industry, there is no GPS farm. There are only PS farms and all grandparent stock are imported. No local breeding programs are available to produce our own local breed due to the high cost and technologies involved.

4.9 Duck

For the duck industry, there is no GPS farm but only PS farms. All parent stock are imported. No breeding work is done here except crossing for production of PS and commercial ducks. No local breeding programs are available to produce our own local breed due to the high cost and technologies involved.

4.10 Quail

DVS has developed "Puyuh IKTA" breed for meat production since 1996. Breeding work on these quails are currently carried out at Institut Teknologi Unggas (ITU) Masjid Tanah, Melaka. This is the only GPS farm in the country and produces only "Puyuh IKTA". There are several PS farms that are using random types of quails to produce crosses for commercial quail farms. For commercial breeders, no systematic selection work is carried out for both broiler and layer quails.

4.11 Deer

Deer are kept in situations varying from small enclosures on fauna parks or intensive deer farms, to extensive grazing at low stocking rates on pastures. Deer are reared mostly for their meat but there are several farms collecting and selling their antler and also velvet for medicine purposes. There are also deer parks in this country that breed this kind of beautiful wildlife animal for agrotourism. Tropical deer do not have a well defined breeding season. They can reproduce throughout the year. Because of their wild behaviour, breeding is mainly by natural mating. Under a restricted mating system, stags are removed from the hinds and reunited during the warmer season.

5. ISSUES AND CHALLENGES

5.1 General Issues and Challenges

1. Breeding performance of introduced breeds rather poor
2. Limited (quality + quantity) genetic resources available locally
3. Limited resources for conservation and improvement of livestock breeds for future generations
4. Low utilization of some indigenous livestock breeds, making them vulnerable to threat/endangerment
5. Lack of national livestock data recording and genetic improvement structure
6. Limited relevant applied research on livestock breeding
7. Poor knowledge base on the breeding and improvement of farm animals
8. Lack of effective livestock breeding services
9. Weak institutional and legal framework to regulate livestock breeding activities
10. High initial capital cost in undertaking breeding projects; Lack of appropriate financial mechanism
11. Poor sanitary and phytosanitary status affecting farm biosecurity and hindering export growth for breeding products
12. Reproductive diseases not properly screened / identified
13. Breeding projects have not taken into account the effect of climate change on breeding stock and the optimization of feed resource usage
14. Limited number of local expertise on breeding technology
15. Technology uptake and utilization rather slow (e.g. artificial insemination and embryo transfer)
16. Limited regional and international networking
17. Lack of continuity in research and breeding program
18. Mismatch of genetic resources to the production system (especially feed)

5.2 Issues & Challenges Affecting Major Classes of Livestock.

BEEF	DAIRY	BUFFALO	GOATS	SHEEP	POULTRY	PIGS
Low breeding population of beef cattle Rely on continuous imports of breeding and slaughter animals Breeding and multiplication not structured Breed productivity generally poor Limited scale of operation of Brakmas, Charoke and KK breeding programs Bio-prospecting for suitable exotic germplasm not given top priority Poor enforcement of regulation and monitoring of health programme. Lack of advanced breeding technology usage	Low breeding population of dairy cattle Rely on continuous imports of breeding cows Mafriwal cattle breeding project of limited scale and confined to government farms No industry model for profitable dairy breeding and farming Breeding and multiplication not structured Breed productivity generally poor Lack of advanced breeding technology usage	No breeding plan for buffalo – Buffalo a neglected species Niche market for buffalo meat in specific regions not fully exploited Import of cheap Indian buffalo meat has lowered demand for local buffalo meat Murrah buffalo has a very limited gene pool Lack of advanced breeding technology usage	Low breeding population of meat goats Rely on continuous imports of breeding and slaughter animals Breeding and multiplication not structured Breed productivity generally poor Bio-prospecting for suitable exotic germplasm not given top priority No breeding program for dairy goats Lack of advanced breeding technology usage	Low breeding population of sheep Rely on continuous imports of slaughter animals Breeding and multiplication not structured Breed productivity generally poor Hair breeds in demand but low population and not fully exploited Qurban market not fully exploited Bio-prospecting for suitable exotic germplasm not given top priority Lack of advanced breeding technology usage	Breeding stock imported depend on expensive, mostly imported feedstuffs No systematic breeding of ayam kampong for the niche market Duck breeding and multiplication not structured Quail in demand but low production Lack of advanced breeding technology usage	Limited genetic quality of breeding pigs Poor usage of imported frozen semen to benefit from top genetics eg. in using pigs improved for lean growth rate Breeding stock have a feeding regime that depends heavily on expensive, mostly imported feedstuffs Non-structured breeding procurement Absence of accredited breeder farms Lack of advanced breeding technology usage

6. RATIONALE

The Malaysian livestock sector is an important entity influencing the socio-economic status of the nation and the environment. Hence, it is imperative that a comprehensive livestock breeding policy be developed for this sector. The livestock sector is of particular significance to:

- Economic growth
- Food security
- National biological heritage
- Socio-economic development
- Environmental impact
- Animal Diseases

6.1 Economic Growth

Farm Animal Genetic Resources (FAnGR) include cattle, buffalo, goat, sheep, deer, poultry and swine. In year 2010, there were a total of 837,543 head of cattle; 125,175 head of buffalo; 494,499 head of goats; 123,349 head of sheep; 13,862 head of deer; 1.88 million head of swine; 225.79 million head of chickens and 7.93 million head of ducks. These animals produce a range of products including meat, milk, eggs, skin/hides and other value-added products. In year 2010, the ex-farm value of the livestock sector was RM 11.26 billion. This represented a significant contribution of 24.7 percent to the food sector. In 2010, the livestock sector contributed 0.84 percent of the national gross domestic product (at constant year 2000 prices) and export earnings for the sector totaled RM 1.68 billion. A total of 159,335 farmers and entrepreneurs were involved in livestock farming in 2010, either on a full-time or part-time basis.

6.2 Food Security

Across Asia, food insecurity continues to be a major policy challenge. Year 2008 saw a major challenge to the food security status of several developing countries, this being exacerbated by the world energy crisis. As a result of this, Malaysia has renewed its commitment to strengthen its food security initiatives. As food is a basic necessity, the country needs to ensure the availability of sufficient and consistent food supply. Besides plants and fish, livestock are an important source of dietary protein to the populace. In year 2010, per capita consumption of beef (from cattle and buffalo), goat meat/mutton, poultry meat, pork, eggs and milk was 5.75 kg, 0.80 kg, 35.86 kg, 8.15 kg, 301 eggs and 48.61 liters respectively. Malaysia is self-sufficient for poultry meat, pork and eggs. However, the self-sufficiency for beef, goat meat/mutton and milk was only at 28.65%, 10.58% and 4.88% respectively.

More needs to be done to increase the self-sufficiency level for ruminant food products. The breeding of high quality livestock in sufficient numbers will go a long way in ensuring that food of animal origin is sustainably produced to meet present and future food security needs of the nation.

6.3 National Biological Heritage

The Farm Animal Genetic Resources (FAnGR) of Malaysia are quite diverse having a known total of 101 breeds and breed crosses. These breeds can be classified into locally adapted, recently introduced and continually imported breeds. Locally adapted breeds are those which are indigenous or have been in the country for a sufficient time to be genetically adapted to one or more of the traditional production systems or environments. Recently imported breeds are those whose importation were within the last 5 or so generations for the species concerned, and were imported over a relatively short period of time. Continually imported breeds are those whose local gene pool is regularly replenished from sources outside the country. Locally adapted breeds are unique to Malaysia/South East Asia and are considered a national biological heritage. Local adapted breeds of FAnGR, of which are 36 breeds, include the Swamp Buffalo, Katjang goats, Kedah-Kelantan cattle and village chickens (ayam kampong). These locally adapted breeds are known to be hardy and perform well in challenging and marginal environments. As they may have the best chance of adapting to climate change and other future challenges, it is crucial that they be sustainably managed for future generations. Specific, planned breeding programs are being put in place to conserve and improve these animals to ensure their sustainable development and utilization.

6.4 Socio-Economic Development

Livestock have a considerable impact on peoples' livelihood, especially with rural folk. Farming livestock can contribute to poverty eradication, increase earnings with which farmers can buy more and better quality food, send their children for a better education and increase physical assets. It can also improve the quality of life for women and increase the participation of women in household decision making. Animals have very important uses in local culture and in religious activities. In Muslim culture for example, cattle, goats and sheep are used in religious sacrifices. Traditional Chinese religion use pigs and poultry in their religious rituals. Hindus view cattle with reverence and these animals are not only spared from being slaughtered but are treated with much respect. Animals have been used by various communities as dowries in marriages. In Sabah state, buffaloes are used in traditional buffalo races. Ruminant animals in particular have been used in risk management in that they are an insurance policy for the farmer. Whenever the farmer faces difficult times or when he has a particular need (eg. to send a child for

further education) he will draw upon his animals, converting them into much needed cash. Although cattle and buffalo have been used in Malaysia as beasts of burden, modernization and mechanization have made them less important for this purpose. It is not possible to fully value the benefit of livestock to the socio-economic development of a country but certainly man will suffer much loss without his trusted animals. As such the various breeds of livestock in the country should be so valued that a proper management strategy for their conservation and utilization should be put in place to make them available to present and future generations.

6.5 Environmental Impact

Since the time animals existed, they have contributed positively to the environment. Properly managed, manure and waste produced from livestock are excellent fertilizers and provide nutrients such as nitrogen, potassium and phosphorus to the soil. Animals are also good vehicles for the dispersion of seeds, such as grass seeds, and can contribute to the maintenance of biodiversity within an ecosystem. In oil-palm estates (integration estates), grazing cattle have been used as a kind of biological "lawn mower" to control weeds and undergrowth. Cattle when used in these integration estates help in reducing the use of inorganic fertilizers and herbicides. While cattle obviously can have a positive impact on the environment, they are also known to produce large amounts of greenhouse gasses, which pollute the environment and contribute to global warming (Steinfeld *et al.*, 2006). Mitigating measures are being put in place to reduce the negative impact of animals on the environment, including the feeding of special feed additives to reduce methane production and harvesting methane as a biogas, through the processing of animal manure. The breeding of special breeds of livestock with lower carbon imprint, will help to mitigate the negative impact these animals have on the environment and on climate change.

6.6 Animal Diseases

Animal diseases cause serious loss to the livestock sector. Diseases such as Bovine Viral Diarrhoea (BVD), Infectious Bovine Rhinotracheitis (IBR), Brucellosis, Trichomoniasis and Campylobacteriosis have a considerable impact on the breeding performance of the livestock. In the past, Malaysia had an outbreak of the zoonotic disease Nipah Encephalitis which had severe consequences on the livestock sector, in particularly the pig industry. New emerging diseases such as Q-fever which has been recently detected also cause serious abortion problems in ruminants. With the reliance on foreign labor, mitigating diseases such as Tuberculosis has emerged in Malaysia and this has affected the production.

In summary, farm animal genetic resources contribute to the economic growth of Malaysia, assist in achieving food security, are a national biological heritage, facilitate socio-economic development and have an impact on the environment. In driving the "New Agriculture", FAnGR will certainly contribute to alleviating poverty and opening alternative means of wealth creation. Hence the breeding of these animals need to be suitably detailed in this policy document.

7. POLICY

Enhancing genetic value of livestock through the application of scientific knowledge and technology, towards moving up the value chain in sustainable animal production.

8. POLICY OBJECTIVES

- Genetic improvement of livestock breeds for sustainable production
- Strengthen research and development in livestock breeding
- Produce quality, quantity and marketable genetic material
- Conservation and sustainable utilization of farm animal genetic resources
- Enhancing strategic sourcing of suitable genetic resources
- Improving effectiveness of breeding strata
- Maximize the utilization of technology in livestock breeding

9. SCOPE

This breeding policy pertains to the breeding of farm animals for food including cattle, buffaloes, goats, sheep, deer, poultry and pigs. The breeding of wildlife, though used in food production, is not provided for in this document.

10. PRINCIPLES FOR BREEDING

These principles of breeding will focus on matters relating to farm animal genetic improvement, breeders rights, genetic conservation, legal framework, capacity building, human resource development and R&D. This will be achieved within the framework of Good Animal Husbandry Practices (GAHP) taking into consideration sanitary and phytosanitary requirements and animal welfare concerns.

The breeding and improvement of farm animal genetic resources will be based on the following principles:

i. Breeding will be based on a sound scientific basis for the genetic improvement of livestock breeds, for superior productivity, optimal resource utilization and environmental sustainability;

ii. Farm animal genetic resources are biological capital which can continue to be utilized for wealth generation, improvement of the socio-economic status of citizens and economic growth of the nation. Their wise use will yield benefits on the local, regional and global front;

iii. Indigenous farm animal genetic resources are recognized as a national heritage and they must be conserved and sustainably utilized for present and future generations;

iv. Formulation and implementation of the policy framework for the breeding, improvement, conservation and sustainable utilization of livestock breeds should be in close cooperation with all stakeholders, including policymakers, scientists, farmers, entrepreneurs, consumers and the public.

v. Farmers must be intrinsically involved in livestock breeding and improvement programs. The formation of breed societies should be encouraged.

vi. The Livestock Industry should strive to take Malaysia into the international arena by ensuring that breeding stock is of premium quality and suitable for export in the form of live animals, frozen semen or embryos. The establishment of private breeding corporations must be actively pursued;

vii. Usage of assisted reproductive technology such as artificial insemination, embryo transfer and other relevant cost-effective technologies should wherever possible, be utilized for the genetic improvement of breeding stock;

viii. Legal framework strengthened to empower the competent livestock authority, regulate livestock breeding and to protect the rights of animal breeders (Breeders' rights);

ix. Knowledge enablement should be pursued to ensure that various stakeholders in the Livestock Industry are well equipped to undertake or support breeding activities;

x. Sanitary and phytosanitary concerns must be adequately addressed to ensure the viability of the livestock enterprise and ensure a future export market for Malaysia's livestock breeding products;

xi. Networking and collaboration with established international partners should be pursued for mutual benefit

xii. The government shall provide long-term support and incentives for breeding programs.

xiii. Establish well documented breeding data which is easily assessable and user friendly such as by using information & communication technology.

xiv. Government and private sector shall create and encourage a smart partnership to ensure the continuous improvement of breeding programs to achieve the desired outcome.

11. TECHNOLOGY APPLICATION

Major changes in livestock production have occurred during the past few decades due to the introduction of several new technologies, e.g. artificial insemination, embryo transfer, and associated reproductive technologies (genomics and transgenics). These speed up reproduction and enable more efficient genetic improvement. Genetic selection technologies such as Best Linear Unbiased Prediction (BLUP) and Marker Assisted Selection (MAS) are good tools for genetic improvement. Its usage is however still in the infant stage in Malaysia. Once practical sampling protocols are developed for important farm animal species and they become financially viable, the entire improvement and conservation platform will change. It is, therefore, necessary that research in newer biotechnologies is intensified, so that traditional genetic improvement methods like progeny testing and sire/dam selection schemes are improved upon. It will be necessary to identify key policy issues and options which are likely to affect the access, development and utilization of such new biotechnologies in relation to the management of livestock genetic resources. These policy issues include access to knowledge and information generated by new biotechnologies, intellectual property management, access and benefit sharing, regulatory issues, international collaboration, public perceptions, animal welfare and ethical issues.

12. STRATEGIC APPROACHES FOR BREEDING

12.1 BEEF CATTLE

1. Pureline breeding of Kedah-Kelantan cattle be continued at the KK Nucleus Breeding Center in Tanah Merah, Kelantan and MARDI Breeding Center in Kemaman, Terengganu and with selected farmers who are involved in the multiplier programme.

2. Pureline breeding of beef cattle as follows:

   2.1 Brahman at Livestock Breeding Station, Tawau, Sabah
   2.2 Brahman at Livestock Breeding Center, Ulu Lepar, Pahang
   2.3 Bali at Livestock Breeding Station, Tawau, Sabah
   2.4 Bali at Institut Veterinar Malaysia, Kluang, Johor
   2.5 Bali at FELDA Farm
   2.6 Brakmas at MARDI Kluang and Muadzam Shah Breeding Station
   2.7 KK, Brahman, Bali and Brakmas breed at Multiplier Programme Farm

3. Establishment of Kedah-Kelantan Cattle Breeders Association and other beef cattle breeders association.

4. Crossbreeding with *Bos taurus* or *Bos indicus* breeds for production of terminal crosses at the commercial level.

5. Establishment of computerized data recording system and data management for efficient genetic selection in lean growth rate, feed efficiency, fertility and tropical adaptability traits

6. Development of breeding strata comprising of Nucleus, Multiplier and Commercial tiers.

7. Development, registration and certification of quality beef breeding animals (male and female) and farms.

8. Development of bull parks for collection, growing and distribution of quality breeding bulls.

9. Technology application focused on artificial insemination, embryo transfer, and semen sexing to be applied to multiply selected breeders.

10. Enhancing local beef cattle breeding so as to decrease dependence on imports of beef and live cattle for slaughter by providing special incentive.

11. Aggressive bio-prospecting with proper pre- and post- evaluation to determine suitability of imported breeds which are adaptable to and highly productive under Malaysian climatic conditions.

12. Establishment of ex-situ conservation for indigenous breed (Kedah-Kelantan) and to ensure sustainable utilization.

12.2 DAIRY CATTLE

1. Dairy breeding is for the primary goal of producing quality milk economically and for the secondary goal of producing beef.

2. MAFRIWAL dairy cattle breeding project revitalized and geared to produce dairy breeders for the medium to high input dairy production system. MAFRIWAL nucleus herd to be strengthened and upscaled to include selected private dairy farms. Contract breeding program initiated with select collaborators. Special incentives given to smart partners.

3. Upgrading of dairy animals using temperate dairy breeds (eg. breeding crossbreds with Holstein) as an option for high input farms.

4. Establishment of Dairy Cattle Breeders Association.

5. Organize contract breeding with strategic local and international partners to produce 75% Friesian (25% Zebu) crossbreds for local dairy producers.

6. Development, registration and certification of quality dairy breeding animals (male and female) and farms.

7. Establishment of computerized data recording system and data management for efficient genetic selection in milk production, milk protein, milk fat, lean growth rate, feed efficiency, fertility and tropical adaptability traits.

8. Technology application focused on artificial insemination, embryo transfer, and semen sexing to be applied to multiply selected breeders.

9. National Dairy Recording Service and National Dairy Breeding Advisory Service established under the Dairy Board to enable nationwide selective breeding of dairy heifers and dairy breeders and establishment of dairy heifer parks.

10. Establishing dairy colonies or clusters and production areas to enhance the development of dairy industry for better management and marketing.

12.3 BUFFALO

1. To encourage the development of farmer driven nucleus herds for swamp and river buffaloes.

2. Strategic sourcing of dairy buffaloes and frozen semen to improve gene pool.

3. Establishment of Buffalo Breeders Association.

4. Collaborate with local and international organizations on buffalo breeding.

5. Develop technology through research and development to overcome reproductive problems in buffaloes.

6. Attempt crossbreeding to capitalize on heterosis and improve meat and milk production.

7. Development, registration and certification of quality buffalo breeding animals (male and female) and farms.

8. Conservation and sustainable utilization of indigenous Swamp buffalo.

12.4 MEAT GOATS

1. Establishment of Katjang Goat Conservation Center to undertake *in situ* and *ex situ* conservation and improvement of Katjang goats.

2. Nucleus breeding farms and genetic improvement program (government or private sector owned) established for Boer, Kalahari Red, Jamnapari and Jermasia goats.

3. Development of breeding strata comprising of Nucleus, Multiplier and Commercial tiers.

4. Establishment of Goat Breeders Association.

5. Establishment of computerized data recording system and data management for efficient genetic selection in lean growth rate, feed efficiency, fertility and tropical adaptability traits.

6. Technology application focused on artificial insemination, embryo transfer, and semen sexing to be applied to multiply selected breeders.

7. Development, registration and certification of quality meat goats (male and female) and farms.

8. Research and development to optimize hybridization of breeds for production of goats reaching market weight at an early age.

9. National Goat Recording Service and National Goat Breeding Advisory Service established under Goat Board to enable nationwide selective breeding of goat breeders.

12.5 DAIRY GOATS

1. Establishment of nucleus breeding farms and genetic improvement program (government or private sector owned) for Saanen, Anglo Nubian, Jamnapari and Alpine goats.

2. Establishment of a nucleus and multiplier farm to produce male and female breeders for commercial dairy goat farms. Selective breeding at nucleus and multiplier farms.

3. Aggressive bioprospecting with proper pre- and post- evaluation to determine the suitability of imported breeds which are adaptable to and highly productive under Malaysian climatic conditions.

4. Establishment of Dairy Goat Breeders Association.

5. Establishment of computerized data recording system and data management for efficient genetic selection in lean growth rate, feed efficiency, fertility and tropical adaptability traits

6. Technology application focused on artificial insemination, embryo transfer, and semen sexing to be applied to multiply selected breeders.

7. Development, registration and certification of quality meat goats (male and female) and farms.

12.6 SHEEP

1. Pureline breeding of Barbados Blackbelly (BBB) sheep to be continued at the Chalok BBB Nucleus Breeding Farm. Infusion of new Barbados Blackbelly germplasm using selected BBB imported frozen semen.

2. Nucleus breeding farms and genetic improvement program (government or private sector owned) established for Malin, Santa Ines, Dopper and Damara sheep.

3. Development of breeding strata comprising of Nucleus, Multiplier and Commercial tiers.

4. Establishment of computerized data recording system and data management for efficient genetic selection in lean growth rate, feed efficiency, fertility and tropical adaptability traits

5. Technology application focused on artificial insemination, embryo transfer, and semen sexing to be applied to multiply selected breeders.

6. Development, registration and certification of quality sheep (male and female) and farms.

7. Aggressive bioprospecting with proper pre- and post- evaluation to determine the suitability of imported breeds which are adaptable to and highly productive under Malaysian climatic conditions.

8. Establishment of Sheep Breeders Association.

12.7 DEER

1. Maintaining pureline breeding of Timorensis spp.

2. Bioprospecting with proper pre- and post- evaluation to determine the suitability of imported breeds which are adaptable to and highly productive under Malaysian climatic conditions.

3. Develop technology through research and development to improve breeding performance.

4. Establishment of Deer Breeders Association.

5. Attempt crossbreeding to capitalize on heterosis and improve meat production.

12.8 SWINE

1. Maintain three-breed crossing to produce terminal swine crosses for the market.

2. Sourcing of breeds for crossbreeding from international breeding companies pursued. Procurement of superior Large White, Landrace and Duroc breeds which are selected for lean tissue growth rate (LTGR).

3. Establishment of Pig Breeders Association.

4. Establishment of breeder farms for Large White, Landrace and Duroc breeds.

5. Establishment of artificial insemination network to disseminate top swine genetics.

6. Development, registration and certification of quality breeders (male and female) and farms.

7. Develop technology through research and development to improve breeding performance.

12.9 CHICKEN

1. Continuous importation of grandparent breeding stock (broiler and layer) from foreign breeding companies maintained.

2. Development and expansion of Ayam Kampong breeding project, using local existing breed, farmed based on organic-free range production system.

3. Development, registration and certification of quality breeders (male and female) and farms.

4. *In situ* conservation of the various strains of Ayam Kampong.

5. Establishment of Ayam Kampong Breed Association.

12.10 DUCKS

1. Continuous importation of parent breeding stock (broiler and layer) from foreign breeding companies maintained.

2. Development, registration and certification of quality breeders (male and female) and farms.

3. *In situ* conservation of the various strains of local ducks.

4. Establishment of Duck Breed Association.

12.11 QUAIL

1. Strengthening and upscaling of "Puyuh IKTA" breeding project.

2. Establishment of layer quail breeding project.

3. Development, registration and certification of quality breeders (male and female) and farms.

4. Bio-prospecting for quail breeding stock which are highly productive and adaptable to local farm conditions.

5. Establishment of Quail Breeding Association.

6. Develop technology through research and development to improve breeding performance.

13. CONCLUSION

The role of animal breeding in the development of the Livestock Industry is highly recognized by the Malaysian government. Unlike other investments, gains made in breeding, though minute, are cumulative and for perpetuity. The diversity of livestock genetic resources is very wide, both in variety and variability in terms of species, breeds, populations and unique genotypes. Animal breeding for food producing animals need to be continuously supported either in terms of qualified and trained personnel and animal breeds to ensure Malaysia achieves its objectives to produce sufficient foods for its peoples to ensure food security.

DEFINITIONS

Competent authority	Person or organization that has the legally delegated or invested authority, capacity, or power to perform a designated function
Farm Animal Genetic Resources	FAnGR for food only
Nucleus breeding farm	A farm having the best genetic material of a given breed, where performance records are maintained on all animals and artificial insemination is practiced on more than 60 percent of the female breeders
Multiplier farm	A farm receiving breeding material from nucleus farms and rapidly multiplying this breeding material for distribution to commercial farms

ABBREVIATIONS

AI	Artificial Insemination
BLUP	Best Linear Unbiased Prediction (a Statistical Genetic Evaluation Technique)
CSIRO	The Commonwealth Scientific and Industrial Research Organization
DVS	Department of Veterinary Services, Ministry of Agriculture and Agro-Based Industries
FAnGR	Farm Animal Genetic Resources
MAJUTERNAK	National Livestock Development Authority
MARDI	Malaysian Agriculture Research and Development Institute
MOA	Ministry of Agriculture and Agro-based Industries
MPF	Modern Pig Farming Areas
NABC	National Animal Breeding Center
NIVB (NIAB)	National Institute for Veterinary Biodiversity, Jerantut, Pahang (formerly the National Institute of Animal Biotechnology)
PFA	Pig Farming Area
SPP	Standing Pig Population

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APPENDIX 1. List of participants involved in workshops and meetings of preparation of Malaysian Livestock Breeding Policy

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