BORANG PENGESAHAN STATUS TESIS

JUDUL: THE IMPACT ON CALF PERFORMANCE TRAITS OF CALF Sired BY STUD BRAHMAN BULLS

IJAZAH: LIVESTOCK PRODUCTION PROGRAM, SCHOOL OF SUSTAINABLE AGRICULTURE

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THE IMPACT ON PERFORMANCE TRAITS OF CALF SIRED BY STUD BRAHMAN BULL

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PERPUSTAKAAN
UNIVERSITI MALAYSIA SABAH

DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF BACHELOR OF AGRICULTURE SCIENCE WITH HONOURS

LIVESTOCK PRODUCTION PROGRAMME
SCHOOL OF SUSTAINABLE AGRICULTURE
UNIVERSITI MALAYSIA SABAH
2010
DECLARATION

I hereby declare that this dissertation is based on my original work except for citations and quotations which have been duly acknowledged. I also declare that no part of this dissertation has been previously or concurrently submitted for a degree at this or any other university.

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ACKNOWLEDGEMENT

First and foremost, I would like to thank Prof. Dr. Ridzwan Abdul Rahman, the Dean of the school for his never ending support, words of wisdom and for guiding me all this while. I would also like to extend my gratitude to my supervisor, Dr. Kiron Deep Singh Kanwal for his guide and encouraging comments regarding this dissertation. In particular, my honorable mention goes to my co-supervisor Dr. Punimin Abdullah for his knowledge, support, guidance, and patience in conducting my dissertation.

I am also very grateful for comments and suggestions from my supervisory committee Miss Chee Fong Tyng and my examiners Dr. Suzan Benedick and Dr. Mohamadu Boyie Jalloh. I also owe my gratitude to En. Assis Kamu for sharing knowledge of software packages in analyzing the data.

My thanks are also to the farm manager of Livestock Breeding Center, Department of Veterinary Services and Animal Industry, Tawau, Dr. Norlena Albert C.J for the permission to use their secondary data and having me to collect recent data for my research. I wish to express my thanks to all department workers who were very cooperative, helpful, and friendly during the interviews and enquiries. Finally my deep appreciation goes to my beloved father Saharani Sharif, my mother Norlindar Salleh, my sisters Noor Faeza and Nurul Atikah and also my brother Muhd Hamed for their invaluable encouragement and support, not to forget my friends who have been helping and supporting me throughout finishing this dissertation.

To all the people mentioned above, my appreciation is in heart. In the process of gaining knowledge, one cannot stand on his or her own all the time because in every success there are always those people who stand behind to assist. Thank you.
THE IMPACT ON PERFORMANCE TRAITS OF CALF Sired BY STUD BRAHMAN BULLS

ABSTRACT

The cattle industry in Malaysia is faced by problems of low quantity and quality beef of cattle breed supply. Brahman cattle is known to have characteristics of early maturing, heavier weights, grew and finished on inferior pasture, have 3% carcass yield advantage, high drought survival rate and carried relatively few ticks. Thus making it the most suitable breed to be further developed in this country. Seventy three heads male and female stud calves born from Stud Brahman bull with Estimated Breeding Value (EBV) and 85 heads of non-stud calves born to Brahman bull with unknown genetic merit at Livestock Breeding Center, Tawau were evaluated to determine sire calf effect on pre-weaning calf growth performance and weaning characteristics. All calves were weighed at birth and at every three months interval until they were weaned when the calves' weight exceed 150 kg or more. Records from 158 calves over 5 years period were used to assess birth weight, weight at three, six and nine months, weaning weight, weaning age and pre weaning ADG of non-stud calves. Birth weight (23 ± 0.4 kg), 3 months (98.68 kg ± 4.39 kg) and 9 months (224 ± 13 kg) of stud male calves were significantly heavier (P<0.05) than non-stud calves. Females of stud calves were significantly heavier at birth (22.26 ± 0.33 kg) and 3 months (98.7 ± 4.33 kg) than non-stud female calves. Weaning weight of stud calves was heavier for both male (186.19 ± 5.33 kg) and female (184.5 ± 6.01 kg). Stud sire significantly affected (P<0.05) weaning age and pre-weaning ADG of calves. Weaning age of stud male and female calves was also significantly shorter (228.68 ± 3.58 d and 226.63 ± 3.75 d) in comparison to non-stud calves. Calf pre-weaning ADG was greater for stud calves for both male and female (0.71 ± 0.02 kg/d). The introduction of stud bull improved calves performances with heavier weight performances, shorter weaning age and greater pre-weaning ADG. Proven stud bulls can enhanced breeding program and promote accountability and cost effectiveness to accelerate the development in the beef industry. Cattle industry in Malaysia could be enhanced with the use of Stud Brahman bull with EBV in breeding program as it gives significant impact towards calf's growth, early weaning characteristic and improve dam performance.
KESAN KEATAS PRESTASI ANAK LEMBU YANG DIBAKAKAN OLEH PEJANTAN BRAHMAN

ABSTRAK

Malaysia menghadapi masalah kekurangan baka lembu pedaging yang berkualiti untuk diperkembangkan di negara ini. Lembu Brahman mempunyai ciri-ciri yang baik seperti mencapai kematangan dengan cepat, mempunyai berat badan yang lebih tinggi bebanding baka lain, kebolehtahanan hidup dengan rumput yang berkualiti rendah. Mempunyai 3% lebih berat karkas, tahan kemarau dan ketahanan terhadap serangan kutu. 73 ekor lembu anak lembu jantan dan betina baka pejantan Brahman tulen dengan Nilai Baka Teranggar (EBV) dan 85 ekor anak lembu jantan dan betina baka pejantan Brahman campur dikaji di Stesen Pembiakan Ternakan, Tawau untuk mengenal pasti kesan baka pejantan terhadap tumbesaran anak lembu sehingga sapih. Kesemua anak lembu ditimbang setiap tiga bulan sehingga sapih apabila berat lembu mencecah lebih dari 150 kg. Data dari 158 ekor anak lembu sepanjang 5 tahun diambil untuk dianalisa bagi ciri-ciri berat lahir, berat pada umur 3,6 dan 9 bulan, berat sapih, umur semasa disapihkan, dan purata berat sehari sehingga sapih. Berat lahir (23 ± 0.4 kg) , 3 bulan (98.68 kg ± 4.39 kg) dan 9 bulan (224 ± 13 kg) bagi anak jantan pejantan Brahman tulen didapat lebih berat secara signifikan (P<0.05) daripada anak pejantan Brahman campur. Bagi anak lembu betina pejantan Brahman tulen, berat lahir (22.26 ± 0.33 kg) dan berat pada umur 3 bulan (98.7 ± 4.33 kg) didapat lebih berat secara signifikan berbanding anak lembu betina pejantan Brahman campur. Berat sapih anak lembu jantan dan betina bagi pejantan Brahman tulen didapat lebih berat daripada anak lembu pejantan Brahman campur dengan berat masing-masing (186.19 ± 5.33 kg and 184.5 ± 6.01 kg). Umur semasa disapihkan didapat lebih cepat bagi anak pejantan Brahman tulen (228.68 ± 3.58 hari and 226.63 ± 3.75 hari) berbanding anak pejantan Brahman campur. Purata berat sehari sehingga sapih didapat lebih tinggi pada anak pejantan Brahman tulen (0.71 ± 0.02 kg/sehari) bagi kedua-dua anak jantan dan betina. Pembakaan dari pejantan Brahman tulen melahirkan anak yang mempunyai berat badan lebih berat, umur semasa sapih yang singkat dan purata nilai berat sehari sehingga sapih yang lebih tinggi.
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CHAPTER 1

INTRODUCTION

1.1 Overview of Malaysian Beef Industry

The Malaysian livestock industry is an important and integral component of the agricultural sector, providing gainful employment and producing useful animal protein for the population. It contributes about 18 percent to the total food sector of agriculture value-added products and export earnings (NAP, 1998). In earlier times, beef industry was practiced in a small scale and managed traditionally, but now the industry had developed into a modernized feedlot system and integration in oil palm plantations. By 1998, there were 370 small feedlot operators with a total population about 16,000 heads of beef cattle. Besides farms owned by the government, there were two commercial beef breeding farms with about 10,000 heads of the Kedah-Kelantan breed and crossbred zebu cattle (Tajuddin, 1994). As for Sabah, the beef industry was not well developed compared to the dairy industry.

Although Malaysia boast of well developed pig and poultry industries with self sufficiency over 100% for pork and poultry meat and egg, the beef, mutton and dairy industries record self sufficiency of less than 20%, 9% and 3% respectively (Anon, 2007). The problem faced by Malaysia regarding beef industries is lack of population growth and breed development (Eusof and Yaakub, 2009). Thus one of the ways to overcome this problem is through genetic improvement which gives a long term effect to the development of the industry and is cost effective (Jothi, 2007).
1.2 Beef Cattle Breeds in Malaysia

There are advantages and disadvantages of the beef breed used in Malaysia at the moment. The indigenous Kedah-Kelantan (KK) cattle and their crossbreds contribute to a large proportion of beef production in Malaysia. Others include the Draughtmaster, Australian Commercial Crosses (ACC) and also the males and culled female dairy animals such as the Local Indian Dairy (LID) and the Sahiwal-Friesian cattle (Hilmi and Yahya 1993). Preliminary results of crossbreeding KK with Fresian, Hereford and Brahman at MARDI Research Station in Kluang showed convincing improvement in birth weight and growth characteristics of crossbreds.

The drawback is that Zebu (Bos indicus) crosses cattle are smaller in size than temperate crosses cattle (Ariff and Johari, 1993). Hereford crosses grow faster than Fresian crosses and Brahman crosses and pure KK breed before and after weaning (Sukri et al., 1990) Moreover, KK cattle have low mature weight, low average daily gain and the growth rate decreased after 4 years and approach zero at 5 years (Samuel and Kwan, 1984). Given these attributes the beef industry is unable to produce the amount of meat required by the market demand.

1.2.1 Brahman Breed

Brahman cattle on the other hand has the characteristics of early maturing, grows and finish on inferior pasture, has 3% carcass yield advantage, high drought survival rate and carried relatively few ticks (Russ et al., 2001). Birth weights of Brahman calves have been larger than those of Angus, smaller than Charolais and comparable to those of Herefords (Franke, 1980). Cows from Brahman sires were heaviest at each age, ranging from 444 kg at 2 years of age to 570 kg at 6 years of age (Arango et al., 2002). Brahman cattle also could adapt fairly well to the humid environment and were able to utilize the native forages (Ariff and Johari 1993).
1.3 Justification

This study will emphasize on the evaluation of performance and genetic improvement of beef cattle by using Stud Brahman bulls and how this breed can enhance Malaysia beef industry in the future. Stud was an animal with high genetic merit to be the sire thus channeling the favorable genes for the desired traits and increasing their frequencies in the subsequent generations (Jothi, 2007). Thus it was hypothesized that the usage of Stud Brahman sire will give significant impact on weight performance of calves sired by it.

1.4 Objectives

The objectives of this study were:

1. To evaluate the performance of the progenies sired by Stud Brahman bulls.
2. To determine the effect of the stud sire in breeding programs towards beef cattle industry development.
CHAPTER 2

LITERATURE REVIEW

2.1 Beef Industry in Malaysia and Sabah

The cattle population in Peninsular Malaysia increased by 86% from 1980 to 1997, reaching 630,000 animals and producing about 20,000 t of beef (Jusoh and Noor, 2002). Beef production only accounted for about one-fifth of total national beef demand. By 2008, the population of beef cattle was 847,757 heads (Anon, 2008). Local beef cattle production can be categorized into five groups, the traditional farms; organized small farms with a feed-cutting system managed by government agencies, feedlot operating farms; large-scale commercial farms; and farms managed by Department of Veterinary Services (DVS) (Jusoh and Noor, 2002).

The livestock industry in Sabah started from a humble beginning of backyard farming some 25 years ago. In the ruminant sector especially cattle there was a gradual shift of management system from backyard to extensive free-grazing followed by a more intensive system where animals are kept in a limited area and fed through cut and carry.

Sabah is free from major animal diseases, which can cause serious economic losses to the livestock industry in the state. With stringent import regulations and constant surveillance at the points of entry, Sabah managed to keep at bay the Foot and Mouth disease, which in a recent outbreak had caused a serious problem to livestock industry in the United Kingdom and other parts of the world.
2.1.1 Present status of beef cattle industry and feed industry in Malaysia

Beef contributes around 25.38% of self-sufficiency in Malaysia (Anon, 2008). It is considered low and is not enough to cater even local demand. The 3rd National Agriculture Policy (1998–2010) has targets of 38,700 Mt of beef being produced by 2005 and 58,600 Mt by 2010. Figure reviewed by Eusof and Abas (2002) stated that presently, imported boneless meat from India dominates major share of beef market in Malaysia as high as 75% out of the country total market share.

Changing lifestyles have influenced demand for convenience foods and a protein-rich diet, the meat. By 2008, per capita beef consumption by Malaysian was 6.6 kg/year (Anon, 2008). Hence, Malaysia imported approximately 88% of its requirement from various countries in the form of fresh chilled and frozen meat and live animals to cater local demand (Yasmin F et al., 2003).

There were 41 feed mills in Malaysia, 33 of which were in Peninsular and the remaining in Sabah and Sarawak (Tajuddin, 1994). The number is expected to increase till date. Feed mills have been supplying sufficient feed for the poultry and other animals but not for the ruminant feeds. Annual production of livestock feed production is 3.9 million mt (Loh, 2004).

Ruminant industry depends primarily on locally available feedstuffs, with some supplementation provided by imported ingredients. The major local materials used are crop residues and other agro-industrial by-products such as rice bran, copra cake, and palm kernel cake (PKC), oil palm frond, sago, tapioca and broken rice.

Oil palm by products such as palm kernel cake (PKC), oil palm fronds (OPF) and silage products have been a good source of animal feed and Malaysia even exported them. PKC supply high amount of energy while OPF silage’s intake and digestibility is said to be as high as of the rice straw (Motohiko and Osman, 1997).
As for roughages, improved pasture or fodder species such as Brachiaria decumbens (Signal grass), B. mutica (Pare grass), Cynodon plectostachyus (African Star grass), Panicum maximum cv. typica (Common Guinea grass), Pennisetum purpureum (Napier grass), Setaria sphacelata (anceps) cv. Kazungula, and Stylosanthes guyanensis (Stylo legume) were planted for grazing in some farms in the country.

The main issue regarding beef industry in Malaysia is inadequate beef in the country to meet the local demand, due to the rapid increase in consumption and human population (Tapsir, 2004). The use of modern breeds of chicken and pigs has boosted the production of chicken meat, eggs and pork but the ruminant sector, comprising of dairy cattle, beef cattle, sheep, goats and buffaloes, has experienced moderate success in growth and population expansion. Small population size, inadequate feed supply and inappropriate production systems are the limiting factors in the expansion of the ruminant sector (Ariff, 2002).

Inadequate grazing acres in Malaysia burdened the ruminant industry further as there was lacking of grazing land and area for pastures culture. Only 1.5% of the total agricultural land is available for livestock. Young (1978) stated that feeding of cereal concentrates is expensive as most of the grains are imported and because of their high nitrogen and fertilizer requirements, they are expensive to grow locally.

According to National Agriculture Policy 1998-2010 (Anon, 1993), beef production could be increased through integration of cattle with plantation crops such as oil palm in smallholdings and plantations and through the expansion of feedlot activities. As for feedlot, a high impact project of National Feedlot Center is currently running with national farms built in Gemas, Negeri Sembilan to enhance beef industry and cater sufficient local demand by 2015.
2.2 Beef cattle breeds in Malaysia

The major breeds of beef cattle in this country are Kedah-Kelantan (KK), Brahman crosses and European-Kedah-Kelantan (KK) crosses. Crosses between KK cattle and imported breeds such as the Brahman from India and the United States, Nellore and Indo-Brasil from Brazil and some of the European breeds such as Limousin, Charolais and Hereford have been generated through the artificial insemination program and the bull and breeder cow loan scheme managed by the Department of Veterinary Services (Ariff, 2002).

The indigenous Kedah Kelantan (KK) cattle and their crossbreds contributes to a large proportion of beef production in Malaysia. Others include the Draughtmaster, Australian Commercial Crosses (ACC) and also the males and culled female dairy animals such as the Local Indian Dairy (LID) and the Sahiwal-Friesian cattle (Hilmi and Yahya 1993). Johari et al., (2009) reported that Brakmas (Brahman x KK) is another breed used developed by MARDI that showed good performance under mixed cattle-oil palm farming and intensive systems.

KK cattle however, is small in size (Ariff and Johari, 1993) and have the ability to graze on poor pasture. Samuel and Kwan, 1984 also stated that KK cattle have low mature weight, low average daily weight gain and growth rate decrease after 4 years and approach zero at 5 years. Young (1978) reputed that the Kedah-Kelantan is a very slow maturing animal with a poor milk production. Thus, Malaysia need a good and better breed to boost the beef industry to another level and march the industry towards an economical and cost effective one.

2.2.1 Stud Brahman and Brahman breed

Stud is animal with high genetic merit to be the sire thus chanelling the favourable genes for the desired traits and increasing their frequencies in the subsequent generations (Jothi, 2007).
The introduction of Brahman cattle in cattle breeding scheme in Australia is an excellent example on how a good beef breed change the industry and developed like what we see today. This breed grew, developed and revolutioned until it is considered as one of the best beef breed in Australia and other tropical countries. Artificial reproductive breeding technologies and breeding programs have resulted in improved genetic gain of the local cattle. Consequently, Brahman has become widely popular due to high genetic merit and is used both as pure and crossbreed in the breeding programs.

In beef production, the three major products are replacement heifers, breeding bulls and feeder cattle. The replacement heifers and bulls are utilized for breeding purposes to increase the number of calves produced both for the production of breeding stock replacements and feeder animals for fattening and for the slaughter market. Importing stud as breeder is a wise choice to create better generation in the future.

The cattle imported from Australia meant for breeding and for the feedlots are mainly commercial crosses of Brahman-European stock. Body weight of these crosses at 12 to 18 months of age ranges from 200 to 300 kg (Ariff, 2002). Phenotypically these cattle are heterogeneous in terms of breed, coat color and body weight.

The Brahman is a Zebu breed developed in the United States from the cattle imported from India and Brazil with two distinctly different types, the Grey Brahman and the Red Brahman (Sanders J.O, 1980). Brahman cattle has characteristics of early maturing, grew and finished on inferior pasture, had 3% carcass yield advantage, high drought survival rate and carried relatively few ticks (Russ, 2001). Brahman cattle could adapt fairly well to the humid environment and were able to utilize the native forages (Johari et al., 1993). A study done on the influence of breeds of beef cattle on ration utilization by Moore et al., (1975) shows Brahman cattle can utilize low energy ration but still have high nitrogen retention twice as compared to Hereford cattle. Howes et al., (1963) also reported that Brahmans still showed higher digestion coefficients for crude protein indicating a more efficient utilization of nitrogen sources by the rumen bacteria. Brahman cattle also have sufficient milk to adequately rear a calf (Croaker, 2002).
Birth weights of Brahman calves have been larger than those of Angus, smaller than Charolais and comparable to those of Herefords (Franke, 1980). Cows from Brahman sires were heaviest at each age, ranging from 444 kg at 2 years of age to 570 kg at 6 years of age (Arango et al., 2002). The progeny of the high estimated breeding value (EBV) from Brahman bulls were on average 1 kg heavier at weaning, 15 kg heavier at 10 months of age, 22 kg heavier at 19 months of age, 31 kg heavier at 31 months of age, 41 kg heavier at 40 months of age (Croaker, 2002). Frahm and Marshall (1985) also reported that cows with Brahman sires were 15 and 18 kg heavier than Hereford-Angus cows at 3 and 4 years of age.

However, this breed also has its drawbacks. Larger cows seem to have lower calf survival (Comerford et al., 1987). It is an important consideration in Brahman cattle where this relationship was due primarily to increased dystocia and poor pregnancy rate due to high hips of the female F1 sired by Brahman. It one study by Olcott et al., (1987) it was found that some Brahman calves were active and vigorous but exhibit poor nursing instinct. (Cartwright et al., 1964) also reported that Brahman cattle has slow maturing rate in comparison to Hereford breed in their experiment.

2.3 Favorable Growth Parameters of Brahman Cattle

2.3.1 Birth weight

Birth weight is a measure of growth made in a relatively homogeneous environment and is the first component of growth rate which can be easily evaluated. Therefore, it becomes a factor to be considered in developing methods for increasing the growth rate potential of beef cattle by genetic means (Ellis et al., 1965). The higher the birth weight, the earlier the calf reaches mature weight and can be mated earlier to enhance production.

Brahman-sired calves were larger than those sired by Boran and Tuli at all ages of evaluation, which could represent economic advantages in a weight-based marketing system (Herring et al., 1996). Reynolds et al., (1980) reported an average 25.8 kg birth
weight for Brahman calves. Plasse (1978) reported an average unadjusted birth weight in Brahman calves in Latin America of 27.2 kg and an average of 28.4 kg for the United States.

In comparison to other beef cattle breeds, research done by (Johari et al., 2009) claimed that the mean birth weight of the Brakmas bull calves was 28.02 ± 1.1 kg. Another research by (Aman et al., 2009) shown that Charolaise x KK (CK), Simmental x KK (SK) and Limousine x KK (LK) weighed 23.6 kg, 21.8 kg, and 20.9 kg at birth respectively. Brahman weighed 21 kg at birth while Hereford crosses weighed only 18.3 at birth.

2.3.2 Weaning weight

Turner and McDonald (1969) found that Brahman calves had preweaning daily gains similar to those of Hereford and Brangus calves and higher than those of Angus calves. Brahman calves were heavier at weaning than Shorthorn calves (Koger et al., 1975) but were smaller than Charolais calves (Peacock et al., 1978).

In a study by (Johari et al., 2009), the mean weaning weight, pre weaning ADG and weight adjusted at 200 days of Brakmas bull calves were 104.4 ± 2.9 kg, 0.44 ± 0.09 kg/day and 120.05 ± 22.24 kg respectively. As for the male, mean weaning weight was 109.9 kg while female weaned at 100.8 kg only. Brakmas weaned at 99.2 kg while Hereford x KK (HK) weaned at 102.7 kg.

2.3.3 Weight gain

There are lots of researches done on different beef cattle breeds available in Malaysia. Differences in mature weight existed among purebred KK and crosses of KK with Hereford, Brahman and Friesian. Crosses were heavier at maturity than KK (Ariff, 2002). As shown by (Aman et al., 2009), CK was 5.4% more than SK and 8.8% more than LK in gain during the first six months of experiment. As for Chinese Yellow Cattle (CYC), birth
weight was as low as 12.25 ± 0.42 kg, 66.72 ± 10.8 kg at six months and 136 ± 19.4 kg at 12 months.

The difference between the mature weight of KK and Brahman-KK cross was smaller than between KK and Bos Taurus -KK crosses (Ariff et al., 1993). However, latest research revealed that purebred Brahman cattle had higher birth weight, weaning weight and average daily gain compared to crossbreed cattle. (Gotti and Benyshek, 1988) reported that straight bred cattle weighted more than crossbred cattle at weaning. Hence it is a need to do more research on Brahman cattle to improve the beef production.

2.4 Mortality

Calf survival was the percentage of calves born alive that survived to weaning. Calves birth weight also represent the size of the calves born and it affect the mother calving ease. Thus there are some cases of still born calves due to dystocia and preweaning mortality due to low body condition scoring of both calf and mother. Increasing the proportion of calves that survive to weaning is of utmost economic importance

Calf mortality before weaning accounts for almost a third of calf crop losses (Cundiff et al., 1982) and is higher in subtropical and tropical regions (Plasse, 1973), where Bos indicus cattle are the predominant type of cattle. Bellows and Short, 1994 reported that a greater incidence of calving difficulty associated with their larger calves is primarily responsible for their low survival and mortality rate.

2.5 Breeding program

The problem faced by Malaysia regarding beef industries is lack of population growth and breed development (Eusof and Yaakub, 2009). Thus one of the way to overcome this problem is through genetic improvement where it gives in long term effect to the development of industry and more cost-effective (Jothi, 2007). The phase of producing calves from breeding cows has to be a least-cost operation, maintaining the cow population on low cost feed resources to achieve a high reproductive rate (Ariff, 2002).
Eusof and Yaakub (2009) suggested that if Malaysia beef industry is to grow and become more relevant, a Herd Improvement Program which is a form of extension work and breed improvement program has to be established along with good breeding and record keeping plan to complement the program.

2.5.1. Breed plan

Research and development strategies in livestock development should be one of supporting in the expansion of the industry (Ariff, 2002). With the lower Ringgit exchange value vis-a-vis the Australian dollar, it is economically not viable to continue to import from Australia to meet our requirements for breeding stock and feeder cattle (Ariff, 2002). Thus, we need to develop our own generation here in Malaysia, starting with enhancing the breed using stud Brahman bull for long term effects.

The Australian Brahman Breeders' Association (ABBA) and the National Beef Recording Scheme (NBRS) have developed the integrated pedigree and performance recording system called the Brahman Breedplan. Animal performance is recorded for growth, fertility and carcass trait. The trait analysed to measure growth is birth weight, 200 weight, 400 weight, 600 weight and mature weight. As for fertility, days to calving and scrotal circumference are measured. The breeding potential of each animal is reported as an Estimated Breeding Value (EBV) for each trait. Breedplan EBV's estimate the genetic differences between animals for a range of economically important traits.

Breedplan has been used in Australiasia and they have made outstanding genetic gains for growth traits. Hence, the implementation of the program in Malaysia starting from the state of Sabah, is hoping to change the whole scenario of Malaysia beef industry by 2015 with better breeds and results in the increase in beef cattle populations all over the country.
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