THE VECHUR CATTLE OF KERALA

Sosamma Type
Centre for Advanced Studies in Animal Breeding and Genetics.
Kerala Agricultural University, Mannuthy, Trichur, Kerala - 680651 lNDIA

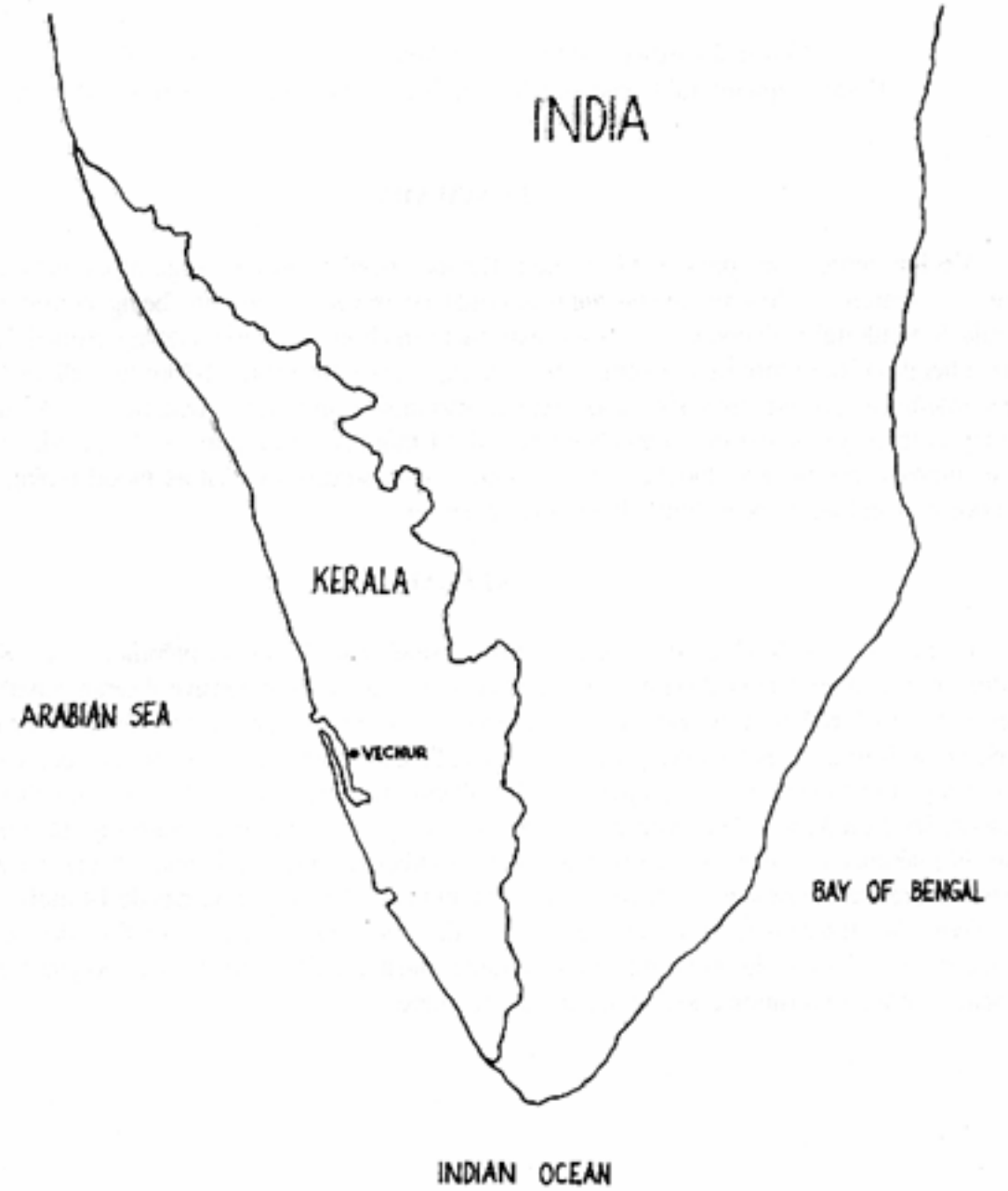
SUMMARY

Vechur cattle, once popular in southern Kerala (India) is on the verge of extinction. By extensive search the few remaining animals could be traced. They are being conserved by Kerala Agricultural University. Cows are extremely sma.ll in size, i.e. weighing around 125 kg with a height of not more than 90 cm They are capable of producing 2-3 kg fat milk per day. Heat tolerance, disease resistance and general adaptability are added qualities. Age at first calving is three years and the intercalving period 14 months. As a part of characterization of these animals, cytogenetic, biochemical, immunogenetic studies as well as blood typing, milk composition and fat globule studies have been taken up.

RESUME

La race bovine Vechur, très dffuse dans le passé dans la région méridionale de Kerala (Inde), se trouve en danger d'extinction. A travers une recherche extensive il serait possible de décrire l'effectif réduit d'animaux existants encore. Ceux-ci sont conservés à 1'Université Agricole de Kerala. Les femelles présentent une taille très réduite, avec un poids aux alentours de 125 kg, et une hauteur qui ne dépasse pas les 9U cm I.e niveau de productionjournalier peut atteindre les 2 ou 3 kg de lait, avec une haute teneur en graisse. Parmi les autres atouts on peut noter la tolérance à la chaleur, la résistance aux maladies, et une bonne adaptabilité générale. L'âge à la première mise-bas est de trois ans, avec un intervalle entre mise-bas de 14 mois. Pour co$_{m}$pléter la description des caractéristiques de cet animnal, on a réalisé des études cytogénétiques, biochimiques et immunogénétiques, ainsi que des études sur le polymorphisme du sang, sur la composition du lait et de la matière grasse.

Map of south India depicting the location of origin of Vechur cattle



1.0 INTRODUCTION

Kerala is the southern-most state in India, a narrow strip of land bordered by western ghats in the east and the Arabian Sea in the west. The cattle originated in the land are dwarf cattle and generally referred to as the local cattle or non-descript cattle of Kerala. But of these, there has been a variety with characters distinguishing the individuals from others and known by a local name i.e. the Vechur cattle.

The people of the locality, especially those above 50 years old, are able to give a good description of the cow. They may that the cow is small, less than 3 ft high. The shape of the horn is such that the rain water from the tip of the horn falls into the eyes of the cow. The extremely small size of the cows, low feed requirement, good adaptation to the locally and high disease resistance are also traits very much favoured by the farmers. Here it is interesting to recollect the metre-tall cow breed in Mexico and thought to be capable of producing around three litres of milk per day. The popularity of the Vechur cattle lay in the fact that the milk production of these cows was relatively high compared to other local cows. This has been recorded in the Trivancore State Manual. It used to be an interesting sight to see these dwarf cattle almost imersed in the water of the paddy fields of the area and moving forward to reach the greens seen above the water. The cows swiming swiftly across the canals and rivers was also a comon sight in earlier days.

2.0 ORIGIN AND DISTRIBUTION

Vechur, a small place near Vaikom in the Kottayam District of Kerala is the place of origin of these animals. In earlier days this area was isolated from other places by rivers and canals and backwaters. The isolation of the animals in the area, coupled with probable selection by farmers, would have resulted in the evolution of the Vechur animals.

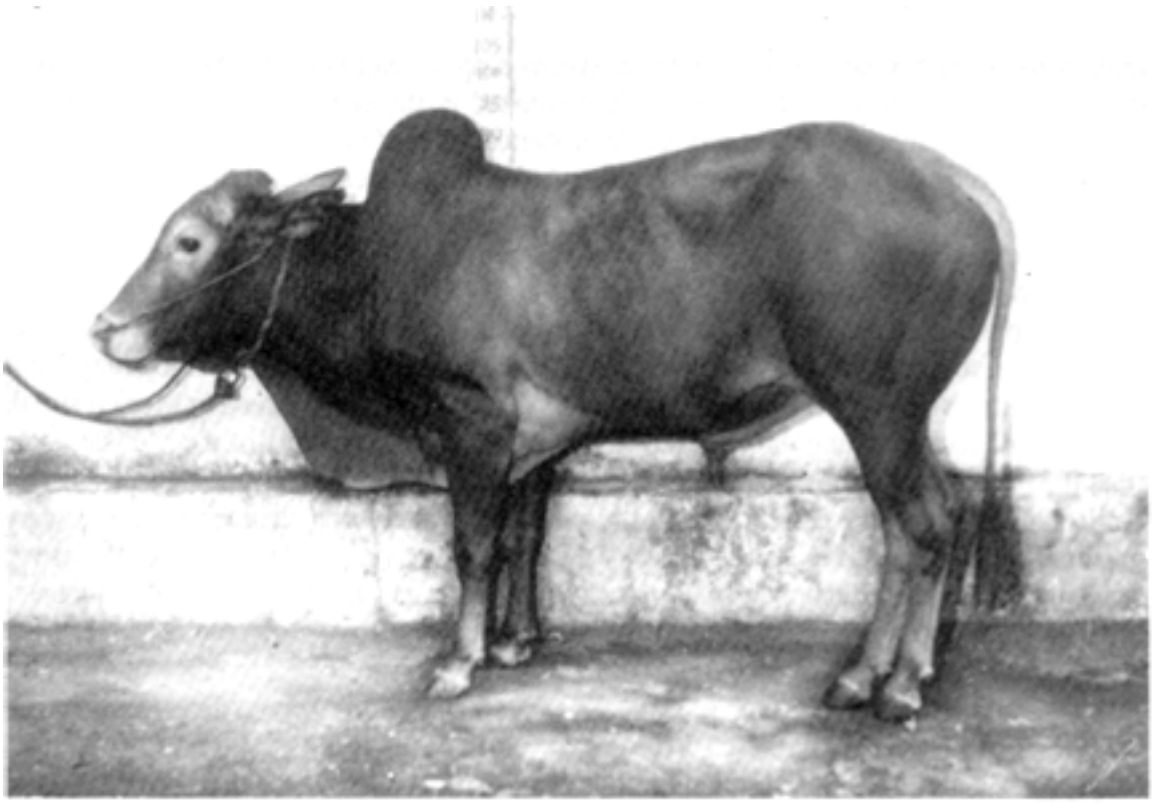
It used to be a custom to give Vechur cows as a gift to the named daughters of the family which added in the spread of these animals to other places. There are no previous recorded statistics about Vechur cattle. Vechur cattle were available in large number and were very popular in Vaikom and nearby areas.

3.0 REASONS FOR NEAR EXTINCTLON

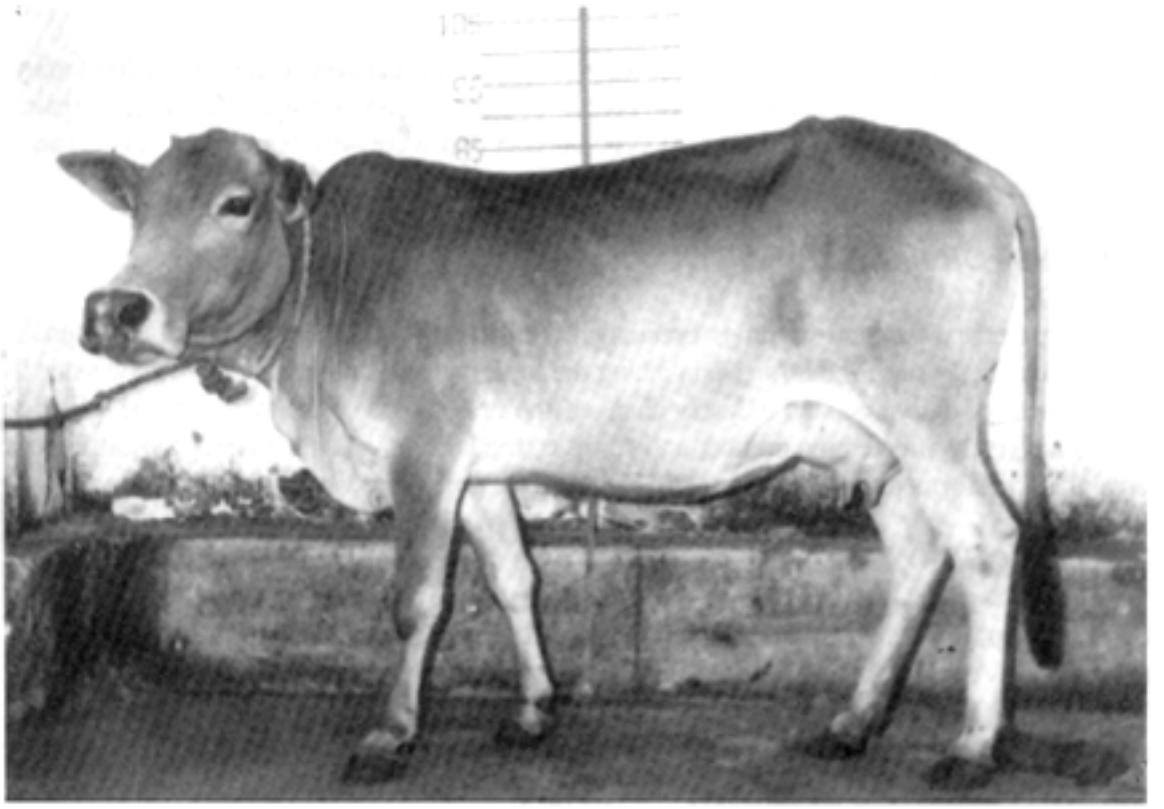
The programe of extensive cross breeding of local cattle with exotic bulls was launched and implemented vigorously since the 60's. Maintaining the local bulls was not permitted by law since the 50's. The development of dairying as an industry changed the first choice of the farmer to be a high yielding cow and this adversely affected the number and status of the local cows. As a result the cattle population of the area was transformed to crossbreds and Vechur cattle are on the verge of extinction now.

4.0 EFFORTS ON CONSERVATION

Kerala Agricultural University has taken up a project under the leadership of the author to conserve the germplasm of Vechur cattle. The speciality of the projects is the intense involvement of the students of the Veterinary college, especially in searching for and spotting the animals. After extensive search and selection a small beginning to conserve the Vechur animals was made on 26-7-1989, by purchasing 4 cows, a heifer, one bull, and 2 calves. Gradually, two dozen animals were purchased and added to the group. At present the strength is about 100, including followers. The stock is being multiplied and genetic studies are being carried out on these animals.



Vechur Cow



Vechur bull

5.0 GENERAL DESCRIPTION OF THE APPEARANCE OF THE ANIMAL

Colour : Light, red, black, fawn or white
Head : Long with somewhat narrow face
Horns : Small thin and curved forward, downward in most cases and very small and only just protruding in certain cases for cows, small and stout for bulls
Hump : Present. Vezy prominent for bulls
Legs : Short
Tail : Long and almost touching the ground
Udder : Well attached, with squarely placed small teats
Milk veins : Well developed
Skin : Smooth and glossy

5.1 Main observations

The birth weight of the calves have been only one third of that of the crossbred calves. One year weight was less than 75 kg. Peak milk production recorded was 3.67 kg/day. But the cows purchased had been very old, over 10 years as younger ones or calves were not available due to the use of exotic or crossbred bull semen in the locality and hence the recorded production cannot be taken as their full potential.

Quite contrary to the expectations, age at first calving was found to be comparable with the crossbred cows of Kerala. The intercalving period of 14 months also had been satisfactory though the animals were old.

The work started at Mannuthy has been appreciated at different levels and at present the project is financed by Indian Council of agriculture. The animals purchased, as well as the progenies born in the farm are under observation and studied for various traits. Cytogenetic, biochemical and imunogenetic work as well as blood typing are in progress. Twenty two animals were blood typed at the University of Bern, which has helped in correcting the record of parentage in two cases. This work is now taken up as a routine in the Centre. Milk composition, milk protein polymorphism and size of fat globules are being studied.

A breeding programe is planned and implemented to avoid inbreeding as far as possible. Maximum care is taken in bull selection. Embryo transfer has been sta ted as a tool for obtaining more progenies from the females with good breed characteristics.

Mortality had been almost nil for growing calves under farm conditions. Under *ad libitum* feeding, the size of the animal is small and heat tolerance and adaptability are as good as expected.

It was seen that these animals are quite resistant to foot and mouth disease. On hot days when panting was observed in exotic animals and their crossbreds, Vechur cattle never showed any sign of distress. In general, the Vechur cow is suitable for a farmer who cannot provide sophisticated management, but wants milk just for home consumption. No research work has previously been done on these animals. No description or characterisation has been made.

Considering all this, it is to be concluded that conserving this small cow for the future generation is a duty of the present generation.

CONSERVATION AND UTILIZATION OF BEEF CATTLE GENETIC RESOURCES IN JAPAN

Taro Obata, Masahiro Satoh and Hisato Takeda
National Institute of Animal Industry (NIAIj
Dept. of Animal Breeding and Genetics, Tsukuba, Ibarab 305, JAPAN

SUMMARY

There are four cattle beef breeds in Japan: Japanese Black, Japanese Brawn, Japanese Poll and Japanese Shorthorn. These breeds were crossed with European breeds in the early 1900's. As a result of introducing European blood, Japanese beef cattle have an expanded and more diverse gene pool. Furthermore, both the breed used for crossing and the selection criteria employed varied significantly from prefecture to prefecture Consequently, a number of distinct strains have been established. At present, however, the genetic diversity is becoming increasingly concentrated around a limited number of strains noted for their superior meat quality. From the genetic conservation view point, it is necessary to stock minor strains by frozen semen and embryos for future domands of genetic resources. This paper discusses the conservation and current utilization of beef cattle genetic resources in Japan.

RESUME

Au Japon il existe 4 races de bovins. Ces races ont été croisées avec des races européennes au début de ce siècle. Avec l'introduction des races européennes, les races bovines à viande japonaises présentent un pool génétique plus diversifié et étendu. En outre, les races utilisées pour les.croisements et les critères de sélection appliqués étaient différents d'une région à l'autre. Par conséquent" on a obtenu nombreuses souches différentes. Actuellement, cependant, la diversité génétique se centre principalement autour d'un nombre limité de souches, connues par la qualité supérieure de leur viande. Du point de vue de la conservation génétique, il est nécessaire de conserver, à travers la congélation de semence et d'embryons, les lignes moins intéressantes du point de vue commercial mais utiles pour une future demande de ressources génétiques. Cet article analyse la conservation et l'utilisation courante des ressources génétiques des bovins à viande au Japon.

1.0 BACKGROUND OF BEEF CATTLE PRODUCTION

1.1 Historical features influencing cattle production

The history of the raising of beef cattle in Japan is extremely short compared to that of Europe. This fact seemed to arise due to the following two reasons. Firstly, the climatic conditions of Japan are suitable for the cultivation of grain and the only purpose for cattle raising was to assist in rice cultivation. And secondly, for a long time Buddhism was predominant in Japan and prohibited the eating of meats, especially of four legged animals. Though meat has been consumed in Japan only for about 130 years which was the beginning of the Meiji era, it has only reached widespread popularity in the last 30 years. Therefore, Japanese beef cattle were not subject to improvement techniques for meat production before the mid 1950's.

In the Meiji era, many foreign cattle were introduced to Japan and initially extensively crossbred with the native cattle under the leadership of the government. Through this, the gene pools of Japanese beef cattle were diluted and greatly expanded. After the initial frenzy of crossbreeding was over, each cattle breeder began to work to improve their breeds without such crossbreeding. These were promoted by each prefecture, so the unique characteristics of Japanese cattle remains today.

1.2 Description of Japanese beef cattle breeds

In 1994 there was a total of 2 971000 beef cattle in Japan. These can be classified into two basic types. One of 1879 000 indigenous Japanese beef cattle and the other of 1093 000 non indigenous fattening dairy cattle and crossbreeds. The category of crossbreed are of a small but expanding part of the total due to a current enthusiasm for crossbreeding Japanese Black with Holstein cattle. The indigenous beef cattle breed is called Wagyu. There are four breeds, Japanese Black (90.2%), Japanese Brown (7.6%) Japanese Poll (0.1 %), and Japanese Shorthorn cattle (2.1 %). Each breed has its own history and distinct characteristics which are detailed in the next paragraph.

1.2.1 Japanese Black

Most Japanese Black were crossbred giving a modern type of this breed, but the original type of Japanese Black cattle can still be found in Mishima cattle designated as a natural treasure in Japan. They are a late maturing breed with a narrower body compared to the modern Japanese Black.

In the Chugoku district, several pre-crossbreed strains (Tsuru) had been developed during the Edo era (1600-1876) and were the primary means of carrying firewood to fuse the iron sand for steel production. They were used as draft animals. After the Meiji restoration in 1867, the government encouraged the introduction of foreign cattle breeds for crossbreeding with native cattle in order to improve body size and milk production. As shown in Table I, various kinds of breed were introduced and crossbred with each regional native cattle. In consequence of this, the genetic diversity of the indigenous cattle was greatly expanded.

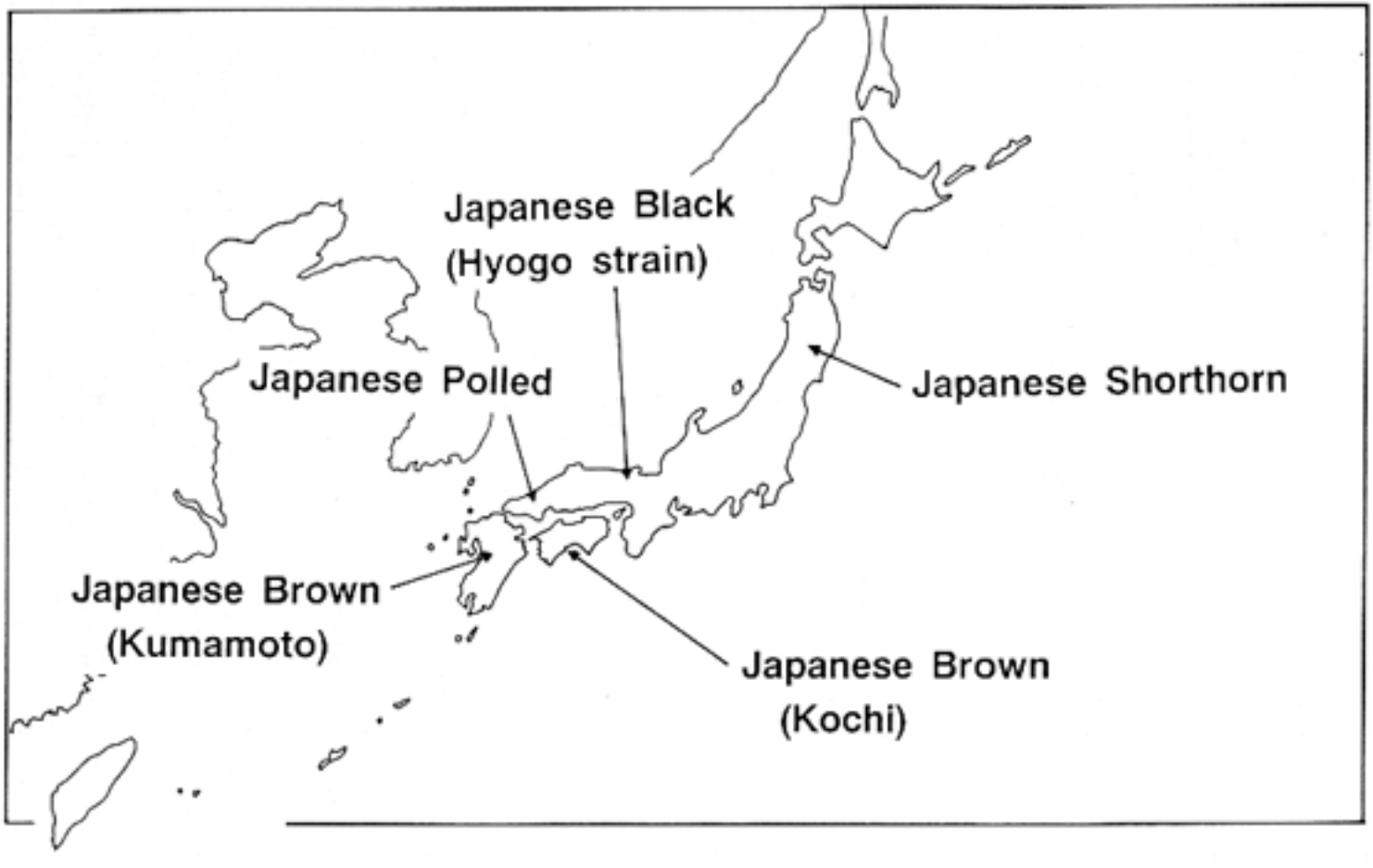


Figure 1: *Geographic Distribution of Japanese Beef Cattle*

TABLE 1:
Foreign breeds crossed with native cattle in each Prefecture

Name of modern breed	Prefecture	Crossed foreign breeds
Japanese Black	Kyoto	Brown Swiss
	Hyogo	Shorthorn, Devon, Brown, Swiss
	Okayama	Shorthorn, Devon
	Hiroshima	Simental, Brown Swiss, Shorthorn, Ayrshire
	Tottori	Brown Swiss, Shorthorn
	Shimane	Devon, Brown, Swiss, Simental, Ayrshire
	Yamaguchi	Devon, Ayrshire, Brown Swiss
	Ehime	Shorthorn
	Ohita	Brown Swiss, Simmental
	Kagoshima	Brown Swiss, Devon, Holstein
Japanese Brown	Kochi	Simental, Korean Cattle
	Kumamoto	Simental, Korean Cattle, Devon
Japanese Poll	Yamaguchi	Aberdeen-Angus
Japanese Shorthorn	Aomori	Shorthorn
	Iwate	Shorthorn
	Akita	Shorthorn, Devon, Ayrshire

After the mid 195U's, agricultural machinery predominated and chemical fertilizer was more popular in agriculture supplanting and reducing the draft cattle. This forced a shift in the reason for raising this cattle to that of beef production.

Japanese Black is now to be found in all regions of Japan. Recently, the number of this breed has been increasing in the Kyushu and Hokkaido regions. In contrast, in the Chugoku region, which was once the mnain production region for this breed, it has been decreasing.

Overall this breed has a dull black coat and skin. This breed has horns, though they do not have humps. Their body size is small to medium. The withers height and body weight of the mature female and male are 129 em, 512 kg and 145 em, 8U9 kg respectively. The milk yield for 180 days is about 1000 kg. The records of the performance and progeny tests are shown in Tables 2 and 3. Compared to the other Japanese indigenous breeds, Japanese Black are noted for their capacity to produce beef with a high degree of fat marbling but with thin fat layer beneath the skin and surrounding the internal organs.

TABLE 2:
*Performance testing records of Japanese beef eattle (1992) **

Items Number of tested	Japanese Black	Japanese Brown	Japanese Shorthorn
Bull calves (nos.)	397	34	90
Birth weight (kg)	31.5	34.9	39.7
initial weight (kg)	263.4	309.8	294.5
Final weight (kg)	399.3	468.9	475.8
365-day weight (kg)	424.1	455.8	437.8
Daily gain (kg)	1.21	1.42	1.30
Concentrates intake (kg)	616.8	767.1	747.5
Forage intake** (kg)	339.0	330.0	562.8
TDN/kg gain	4.58	4.62	4.56

TABLE 3:
Progeny testing records of Japanese beef cattle (1992)

Items Number of tested	Japanese Black	Japanese Brown+	Japanese Shorthorn
Bulls* (nos.)	76	5	7
Testing period (day)	364	329	308
Initial age (day)	265.2	302.8	265.1
Initial weight (kg)	259.6	317.7	247.6
Final weight (kg)	586.0	684.1	585.9
Daily gain (kg)	0.9	1.12	1.10
Concentrates intakes (kg)	2571.7	3365.4	2203.9
Forage intake** (kg)	733.9	-	1187.6
Carcass weight (kg)	353.3	415.3	346.1
Dressing weight (%)	73.1	64.3	62.0
Marbling score***	7.1	4.9	3.0
Rib eye area*** (cm)	45.1	45.1	43.1

** Eight to ten steer progenies per bull were used*

*** Air dry basis*

**** Carcass measurements are on the 6th to 7th rib section*

+ Kumamoto strain

The Japanese Brown breed has two distinct strains. One is mainty reared in the Kumamoto prefecture and the other in the Kochi prefecture. The developmental processes of these strains are quite different, so that they are usually described separately:

a) Kumamoto strain

Originally in the Kumamoto prefecture, a strain of red coloured cattle was reared. This strain was developed from imported Korean cattle. After the late 1900's, many foreign breeds such as Simental and Devon were importeti and crosseri with this breed. When this crossing was made with Simental cattle, in particular, a large body size cattle was produced. The features of this breed are their high rate of body-weight gain and a large rib eye area.

b) Kochi strain

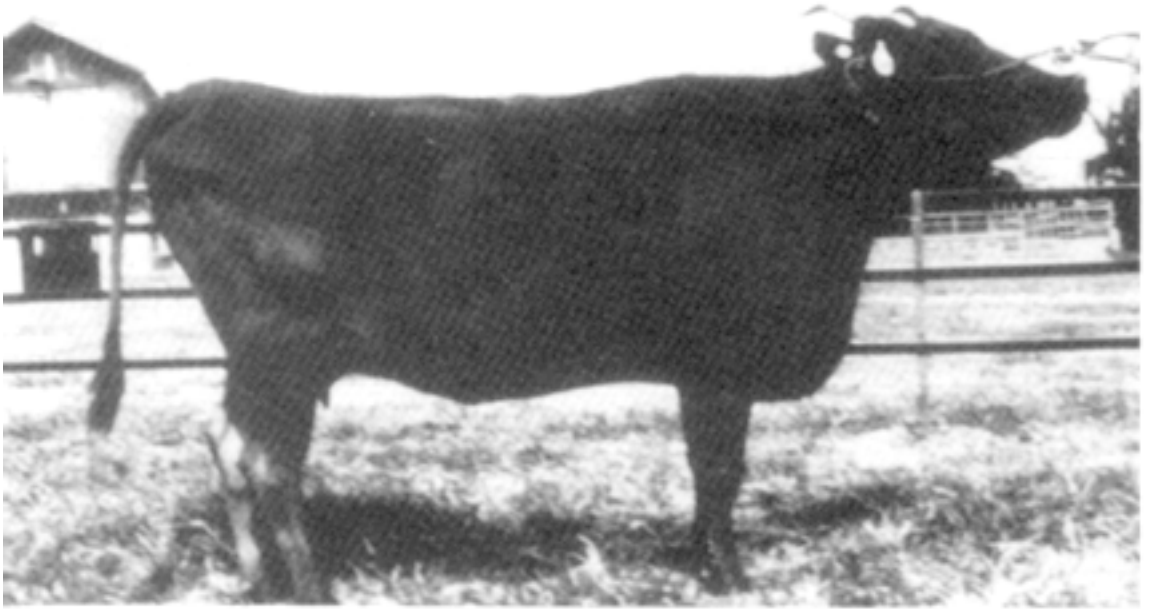
The kochi strain was developed from crossing Simental with Korean cattle introduced from Kyushu island. The period in which. this crossing was practised was substantially shorter than that for the Kumamoto strain. This reduced the dilution of the original breed's characteristics, retaining important differences. They also have a yellow-brown coat, which is much lighter than the Kumamoto strain. The cattle that have black skin at their horns, hoofs, eyelids, muzzle, tongue, switch and anus was valued more highly because it was typical of the original Korean breed. The beef production performance of this strain is closely similar to the Kumamoto strain.

c) Japanese Poll

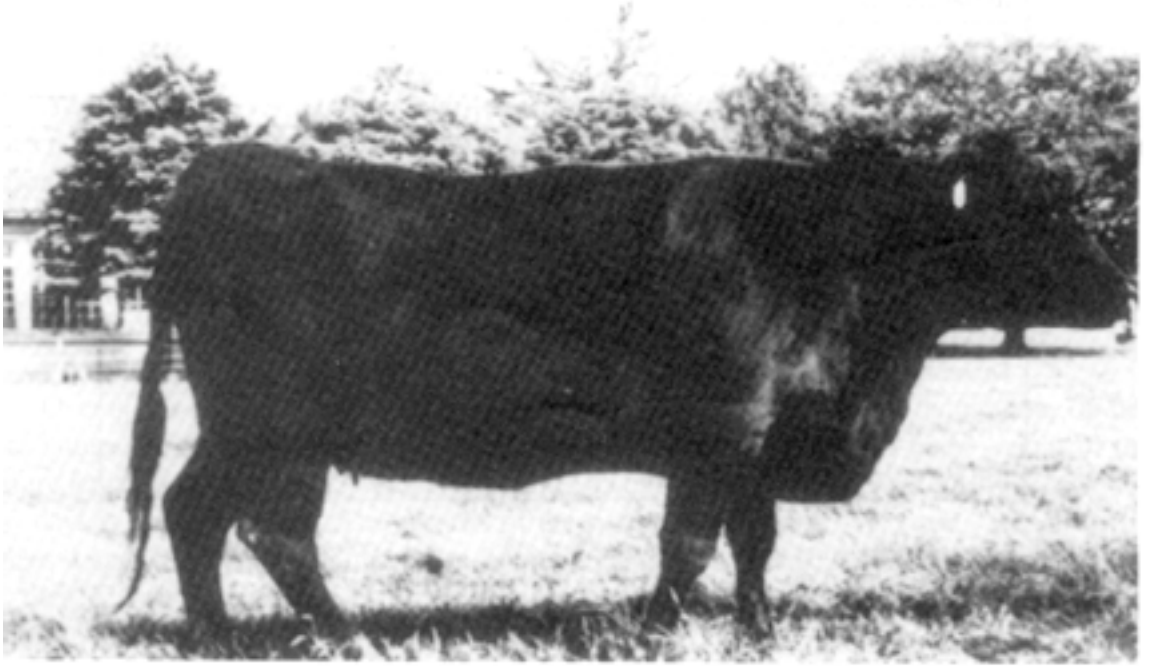
This breed has been developed since 1916 from a cross between the indigenous cattle with Aberdeen Angus bulls imported from England. Japanese Black bulls were crossed with those females in order to improve their meat quality in 1975, and it is likely that there are not many pure bred Japanese Poll cattle left. 'Their coat colour is black and they have no horns. Neither performance nor progeny tests have been practised since 1986.

d) Japanese Shorthorn

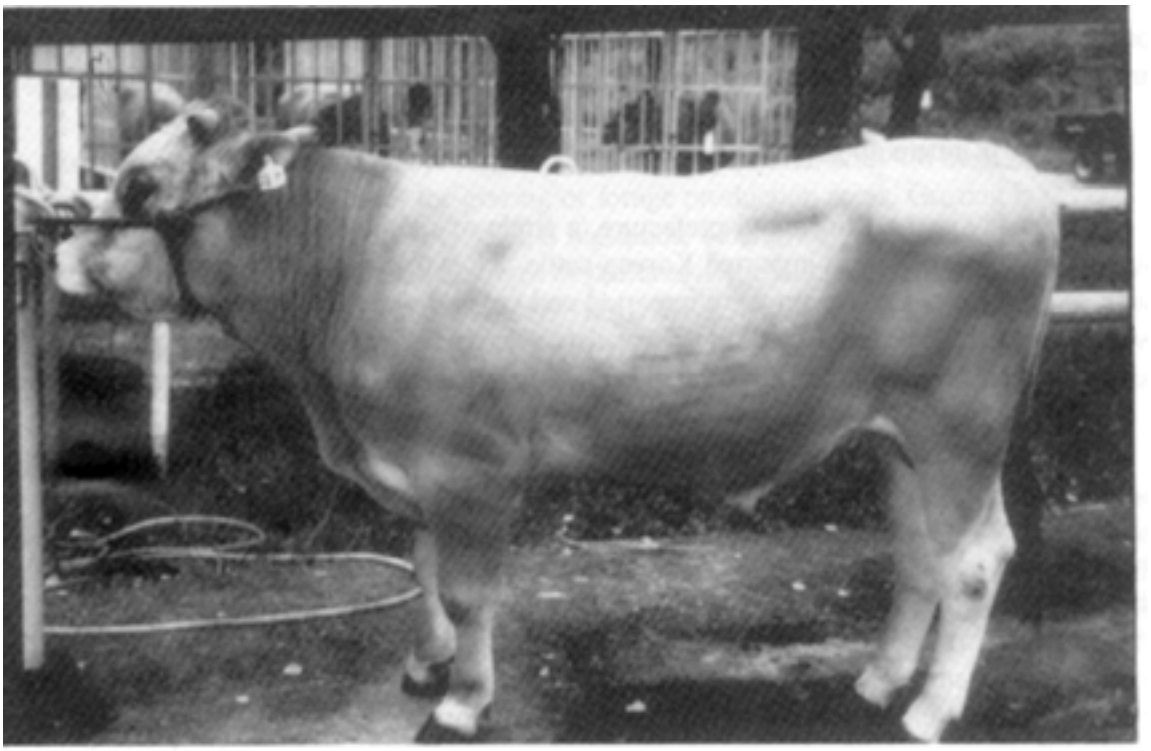
This breed is the result of crossbreeding, begun in 1871, between the indigenous cattle in the northern parts of Honshu Island (Tohoku region) and the imported dairy Shorthorn cattle. It is



Japanese Black



Japanese Poll



Japanese Brown (Kochi strain)

Japanese Brown (Kumamoto strain)

claimed that this breed can utilize the rough snmer grazing, which is available in the mountainous parts of this region, better than other breeds. They are mainly distributed in the Tohoku and Hokkaido regions.

The coat colour of this breed is deep red-brown, which is darker than the Japanese Brown. The Japanese shorthorn seem to be superior to the Japanese Black for milk production, forage intake and growth rate.

2.0 CURRENT REARING STTUATION AND AVERAGE PERFORMANCE

2.1 Rearing situation

On-farm cattle rearing, for calf production, is a small operation, with 4.6 head on average, due to the lack of productive bases for grazing or forage production areas. Grazing is generally limited to mountainous areas, hilly regions and highlands, where rice production is impossible. Cattle are grazed rotationally on fenced ranges or pastures in the summer from May to October, but they are usually kept in barns in the winter. This is because foliage is unavailable in most of the grazing areas, due to withering or heavy snow in the winter. In the south-western region of Japan, where all year round the temperature is higher than in the northem region, yearlong grazing is possible.

All bull calves except those retained for breeding purposes are castrated during the suckling period, because castrated calves are marketed as feeders for fattening. Castration is carred out before the calves are 3 months old. Almost all calves are fed on supplements from the age of 2 or 3 months to weaning age of 6 or 7 months. The average number of calves on fattening farms is larger than on calf production farms, at 24.7 head per farm.

2.2 Reproduction

In Japan, about 94 percent of cows are artificially inseminated and about 99 percent of the inseminated cows are served with frozen semen. As only selected superior males are used in the system, the ratio of males to females is extremely low. The semen of young bulls is cotlected first at about 18 months of age, and periodically thereafter.

Heifers have their first service when they are 13 to 16 months old. The first parturition is expected when they are about two years old without any calving diffculties. In order to shorten the calving interval, cows have the next service within 40 to 60 days after calving. The conception rate was about 88 percent in 1994 and the calf crop rate was 84 percent. The natural rate of twinning is very low, accounting for 0.11 percent for Japanese Black. The average calving interval is estimated at about 13.5 months. The management of cattle is so intensive that the mortality of cattle is fairly low.

2.3 Meat production

Japanese beef cattle fattening methods are quite different from those common in other countries. Steers are finished at 696 kg live weight and 29.8 months of age on average, after spending about 20.2 months fattening from weaning. During this time, they consuzne about 3 tons of concentrate rations and gain 0.68 kg a day. Such a fattening system is too long and not reasonable, but can be profitable at present, as a result of the strong demand for high quality beef.

There are many cattle strains based on their genetic background. One typical cattle line is found in the Hyogo Prefecture. These cattle are characterized by the excellence of meat quality. Their finely marbled beef is famous under the name of “Kobe-beef’ or “Matsuzaka-beef’ lt is a general misconception that high quality beef is produced by special feeding and management techniques. Since these animals have a unique genetic resource, they deserve to be conserved and made the best of.

3.0 REVOLUTLON IN BEEF CATTLE BREEDING

Since 1968, two-stage selection, based on gerformance and progeny testing, is practised on a station testing system. Fig. 2 shows an outline of the two-stage selection programme.

3.1 On-station beef bull testing programme

In the performance testing programme, male progeny from the planned matings are chosen at weaning and transferred to the breeding station within each prefecture and/or Livestock Improvement Association (LIS). The performance testing period is I 12 days (16 weeks). The selection criteria are growth rate, 365-day weight, feed efficiency, semen quality, type score, etc., and the election intensity is 1 (l to 20'%%. Selected growing bulls can proceed to the progeny testing programme.

In the progeny testing programme, half sib steer calves sired by particular bulls are fattened (the prefectural stations use 8 paternal half sib steer calves and the LIA stations 15). The progeny testing period is 364 days (52 weeks). The selection criteria are marbling score at the eye muscle at 6-7th rib section, rib eye areas, fat thickness, growth rate, etc., and the selection intensity is about 30%. Marbling score at the eye muscle are given priority over all else in the assessment of performance. In all breeds, about 500 animals were performance tested and about 100 animals were progeny tested yearly at 21 offciaI stations in 1994.

These testing programmes have been playing a very important role in beef cattle breeding, however, it is pointed out that there are at least three important defects in such programmes. Firstly, at the initial selection stage, the performance of carcass quality traits, especially those of marbling score, were not evaluated in the test. Secondly, more money is required to practise the performance and progeny tests in a station testing system. Thirdly, only males are tested.

3.2 Changes in the circumstances of testing programme

There are four influential factors which have changed the circumstances of the testing programme. These are, (a) new reproductive technologies, (b) innovation in computer technology, (c) standardization of carcass grading, and (d) how ta make most of Japanese beef cattle.

Recently, many reproductive technologies, e.g. multiple ovulation, embryo transfer, cloning, in vitro embryo production, embryo sexing, etc., have been proposed for advancing genetic improvement. Such reproductive technologies, especially those of multiple ovulation and embryo transfer (MOET), require that data on the performance of females be known. Whereas before, data on the genetic potential of bulls only was necessary, now that for the carcass performance, etc., of cows is required.

As BLUP (Best Linear Unbiased Prediction) procedure has become widely used for estimating breeding values, technical innovations in computers enable the calculation of large size equations on personal computers that were impossible 10 years ago. Advances in computer technology have recently greatly increased the power of personal computers and equally reduced the cost. Such advances have brought about the widespread use of BLUP for beef cattle improvement. It is now very possible to undertake multiple factor calculations that provide more accurate predictions of breeding values through using cattle pedigree data and that make suitable correction for environmental factors. Moreover, such calculations can now easily be carned out on the personal computers.

In 1988, the beef carcass grading standard was revised. The separation of carcasses between the 6th and the 7th ribs was standardized throughout Japan. Standardized evaluation systems were also introduced, e.g., meat yield grade is classified in three ranks (A,B,C) based on the numerical value, meat quality grade is classified in 5 ranks (1-5) with the standard marbling and colour figures.

The rearing system of Japanese beef cattle is very different from other countries: (a) more than 90% of cattle are pure breeds; (b) more than 95o/a of matings have been practised through artificial insemination; (c) more than N8% of cattle are registered and their pedigre records are kept; and (d) more than 80o/o of slaughter cattle are graded at the meat markets by the standardized carcass grading systems. To fit these changes and to znake the most of these features, the field progeny testing programme was introduced.

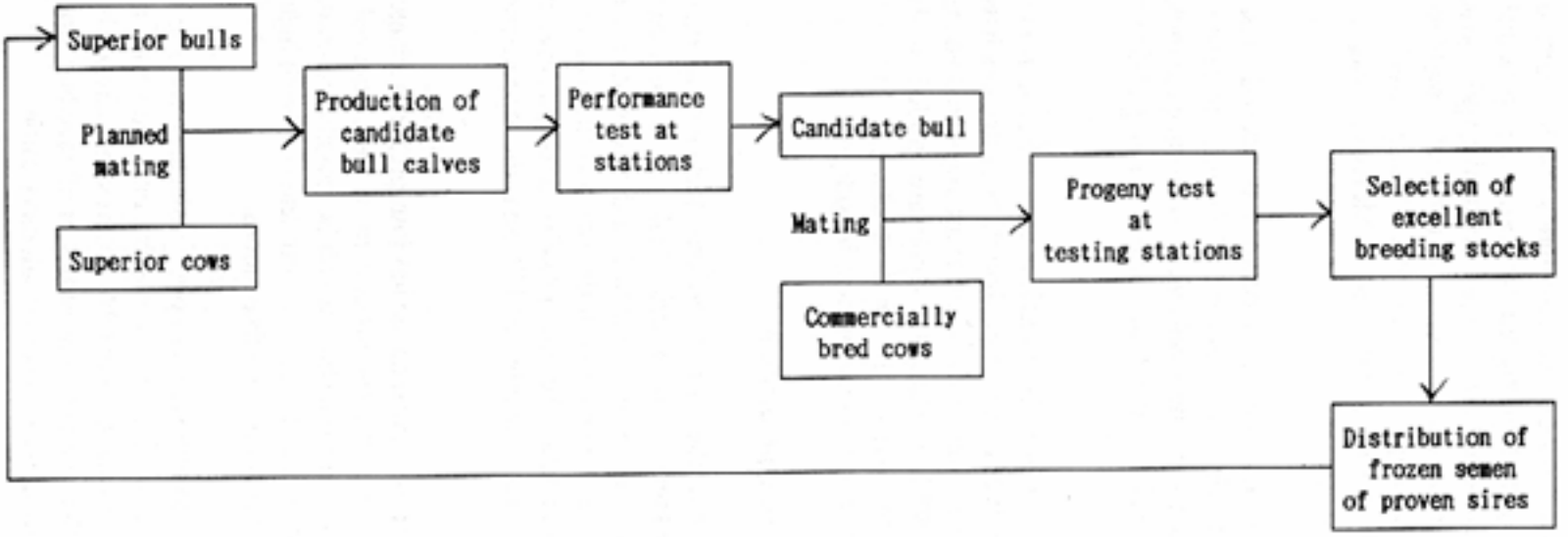


Figure 2: *Outline of the on-station beef bull progeny testing programme*

3.3 On-farm progeny testing programme

Fig. 3 shows an outline of the on-farm progeny testing programme. All feeder calves that joined in this plan were ear-tagged with an individual code at the weaning age. And when they are slaughtered at the meat markets, the identified field carcass data was collected. This data is used to estimate the breeding values on both the sire and the dam by matching with pedigree information. This type of estimation became possible through development of the calculation procedure that is called Animal Model BLUP and the application systems for personal computers.

The on-farm progeny testing programme has four great advantages: (a) more cattle can be tested, and a higher selection pressure and faster improvement achieved; (b) the cost of testing is reduced; (c) before the performance testing, it will be possible to evaluate the performance of young bulls; and (d) by planned mating between sire and cow with high breeding value ranking, it will be possible to produce excellent breeding stocks.

Until recently, various conditions were not satisfactory and the on-farm progeny testing programme was not used nationwide. At the present time, however, more than 20 prefectures are trying to introduce this plan alnd considerable progress has already been achieved. In the near future, it may be expected that the breeding values of all breeding stocks of beef cattle will be calculated on a nationwide scale, as in the case with dairy cattle.

4.0 DISCUSSION

Four beef cattle breeds, Japanese Black, Japanese Brown, Japanese Poll and Japanese Shorthorn are reared in Japan. These breeds are considered to be indigenous to Japan, but many foreign cattle were introduced to Japan and initially extensively crossed with the native breeds in the early 1900's. Through this, the genetic diversity of Japanese beef cattle was greatly expanded. Furthermore, both the breed used for crossing and the selection criteria employed varied significantly from prefecture to prefecture. Consequently, a number of distinct strains have been established. At present, however, the genetic diversity is decreasing due to the concentration around a limited number of strains noted for their superior meat quality. From the genetic conservation point of view, the systematic conservation of minor strains using frozen semen and embryos for future demands of genetic resources is recommended.

Considerable genetic improvement of Japanese beef cattle has been obtained using traditional on-station testing schemes. To make full use of Japanese beef cattle features, however, it is more appropriate to carry on-farm progeny testing programmes, based on the Animal Model BLUP. The introduction of multiple ovulation and embryo transfer (MOET) could lead to dramatic changes in conventional beef cattle improvement schemes, rather than replacing conventional breeding schemes. In the near future, biotechnology will make such assessments easier and more accurate through allowing the specific DNA portion responsible for the desired phenotypic feature to be detrmined. This will have a sigrificant impact on cattle improvement. Until now, the use of molecular genetics has been mostly confined to the laboratory research stage and only a few techniques have spread beyond this to practical application for cattle breeding. Further basic studies are required to make it more readily available and practical for everyday use in the field.

All of this indicates that a new era in beef cattle breeding has been entered. To approach the goals of beef cattle improvement, it is strongly recommended that a combination of the new breeding techniques and the conventional breeding procedures be simultaneously pursued.

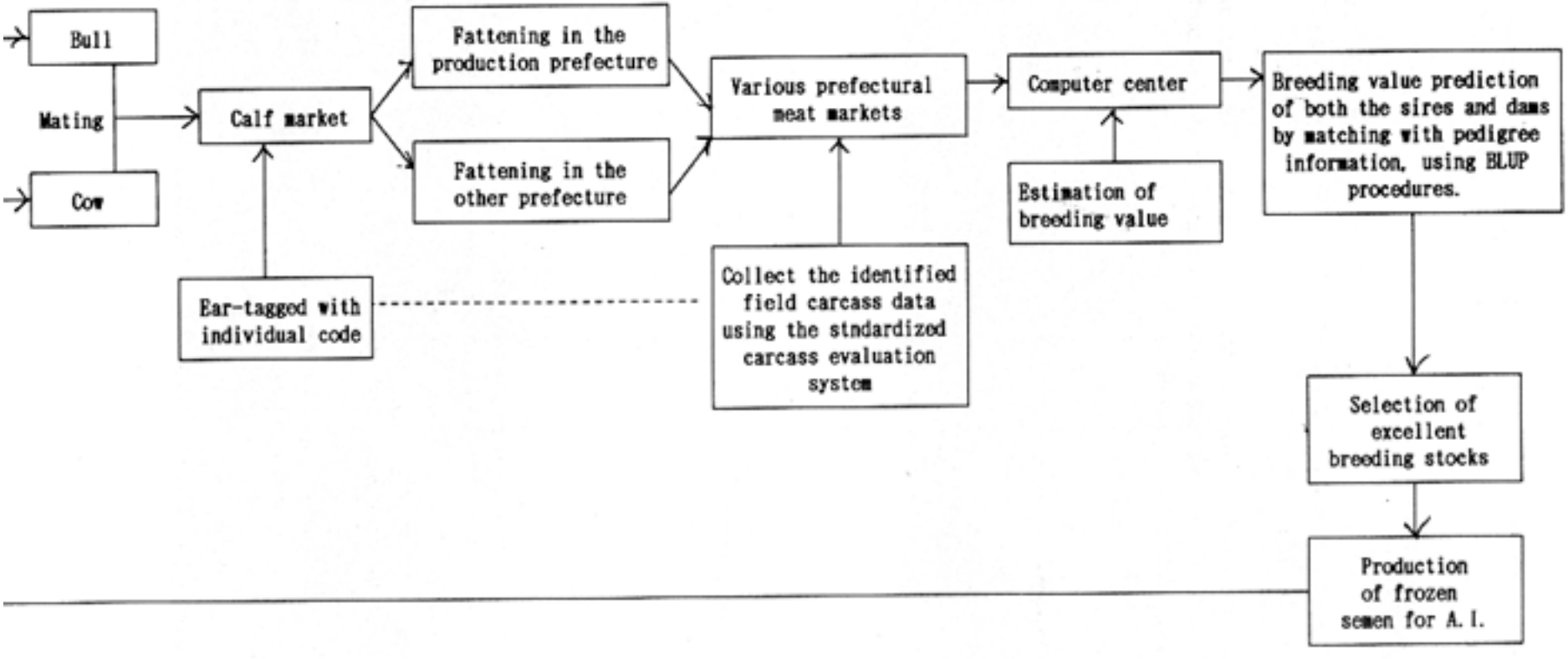
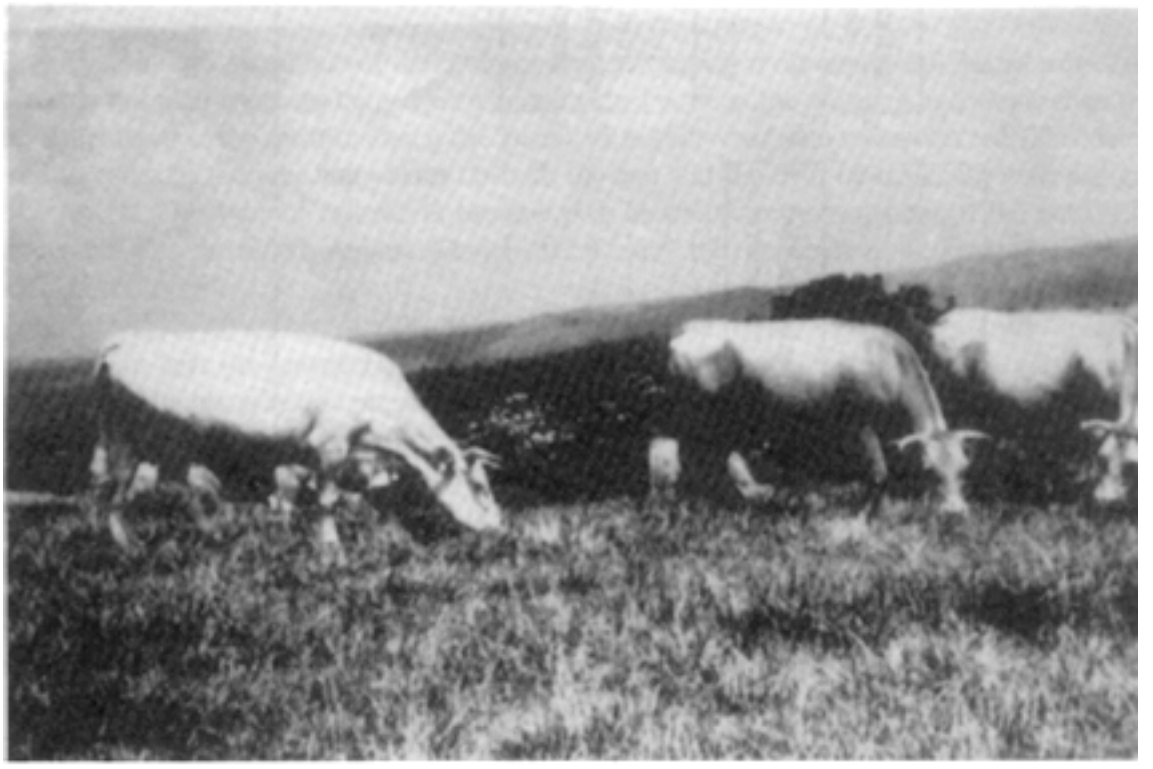


Figure 3: *Outline of the on-farm beef bull progeny testing programme*

Japanese shorthorn



Japanese Brown (Kumamoto strain)

5.0 REFERENCES

Livestock Industry Bureau. (1993). Livestock statistics, MAFF [in Japanese].

Mukai F. (1994). Genetic evaluation and selection methods for carcass traits in Japanese black cattle. Jpn. J. Zootech. Sci. (65):890-905 [in Japanese].

Namikawa K. (1979). Animnal genetic resources in Japan. Proceedings of a workshop of the SABRAO, 205-232.

Obata T. et al (l992). Preservation of animal genetic resources in Japan. Japan Agmculture Research Quarterly (26):1-6.

Obata T. (1993). Animal genetic resources in Japan. Proceedings of Japan-Russia workshop on genetic resources and biotechnology. NIAR, March.

Obata T. and Takeda H. (I 993). Germplasm conservation of Japanese native livestock bleeds (Horses, Cattle and Goats). Japan Agriculture Research Quarterly (27):8-12.

Obata T. et aL (1994). Japanese native livestock breeds. FAO Animal Genetic Resources Inforrmation,: I3, p.l3-24.

Obata T. and Satoh M. (1994). Beef cattle breeding through using biotechnology. Animal Husbandry, 48, p.l44-150 [in Japanese].