Chapter 1

INTRODUCTION

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The livestock industry is an important component of the Malaysian agricultural sector. The ex-farm value of the industry had increased by 61.94%, from RM 2,010,561,911 in 1987 to RM5,284,720,000 in 2001 mainly due to the strong growth of the non-ruminant sector (Department of Veterinary Services, Malaysia, 2002). Remarkable progress during the last four decades in pig and poultry production in Malaysia, which account for 90% of the total value added product has not only made the country self sufficient in these two products but significant progress in the export of processed products of these two commodities in Singapore and Hong Kong are also observed. The ex-farm value of these two sectors in 2001 is estimated at RM1,025,310,000 and RM2,827,170,000 respectively. In comparison, the ex-farm value from mutton production contributes only RM15,530,000 from the total.

Large-scale import of beef and mutton from overseas at a cheaper price may be a major factor that dampens the enthusiasm of large and small ruminant farmers to enhance their business activities. Local beef and mutton production meets only 10% of the current national requirement. The latest statistics of the sheep population in Malaysia stands as 118,715 heads (Department of Veterinary Services, Malaysia, 2004) with a decrease of 1.51% from the population in 2001 (120.529 heads). The sheep population in 2002 and the total livestock population of Malaysia for the years 1970 - 2002 are tabulated in Appendices 1 and 2.

The ruminant industry contributed only about 5.5 % of the total ex-farm value of the livestock industry. The dairy industry is small, contributing about 0.88% of the total ex-farm value, but it is expected to expand rapidly. The small ruminant industry does not have a significant impact yet but the integration of small ruminants with plantation crops and rearing of imported dairy and meat type goats from Australia, New

Zealand and Indonesia have enhanced interest of local farmers in the small ruminant sector.

To date, the sheep industry is still small and insignificant when compared to the other sectors of the economy and its progress has been fluctuating. There was a remarkable growth of 9.29% in the sheep population from 1986 (90,359) to 1992 following the government's effort to promote sheep farming in Malaysia. The sheep population peaked in 1993 (244,023) but in 1999 the sheep population decreased by 42.26% to a total of 140,292 and kept on decreasing until 2002 (118,715). Some of the reasons for the decreasing population are lack of sufficient suitable breeding stock, unresolved health and disease problems, high cost of agricultural land to produce feed and fodder and lack of market promotion.

For the long term growth and viability of the sheep industry, the question of breeds and their efficiencies under local conditions, having highly efficient breeds that respond well to high capital inputs and developing value added products or by-products such as pelts, blood, bones, dung and others must be taken into consideration. Optimum growth, reproductive fitness, disease tolerance and adaptability of the animals to low quality roughages in plantations have to be considered when importing breeds from overseas.

Sheep has a high reproductive rate when compared to cattle or buffaloes and has a much greater potential for exploitation of this trait than the large ruminant species, especially in plantations and small holders' fringe land in villages. This attribute, coupled with a short generation interval, gives the sheep good potential for high rate of genetic improvement in a number of performance traits. Its size, particularly in the tropics, makes it easy to handle. Along with goat, it is the exploiter *par excellence* of marginal land.

In contrast to large ruminants, sheep are small enough to be totally consumed on the day of slaughter by a family and its neighbours, thus avoiding the need for storage which is very difficult in a hot climate. Sheep also may provide non-edible products such as manure and skin. As a form of investment, sheep has many advantages. One or more animals can be readily sold for cash. The flock requires little input other than labour, and gives a good rate of return. Women folk in the rural household can take care of small herds of sheep in plantations and smallholders' farms.

In the early 1980's various Government Institutions namely the Department of Veterinary Services, Malaysian Agricultural Research and Development Institute (MARDI), University of Malaya (UM), Universiti Putra Malaysia (UPM) and the Rubber Research Institute of Malaysia (RRIM) started verification trials on farmer's land in order to demonstrate the technology of keeping animals under tree crops (Devendra, *et. al.*, 1982). Integration of sheep in rubber and oil palm plantations was successful and profitable (Wan Mohamed, *et. al.*, 1988). Sustainability of this system is based on the utilization of the undergrowth in plantations as the sheep feed and the usefulness of their manure for the partial enrichment of the plantation soil.

Sheep breeding

Due to the drastic decrease in the local Malin sheep during the 70's and the 80's, the main exotic wool sheep breeds such as the Dorset Horn, Polled Dorset and Suffolk were imported into this country, but many of these breeds suffered from acclimatization problems in the hot and humid climate of Malaysia (Davis and Rajion, 1990). In later years, a large number of Thai Long Tail sheep were imported from Thailand. The number of imported sheep for breeding and slaughter increased to 43113 head from Australia and 28000 from Thailand by 1995 (Department of Veterinary

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Services, Malaysia, 2002). Recent surveys on smallholder sheep farms in West Malaysia revealed that, 85% of the respondents have the local wool sheep breeds, Malin and Thai Long Tail in their farms.

In the strategy of upgrading the local breeds, several crossbreeding programs involving the local Malin with the imported exotic breeds like the Dorset Horn, Polled Dorset and Suffolk have been performed. The crossbreds of Dorset Horn and Polled Dorset with the local Malin were reported to perform well under sheep-rubber tree integration systems (Tajuddin and Chong, 1988). Kumpulan Guthrie Berhad, a multi-national enterprise, started its sheep breeding cum production project in their rubber plantation in May, 1994 and has successfully developed two new types of crossbred lines known as the Guthrie Dorsimal (Dorset x Malin) and the Guthrie Suffrimal (Suffolk x Malin) (Michael and Mohamad, 1994). Another big plantation agency, Sime Darby, in cooperation with Universiti Putra Malaysia, implemented two sheep rearing projects under integration with immature oil palm and under young rubber in plantations. Both these projects are now defunct and the major role of sheep breeding and distribution are being performed by the Department of Veterinary Services and various commercial breeders.

The introduction of temperate purebreds into this country has not been successful due to their poor adaptability and fertility (Abdul Wahid and Bolhassan, 1994). The high mortality rate within the first year of importation (40-50%), retarded the performance potential of pure breeds under Malaysian conditions compared to their performances in their countries of origin.

Crossbreeding in sheep may be regarded as the best method for genetic improvement (Mukherjee, 1994) as there is less potential of such improvement in the depleting population of the local Malin sheep. Although any of the crossbred options (production of F_1 and inter-se mating of F_1 in subsequent generations (F_2, F_3 ....), and

creation of a genome with 75% or 62.5% contribution of the superior breed and subsequent inter-se mating) may bring genetic improvement of desirable traits through heterotic effect and complementation, yet, without a continuous selection programme for further improvement of desirable traits from the second generation onwards, there will be no further visible improvement.

The government of Malaysia used to import breeding sheep from Australia, mostly Dorset Horn and undomesticated, non-descript Ferals. Adaptability to tropical climate and the degree of susceptibility to external and internal parasites of these breeds have been studied in Malaysia. The high mortality of these imported breeds during their juvenile periods has been reported earlier. Many attempts in the past by several public and private sector agencies to incorporate exotic temperate or wool breeds of sheep into the local sheep industry have also produced dismal results when the breeds failed to reproduce regularly. The enthusiastic for adaptive breeds of sheep to sustain viable production under the local feeding environment remains alive with a shift in research and development efforts from woolly breeds to hairy breeds from the tropical regions of Africa and Central and South America (Ariff, *et. al.*, 1994).

Although crossbreeding of the local sheep of Malaysia with productive temperate wool sheep has shown improvements on growth, reproduction and other traits, these crossbreds still possess thick wool of poor quality, which is prone to wetness and ectoparasites, as well as causing heat stress to the animals. Their ability to adapt to tropical environments, resistance to diseases and the ability to survive on poor nutrition are still low (Noraida and Mukherjee, 1996).

The main disadvantage of the local breed is their fleece. As it is of poor quality, it does not have a reasonable market value. It's unnecessary nutrient requirement for wool production, especially for essential thio-aminoacids requirement, decreases the amount of nutrients available for meat production. For these reasons there was a strong

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local demand for an improvement of the local sheep population through selective animal breeding techniques. Removal of the 'unproductive' fleece by means of crossbreeding (natural mating or artificial insemination) with hair sheep may increase the meat production capability as an effect of improved productive adaptation of the crossbreds in the humid tropical climate of Malaysia (Halbesien, 1998).

Hair Sheep

Hair sheep breeds are regarded as an alternative and a valuable genetic resource for meat production in the humid tropical environment (Fitzhugh and Bradford, 1983) as they are much better adapted to the environment, have higher survivability at all ages, are more fertile and have relatively good rates of growth in comparison to wool sheep crossbreds. A few hair sheep breeds from locations with similar latitudes as Malaysia were chosen for evaluation in Malaysia by the Department of Veterinary Services (DVS), Government of Malaysia and the Malaysian Agricultural Research and Development Institute (MARDI). The chosen breeds were the Bali-Bali (from Mali, West Africa), Virgin Island St. Croix (from the Caribbean Islands) and Barbados Blackbelly (from the Caribbean Islands). Crossbreeding the local Malin and Dorset Malin (Dorset x Malin) with exotic tropical hair sheep breed namely Bali-Bali was conducted in MARDI to produce hair sheep crossbreds such as Balin (Bali-Bali x Malin) and Badorlin (Dorset-Malin x Malin) (Ariff, *et. al.*, 1994). Currently, research in sheep breeding emphasizes on the development of suitable hair sheep breeds, better adapted to the Malaysian climate as well as large-scale integration of sheep in plantations.

In response to that and in order to minimize the above problems, the Institute of Postgraduate Studies and Research, University of Malaya started a collaborative

research programme with Humboldt University of Berlin on the development of a hair sheep breed, suitable for the humid tropics. The crossbreeding programme was started in 1991, involving the local wool sheep known as the Thai Long Tail (TLT) and the imported Cameroon (C) hair sheep from Germany, with the aim of producing a woolless variety of sheep, with higher growth rate, better adapted to Malaysia's tropical hot and humid climate and requiring at least 5-10% less feed. Various genotypes (F_1, F_2 and F_3) have been produced at the University of Malaya's farm through crossbreeding of Thai Long Tail and Cameroon. Some of these genotypes were also tested in farms outside the university.

This study is a part of a German-Malaysian multi-disciplinary project during which evaluation was made based on the quantitative analyses of the performance data of the hairy Cameroon (C), woolly Thai Long Tail (TLT), their filial crosses (F_1, F_2, F_3) and backrosses of the F_1 to the parental genotypes (BC_1, BC_2), in terms of growth, body conformation and reproductive performances. The choice of using the hair sheep breed in the programme was on the assumption that the gene for hairiness is partially dominant over the woolly gene, therefore genotypes consisting of heterozygotes will have hairy coat, complete or partial, while the recessive homozygotes will express a woolly type. The expected dominance of a single hair gene of the Cameroon hair sheep is expected to reduce or suppress the wool formation of the crossbreds. The partially hairy crossbreds may thus be selected for further breeding to produce the woolless generation.

Studies on the segregation of the hair and the wool genes and the fleece characteristics were not included in this study as it was done by another researcher in her doctoral dissertation (Halbesien, 1998). Therefore, this study pertains only to growth, body conformation and the reproductive traits of the above mentioned purebred and crossbred groups.

Statistical estimates of parameters pertaining to growth, body conformation and reproduction in this study, as well as the study in MARDI and in the Department of Veterinary Services are expected to help in the formulation of future breeding and selection programmes for sheep improvement in general and the improvement of hair sheep breeds in particular.

The objectives of this study are:

1. to compare the body weight and body conformation traits of the C, TLT, F_1 (C x TLT), F_2 (F_1 x F_1), F_3 (F_2 x F_2) and the reciprocal backcrosses, BC_1 (F_1 male x TLT female) and BC_2 (TLT male x F_1 female)
2. to compare the reproductive performances of C, TLT, F_1 (C x TLT) and F_2 (F_1 x F_1)
3. to estimate the heritabilities (h^2) of different body weights by regressing F_3 offspring data on F_2 parental data
4. to estimate genetic and phenotypic correlations between various growth traits