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CONSERVATION AND UTILIZATION OF THE INDIGENOUS ANIMAL GENETIC RESOURCES IN MALAYSIA

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SUMMARY:- This paper discusses, in the context of current development, the conservation and utilisation of animal genetic resources in Malaysia with special reference to buffaloes, cattle, goats, sheep and pigs. The functional value, numerical importance, description and type traits of each class is given. Over the period 1940 to 1976, the most prominent rates of growth were found for cattle and pigs. Data given for each class of animal concern growth characteristics, reproductive performance and present levels of performance. Constraints to production are discussed in relation to the significance of nutrition, breeding and genetics, health and diseaes. Diseases that can be prevented by better attention to improved husbandry were as much as 61, 64 and 30 per cent for buffaloes, cattle and small ruminants respectively. Real opportunities exist for much higher performance and productivity by these animals. Increasing productivity in the future is discussed in relation to intensive exploitation, overcoming the constraints and the need for conservation. Maximum productivity from the indigenous animal genetic resources will depend on total exploitation of the resources and the real efficiency in production systems.

INDEXING KEY WORDS: Indigenous animals, genetic resources, buffaloes, cattle, goats, sheep, pigs.

In recent years a spate of conferences, both national and international, have been held in this country on the subject of farm animals. However, most of them have concerned themselves mainly with problems associated with production and/or performance, for a given set of circumstances, of farm animals in Malaysia. Very little or no attention has been directed at the value of indigenous animals and its conservation.

The present meeting is therefore a refreshing change, and is both realistic and timely. Realistic because of the important subject of conservation has never been considered seriously before, and timely because in the context of the current wave of importing large numbers of exotic animals into Malaysia, an enquiry into the value of the indigenous animals, and of its conservation is relevant. This paper focuses attention therefore to the status of the indigenous animals in Malaysia. The indigenous animals, for the purposes of this paper, include the ruminants and pigs.

THE ANIMAL GENETIC RESOURCES

The indigenous animal genetic resources that fall within the scope of this paper are defined in Table 1. The table indicates the type of the animals under consideration and their relative importance in Malaysia. The latter estimates are approximate values, but nevertheless, these are considered to represent realistic figures of the size of individual ruminant species and Local Chinese pigs in Malaysia. Notable in the former category are the indigenous swamp buffaloes, Kedah-Kelantan cattle, Kambing Katjang goats and

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Table 1: The population of indigenous animal genetic resources and their numerical importance in Malaysia

Species	Name	Population[1]	Numerical[2] importance (%)
Buffaloes *(Bubalus bubalis)*	var. Murrah	2,449	1.2
	var. Indigenous swamp	210,067	98.8
Cattle *(Bos indicus)*	i) Bali *(bibos banteng)*	50	—
	ii) Local Indian Dairy	71,778	17.4
	iii) Kedah-Kelantan	340,067	82.6
Goats	Kambing Katjang	332,636	80
Sheep	Indigenous	47,017	90
Pigs	i) South China) ii) South China) Black)	5,000	0.4

[1]Veterinary Division, Ministry of Agriculture (1976).

[2]These are approximate values.

the indigenous sheep. Murrah buffaloes, Bali cattle, the South China and South Canton Black indigenous pigs are on the other hand, of low numerical importance.

Table 2 gives the population of the individual animal species between 1940 to 1976. Except for the indigenous swamp buffaloes (-0.10 per cent) all other species recorded a positive growth. The most spectacular increases were in pigs (+3.64 per cent) and

Table 2: Types of animal genetic resources and population changes (1940-1976)

Type	Population (10^3) 1940[1]	1976[2]	% Change per annum
ANIMALS			
Indigenous buffalo (IB)	218	210	— 0.10
Murrah buffalo (MB)	?	3	?
Banteng (B)	?	50	?
Local Indian Dairy (LID)	40	72	+ 2.22
Kedah-Kelantan (KK)	290	340	+ 0.48
Goats (G)	330	333	+ 0.03
Sheep (S)	35	47	+ 0.63
Pigs (P)	566	1,308	+ 3.64
HUMAN[3]	4,976	10,377	+ 3.02

[1]Marsh and Dawsan (1947)

[2]Livestock census, Veterinary Division (1976)

[3]Statistics Department (1976)

2

Kedah-Kelantan cattle (2.22 per cent). It is perhaps of interest to note that the human population increased by 2.67 per cent annually over the same period.

Table 3 summarises the main type traits of individual animals: height at withers, body length and heart girth, and also mature weight. The description is considered to encompass the main body characteristic of the ruminants under consideration in Malaysia.

With reference to type traits, it is useful to describe briefly the individual animal types to keep the subject in perspective.

Table 3: Type characteristics of the adult large ruminants in Malaysia

Parameter	IB[1]		MB[2]		B[3]		LID[4]		KK[5]	
	M	F	M	f	M	F	m	F	M	F
Height at withers (cm)	131.1	124.0	142.0	132.0	120.5	108.1	123.1	110.3	119.4	99.3
Body length (cm)	124.7	122.7	150.0	147.0	170.2	163.8	125.6	113.5	116.6	105.7
Heart girth (cm)	185.9	182.9	221.0	217.5	165.2	144.1	160.3	145.3	147.6	131.3
Mature weight (kg)	420.0	380.5	567.0	500.0	432.0	264.0	302.2	180.3	214.5	173.7

[1]IB : Indigenous buffalo (Camoens, 1976)

[2]MB : Murrah buffalo (McDowell, 1972)

[3]B : Banteng (Devendra *et. al.*, 1973)

[4]LID : Local Indian Dairy cattle (Devendra, 1976; Camoens, 1978a)

[5]KK : Kedah-Kelantan cattle (Devendra *et. al.*, 1973; Camoens, 1978b).

BUFFALOES

Murrah

The Murrah buffalo is a dairy breed from the Indian sub-continent which has been extensively selected for that trait. It is a large animal uniformly black in colour, with a black switch, dished fore-head, and short, curly horns. The latter characteristic has been widely used to differentiate the Murrah from the indigenous swamp buffalo.

The head is small in relation to the whole body, and the hooves on the legs are wide and well-spaced. The animal is docile, intelligent and the movements are in general slow and lethargic. Since this buffalo has been selected for milk production, it has good dairy conformation and the udder is well developed. The height at withers is 133 to 142 cm, and adult live weights are comparable to the indigenous buffalo. The average daily yield is about 4 to 5 kg (Devandra, 1976a). The population of these animals in Malaysia is however low, as they represent only about one per cent of the total buffalo population (Table 2). The Murrah buffalo responds well to good management.

Indigenous Swamp

The indigenous swamp buffalo is numerically the more important animal compared with the Murrah, representing about 99 per cent of the total buffalo population. It is a powerful draught animal which is also used for meat. It is blocky, well rounded when the nutritional management is adequate and has strong bones. It is generally black to dark grey in colour, but white animals can also be found. The switch and hair may be black, rusty brown, yellow or white.

The head is large in comparison to the whole body, and the forehead is flat. The horns are large, sweep laterally and horizontally, and are usually crescent-shaped. The hooves are also large and widely spaced. The height at withers is around 124 to 131 cm

3

(Camoens, 1976), and adult weights are around 380 to 420 kg. The animal is docile and very useful for haulage such as in ploughing operations. It can give quite good growth rates with average nutritional management. However, the animal is somewhat unpredictable under range conditions.

CATTLE

Kedah-Kelantan

These animals are of Zebu ancestry, and are hardy, well-adapted animals found throughout Malaysia. They are used for meat and draught. Brown is the most predominant colour, and the mean height at withers is 102 cm. The body is compact and has a well developed hump. The ears are small and point forwards. The horns are small (Devandra *et. al.*, 1973).

The mean birth weight of these animals is 14.7 to 15.8 kg. Recent research has demonstrated that with good feeding and management the mean daily live weight increase for heifers up to 24 months age was 339 g, age at first oestrus was between 10-12 months, mean calving interval 451 days, and dressing per cent 46 to 55 per cent (Devendra and Lee, 1975, 1976a and 1976b).

Local Indian Dairy

These cattle are of mixed ancestry and are therefore very heterogenous. At least four breeds, the Kangayam, Halikar and Ongole from India, and possibly also the Red Sindhi from Pakistan are involved. Furthermore, there has also been some breeding with the Kedah-Kelantan so that the genetic variability is quite considerable.

The animals are taller than the Kedah-Kelantan cattle with a height at withers of around 120 cm (Table 3). They have a very loose skin and appendages. The colours, as would be expected, are very variable ranging from white, brown to grey. The dewlap is very conspicuous and the hump, horns and udder are very well developed. The daily milk yield is about 4 kg, and the mean lactation milk yield over five lactations was 820.7 kg over a mean lactation length of 230 days (Sivarajasingam, Mukherjee and Djafar, 1974). The mean birth weight is 19.0 to 20.2 kg, and the daily live weight increase up to 12 months age was 380 g (Devendra and Sivarajasingam, 1975). The age at first calving was 47.7 months and calving interval 412 days.

Bali

These cattle are believed to have descended from the Banteng *(Bibos banteng)*, the indigenous wild cattle of Indonesia by domestication. The Banteng has also been called *Bos sondaicus* so that both names are synonymous. The animals are valuable in meat production and draught.

The animals have the general conformation of beef cattle. The skin is tight, and the dewlap and the hump are inconspicuous. They have a striking appearance with tanned brown skin, and white on all four legs and also an oval patch on the rump. A think black line runs from the tail through the dorsal part of the body. The average height at withers is 108 cm, and adult weights are between 250 to 400 kg. The average birth weight is 15.3-16.7 kg, the daily live weight increase up to 24 months was 221.9 g, age at first calving 42.2 months, and dressing percentage 44.2 (Devendra *et. al.*, 1973).

The populaton of these animls in Malaysia is negligible (Table 1), and has in fact been declining. The problems has been accenuated by lack of any fresh infusion of new stock from Indonesia.

GOATS

Kambing Katjang

The indegenous Kambing Katjang is numerically the most important goat breed in Malysia. The breed is usually black, sometimes with a few white patches on the belly and the feet. The horns are scimitar-shaped and are found in both sexes. The ears are generally short, pricked and upright. The primary value of these animals is in meat production (Devendra, 1966). The goats are very hardy and twinning is very common. The average height at withers is 55-65 cm. The average birth weight is about 1.5 kg, mature adults weigh about 20-25 kg, and the daily live weight increase up 12 months age is about 45-60 g. The dressing percentage is about 44 to 51 per cent, and the mean edible and total saleable proportions was 69.3 and 88.1 per cent respectively (Devendra, 1967). Recently, the phylogeny, distribution, importance and contribution of these animals in South East Asia has been reported (Devendra and Nozawa, 1976) and especially in small farms (Devendra, 1975a).

SHEEP

Indigenous

These sheep owe their origin to the Tibetan sheep from the Yunan province in China. They are white to biscuit in colour, but brown and grey are also common. Horns are present in rams but seldom in ewes. The average height at withers is about 47 cm.

The mean birth weight is 1.8 kg, and the mean daily live weight increase up to 12 months age is 28-45 g. Adult is 23.3 months and lambing interval 248 days. The grease fleece weight is about 0.8 to 1.4 kg, and dressing percentage 37.2 per cent (Devendra, 1975b).

CURRENT STATUS OF THE RESOURCES

Growth Characteristics

Some idea of the current status of the resources, especially in terms of their growth potential is reflected in Table 4. The data reveals that there is considerable genetic variability suggesting that there is scope for selection and improvement. Concerning daily live weight gain and dressing percentages, there is sufficient genotype x environment interaction.

In other words, these parameters are largely dependent on environmental factors of which, nutrition is probably the most important. It follows therefore that there is room

Table 4: Growth characteristics of the adult large ruminants in Malaysia

Parameter	IB[1]	MB[2]	B[3]	LID[4]	KK[5]
Birth weight (kg)	36.0	41.0	16.5	15.0	15.3
Av. daily gain (g)	610-960	?	290 - 368	50 - 500	50 - 295
Dressing %	45-48	45 - 48	36 - 44	49 - 52	46.1 - 54.8

[1]IB : Indigenous buffalo (Camoens, 1976)

[2]MB : Murrah buffalo (McDowell, 1972)

[3]B : Banteng (Devendra *et. al.*, 1973)

[4]LID : Local Indian Dairy cattle (Camoens, 1978a)

[5]KK : Kedah-Kelantan cattle (Devendra *et. al.*, 1976; Camoens, 1978b).

for a higher response and improved performance through efficient feeding and management.

Reproductive Characteristics

Reproductive characteristics (Table 5), are almost entirely influenced by the

Table 5: Reproductive characteristics of the adult large ruminants in Malaysia

Paremeter	IB[1]	MB[2]	B[3]	LID[4]	KK[5]
Age at 1st Oestrus (mths)	8 - 18	8 - 18	?	6 - 12	10 - 12
Age at 1st successful mating (mths)	22 - 56	?	40.0	17 - 30	17 - 45
Age at 1st calf (mths)	54 - 5	?	?	38 - 5	38 - 5
Interval between 1st calf to conception (days)	90 - 100	?	?	?	61 - 610
1st calving interval calf to conception (days)	400 - 910	?	512	517	341 - 890
Interval between 2nd (days)	50 - 300	?	?	?	54 - 519
2nd and subsequent calving interval (days)	380 - 625	?	452 - 481	?	334 - 799

[1]IB : Indigenous buffalo (Camoens, 1976), [2]MB : Murrah buffalo (McDowell, 1972), [3]B : Banteng (Devendra *et. al.*, 1973), [4]LID : Local Indian Dairy cattle (Sivarajasingam, 1975; Camoens, 1978a), [5]KK : Kedah-Kelantan (Devendra and Lee; Cameons, 1978b).

Table 6: Coefficients affecting population changes in the adult ruminants

Parameter	IB[1]	MB	B[2]	LID[3]	KK[4]
Calf crop (% per annum)					
unculled	29.5	?	?	66.7	41.4
culled	54.1	?	?		81.5
Mortality of dams (% per annum)	3.3	?	20	1.0	5.0
Mortality of calves (% per annum)	2.5	?	?	1.0	5.5
Natural increase in numbers (% of breeding stock)	6.6	?	?	15.0	12.2
Extraction (% per annum)	11.4	?	?	30.0	25.0
Culling breeding stock (% per annum)	1.0	?	?	1.0	1.0

[1]IB : Indigenous buffalo (Camoens, 1976), MB : Murrah buffalo, [2]B : Banteng (Devendra *et. al.*, 1973), [3]LID : Local Indian Dairy cattle (Camoens, 1978a), KK : Kedah-Kelantan cattle (Camoens, 1978b).

6

environment. It is now generally accepted that the genetic components of these parameters are very low and are minimally influenced by genes (McDowell, 1972). Considering for example age at first oestrus, a fast growing animal will tend to show oestrus symptoms much earlier than a slower growing animal. Efficient management therefore is extremely important in ensuring high reproductive efficiency. Table 6 also demonstrates considerable variability in individual parameters parallel to those in Table 4.

Additionally, data are given concerning the coefficients that affect population changes in the different classes of large ruminants (Table 6). Of these, the natural increase in numbers is highest in the Kedah-Kelantan cattle, followed by the Local Indian Dairy cattle. Murrah buffaloes were lowest in terms of the natural increase as percentage of the breeding stock. It is significant to note that no data are currently available on the natural increase of Murrah buffaloes and Bali cattle in Malaysia.

CONSTRAINTS TO PRODUCTION

The Significance of Nutrition

Of the constraints to production, nutrition is considered to be the most important. A discussion of problems on animal production invariably turns to feeding and management, and it is now widely recognised that in itself animal nutrition represents one important component in the success, extent of production and profitability of the animal production system. On the one hand it influences to a very large extent the expression of genetic worth of an animal and on the other, this affects the level of productivity, viability and economic success of the enterprise. Implicit in this point is the need for skill in the application of the principles of efficient nutritional management.

There is room to believe that the indigenous resources have by and large evolved with limited scientific attention. The overall population growth has been slow, in some cases it has been static so that conceivably their contribution can be very much higher than their current contribution suggests. The present level of productivity is therefore low, and there is evidence that the main reason for this low production is poor husbandry, inadequate nutrition and also disease.

Table 7 demonstrates that proper feeding can increase live weight at 24 months by 80.2 per cent, daily live weight gain (6-24 months) by 133.8 per cent and age at first service by 94.4 per cent; these improvements are quite enormous.

These results together suggest that the opportunities for improved performance of

Table 7: Magnitude of improvement possible in Kedah-Kelantan cattle with improved nutrition

Parameter	Previous data	Improved data	% Improvement
Birth weight (kg)	15.3	15.2	Nil
Weaning weight (kg)	57.6	73.0	26.7
Growth rate (g/day)			
0-6 months	234.7	332.2	41.5
6-24 months	145.0	339.1	133.8
Live weight at 24 months (kg)	133.5	240.6	80.5
Milk yield (kg/day)	2.5	3.5	40.0
Age at first serve (months)	35.0	18.0	94.4
Slaughter weight at 24 months (kg)	122.5	200.9	64.0
Dressing percentage (%)	46.1	53.3	7.2
Weight of meat (kg)	46.3	88.3	103.9
Meat as % of carcass weight	79.7	82.6	3.6

Kedah-Kelantan cattle, and potentially higher increased beef production from them is quite feasible. If it is remembered that these cattle constitute about 82 per cent of the total cattle populations (Table 1), then the increased national productivity of beef from sheer attention to improved feeding is quite enormous.

Breeding and Genetics

When the animals can be efficiently fed and managed, great strides can be made by the application of breeding and genetics. These responses and the measures of heritability of traits become realistic because they reflect the genetic potential of the animal. With the breed characteristics defined, and some idea of the production potential indicated, it is now timely to consider the effect of selection and breeding among indigenous animals.

This has been examined for the indigenous buffalo, Kedah-Kelantan cattle, indigenous Kambing Kacang goats and indigenous sheep and the results are given in Table 8. Concerning milk yield in buffaloes and Kedah-Kelantan cattle, selection has to

Table 8: Improvement per generation in some important traits in indigenous ruminants in Malaysia due to selection+

Trait	Buffalo	Kedah-Kelantan Cattle	Goats	Sheep
Birth weight	—	—	0.02	0.02
Mature weight (kg)	18	52.4	0.28	0.2
Av. daily gain (kg)	—	0.013	1.2	0.4
Height at withers (cm)	56	1.98	2.4	2.3
Heart girth (cm)	43	4.58	2.2	3.2
Body length	43	2.80	3.1	4.0
Dressing %	—	—	0.72	0.2
Milk yield (kg)	353	23.2	1.4	—
Location length (days)	105	10.0	1.2	-

+ The values refer to the number of years required to achieve the projected mean.

be extreme so as to be unrealistic. A projected mean of 909 kg milk yield in Murrah buffaloes for example can only be achieved in 353 years. Likewise, the predicted improvement per generation in milk yield in Kedah-Kelantan cattle was only 23.2 kg per generation.

Concerning goats and sheep, the improvement of some of the traits have also been considered. The potential genetic improvement in these species has been done in the absence of genetic data locally, by considering heritability data published by Rice *et. al.*, (1962), Devendra and Burns (1970), McDowell (1972) and Turner (1977).

Concerning goats, quite significant improvements can be made in daily live weight gain, dressing percentage, lactation milk yield and lactation length. Using the top 50 per cent of the population and continuing to select within this population, it is estimated that a lactation milk yield of 200 kg can be achieved in five years. With sheep, attention is drawn to their importance in producing coarse wool. Carpet wool is in demand in world markets, and there is therefore justification in exploiting these animals for the product. Inadequate attention has been given to this potential, and the merits of doing so have been previously emphasised (Devendra, 1975b).

Because of the slow rate of progress that can be achieved by selection, quite obviously much faster progress can be made by infusion of genes, which justifies upgrading as an important tool in animals improvement programmes. Consequently there is merit in exploring the use of upgrading especially in situations where this is justified, such as in

the current tendency to increase lactation milk yields from the Local Indian Dairy Cattle using the Holstein-Friesian. Such a programme must however also involve selection for other important traits such as growth rate to achieve maximum progress.

Table 9 demonstrates the improvements feasible in the buffalo due to upgrading,

Table 9: Expected response of some traits of the buffalo to grading in Malaysia

Trait	Population Value			% increase in two generations
	Present	1st Cross	2nd Cross	
Mature weight (kg)	390	536	609	56
Daily live weight gain (kg)	0.30	0.59	0.77	156
Height at withers (cm)	122	132	137	13
Body length (cm)	124	137	142	17
Heart girth (cm)	183	201	211	15
Milk yield (kg)	195	1916	2776	1320
Lactation length (days)	164	232	266	62

Table 10 grading towards the Murrah buffalo, and Table 11 potential improvements in the Kedah-Kelantan cattle due to upgrading with the Holstein.

Table 10: Expected response to grading to the Murrah if the top 50% of the swamp buffaloes were used in Malaysia

Trait	Population Value			% increase in two generations
	Present	1st Cross	2nd Cross	
Mature weight (kg)	418	550	616	58
Daily live weight gain (kg)	0.36	0.64	0.82	62
Height at withers (cm)	132	137	140	15
Body length (cm)	135	142	147	17
Heart girth (cm)	191	206	211	16
Milk yield (kg)	273	1955	2795	1330
Lactation length (days)	180	240	270	65

[1] Per cent over the unselected population as in Table 9

Table 11: Expected responses of the Kedah-Kelantan when graded to the Holstein using the top 50% of the population

Parameter	Population Value		
	Present	1st Cross	increase
Mature weight (kg)	193.3	346.5	79.3
Height at withers (cm)	105.4	118.7	12.6
Body length (cm)	114.6	127.3	11.1
Heart girth (cm)	145.5	164.2	12.9
Lactation yield (kg)	629	1664.5	164.6
Lactation length (days)	255	280	9.8
Average daily gain (g)	255	377.5	48.0

These considerations emphasise that genetic improvement should form an integral part of the improvement programme. In unimproved populations, highly variable estimates of the genetic components of production are usually obtained, indicating varying responses of sub-population of genes to environments and a genotype-environment interaction (Tables 4 and 6). Populations of varying genetic potential exist in widely separate locations due to the lack of selection. Indiscriminate breeding could result in the same situation.

Studies on animal performance or productivity, also indicate heterogeniety of variance between locations, reflecting once again scope for selection and improvement. The gene frequencies in animals can be altered by migration, selection and the introduction of exotic genes.

Health and Diseases

One other important constraint to production is health and diseases. Of these, disease incidence and mortality due to diseases are the most important. Table 12 demonstrates firstly the extent of specific diseases in ruminants and pigs. The data for ruminants refer to responses in field situations and for Local Chinese pigs under experimental conditions (Fischer and Devendra, 1963). The incidence is highest in small ruminants due mainly to parasitism and also pneumonia. The high incidence of mortality due to specific diseases in small ruminants means in the final analysis that with the high demand for meat from these animals, the rate of replacement of breeding animals is hampered.

Of particular highlight in Table 12 is the extent to which disease can be prevented by sheer attention to improved husbandry and management. It is perhaps worth stressing

Table 12: Major diseases of domestic ruminants and pigs in Malaysia

Major diseases	Percentage incidence in:			
	Buffalo[1]	Cattle[2]	Small Ruminants[3]	Pigs[4]
Specific diseases	3.9	4.8	40.0	29.1
Accidents, acci[illegible] of gestation	1.0	26.1	10.0	51.1
Diseases preventable by better husbandry	61.4	63.9	30.0	12.8
Diseases caused by negligence	31.6	2.6	10.0	—
Miscellaneous	2.1	2.6	10.9	7.0

[1]Indigenous swamp buffalo (Camoens, 1976).

[2]Kedah-Kelantan and Local Indian Dairy cattle (Camoens, 1978a; 1978b).

[3]Goats and Sheep.

[4]Local Chinese pigs (Fischer and Devendra, 1964).

that one major determinant of predisposing causes to disease and poor condition of the animals is malnutrition and undernutrition, due to deficiencies in energy, protein, mineral and vitamin supply, worms and ectoparasites, enteric disorders (tympanitis and diarrhoea) attributable to poor quality feeds and drastic changes in the diet. Copper deficiency (Hill and Rajagobal, 1962) and cobalt deficiency (Mannetje, Sidhu and Murugiah, 1976) have for example been found.

With pigs, the high motality of 51.1 per cent due to problems of gestation refer to very severe culling, using a standard of 6 piglets per litter. Specific diseases refer mainly to pneumonia and mastitis. With piglets, specific disease (pneumonia and animal) accounted for 22.2 per cent of the deaths. Fischer and Devendra (1963) also reported

10

that 37.9 per cent of all piglet deaths up to seven days of age and 63.1 per cent up to three weeks age.

The relatively lower value of 30 per cent extent to which diseases can be prevented by improved husbandry in goats, is associated with the characteristics of hardiness, adaptibility and resistance to diseases in the species. Also, the browsing habits of goats enables selection of feedingstuffs which extends their feed preferences and their nutrient requirements (energy, protein and minerals) to be met.

The disease situation is not very critical in Malaysia as the country is generally free from the major diseases. There have been periodic outbreaks of haemorrhagic septicaemia in cattle and buffaloes, swine fever in pigs and contagious ecthyma in goats, but have been readily controlled by vaccination. As a consequence, specific endemic disease form a small proportion of the diseases that act as constraints to production. With goats, specific disease such as contagious ecthyma and pox drastically reduce productivity. Disease conditions caused by negligence in ruminants include incised wounds, maggot wounds, weedicide and insecticide poisonings.

Breeding efficiency is greatly inhibited by the presence of veneral diseases in all classes of livestock. Brucellosis, vibriosis and trichomoniasis present that additional hazard of possible commu nication to humans; tuberculosis also falls in this category.

INCREASING PRODUCTIVITY FROM THE RESOURCES

Increasing the productivity and contribution of the animal genetic resources implies that these are fully exploited. Since the need for animal proteins will increase (Table 13), meeting this increased demand also necessitates that productivity from farm animals be vigorously pursued.

Table 13: Percentage contribution of protein sources to the total daily per caput protein intake in Malaysia (g per day) (Leong, Devendra and Chong, 1976)

	Category	Livestock Products	Fish and Prawns	Vegetables	Rice	Total Intake
1975	Intake	11.27	14.72	6.84	26.44	59.28
	% Contribution	19.0	24.9	11.5	44.6	100.00
1980	Intake	12.89	14.92	7.79	27.50	63.10
	% Contribution	20.4	23.7	12.3	43.6	100.0
1985	Intake	14.92	15.01	9.20	27.59	66.72
	% Contribution	22.3	22.5	13.8	41.4	100.00
1990	Intake ntake	17.46	14.92	10.36	27.76	70.50
	% Contribution	24.8	21.2	14.7	39.3	100.00

The greatest contribution among farm animals is expected to come from ruminants in Malaysia (Devendra, 1977), and the current accelerated development of these animals reflects this fact. It is important in this context that all ruminant species are fully utilised, since each species has its own inherent special attributes which makes it important in its own right. Planning should thus accomodate all species and there should be no reason for bias. Currently inadequate attention is being given to buffaloes, goats and sheep in Malaysia and there is much to be said for exploiting the potential attributes of these species in the future.

Of the avenues that lend themselve to this task, that of nutrition is foremost. Concerning efficiency in nutritional management, much will depend on the use of the right grasses with or without legumes and at the right stages of growth. The actual levels

of production from grasses will depend on the amount and quality of the grass grown, the proportion of this crop actually eaten by the animal, and the efficiency with which this proportion is converted to animal products. A variety of grasses are available for this purpose and concepts for the integrated use of pasture in rotation systems have recently been reviewed (Evans, 1977).

Associated with the utilisation of grasses is the availability and potential value of various agro-industrial by-products in Malaysia. A number of these by-products have been demonstrated to be very useful in practical diets for farm livestock (Devendra, 1976b; 1977; Hutagalung, 1977), and while these have indicated potential usefulness, large scale application of the results is very limited. Some effort has been made to feed pineapple by-products and oil-palm by-products commercially, but the opportunities for much greater use of the by-products with or without grasses is enormous. Expanded use of these by-products can also be stimulated by the concurrent development of intensive fattening systems.

NEED FOR CONSERVATION

The domestication of animals by man is an evolutionary process which is dynamic and in operation today. The process has brought with it the domestication of certain species, and more latterly breeds within a species. This trend has brought with it a wide variety of different breeds of cattle, goats and sheep. Diversity in the living world is desirable for scientific attention, however, if varieties are allowed to continue increasing, the value of individual breeds, with their special attributes and pecularities will in the long run be diluted. Consequently, and in practice, it is more important to preserve a given species and selected breeds, and in this context the conservation of animal genetic resources is important. The value of this conservation is recognised, and is in fact being actively encourage by the F.A.O. (1966).

As it affects Malaysia, conservation of the animal genetic resources has not received the attention it deserves. Part of the reason for this may perhaps be associated with the fact that until relatively recently, the ruminant resources have never been accurately described to include Kedah-Kelantan cattle (Devendra *et. al.*, 1973); Local Indian Dairy cattle (Devendra, 1976a), indigenous buffalo (Devendra, 1975b) and indigenous pigs (Fischer and Devendra, 1963; Mahendranathan, 1972). A second factor is associated with the fact that until relatively recently as well, there has not been concerted research to assess the potential productive capacity of these animals. A third reason rests with the possibility that in view of limited attention and understanding of these species previously, and more particularly because of the fashionable trend to import exotic animals as a means to increasing numbers presently, the indigenous populations have tended to be neglected.

For all these reasons, but more particularly in view of the presence of important production traits in the indigenous ruminants, a plea is made for special efforts to conserve the species. Indigenous pigs are almost extinct due to inadequate attention, and it is hoped that the current emphasis on exotic cattle will not shift the need to recognise valuable production traits in Kedah-Kelantan cattle.

CONCLUDING COMMENTS

The future for more complete utilisation of the indigenous animal genetic resources, consistent with measures to improve and conserve them rests in alleviating the status of livestock in a predominantly crop-oriented agriculture. Farm animals need to be promoted and also integrated where appropriate within cropping systems and plantation agriculture.

12

The approach is linked in perspective and direction to three components (Devendra, 1977):-

(1) The concept of animal agriculture
(2) Systems synthesis for increased resource use and
(3) Research for new technology.

It is by a careful consideration of these components and the real efficiency of animal production that we can expect maximum contribution from the indigenous animal genetic resources of Malaysia.

RINGKASAN:- Kertas kerja ini membincangkan tentang pemeliharaan dan penggunaan punca-punca baka haiwan di Malaysia dengan pengkhususan terhadap kerbau, lembu, kambing, biri-biri dan babi di dalam konteks pembangunan sekarang. Nilai fungsi, kepentingan numerik, penerangan dan jenis-jenis sifat setiap kelas diberikan. Di dalam jangkamasa 1940-1976, kadar-kadar pertumbuhan yang paling utama adalah didapati bagi lembu dan babi. Data yang diberikan bagi setiap kelas haiwan adalah berkenaan dengan sifat-sifat pertumbuhan, kebolehan membiak dan tingkat-tingkat perlaksanaan sekarang. Pemaksaan (constraints) terhadap penghasilan ada dibincangkan berhubung dengan kepentingan pemakanan, membaikbiak dan kajibaka, kesihatan dan penyakit-penyakit. Pencegahan penyakit-penyakit dengan pemerhatian yang lebih terhadap memajukan pengusahaan adalah masing-masing 61, 64 dan 30 peratus bagi kerbau, lembu dan haiwan-haiwan ruminen kecil. Peluang yang cerah masih ada untuk pelaksanaan dan daya penghasilan yang lebih baik bagi haiwan-haiwan ini. Pertambahan daya pengeluaran untuk masa hadapan ada dibincangkan berhubungan dengan penggunaan yang intensif, mengatasi pemaksaan-pemaksaan (constraints) dan keperluan pemeliharaan. Penghasilan yang maksima daripada punca-punca baka haiwan-haiwan tempatan akan bergantung kepada jumlah penggunaan punca-punca ini dan kecekapan yang sebenarnya di dalam sistem-sistem pengeluaran.

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13

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GENETIC RESOURCES OF FARM ANIMALS FOR IMPROVEMENT IN MALAYSIA

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SUMMARY:- The present paper briefly refers to the earlier publications dealing with indigenous and non-indigenous genetic resources of farm animal in Malaysia. Attempts have been made to document the early works on native and imported breeds of animals, to suggest procedures for evaluation of pure breeds and conservation of genetic materials. Finally the relevance of genetic reservoirs for animal improvement has been discussed.

INDEXING KEY WORDS: Genetic resources, farm animals.

Farm animal genetic resources of Malaysia may be divided into two categories: (i) indigenous and (ii) non-indigenous. Malayan jungle fowls, wild pigs, swamp buffaloes, Kedah-Kelantan cattle, local goats (Kambing katjang) are probably true indigenous animals of Malaysia. Other farm animals such as L.I.D. cattle, Kelantan sheep, local Chinese pigs, Canton type chickens, some local ducks and geese, and local Bronze turkeys may be termed indigenous because over the generations their habitat perhaps modified their genome to a considerable extent for their adaptation to the new environment, and the gene frequencies within each of the populations might have been stabilized a long time ago.

Non-indigenous animals are mainly breeding chickens, pigs, cattle and goats which have been imported into this country from all over the world. Importation of these animals have enriched the gene pool of the different species considerably. This is especially true for chickens and pigs because the physical and nutritional environments required for the maintenance of these animals are easier compared to ruminants. Importation of these animals in large numbers have also created greater genetic variability within each species, mainly due to differences in gene frequencies amongst the breeds imported and partly due to the increase in numbers of animals in each of these species. Livestock census available for 1975 and 1976 (Table 1) shows there is a slight decline in the numbers of buffalo population but an increase in the numbers of cattle partly due to import of exotic purebred and crossbred animals. Figures for chickens for many states are not available: hence the total figures for 1975 and 1976 are not presented (Osman, 1977).

Table 1: Livestock census of Malaysia for 1975 and 1976

	Buffalo			Cattle			Pig	Sheep	Goat
Year	Swamp	Murrah	Total	Drought	Milch	Total			
1975	210,036	2,857	212,893	320,121	65,868	385,989	1,168,300	329,102	45,495
1976	210,065	2,349	212,514	340,067	71,778	411,845	1,308,300	332,636	47,017