...IMAL GENETIC RESOURCES INFORMATION 4

BULLETIN D'INFORMATION SUR LES RESSOURCES GÉNÉTIQUES ANIMALES

BOLETIN DE INFORMACION SOBRE RECURSOS GENETICOS ANIMALES

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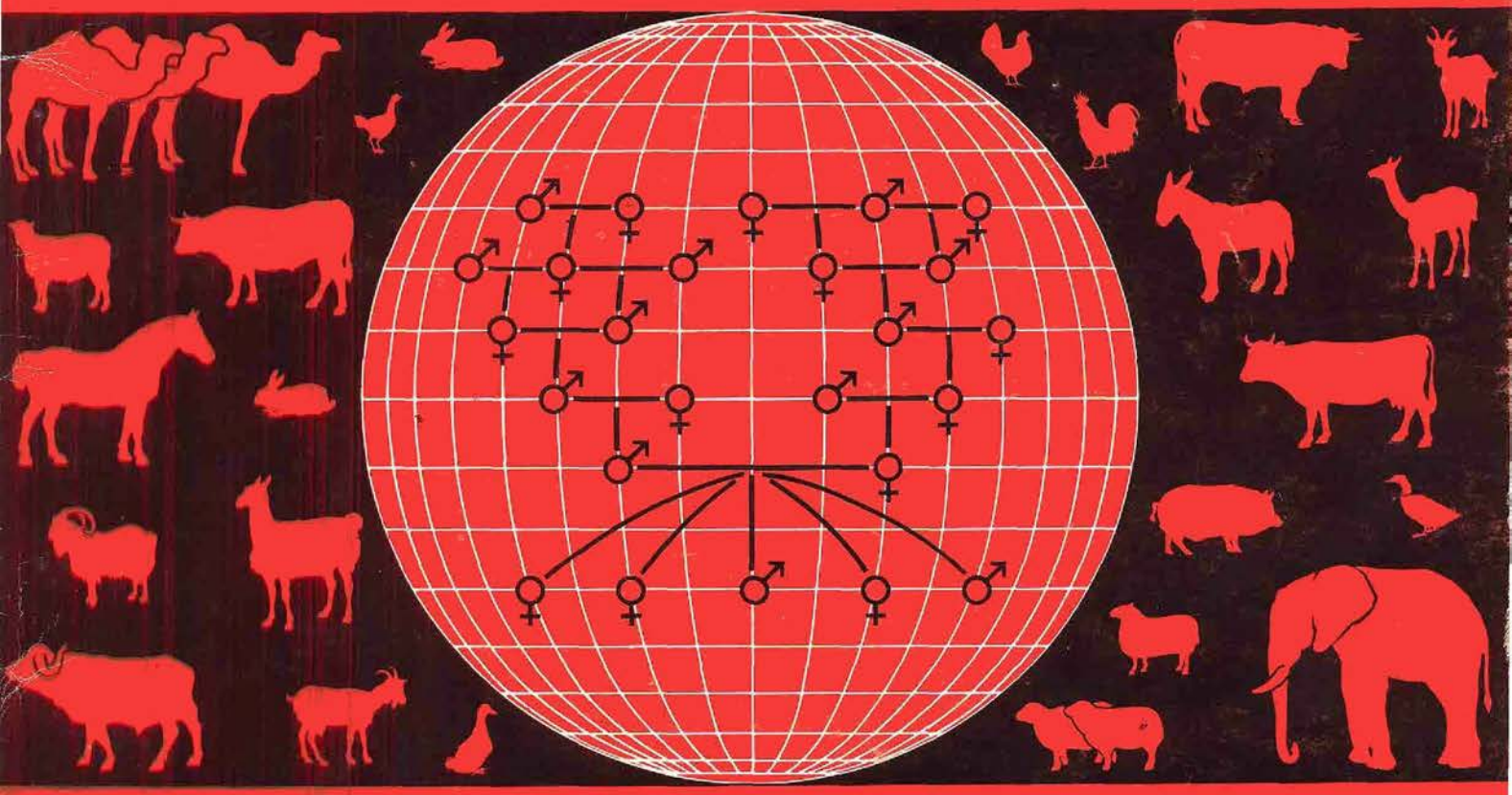

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UNITED NATIONS ENVIRONMENT PROGRAMME
PROGRAMME DES NATIONS UNIES POUR L'ENVIRONNEMENT
PROGRAMA DE LAS NACIONES UNIDAS PARA EL MEDIO AMBIENTE

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EDITORIAL

Mankind has been using animals to improve human standards of living from the early days of civilization. The original selection of certain species for domestication was only a start. Within most species there has always been large genetic variation, which man has used to develop different breeds for a variety of purposes and products. At a later stage in the history of animal improvement, man began to practise selection within breeds, where there is also extensive genetic variation. This within breed selection has become very intense in developed countries in the recent years of this century, aided by the new knowledge of quantitative genetics and by the techniques of artificial insemination and embryo transfer. The twentieth century has also produced an increase in the use of crossbreeding and of breed substitution to increase the production of food and fibre from animals. The process continues and there is already on the horizon, the prospect of molecular engineering by which individual segments of hereditary material will be transferred between animals and breeds and species. Today the prospects for even more rapid increases in animal production due to genetic selection have never been greater. Established techniques in the developed countries are being quickly adapted to the different conditions and environments of developing countries. At the same time, the prospects are increasing for a quantum leap in the application of genetics in high technology societies.

In this situation, what is the place of preservation? Few would disagree with the preservation of an endangered species of domestic livestock. In theory, few would protest the preservation of a breed in danger of extinction; however, when the cost of the preservation has to be found, it becomes more difficult to find supporters. There are those who, with the promise of molecular engineering, would argue that it is not breeds as such which need preserving, but simply the gene segments which code for the unique traits of the breed. Clearly we have not reached that stage yet, and if the method is to be successful when the technology is available, it will be essential that the breeds concerned are still around.

Meanwhile preservation has to be followed in the light of the uniqueness of the breeds at risk, and also within the bounds of economic reality. There is no value for example in preserving animals or semen from a breed with a unique name, which is in fact genetically the same as another breed in an adjoining country, with a different name. The aim of FAO and UNEP in the conservation and management of animal genetic resources is to ensure that present production and future prospects for production from animals for the benefit of mankind are maximized at minimum cost. Data banks for example are visualized as having immediate value for enhancing livestock improvement projects by making available essential information for breed substitution and crossbreeding programmes which are the centrepiece of much current livestock improvement work in developing countries. At the same time, data banks will identify truly unique breeds which are endangered, and which may therefore merit having semen or fertilized ova stored cryogenically and which is much cheaper usually than the management of live animals not contributing to economic production. The preservation of livestock should be secondary to, and the servant of production, rather than being an academic end in itself; and the process of identifying which breeds to preserve must be closely tied to the realities of food and fibre production for human benefit.

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ANIMAL GENETIC RESOURCES INFORMATION will be sent free of charge to those concerned with the conservation, management or utilization of domestic livestock. Anyone wishing to receive it regularly should send their name and address to The Editor, at the address on page vii.

BULLETIN D'INFORMATION SUR LES RESSOURCES GENETIQUES ANIMALES sera envoyé gratuitement aux personnes intéressées par la conservation, l'élevage ou l'exploitation du bétail domestique. Les personnes souhaitant recevoir cette publication régulièrement voudront bien faire parvenir leurs nom et adresse à l'éditeur, à l'adresse indiquée en page vii.

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RUMINANT LIVESTOCK GENETIC RESOURCES IN CYPRUS

A. Constantinou
Department of Agriculture
Nicosia, Cyprus

SUMMARY

Friesian cattle, Chios sheep and Damascus goats have become dominant livestock breeds in Cyprus. Chios sheep were found to be superior to the indigenous Cyprus Fat-Tailed and the imported Awassi with respect to precocity, fertility and prolificacy. Awassi performed very well with regard to milk yield and lamb viability. Crossbreds were more or less intermediate. Crosses of Chios with Cyprus Fat-Tailed have contributed substantially to the improvement of milk and meat production from sheep in the country.

Damascus goats are very good in litter size and milk yield; a specific strain of the indigenous goat also appears to be a valuable genotype.

RESUME

Les bovins Frisons, les ovins Chios et les caprins Damas sont devenus des races dominantes à Chypre. Les ovins Chios se sont révélés supérieurs à la rae indigène chypriote d'ovins à grosse queue et aux Awassi importés, en ce qui concerne la précocité, la fécondité et la prolificité. Les Awassi ont d'excéllentes performances du point de vue du rendement en lait et de la viabilité des agneaux. Les produits de croisement sont plus ou moins intermédiaires. Les croisements entre Chios et ovins chypriotes à grosse queue ont beaucoup contribué à améliorer la production de lait et de viande ovine dans le pays.

Les caprins Damas sont très intéressants pour la taille des portées et le rendement en lait; une souche spécifique de chèvre indigène semble aussi être un génotype intéressant.

RESUMEN

El vacuno frisón, las ovejas de Kios y las cabras de Damasco se han convertido en las razas de ganado que más abundan en Chipre. Se ha descubierto que las ovejas de Kios son superiores a las indígenas de rabo grueso y a las importadas de Awassi en cuanto a su precocidad, fertilidad y prolíficidad. Las ovejas Awassi habian dado muy buen resultado en cuanto a la producción de leche y a la viabilidad de las crías. Los cruces presentaban caracteristicas más o menos intermedia. El cruce de las ovejas de Kios con las de Chipre de rabo grueso, ha contribuido considerablemente a mejorar la producción de leche y cárne de las ovejas del país.

Aspectos muy positivos de las cabras de Damasco son el número de las crías y la producción de leche; existe una casta especial de la cabra indígena que parece ser también un genotipo valioso.

1. INTRODUCTION

Within the framework of its national Livestock Improvement Programmes, Cyprus has imported a number of prominent breeds which are utilized for grading-up or replacing the indigenous breeds and for crossbreeding. Most of these breeds have been kept as pure and/or crossbreds in government stations for a number of years and have been compared under the same conditions. The purpose of this article is to summarize some results from these comparisons and to present a comprehensive list of the ruminant livestock genetic resources available in Cyprus. Physical characteristics of the breeds are not described.

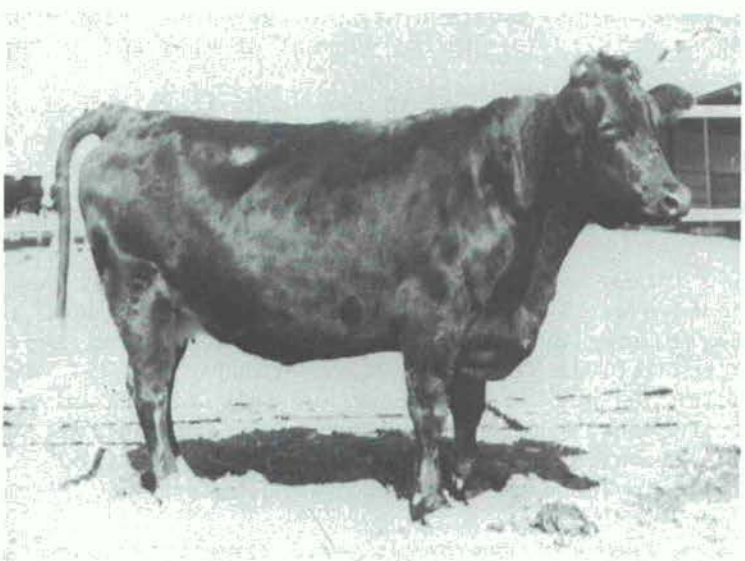
They have been documented elsewhere (e.g. Mason 1967; Constantinou 1981; Lysandrides 1981).

The main "exotic" breeds involved in the study are Friesian cattle, Chios sheep and Damascus goats. Following a long period of intensive exploitation, either pure or in crosses with indigenous animals, these breeds have now become dominant genotypes on the island (Department of Statistics and Research 1980).

2. MATERIALS AND METHODS

2.1 Cattle

The data on indigenous and Friesian cattle were collected over several years at the Athalassa Government Stock Farm in the vicinity of Nicosia. A small number of native cows have been kept there over the last 30 years for conservation purposes and for supplying villagers utilizing this breed for draught with bull calves for breeding purposes. Imported frozen semen from a number of countries (Greece, Israel, Canada, USA, Finland) has been used for inseminating the dairy herd. Animals were fed on concentrates, hay and straw. Roughage quality was poorer for indigenous than for dairy cattle. Due to shortage of roughages concentrate supplementation was rather heavy at times. Indigenous calves were suckled for about 5 months and then fattened on straw and barley, supplemented with soybean meal, vitamins and minerals according to National Research Council standards (NRC 1971). Friesian calves were weaned at 60-80 days and males were fattened on concentrates ad **libitum** with a limited amount of roughage.



Indigenous cow

2.2 Sheep and Goats

Sheep and goats were kept in a number of locations (Athalassa, Akhelia, Orites) and were managed semi-intensively. They were grazed on sown pastures from January to April and on cereal stubbles for 4-5 months thereafter. Hay was fed in late pregnancy and early lactation. During the period six weeks before lambing to 10 weeks after lambing concentrate supplementation was rather heavy. Free suckling was allowed to a maximum of two lambs per ewe for 4 weeks followed by 8 hours a day suckling for 14 days and complete weaning at 42 $\pm$ 3 days of age. Surplus lambs were reared artificially. Kids were weaned at 70 $\pm$ 3 days following two weeks of partial suckling. Lambs and kids had access to a creep feed during suckling and were fattened after weaning on concentrates and hay. Ewes and lambs were handled for recording purposes. Milk yield was recorded only after weaning and lactaction production was computed from monthly test-day records.

The data concerning the indigenous white goat originate from a preliminary field study carried out by the Agricultural Research Institute. Two private flocks were recorded in one year and basic information was collected individually.

3. RESULTS AND DISCUSSION

3.1 Cattle

Comparative data on the performance of indigenous and Friesian cattle are presented in Table 1. Cows of the local breed are smaller and mature later than Friesian cows. Calves are carried for an extra week and are smaller at birth. Commercial milk production is non-existent in native cattle whereas in Friesians production levels are fairly high. Growth rate of indigenous calves to one year of age was satisfactory and the difference compared with Friesian calves might have been smaller if native calves had also been fed **ad libitum**.

Table 1 COMPARATIVE DATA ON THE PERFORMANCE OF INDIGENOUS AND FRIESIAN CATTLE IN CYPRUS*

Trait		Indigenous cattle		Friesian cattle	
		No. of records	Mean	No. of records	Mean
Cows					
Age at 1st calving (months)		56	29	141	24
Weight at 1st calving (kg)		39	437	83	507
Adult cow weight (kg)		49	517	58	549
Calving interval (months)		193	13.2	161	12.2
Gestation length (days)		247	289	307	281
1st lactation 305-day yield (kg)			-	62	4833
305-day yield (later lact., kg)			-	118	6069
Fat (%)			-	112	3.8
Protein (%)			-	111	3.4
Calves					
Birth weight (kg)	male	161	31	162	41
	female	131	30	145	39
Six-months weight (kg)	male	84	162	131	210
	female	70	149	not available	
Twelve-months weight (kg)	male	84	342	131	423
	female	70	307	83	324
ADG of bull calves from 6-12 months of age (kg)		84	0.99	131	1.17

* Data on Friesian calves derive from fattening trials carried out at the Agricultural Research Institute, Nicosia.

3.1 Sheep

Data collected over five successive lambing seasons (1978/79 to 1982/83) on the performance of various sheep breeds and crosses are presented in Tables 2-5. A summary of performance characteristics of ewe lambs (yearlings) is given in Table 2 and performance of adult ewes in terms of fertility, prolificacy, milk yield and lamb growth is detailed in Tables 3-5.

Compared with the indigenous fat-tailed sheep and the imported Awassi, the Chios breed is much more early maturing and most of this precocity is transferred to its crosses with the other two breeds. The Chios is also superior in terms of fertility (percentage of ewes becoming pregnant) and prolificacy (litter size). Litter size and milk yield of various crosses with Cyprus Fat-Tailed and Awassi sheep were intermediate but somehow lower than expected. Crosses of Chios with East Friesian Milk Sheep

Table 2 PERFORMANCE OF EWE LAMBS (YEARLINGS) IN SHEEP BREEDS AND CROSSES

Breed/cross	No. of ewe lambs	% pregnant	Litter size at birth	Milk yield after weaning (kg)*	Days in milk
Cyprus Fat-Tailed (CFT)	131	28.2	1.15	41	68
Chios (C)	501	72.9	1.64	133	137
Awassi (A)	274	32.5	1.01	129	144
C X CFT (F_1)	49	59.2	1.21	68	80
¾ C ¼ CFT	69	55.1	1.44	67	83
C X A and A X C (F_1s)	177	65.5	1.26	109	116
¾ C ¼ A	98	63.2	1.39	112	102
East Friesian (EF) X C (F_1)	158	31.6	1.61	160	168
¾ C ¼ EF	106	75.5	1.42	119	114

* Weaning of lambs was at about 6 weeks of age; first milk recording occurred no sooner than seven days after weaning.

Table 3 FERTILITY AND PROLIFICACY OF SHEEP BREEDS AND CROSSES

Breed/cross	No. put to the ram	% barren	% aborting	% lambing	Litter size at birth	Litter size at weaning	Adult ewe weight (kg)
Cyprus Fat-Tailed	684	18.0	6.0	76.0	1.17	1.08	66
Chios	1371	6.4	2.5	91.1	1.69	1.44	62
Awassi	918	12.9	0.9	86.3	1.11	1.03	70
C X CFT (F_1)	131	13.7	4.6	81.7	1.36	1.20	n.a.
¾ C ¼ CFT	106	5.7	2.8	91.5	1.51	1.27	62
C X A and A X C (F_1s)	274	7.7	1.4	90.9	1.34	1.22	72
¾ C ¼ A	78	1.3	-	98.7	1.44	1.34	62
EF X C (F_1)	310	5.5	1.3	93.2	1.81	1.55	84
¾ C ¼ EF	87	3.4	4.6	92.0	1.76	1.55	69

n.a. not available

Table 4 MILK PRODUCTION AFTER WEANING OF SHEEP BREEDS AND CROSSES*

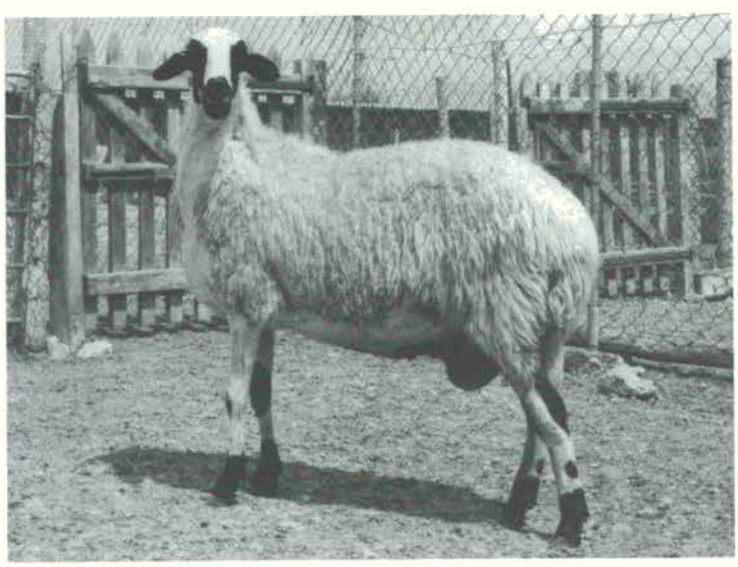
Breed/cross	No. of ewes	Milk yield (kg)**	Days in milk	Fat %	Protein %
Cyprus Fat-Tailed	453	63	98	7.1	6.5
Chios	1066	161	174	6.7	6.5
Awassi	750	179	185	7.7	6.6
C X CFT (F_1)	91	94	113	6.7	6.3
¾ C ¼ CFT	85	102	107	6.5	6.2
C X A and A X C (F_1s)	220	161	139	6.5	6.2
¾ C ¼ A	66	141	120	6.2	6.2
EF X C (F_1)	282	211	174	5.9	6.1
¾ C ¼ EF	80	177	144	6.2	6.2

* CFT and all crosses are kept at Athalassa; Awassi at Orites; Chios at both stations. Fat % of Chios at Orites was 7.0% and at Athalassa 6.2%.

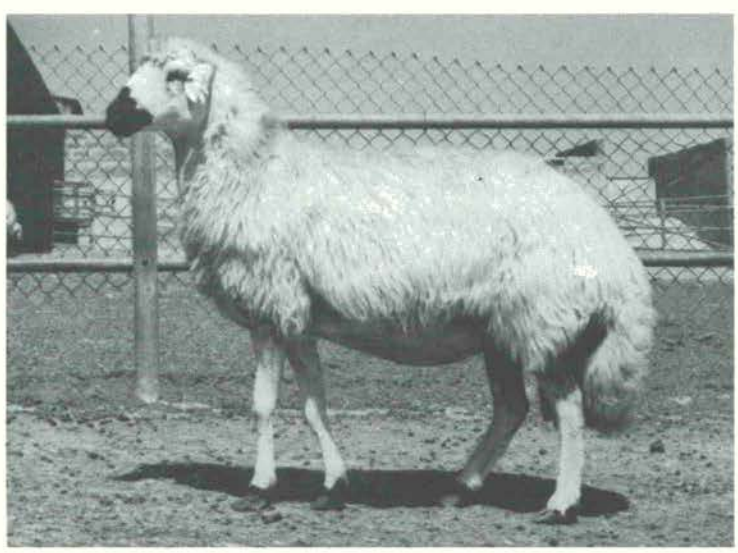
** Weaning of lambs was at about 6 weeks of age; first milk recording occurred no sooner than 7 days after weaning.

Table 5 LAMB WEIGHTS OF SHEEP BREEDS AND CROSSES

Breed/cross	No. of lambs	overall			lambs born as singles			
		birth kg	weaning kg	15 wks kg	birth kg	weaning kg	15 wks kg	post weaning ADG (g)
Cyprus Fat-Tailed	459	4.5	14.9	26.1	4.7	15.2	27.2	190
Chios	2048	3.8	14.4	27.4	4.7	15.3	29.8	230
Awassi	738	4.8	16.9	30.5	4.9	17.6	31.1	214
C X CFT (F_1)	162	4.7	15.2	28.3	4.9	16.0	28.9	205
¾ C ¼ CFT	152	4.4	14.8	28.4	4.9	15.9	30.2	227
C X A and A X C (F_1s)	530	4.5	17.1	33.0	5.2	19.4	34.7	243
¾ C ¼ A	209	4.7	15.3	29.4	5.2	16.2	30.3	224
EF X C (F_1)	45	4.6	15.6	33.2	5.3	17.9	39.3	340
¾ C ¼ EF	289	5.3	14.8	31.0	5.0	16.6	32.0	254



Chios ewe



Cyprus Fat-tailed ewe (local)

(imported from Germany) gave very good results in terms of fertility, litter size and lamb growth but they also increased body weight and consequently maintenance cost. The excellent performance of F_1 animals was not fully sustained in the backcrosses with Chios but a superiority over the Chios breed was still evident.

Awassi sheep performed very well with regard to milk yield, fat percent in milk, percentage of ewes aborting and lamb viability to weaning. Awassi sheep, however, together with Cyprus Fat-Tailed, were the poorest with respect to ewe fertility and prolificacy. Awassi sheep combine small litter size with high milk yield; hence maternal components contribute substantially to lamb growth and possibly to other characters which manifest themselves later in life (Mavrogenis 1983; Constantinou 1984).

The results presented in this study with respect to the performance of various sheep breeds and crosses underline the philosophy of sheep improvement policies in Cyprus, namely: to continue using the indigenous fat-tailed sheep where social, economic and physical conditions allow in order to utilize poor feed resources that would otherwise be wasted (15 percent of sheep still belong to this breed); to gradually improve local sheep by crossing them with the Chios, in line with intensive efforts to improve management and feeding practices; to keep Awassi as a stand-by sire breed for use whenever there is a discrepancy between level of managment and level of genetic improvement; to introduce pure Chios sheep to areas and to people that can provide good management and feeding (presently 20 percent of the national flock, i.e. about 40 000 head are pure Chios); to further improve the Chios by selection and crossbreeding (with the East Friesian Milk sheep) in order to produce a genotype that would respond to even better management (for example in irrigated areas with indoor feeding).

3.3 Goats

Only goats of the Damascus (Shami) breed are currently kept in government stations. A summary of performance characteristics of this breed is given in Table 6 along with some preliminary data concerning the indigenous white goat. The latter forms a distinct strain of the local breed and is mainly concentrated in a mountainous area where the Makhera monastery kept a large breeding flock over many years. The breed is considered endangered both in terms of population size (currently about 750 head) and purity.

Damascus is a relatively early maturing and prolific breed which was imported to Cyprus from Syria some 40 years ago (Constantinou 1981). Lactation performance of this goat is very good if one considers that an additional 250-280 kg of milk are produced during the suckling period (Constantinou 1980). Growth rate to weaning is satisfactory but after weaning it is variable and in this study it was poorer than typically found for the breed (Hadjipanayiotou and Louca 1976; Constantinou 1981). This inconsistency may be attributed to insufficient control of environmental factors affecting kid growth in large-scale operations. Indigenous kids on the other hand, which were managed extensively, grew at a satisfactory rate both before and after weaning. This breed, which is of moderate size (40-50 kg), also excelled itself in fertility, fat content in milk and lamb viability and may not be inferior to the Damascus in terms of live weight of kid sold per unit of metabolic body weight of the dam. These data are strictly preliminary and the results presented here require further verification but they do demonstrate the need for immediate action to conserve and futher evaluate this promising genotype.

ACKNOWLEDGEMENTS

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Table 6 PERFORMANCE CHARACTERISTICS OF GOAT BREEDS

	Damascus (Shami) goat	Indigenous white goat*
Yearlings		
No. of goats	499	n.a.
% pregnant	46	(>60)
Litter size at birth	1.41	n.a.
Milk yield after weaning** (kg)	171	n.a.
Days in milk	155	n.a.
Adult goats		
No. put to the male	1677	170
% barren	12.8	4.0
% aborted	2.3	3.0
% lambed	84.9	93.0
Weight at kidding (kg)	65	(40-50)
Litter size at birth	1.90	1.60
Litter size at weaning**	1.65	1.50
Milk yield after weaning (kg)	283	120
Days in milk	191	150
Fat %	3.7	6.0
Protein %	3.6	n.a.
Kid weight (kg)		
At birth	4.4	3.5
At weaning	17.5	(~18.0)
At 20 weeks	27.3	(~28.0)

* Data concerning this breed originate from a preliminary field study carried out by the Agricultural Research Institute, Nicosia, Cyprus.
** Damascus kids weaned at 10 weeks; indigenous kids at about 13 weeks.
n.a. = not available

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THE NATIVE PIG OF SRI LANKA

R. Rajamahendran, V. Ravindran, L.A. Goonewardene,
P. Sahaayaruban and A.S.B. Rajaguru
Department of Animal Science, University of Peradeniya,
Peradeniya, Sri Lanka

SUMMARY

The origin and breed characteristics of the native pig of Sri Lanka are reported. The breed suffers from many disadvantages including inter alia small litter size, heavy preweaning mortality and poor growth rate. Nevertheless, it will remain a valuable genetic resource and a source of meat, providing additional income to the household economies in the western coastal belt of Sri Lanka.

RESUME

L'origine et les caractéristiques de la race porcine autochtone de Sri Lanka sont décrites. Cette race présente de nombreux inconvénients parmi lesquels la petite taille des portées, la forte mortalité avant le sevrage et le rythme de croissance médiocre. Néanmoins, elle reste une ressource génétique intéressante et une source de viande fournissant un revenu supplémentaire aux familles paysannes de la côte ouest de Sri Lanka.

RESUMEN

Se describen el origen y las características raciales del cerdo indigena de Sri Lanka. La raza tiene muchas desventajas, entre otras, el miniero pequeño de la camada, el alto grado de mortalidad antes del destete y un escaso crecimiento. Sin embargo, seguirá representando un valioso recurso genético y una fuente de carne que representá un ingreso adicional para las economías domésticas de la faja costera occidental de Sri Lanka.

1. INTRODUCTION

Native pigs have long been reared as backyard scavengers in the western coastal belt of Sri Lanka. At present, native pigs constitute only 50 percent of the total pig population as against 80 percent in 1972. This decline is similar to that experienced elsewhere in the tropics (Eusebio 1980; Devendra 1980), where the need to maximize profits rather than to subsist has resulted in native types being replaced by exotic breeds. However, because of their large numbers, the native breed comprises a valuable component of local genetic resources and this report documents its productive traits under a restricted feeding system.

2. ORIGIN

The native pig closely resembles the Sri Lankan wild pig and must have evolved as a result of gradual domestication of wild pigs, although studies on its phylogeny have yet to be undertaken. Th Sri Lankan wild pig, which still abounds in the local jungles, resembles the Indian wild pig (**Sus scrofa cristatus**) in many physical aspects, but is smaller in size. The presence of horizontal stripes in newborn piglings, which gradually disappear with age, is further proof of the native pig's wild ancestry. The tendency to use all four toes while standing and walking also links the native type to wild pigs, as it is characteristic of wild pigs to use all four toes to get more footing in their natural habitat (Fisher and Devendra 1963). The exotic breeds, in contrast, use only the two front toes.

3. BREED DESCRIPTION

The native pig is small in size. The average height at shoulders of adult males and females is 60.2 and 49.3 cm respectively (Table 1). The striking features of the native breed are its tapering face, long snout and compact body. Length of head accounts for 25-30 percent of total body length, whereas the corresponding value for exotic pigs is only 10-12 percent (Sahaayaruban et al. 1983). The legs are short and this results in the abdomen and udder being dragged almost on the ground in pregnant animals. The ears are short, erect and pointed backwards. The predominant colour is black. Dark grey, tan and mixtures of tan with grey or black are also seen.

The native boar is characterized by its coarser hair with an almost mane-like crest along the back and a narrower body. The tusks are well developed and project from the mouth.

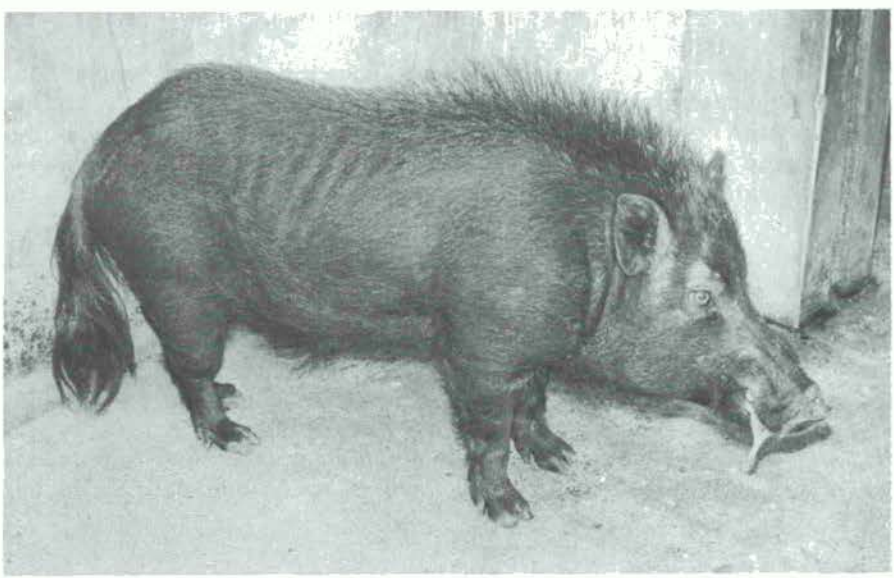

Fig. 1

The native boar. Note the characteristic long snout and the mane-like crest along the back.

Fig. 2

A group of native females. Predominant colour is black. The black-spotted female is a crossbred with Large White.

Table 1 BODY MEASUREMENTS OF ADULT INDIGENOUS PIGS (cm)

Parameter	Male	Female
Length of head	28.8	25.0
Width of head	10.9	9.6
Length of ear	13.2	9.2
Width of ear	8.3	7.7
Height at shoulders	60.2	49.3
Heart girth	89.0	73.2
Barrel girth	89.6	81.8
Length of tail	36.5	25.0
Total body length (tip of the snout to last sacral vertebra)	111.4	86.0

4. REPRODUCTIVE PERFORMANCE

The average age at first farrowing is 298 days (range 246-417 days). This would indicate that age at first mating is around 6 months. Native females are known to exhibit signs of oestrus as early as 3½ months, but breeding is usually delayed until after 6 months to ensure that conception occurs only after reasonable body size is achieved. The average interval between farrowings is about 216 days. Gestation length ranges from 108 to 118 days with a mean of 113. The average weaning to oestrus interval ranges from 21 to 45 days.

The native males show sexual activity from 3 months onwards, but they are not generally fit for service until 12 months. The boars perform satisfactorily until they are 3½-4 years of age.

The average litter size at birth is 6.0 (Table 2). Preweaning mortality is high, ranging from 26 to 40 percent, resulting in a litter size of only 4.2 at weaning. The high mortality rate among native pigs appears to be related to low birth weights and insufficient milk, both corollary to the low body weights and inherent limitations of the dam. Almost one third of deaths occurs during the first two weeks of life.

Table 2 LITTER CHARACTERISTICS OF INDIGENOUS PIGS

Litter size at birth	6.0
Litter size at weaning	4.2
Litter weight at birth, kg	3.4
Litter weight at weaning, kg	21.5
Preweaning mortality, %	30.3

5. GROWTH AND CARCASS TRAITS

The average birth and weaning weights are 0.56 and 5.12 kg respectively (Table 3). This corresponds to a preweaning average daily gain of 81 g. The animals are slow growing and maturity is reached only aroung 18-24 months. The mature weights of native males and females are 45-55 and 35-40 kg respectively.

Data from limited observations indicate that the dressing percentage of native animals is 50-55 percent. This is much lower than the value of 75 percent reported for improved pigs in Sri Lanka (Rajamahendran et al. 1978). The lower dressing percentage of native pigs is due to a relatively larger head and to a relatively larger proportion of

internal organs. Native pigs under backyard rearing produce excessively fatty carcasses, but this does not hold true under improved feeding conditions.

Table 3 GROWTH CHARACTERISTICS OF INDIGENOUS PIGS

Age	Weight (kg)		
	Male	Female	Mean
Birth	0.59	0.52	0.56
2 months (weaning)	5.92	4.16	5.12
4 months	7.27	6.41	6.88
6 months	13.24	13.08	13.18
18-24 months (maturity)	45-55	35-40	-

6. CONCLUSIONS

Though the native pigs are of little value for commercial pork production, it is concluded that they will remain valuable as sources of meat and secondary income to the household economies in the western coastal belt of Sri Lanka. Their hardiness and adaptability to existing conditions seem to compensate for their low productivity. Under the backyard pig production system, practically no expenses in housing, feeding or veterinary care are incurred. The income from these animals may be low, but it is all profit.

Since the component traits of sow productivity have low to medium heritabilities, attempts have been made to exploit heterosis by crossbreeding the native females with exotic boars (Goonewardene et al. 1983). The preliminary results from the upgrading programme do not look promising due to the inherent limitations of the native females. Litter sizes at birth and weaning were improved over the mean performance of parent breeds by 12 and 11 percent respectively. Crossbreeding, however, had little effect on the birth weight and preweaning daily gain of piglings.

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THE BARROSO CATTLE OF GUATEMALA

Raúl A. Melgar, Romeo Solano and Jorge De Alba
CATIE, Turrialba, Costa Rica

SUMMARY

The Barroso cattle of Guatemala was developed on the Pacific coast of Guatemala as a dual-purpose breed suited to a tropical environment. Numbers are fast diminishing but one large herd remains where certain measurements were made to describe the breed.

RESUME

Les bovins Barroso de la côte pacifique du Guatemala sont une race à deux fins adaptée au milieu tropical. Leur nombre diminue rapidement, mais il subsiste un grand troupeau dans lequel ont été faites certaines mensurations pour décrire la race.

RESUMEN

El vacuno Barroso de Guatemala se desarrollo en la costa pacífica de país, como raza de doble finalidad, adaptable al medio tropical. El número de cabezas está disminuyendo rápidamente pero existe todavía un nato grande donde se efectuaron algunas mediciones para describir la raza.

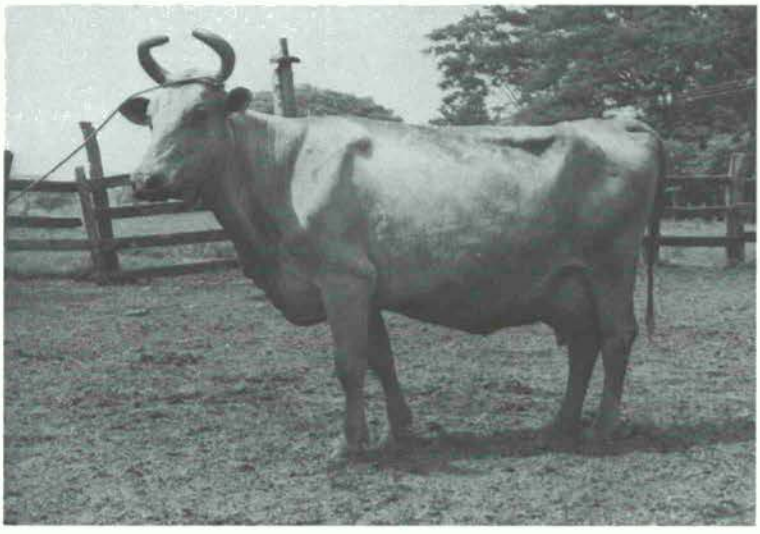
Central America has had several nuclei of improved tropically adapted dairy cattle. They share the characteristics of thick, deeply pigmented skin and short sparse hair. Areas that have animals selected for dairy characteristics were found in Choluteca, Honduras and Rivas, Nicaragua, with a predominance of yellow and red cattle. CATIE at Turrialba selected a herd with animals from Honduras and Nicaragua in 1955 (De Alba and Carrera 1958). Samples of the Barroso were not included largely due to distance but also poor knowledge of where to find superior animals. Since then a relic herd, privately owned, has been making progress in building up numbers. This herd was started by Salvador Malgar about 216 years ago; he gathered representative animals from the west coast of Guatemala. The present herd numbers about 800 animals of all ages. Observations on this herd form the basis for this note. A thesis was presented by the senior author at the University of Guatemala with some of these observations included (Melgar 1984).

The name "Barroso" means dun. It resembles the coat colour that comes from crossing a Charolais with Aberdeen Angus; it is similar also to the colour of the new beef breed from Australia, the Murray Grey. It is assumed that the same "dilution" genes are involved. A quick survey of the herd revealed the presence of about 1 percent white cows and 0.5 percent black. It is assumed that a homozygous state can be attained for the pure barroso colour in the whole herd.

The main herd is located in the municipality of Chuiquimulilla, about 20 km from the sea and at an altitude of 60 metres above sea level. Mean maximum temperatures per month give a yearly average of 34.7°C. Rainfall is decidedly seasonal with less than 20 mm from December to March, and highest monthly average in September, with 207 mm.

Some of the more distinguishing characteristics are a very short sparse hair, pigmented skin, a scanty tail switch, very small ears, incurving horns, wrinkles around the eyes and neck, pronounced angular lines in the cows but a decided sexual dimorphism in bulls which are very muscular and much taller than cows. The nostrils are black. The udder is always well placed and attached and of the same colour as the rest of the coat, but white spotting in the udder was found in 10 percent of the cows. Males are always darker in colour than cows.

Fifty adult cows were measured and the average height at withers was found to be



Representative Barroso cow at the Herd of Dn. Salvador Melgar. Note short hair and scanty tail switch

131 ± 4.8 cm, heart girth 180 ± 9.24 cm and barrel circumference 218 ± 11.3 cm. Adult weight of 50 cows in lactation was 460 ± 41 kg and 10 bulls running with the herd averaged 788 ± 59 kg.

The herd is milked once a day with a calf used to aid milk let-down and tied to one front leg of the cow while milking proceeds. Milking is done between 05.00 and 07.00 hours. Then the calves run with their dams on pasture until noon and are separated in pens for the rest of the day and night. Milking is suspended at about 225 days and the calves turned to pasture with their dams for about 30 more days before weaning. Bulls are run with cows at all times. The short term nature of these observations does not permit measurements of herd fertility to be made. Pasture feeding is used exclusively with no additional supplement except salt and minerals once a month. Pastures are irrigated in the months of near zero rainfall and are not fertilized. Species on pastures are mainly African Star (**Cynodon nlemfuensis** and **Echinocloa polystachia**).

Milk from 50 cows was weighed fortnightly and up to 225 days of lactation. The maximum individual production for that period was 1380 kg. Twenty of the 50 cows surpassed 1000 kg. Mean for 225 days was 976.6 ± 359 kg. Lowest yield was 650 kg. Birth weight of the calves of these 50 cows was 30 kg and weight at end of milking period 139 kg.

No age or month of calving effect could be proved by least squares analysis, due mainly to small numbers. Milk samples taken at various periods on these 50 cows showed an average butterfat content of 4.6 percent and total solids of 12.69 percent. Monthly observations showed respiratory frequency average for morning of 44 ± 9 and afternoon of 59 ± 8, highest value was observed in the afternoon of June with 71 ± 18, lowest value for morning of January with 32 ± 6. Highest rectal temperature was recorded in May with 38.8 °C and lowest in the morning of January with 37.9°C. None of the animals observed showed evidence of heat stress on the hottest days.

The studied herd of Barroso cattle constitutes a very valuable source of germ plasm for genetic studies of tropically adapted dairy cattle. It would make an excellent base to make progress on selection for milk production under tropical conditions and or crossbreeding studies. It has greater size and more uniformly short hair than the milking criollos of Nicaragua selected at Turrialba. The best herd of these (red criollos) is still to be found in Rivas, Nicaragua. Should these herds be mixed and coat colour differences disregarded? The herd at Turrialba was strongly selected for ability to milk without the calf so it could be incorporated into more intensive dairy systems. The herd of Barroso has had no such selection, but is much larger. Should similar methods be recommended for it?

FAO made a small grant to CATIE in Turrialba to purchase three selected bulls from this herd. It was found too difficult to bring them overland to Turrialba. They have remained in the care of the second author of this note and placed in small herds of cattle, with mixed breeding with Zebu and Brown Swiss evident. Recorded milk yields from these crossbreds is lower than the present average of the Barroso. Observations will be made on these offspring of the Barroso bulls.

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HUNGARIAN ACTIVITIES ON THE CONSERVATION OF DOMESTIC ANIMAL GENETIC RESOURCES

Imre Bodó
University of Veterinary Science
Department of Animal Husbandry
Budapest, Hungary

SUMMARY

In Hungary there is an official programme for maintaining domestic animal genetic resources which is supported financially by the government. The following breeds are involved: Hungarian Grey cattle; Water buffalo; Racka, Cigája and Cikta sheep; Mangalica pig; Nonius, Mezöhegyes Halfbred, Gidran, Kisbér Halfbred, Shagya Arab and Lipizza horses and some poultry and dog breeds.

RESUME

Le gouvernement hongrois finance un programme officiel de conservation des ressources génétiques des animaux domestiques. Ce programme porte sur les races suivantes: bovins hongrois gris; buffles; ovins Racka, Cigája et Cikta; porcins Mangalica; chevaux Nonius, demi-sangs Mezöhegyes, Gidran, demi-sangs Kisber, arabes Shagya et Lipizza, ainsi que quelques races de volaille et de chiens.

RESUMEN

En Hungría existe un programa oficial para mantener los recursos genéticos animales del país, con apoyo económico del Gobierno. Las razas incluidas en el programa son las siguientes: vacuno Gris Húngaro, Búfalo Aenático; ovinos Racka, Cigája y Cikta; porcino Mangalica; caballos Nonius, mestizos de Mezöhegyes, Gidran, mestizo de Kisber, arabe Shagya y Lipizza, y algunas razas de ave de corral y perros.

1. INTRODUCTION

Although in recent decades manufacturing industry has developed, agriculture remains of vital importance in Hungary. The task of agriculture is not only to supply the population with food, but it also produces a large proportion of exports. Animal husbandry plays a significant role in agricultural production; therefore the old non-commercial breeds have been more or less replaced by more productive modern ones. This process has caused a rapid decrease in the traditional breeds and populations.

For the maintenance of these breeds conservation work became essential. The conservation of the old breeds of domestic animals was started at the end of the 1950s by some individuals employed by state farms, who did not allow the slaughter of the last herds of some old breeds threatened by extinction.

Recognizing the importance of preservation of genetic resources both at national and international level, the Hungarian Ministry of Agriculture and Food in 1973 charged the Institute for Animal Breeding and Feed Control with the conservation of declining breeds. The official preservation programme involves the maintenance of cryogenic gene banks and the direction of breeding work in the old non-commercial herds in the state farms and cooperative farms. This institution (ATMI) distributes also the financial support of the government among the farms participating in the programme.

The amount of financial support depends on the performance of the herds (e.g. the number of weaned calves in the case of the Hungarian Grey cattle).

The indigenous pig and horse breeds of Hungary have already disappeared, but there are some very old cattle, buffalo, sheep, goose and dog breeds as well as some strains of horses, sheep, pigs, dogs and poultry developed one or two centuries ago which are now involved in the official preservation programme. The Hungarian Spotted (Simmental) cattle breed is also included.

In the framework of the programme the task is to purify (if necessary), propagate (if possible) and preserve these rare domestic animal breeds. These relic herds of living animals are in the possession of state farms and cooperative farms as they are relatively large. Thus the herds and flocks are also large; the number of hobby breeders is relatively small but it is increasing.

Some words about the scientific work in connection with the maintenance of indigenous breeds. The Institute for Animal Breeding and Feed Control coordinates a research programme which is financially supported by the Ministry of Agriculture. The most important topics of research are the following: evolution and history of the breeds in question, their genetic structure (including blood groups and other biochemical polymorphisms), the specification of the necessary environmental and veterinary conditions, study of the best breeding and mating methods, estimation of the possible usefulness of the indigenous breeds in modern breeding programmes.

The indigenous breeds involved in the official preservation programme are described below.

2. HUNGARIAN GREY CATTLE

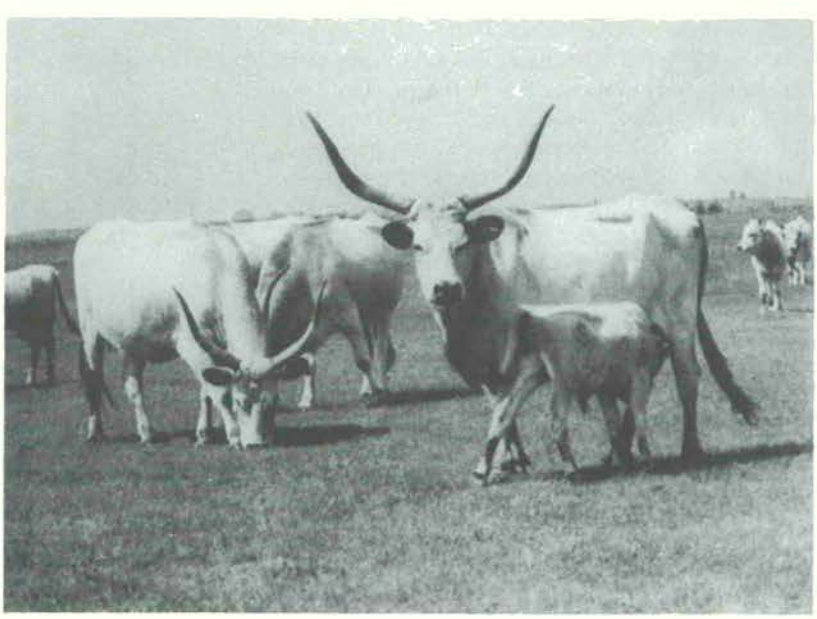
There are three theories about the origin of Hungarian Grey cattle; none is proved by archaeology or history:

- According to general opinion in the last century this breed arrived here with the Hungarian conquerors in the 9th century.
- The most ancient bone relics of Hungarian Grey cattle were found from the 13th to 14th centuries onward. Therefore, the second theory suggests a later importation. This may have been from the east (by the Cumanen or by the Besenyö people) or from the south (from Italy or from the Balkan peninsula).
- The third theory suggests a relatively recent domestication (Middle Ages) in the Hungarian forests.

It is very difficult to settle this dispute, but it is obvious that there may be some truth in more than one of these theories.

During the 14th-18th centuries, Hungarian Grey cattle were a very successful beef breed, not only in Hungary but also abroad. Large herds were driven on foot to Germany and Italy and arrived in relatively good condition. They were well known and appreciated on the markets of Venice, Nuremburg, Augsburg and Vienna.

In the 19th century agriculture became very intensive in Hungary and the role



Hungarian Grey cattle on native pasture at Hortobágy (Photo: Hudetz)

of the Grey cattle changed; it became a producer of excellent draught oxen.

At the end of the last century the number of Hungarian Grey cattle started to decrease. The lowest figures recorded were 187 females and 6 males. At present the stock of cows amounts to 1000 individuals in 6 herds.

Milk production is relatively poor (about 2000 kg milk per lactation). The calf crop is good but fattening performance for beef production is poor. It is an excellent draught animal. Other valuable traits are: easy calving (100 percent without any assistance); resistance against diseases; endurance of unfavourable conditions; very hard hooves; capacity for compensatory growth after a setback; the beauty and nobleness of the long horns.

Selection is based on breed type, reproductive ability, health and longevity. Inbreeding is avoided by a rotational mating system and by crossing of inbred lines.

Recently some successful experiments were executed using Hungarian Grey cattle as a component of maternal lines in beef cattle breeding. Nowadays Hungarian Grey cattle may be considered as a non-commercial breed which has been rescued from extinction. In the future it may once again be a commercial breed, but this depends on several factors.

3. SHEEP

Three sheep breeds are involved in the programme; the most interesting is the Racka.

3.1 Racka

The Racka is one of a group of breeds living in the neighbouring countries called Zackel. The screw-horned Hortobágy Racka is a unique and very interesting breed.

Formerly the general scientific opinion was that this breed arrived here with the Hungarian conquerors in the 9th century. Now the results of excavations suggest that the breed was established in Hungary only in the 13th-15th centuries.

The Hungarian Racka sheep was already decreasing in number in the 18th and 19th centuries, because of competition by Merinos. The present stock of Hortobágy Rackas has been kept since the 1950s in state or cooperative farms, and the number of ewes is about 1500. Recently more and more hobby breeders are keeping Racka sheep.

Two colour types can be distinguished within the breed, white (with light brown or rarely with grey face and legs) and black (greying with age). The mating system consists of rotating ram lines to avoid the disadvantages of inbreeding (which have not yet been observed). The main objectives of selection are: breed type, reproductive ability and vitality.

Racka ram
(Photo: Hudetz)

Liveweight of ewes is 35-45 kg. Staple length is 25-30 cm and fibre diameter is 30-60 μ. Annual fleece weight in ewes is 1.5-2.0 kg with a yield of 60-70 percent clean wool. The wool is used for handwoven carpets and from the fur of Racka, shepherds' traditional furcoats are manufactured. Very promising crossbreeding experiments were made in the early 1960s with Karakul rams for improving the fur quality of lambs.

3.2 Cigája (Tsigai)

This breed has a relatively large population in neighbouring countries; therefore Hungary is planning to preserve only a small stock. At present there is only one herd in Hungary with 240 ewes.

The liveweight of ewes is about 45-60 kg and that of rams is 65-100 kg. The staple length is 25-30 cm and the fibre diameter is 26-40 μ. The annual fleece weight of ewes reaches 2.5-3.0 kg with a yield of 40-65 percent. The milk production of Cigája ewes is considerable: it is 60-70 percent more than that of Merinos. The wool is yellowish-white; the face and legs are black.

3.3 Cikta

This is a unique breed; it originates from the Zaupel sheep of Bavaria which is now extinct. It was brought to Hungary by German settlers in the 18th century.

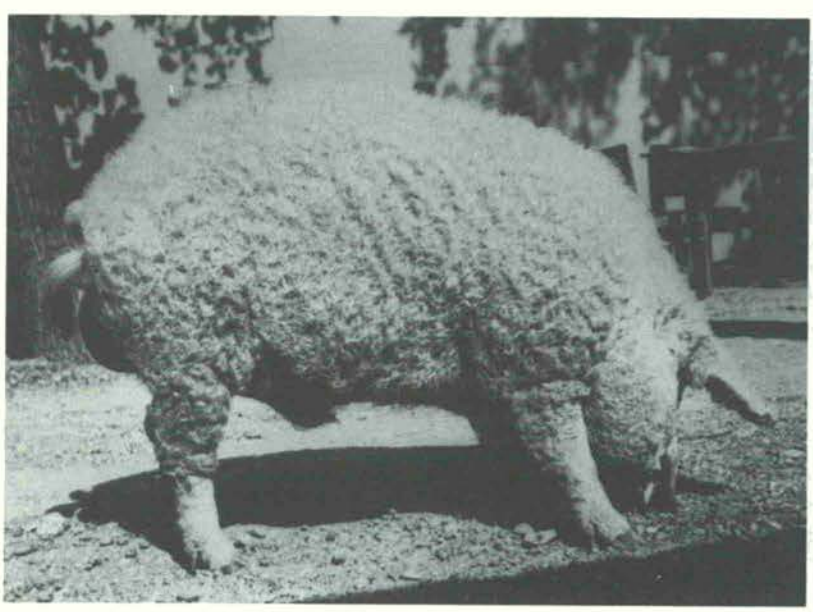
It is a white, coarse-wooled sheep with bare white face and legs. The liveweight of ewes is 25-45 kg. The staple length is 20-40 cm and the usual fibre diameter 30-40 μ, but with extremes of 16-70 μ. Annual fleece weight of ewes is 1.5-2.0 kg with a yield of 65-70 percent. The wool was formerly used for making hand-woven materials. There is only one flock in Hungary (270 ewes) kept by ATMI at a testing centre. After a period of crossbreeding with Merino, Berrichon and East Friesian sheep, sufficient purebred ewes and rams survived and formed the present flock. The main point of selection is breed type.

4. PIGS

Mangalica (Mangalitsa)

This breed originates from the Serbian Sumadija breed, and has been kept in Hungary since the beginning of the 19th century. A hundred years ago it was a famous commercial breed with a very high level of fat production; at that time it was the main pig breed of Hungary. Times have changed and because of the demand for lean pork this breed is already completely replaced by other breeds and hybrid strains.

Within the Mangalica breed three colour varieties survive: the common blonde or yellowish-white, the "swallow-bellied" (black with pale belly), and the light red (rose) variety.



Mangalica boar (Photo: Eszes)

About 200 sows and 30 boars are kept at 8 locations. In order to avoid inbreeding, in the last five years some imports have taken place from Transylvania (Romania) and Vojvodina (Yugoslavia).

5. WATER BUFFALO

Transylvanian buffaloes are kept on two farms and in zoological gardens. The stock numbers 70 females and 7 males. This stock was collected in the 1970s. This water buffalo is not a special strain and it serves primarily for demonstration. The genetic material can be refreshed from neighbouring countries where a relatively large stock is still living.

6. HORSES

There are also some famous horse breeds (or strains) in Hungary which are worthy of being preserved. The original Hungarian horse breed was transformed in the past. It seems that the horse was so important in the life of our forefathers, that they have always transformed the whole stock of the country according to the demand of their age.

6.1 Nonius

This breed was founded in 1816 by an Anglo-Norman stallion named Nonius at the military stud of Mezöhegyes. The founder stallion gave very good foals out of Spanish mares, the advantageous traits of which could be fixed by inbreeding. Later some Thoroughbred stallions were also used. The Nonius was suitable for the artillery and for hard agricultural work. There are still some thousands of mares of the breed, but the number is declining rapidly.

6.2 Mezöhegyes Halfbred

Also in the last century the Mezöhegyes Halfbred was founded on the basis of two English Thoroughbred stallions; it was excellent for both riding and light draught work. The strain (called also Furioso-North Star according to the names of the founder stallions) is noble and elegant and owing to its large size and working ability it is also suitable for agriculture. The whole breed numbers 120 mares on 6 farms.

6.3 Gidran

The Gidran strain was also bred at Mezöhegyes, since the 1810s. The founder was a chestnut Arab stallion named Siglavy Gidran the colour of which has been preserved up to the present time. The breed can be considered an Anglo-Arab strain because Arab stallions and English Thoroughbreds played the main role in its development.

This breed is very suitable for modern sports owing to its relatively large size. The whole stock of the breed is very small (numbering about 30-40 mares); therefore it really is threatened with extinction.

6.4 Kisbér Halfbred

This is a breed of much finer constitution heavily permeated by Thoroughbred blood. Several Thoroughbred stallions were used to establish and to improve the breed. It has been used as an ideal hussar (light cavalry) horse. The purpose of establishing the Kisbér Halfbred was to breed stallions which could transmit the advantages of the English Thoroughbred without the disadvantages of the direct input of Thoroughbreds. The Kisbér Halfbred has provided a lot of excellent sport horses. The number of the ancient strain has declined (about 70 mares) and there is a discussion whether the Kisbér Halfbred is a breed or a breeding method.

6.5 Bábolna or Shagya Arab

Shagya, an Arab stallion, was imported from Arabia to the military stud of Bábolna in 1836. Using other Arabians (O-Bajan, Siglavy, Mersuch, Gazal, etc.) and some Hungarian mares a noble but large size Arab strain was established with good riding characteristics, better than that of the purebred Arabians. This Bábolna strain was accepted by the World Arabian Horse Organization only recently as Shagya Arab in spite of the fact that the Bábolna Arab would be the more logical name. The number of Shagya Arab mares is declining very rapidly and now it is in real danger of extinction.

6.6 Lipizza Breed

The breed was developed since 1580 at the Lipizza (Lipitsa) stud (Yugoslavia). It is now bred in the neighbouring Danube countries: Austria, Czechoslovakia, Romania, Yugoslavia and Hungary. Each of the studs has 40-80 brood mares. Breeding is based upon the same 7-8 male lines in all countries. Exchange of stallions between countries occurs after some generations of inbreeding (Yamada 1980). Therefore I think the maintenance and preservation of the Lipizza breed can be considered a very appropriate exercise in international cooperation.

7. POULTRY

The preservation of poultry breeds is not so difficult as that of domestic mammals because it is not so expensive and one can use more efficient methods. This paper only lists the old breeds and varieties threatened by extinction and which deserve consideration as genetic resources.

Hen: Speckled Hungarian, Yellow (Gold) Hungarian, White Hungarian, Naked-Neck Black and Speckled.

Goose: Frizzled Feather.

Although the preservation of the genes of poultry breeds is possible by scientific mating systems in batteries, it is very important also to keep old breeds under their original environmental conditions in small farms.

8. DOGS

Some native dog breeds are registered in Hungary as listed below: Herder's dogs: Komondor, Kuvasz, Mudi, Puli, Pumi. Magyar agár (Hungarian Greyhound). Erdélyi kopó (Chien courant of Transylvania). Magyar vizsla (Hungarian Pointer).

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PRESERVATION AND IMPROVEMENT OF ONGOLE CATTLE

Mullapudi Narendra Nath*
Tanuku - 534 211 (AP), India

SUMMARY

The characteristics of the Ongole cattle of India are described, their distribution and numbers in India and other countries is given, and plans are outlined of the need to conserve and to improve the breed.

RESUME

Cette note décrit les caractéristiques des bovins de la race Ongole et donne des indications sur leur répartition et leur nombre en Inde et dans d'autres pays ainsi que sur les programmes de conservation et d'amélioration de la race.

RESUMEN

Se describen las características del vacuno Ongole de la India, se dan datos sobre su distribución y número en la India y otros países, y se sugieren planes para conservar y mejorar la raza.

The cattle of India (**Bos indicus**) have been in the service of mankind for many thousands of years. They have endured famine, insect pests, diseases and the hot and cold climates of India. They have been fortified by nature with an ability to preserve and perpetuate their life where other breeds have failed. The adaptation qualities of a few Indian cattle breeds have kept them in wide demand since the early days of history. In their expansion abroad, these cattle have helped improve cattle in their adopted countries.

Some thirty well defined breeds of cattle exist in India. They vary in type and characteristics according to the need of the regions where they originated. Only a few Indian cattle breeds have spread outside India. One is the Ongole which has spread to many other countries. The Ongole is one of the ancient breeds of Indian cattle originating from the coastal belt of Andhra Pradesh State, on the east coast of peninsular India. The best work type specimens of this breed were developed south of the river Krishna and north of the river Penna, covering the districts of Guntur, Prakasam and Nellore; the best dairy type specimens, capable of producing eight to ten litres per day peak yield, were developed in the delta of the river Godavari, covering the districts of East and West Godavari.

Ongoles are well adapted to warm climates. They are extremely heat tolerant. They do well in areas of high temperature and humidity, requiring little shade and will graze or rest in the hottest weather without any apparent discomfort. Ongoles are little affected by insect pests, and are strongly resistant to diseases spread by blood-sucking insects and external parasites.

Ongoles do well on the range because of their hardiness, thriftiness and rustling ability, being able to respond to good pasture, and also thrive under conditions of poor range and drought. They can range to greater distances than some breeds. Ongole cows make excellent mothers, giving milk with a butterfat content of over five percent,

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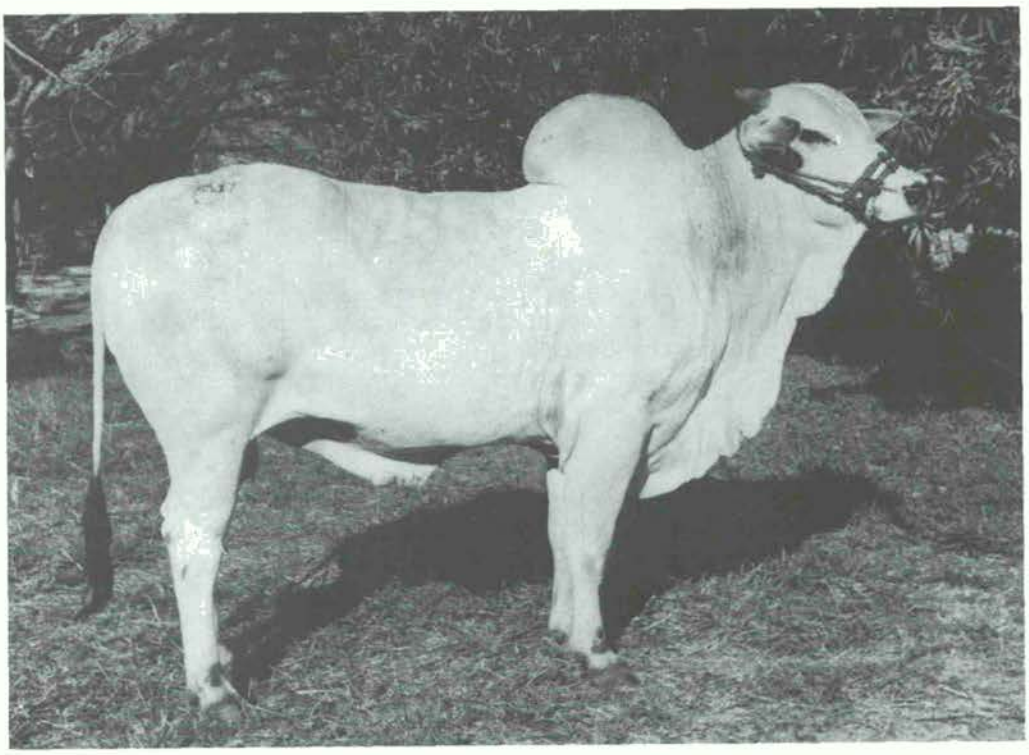
* The author is Secretary of the Ongole Cattle Improvement Society, described in this paper.



resulting in big, thrifty calves with considerable bloom at weaning. One very important characteristic of Ongole cows is their mothering instinct. They stay with their calves and protect them from predatory animals and other dangers.

As feeders, Ongoles compare favourably with European breeds, are efficient users of roughage, and in the warm tropics, have attractions because of their heat tolerance.

Ongole cows can remain active producers until 15 years of age, which is often longer than the European cows. Occasionally one can find Ongole cows in regular production up to 20 years of age.

Ongole cattle were exported to many tropical regions of the Americas, West Indies, Southeast Asia and Australia up to the early 1900s and earned international recognition for their capacity to survive and perform well on tropical pastures, their hardiness, efficiency and resistance to various insect transmitted diseases of the tropics.

With improved irrigation facilities came commercial crops and mechanization of agriculture, in the homeland of the Ongole, where their numbers have dwindled and continue to drop further. With an increased demand for milk and introduction of crossbreeding with Jersey and Holstein breeds, to boost milk production, this drop in the numbers of Ongole cattle has been accelerated. Unless this trend is arrested, the world may lose an excellent breed of cattle that could contribute a lot to livestock production in the tropics. Ongole has some traits needed in the tropical cattle industry. Hence, it has become necessary in the interest of livestock production in the tropics to preserve and improve the Ongole in its homeland.

The well established Ongole herds at state and university farms that had five to ten generations' breeding were lost due to policy changes of the government in favour of crossbreeding with European exotics. Therefore, a farmers' organization has stepped in to avoid liquidation of a useful breed of cattle whose potential, they believe, has not been fully exploited.

The objectives of this project are:

- to maintain a good germplasm centre of Ongole cattle and to improve further the genetic potential of the herd;

- to conduct genetic analysis of the herd for growth, milk yield, reproductive efficiency and draught capacity;

- to establish a frozen semen and embryo bank to help in the spread of the breed;

- to help in the international spread of Ongole cattle.

This project will consist of Preservation (Phase I) and Improvement (Phase II).

Phase II will be taken up only after Phase I is in an advanced stage of execution.

Phase I

Purebred Ongole cattle available at different livestock farms in the home breeding territory will be pooled and an initial herd of 100 breedable females will be established. This herd will be maintained under an extensive management system and the performance of the base population and progeny generations will be recorded on the following traits: growth, production, reproduction, and fitness.

Phase II

A herd of 100 purebred Ongole cows will be bred using frozen semen from selected Italian Chianina/Piedmontese bulls to produce half bloods. The resulting female progeny will be bred back to 7/8 Ongole blood level, using frozen semen from Ongole bulls, selecting for better conformation and muscling, while retaining the other traits of the Ongole cattle. The selected 7/8 Ongole progeny will be mated **inter se** and stabilized to produce an improved version of the original Ongole.

Ultimately, the project will have a herd of about 200 purebred Ongole cattle under Phase I and a herd of about 200 improved Ongole cattle under Phase II. Phase I of the project will be self-supporting from the 8th year onwards. The project will, by this stage, be in a position to meet the semen requirements of the Indian Ongole cattle breeders and other international requirements.

THE CONSERVATION OF ANIMAL GENETIC RESOURCES IN GREAT BRITAIN

Lawrence Alderson
Rare Breeds Survival Trust
Droitwich, UK

SUMMARY

Resources available for animal genetic conservation should be used judiciously. Thus breeds qualifying for conservation should not only be numerically endangered but also possess genetic merit. In determining genetic merit, future changes in market requirements or production systems should be considered. There is an urgent need for an evaluation of the present commercial value of rare breeds in breeding programmes. Support for rare breed preservation in Great Britain is implemented through conservation programmes, evaluation studies and education at different levels.

RESUME

Les ressources disponibles pour la conservation du patrimoine zoogénétiques doivent être utilisées judicieusement. C'est ainsi que les races à conserver ne doivent pas être seulement menacées d'une réduction numérique mais doivent aussi posséder des caractéristiques génétiques intéressantes. En évaluant les qualités génétiques, il faut tenir compte de l'évolution future des besoins du marché et des systèmes de production. Il faut examiner d'urgence la valeur commerciale actuelle des races rares dans les programmes de sélection. Pour aider à préserver ces races en Grande-Bretagne, on exécute des programmes de conservation, on procède à des évaluations et on prend des mesures éducatives à différents niveaux.

RESUMEN

Es preciso utilizar con prudencia los recursos disponibles para la conservación genética animal. Por lo tanto, a fin de determinar qué razas deben conservarse, estas no solo han de estar numéricamente en peligro sino también ser valiosas desde el punto de vista genético. Para determinar su valor genético, deberán tenerse en cuenta los futuros cambios en las necesidades del mercado o en los sistemas de producción. En los programas de mejora genética es urgente una evaluación del actual valor comercial de las razas raras. En Gran Bretaña, el apoyo para la conservación de esas razas se presta mediante programas de conservación, estudios de evaluación y educación a distintos niveles.

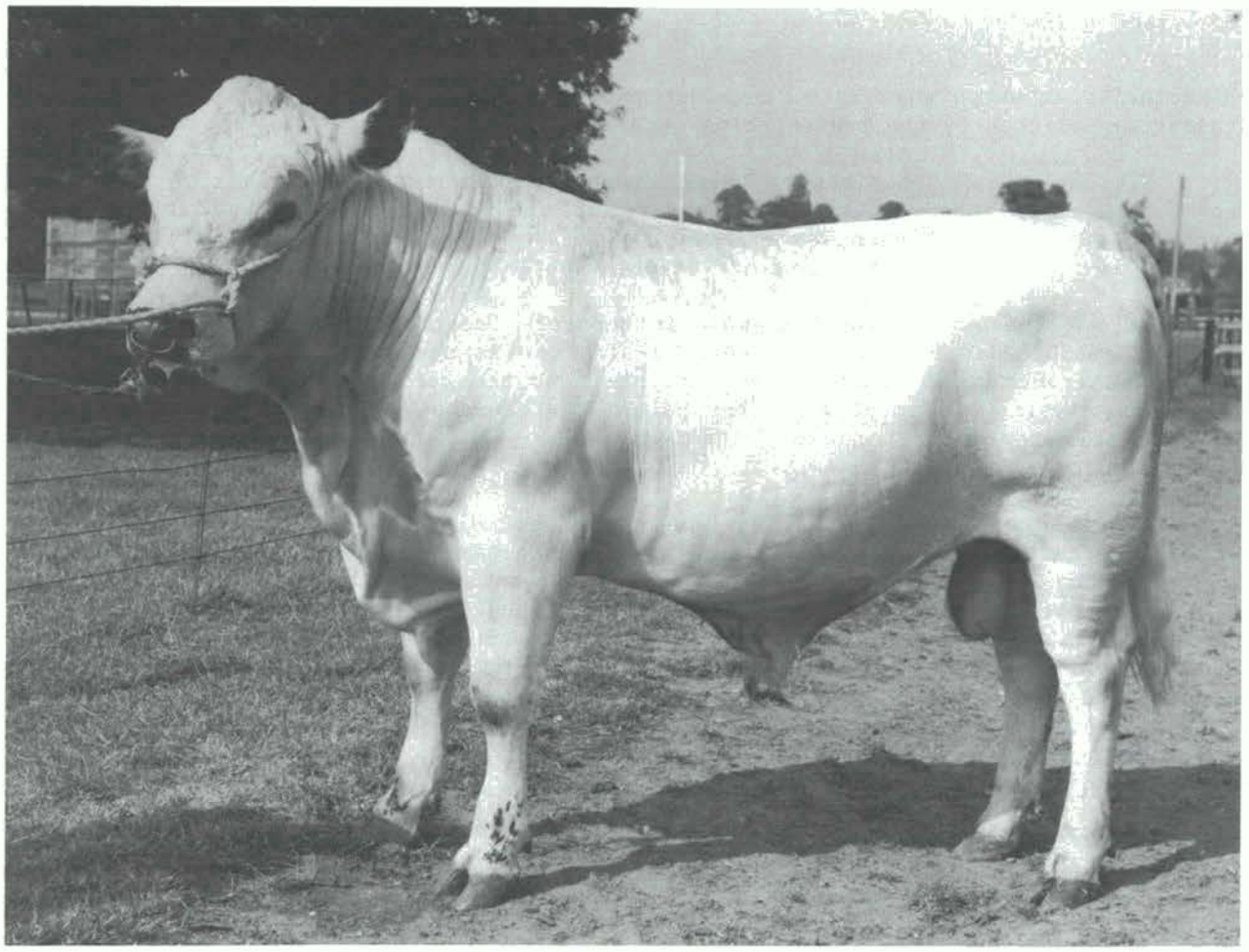
In Great Britain the conservation of animal genetic resources is achieved by maintaining pure breeds of domestic livestock, each with clearly defined and distinct characteristics.

The "gene pool" method of conservation is not used owing to the difficulty of identifying and utilizing specific characteristics in a large random-breeding population of diverse origins. There is also a danger of genetic drift and wastage unless sufficient "gene pool" populations are maintained in a variety of environments.

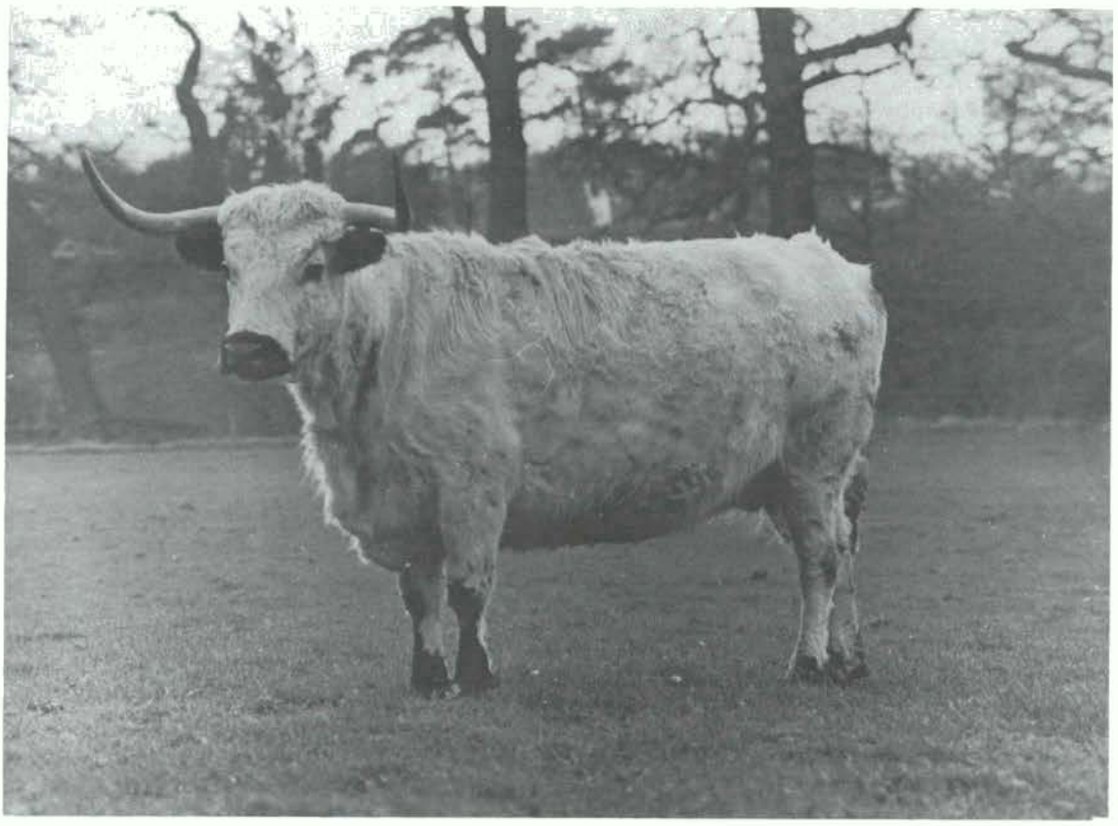
Genetic conservation in recorded breeds is more easily controlled and monitored, but there is also a danger of genetic drift within pure breeds owing to the small population size, and it is necessary to follow carefully planned breeding programmes to prevent this happening.

What is a Breed?

It is necessary to define a breed. It may be taken as a group of animals of similar



British White bull. This polled breed is particularly favoured for its ease of calving.



White Park cow. Animals of this type were found in pre-Christian Ireland more than two thousand years ago.

characteristics which when mated together produce progeny of the same type, within the standards published by the registration organization.

New breeds are continually being created. In Britain the primitive Castlemilk Moorit was established in the early years of the present century, while the high-perfomance British Milksheep was established in the 1970s. Meanwhile 23 British breeds of large livestock have become extinct in the twentieth century.

In some cases a breed may exist in separate locations and may have been recognized as sub-breeds. For example, the Friesian cow is seen in different types ranging from the extreme dairy North American Holstein to the beefier European Friesians, but from a conservation point of view they belong to the same breed, and provided each type is adequately represented in the total population, resources should not be allocated separately to each type.

Similarly in Britain the various varieties of Shorthorn, although they show marked divergent evolution, are all derived from the same genetic base. They include the Beef Shorthorn, Whitebred Shorthorn, Dairy Shorthorn and Northern Dairy Shorthorn. In other cases one breed may have exerted such an influence on other breeds of similar type that they can be considered as one group within a conservation programme. For example, Lincoln Longwool, Cotswold and some other British longwool breeds are now almost identical to the Leicester Longwool.

Organizations

In Britain, the various organizations which have initiated conservation programmes are all concerned with pure breeds. The Milk Marketing Board, whose commercial activities are based on wholesaling milk and the sale of semen, established a semen bank for bulls of rare breeds. Countrywide Livestock Limited, an animal breeding consultancy company, established a registration programme for breeds not administered by a breed society. The Rare Breeds Survival Trust, a specialist conservation organization, assists breed societies and breeds of rare breeds of domestic livestock.

Philosophy of Conservation

The philosophy on which the conservation of rare breeds is based in Britain places different priorities on each breed and on each method of conservation. For example, to qualify for the support of the Rare Breeds Survival Trust a breed must satisfy two criteria. It must be numerically endangered. Population size is based on the number of breeding females producing purebred progeny. For sheep the critical number is 1500 ewes, for horses 1000 mares, for cattle 750 cows, for goats 500 nannies, and for pigs 150 sows. These numbers are based on British standards of average herd or flock size, reproductive capacity and the ratio of males to females. Systems of management in other countries would give different standards.

The second criterion is that a breed must be of sufficient genetic value. Thus some breeds are not supported by the Rare Breeds Survival Trust. For example, the Norfolk Horn, an old breed from eastern England, is not recognized because the purebred population became extinct and the present population is derived from graded-up animals. The Oxford Sandy and Black pig and Blue Albion cattle are not recognized for the same reason. However, the Milk Marketing Board stores semen from Blue Albion bulls, and Norfolk Horn sheep are registered in the Combined Flock Book set up by Countrywide Livestock Limited.

In other cases breeds are not supported because they are merely colour varieties of a popular breed. Examples of this are the Bolian Gwynion, a belted variety of the Welsh Black, and the White Galloway, a variety of the Galloway.

Some foreign breeds, which have become neglected or even extinct in their native country, have found a haven in Great Britain. For example, the Caspian Horse, which is almost extinct in Iran, is now being actively conserved in England and elsewhere.

Ideally a breed should be conserved in its native environment, but if this is not possible, then alternative locations must be found.

Fluctuating Population Size

It must be recognized that market requirements and breeding fashions are changing continuously, and as a result the fortunes of each breed fluctuate depending upon their suitability for the contemporary market or their appeal to succeeding generations of breeders. Within the last ten years several rare breeds in Britain have improved their numerical status sufficiently to be no longer classified as rare. These breeds include Jacob, Black Welsh Mountain, Teeswater and Southdown sheep, and Shire horses.

In contrast, the fortunes of other breeds have improved relatively slowly despite considerable support and it is relevant to consider why they are rare. Three main causes can be identified:

i. No commercial value. Breeds such as Gloucester cattle, Portland sheep or Bagot goats have no obvious immediate or medium-term commercial value.

ii. Changing fashion. The Wensleydale, for example, was superseded by the Teeswater for reasons of fashion rather than genetic merit.

iii. Crossbreeding. Some rare and minority breeds have been seriously modified in an attempt to meet changing market conditions. Thus the Beef Shorthorn has attempted to regain size by crossing with the Maine-Anjou, while the Sussex may improve its carcass quality by using Limousin bulls.

Distinctive Qualities

There are at present 45-50 rare breeds of large farm livestock in Britain, and they can be classified according to their potential value within the livestock industry. A basic principle to be observed when assessing the value of a rare breed is that it must be conserved for its own distinctive qualities. If a breed needs to be changed too much it would be more relevant to use a different breed. It is more important to discover the conditions and systems of production in which a breed can be used most effectively. For example, Shetland cattle are well suited to marginal land, and as marginal land becomes increasingly important in the world economy, breeds and species adapted to this environment will have a greater role to play. Even wild species such as the bison might be utilized.

Categories for Conservation

Some rare breeds can contribute immediately to the livestock industry. They have been prevented from doing so by whims of fashion or by isolation. For example, North Ronaldsay sheep have the ability to exist exclusively on a diet of seaweed, and this could be of value in many parts of the world. British White bulls could be of great benefit when used on heifers of dairy breeds as they cause minimum difficulties at parturition, and they could replace the Aberdeen Angus for this purpose. In these cases the main function of a conservation policy is to establish commercial units of these rare breeds to demonstrate their value.

Some other rare breeds possess characteristics which make them potentially valuable. White Park cattle are an ancient breed which has been relatively unaffected by changes in fashion and market requirements during the last three hundred years. Thus they have retained important characteristics lost by some other breeds. They have strong colour marking, good growth rate, longevity and great vigour. Wensleydale sheep, although used very little now in their original role as the sire breed of prolific sheep, could find another role by virtue of the special quality of their wool, their high growth rate and their heavily pigmented skin. For these breeds conservation programmes should give maximum publicity and promotion to advise breeders of their qualities.

Some breeds do not appear to possess characteristics which have any commercial relevance. Examples of these breeds were mentioned earlier, but perhaps the best example is Chillingham cattle. Despite their apparent lack of commercial value, such breeds should be provided with financial incentives to enable them to survive. It is possible that future market requirements, unforeseen at this time, may enable their unique genotype to make a significant contribution to the livestck industry. But even in the absence of this justification, their conservation on the grounds that they are an integral part of national heritage and history should be sufficient reason.

Methodology

In Great Britain the programme of rare breeds' support is implemented in three stages, namely conservation, evaluation and education.

1. Conservation is concerned mainly with the identification of problems and the implementation of both emergency and long-term solutions. The main aspects of this programme are:

   a. A survey of rare breed populations carried out triennially.

   b. Identification of immediate problems by liaison with breed societies and breeders.

   c. Identification of potential problems by monitoring the status of individual bloodlines and of levels of inbreeding within each breed.

   d. Immediate solutions provided mainly by financial incentives for specific activities including AI programmes, publication of herd and flock books, importation of livestock, and stud premiums.

   e. Long-term solutions provided by programmes such as:

      i. Gene bank of frozen semen and embryos
      ii. Creation of new breeding units
      iii. Approval of breeding centres

2. Evaluation is necessary if rare breeds are to be used in the future. It is necessary to know the characteristics of the breeds which are maintained either as live populations or in gene banks. Various evaluation projects and trials have been undertaken including the following:

   a. Multibreed trials at the Animal Breeding Research Organisation in Scotland to evaluate breeds for efficiency of production.

   b. White Park cattle trials by Livestock Improvement Services in England which showed White Park bulls to be superior to Welsh Black and Hereford for crossing with dairy cattle.

   c. Heavyweight lamb production trials by the Royal Agricultural Society of England which showed the Oxford Down to be superior for this performance characteristic.

   d. Evaluation of Soay sheep which showed their high efficiency of production when crossed with rams of a Down breed.

   e. Polyunsaturated fats. The carcasses of animals of unimproved primitive breeds appear to contain less saturated fat.

   f. Polymorphisms. A study of blood types and chromosome structure helps to show the relationship between breeds. For example, the British White has a high frequency of the 1.29 translocation, while it is absent from the White Park although the two breeds are the same colour.

g. A Register of Congenital Defects is maintained. Defects are potentially much more dangerous in a small population and need to be monitored carefully. Several defects have been identified, including split eyelid in multihorned sheep (Jacob, Hebridean, Manx Loghtan) and entropion in Cotswold sheep.

3. Education is a necessary support for both the conservation and education programmes. Genetic conservation and the maintenance of native minority breeds have been neglected by livestock breeders and farmers in modern times, because they have been concerned with the intensive selection of a small number of breeds for high levels of production. With the realization that genetic variation is necessary for ongoing progress, and that efficiency of production is more important than total production, a programme of re-education to make breeders aware of the merits of minority breeds has been undertaken.

Education is provided in three main ways:

a. Technical meetings and seminars which are held regularly throughout the year.

b. Symposia and specialist conferences to discuss in detail major projects and new developments.

c. A technical consultant who conducts a series of breeders' workshops, prepares breeding programmes, maintains an information bank, and designs the overall strategy of conservation policy.

The result of these programmes is that out of almost 50 rare breeds in Great Britain, only two have decreased in numbers in the past ten years.

RARE BREEDS OF LARGE LIVESTOCK IN GREAT BRITAIN

Cattle:

Belted Galloway, British White, Dexter, Gloucester, Irish Moyled, Kerry, Longhorn, Northern Dairy Shorthorn, Red Poll, Shetland, White Galloway, White Park, Whitebred Shorthorn.

Sheep:

Cotswold, Hebridean, Leicester Longwool, Lincoln Longwool, Manx Loghtan, North Ronaldsay, Oxford Down, Portland, Ryeland, Shetland, Shropshire, Soay, Wensleydale, Whitefaced Woodland, Wiltshire Horn.

Goats:

Bagot, Golden Guernsey.

Horses:

Caspian, Cleveland Bay, Clydesdale, Dales Pony, Exmoor Pony, Fell Pony, Suffolk.

Pigs:

Berkshire, British Lop, British Saddleback, Gloucester Old Spots, Large Black, Middle White, Tamworth.

NEWS ITEMS

FAO/UNEP ANIMAL GENETIC RESOURCES DATA BANKS - A PROGRESS REPORT

An outline of the work being undertaken on this subject was given in the last issue of AGRI (No. 3). This note briefly brings the latest news. The Pilot Trials to investigate a methodology for preparing genetic characterizations of indigenous breeds of livestock and poultry in Africa, Asia and Latin America were concluded at the end of 1984. Regional evaluation meetings were held in Bangkok for the trials in Malaysia, Sri Lanka and Thailand, and in Maracay for the trials in Mexico and Venezuela. The trials in Africa were of a different nature, since a regional planning meeting was held in 1983, which resulted in individual scientists working on the subject. Their reports were received in 1984.

A consultant expert in computer system analysis was present at the regional evaluation meetings. He subsequently worked on the experiences gained in each region, and made recommendations on the most suitable hardware and software for data danks on animal genetic resources.

The recommendations from the regional evaluations and from Africa were then studied, and compiled by two experts with the aim of taking all the desirable features from each trial and compiling them into a uniform system suitable for global use. FAO/UNEP have been committed to the definition of such a unified methodology for data banks for animal genetic resources. This is needed to achieve the objectives of making genetic characterizations available to users throughout the world in an easily accessible form, without loss of any important information. The two experts are Mr. John Turton, Director of the Commonwealth Bureau of Animal Breeding and Genetics in the UK, who worked with the mammalian species, and Dr. Roy Crawford, Professor in the University of Saskatchewan, Canada, who worked with domestic bird species.

These two experts produced draft Descriptor Lists for each species and also draft Descriptors for the Environments. With experience coming from 3 regions of the world and from the many scientists who had worked on the Pilot Trials, they had a wealth of information from many natural environments and different management systems. These, together with a recommended methodology for the Data Bank and the recommendations of the systems analyst, were presented to an FAO/UNEP Expert Consultation which was held in Rome from 17 to 21 June 1984. At this Consultation, experts in each species and with interests in different parts of the world, and connections with regional animal genetics and production professional societies, considered these draft descriptor lists and methodology with the aim of defining the approved FAO/UNEP methodology. A full report of the recommendations of the Expert Consultation will be given in the next issue of AGRI.

PRZEWALSKI'S HORSE

The Przewalski Horse (**Equus Przewalskii**), also known as the Mongolian Wild Horse, was first described by the Russian Zoologist Poliakov in 1881, who named the horse after Colonel Nikolai Przewalski, a Polish-born soldier in the Czar's army. Colonel Przewalski had obtained the skull and skin of a wild horse in the Mongolian District of Kobdo. Przewalski's Horse is the only true wild horse. The feral horses of the world are all derived from the domestic horses (**Equus caballus**). The last confirmed sightings of the Przewalski Horse in the wild in Mongolia were in the 1960s. Fortunately, living Przewalski's Horses were brought from the wild in Mongolia from 1899 onwards, and in 1980 there were 388 animals in captivity in some 70 institutions throughout the USSR, Europe and North America. Many of these are in zoos in small numbers. The largest group is at Askaniya Nova, a nature reserve in the Ukraine (USSR), comprising about 55 animals in a semi-wild state. A herdbook is maintained by Dr. Jiri Volf at the Prague Zoo, and pedigree information exists on all animals. All the Przewalski Horses now in captivity derive from twelve **E. przewalski** and one **E. caballus**. The percentage contribution of each founder can be traced in each currently living animal.

The Government of the Mongolian People's Republic have requested restoration of

the Przewalski's Horse to Mongolia in the area from which it came. FAO and UNEP are cooperating with the Government of the USSR to draw up an Action Plan to achieve this. Funding is being provided by UNEP and FAO is responsible, with the Centre for International Projects of the USSR for the organization of an Expert Consultation to design the Action Plan. IUCN, who have promoted much recent work with Przewalski's Horse, are also involved in the programme design. The Expert Consultation is planned for Moscow at the end of May 1985. A report of the Expert Consultation and the Action Plan will be given in the next issue of AGRI.

[Note: The background information given here derives from "Guidelines for the Development of a Captive Management and Reintroduction Plan for **Equus Przewalskii**", which is a report by the Przewalski Horse Committee of the IUCN Survival Service Commission Captive Breeding Specialist Group, July 1982.]

MOST THREATENED ANIMALS

According to a report in The Times of London of 17 November 1984, the International Union for Conservation of Nature (IUCN) at its meeting held recently in Madrid, highlighted the grave situation with regard to certain plant and animal species threatened with extinction. Among the six "most threatened" animals listed by them were the Kouprey wild ox of Southeast Asia and the Pygmy hog of the Himalayan foothills; others being the Sumatran rhinoceros, the Mediterranean monk seal, Orinoco crocodile and the Brazilian wooly spider monkey. The Kouprey ox, which has dwindled in numbers to only one small herd after Indo-China's various wars, is believed to be resistant to rinderpest. If this could be confirmed, the disappearance of this breed is a matter of genuine concern. It may interest AGRI readers to know that the Kouprey ox is a humpless animal which is classified in the sub-genus **Bibos** along with the Banteng - the wild ancestor of Bali cattle in Indonesia. When interbred with domestic cattle, the male hybrids will therefore be expected to be sterile.

INTERNATIONAL GENETIC RESOURCES PROGRAMME

The IGRP was founded by the Rural Advancement Fund International to address the problem of the loss of genetic resources in plants and animals. (The RAFI is a non-profit organization chartered in the Netherlands.) Work to date includes the following:

- Initiation of educational campaigns on the loss of genetic diversity in agriculture.
- Promotion of the establishment of an international network of gene banks and a legal convention mandating the full exchange of genetic materials between countries.
- Support of national groups in several countries in their efforts to block legislative moves that would encourage the monopolization of genetic resources.
- Assistance to organizations around the world in their efforts to initiate genetic resources education and conservation programmes.
- Publication (shortly) of a book on the politics of genetic resources.
- Production of a slide show on the loss of genetic resources.

IGRP Report, Vol. 1, No. 2 was published in October 1984. Most of its 6 pages are devoted to plants. In fact there are only two references to animals - a short paragraph about the work of the Rare Breeds Survival Trust in the UK and a note about a herd of Belted Galloway cattle in the USA.

IGRP also has a speakers' bureau and undertakes consulting work on special projects.

For further information write to: IGRP, RR1 (Beresford), Brandon, Manitoba R7A 5Y1, Canada, or P.O. Box 1029, Pittsboro, NC 27312, USA.

ANIMAL PRODUCTION IN ARID ZONES

The Animal Science Division of the Arab Centre for the Studies of Arid Zones and Dry Lands (ACSAD) is planning an international conference on animal production in dry zones to be held in its headquarters in Damascus from 7-12 September 1985. It will cover sheep, goats, cattle and camels and the disciplines of breeding, nutrition, reproduction, socio-economics, animal health and management. For further information write to: Dr. Ousama A. Awa, Director, Animal Science Division, ACSAD, P.O. Box 2440, Damascus, Syria.

N'DAMA CALVES BY EMBRYO TRANSFER

Embryo transfer technique has been successful in introducing the trypanotolerant N'dama breed to the International Laboratory for Research on Animal Diseases (ILRAD) located in Kenya. This technique was resorted to, because not only is live animal transfer expensive but animal health regulations also restrict the movement of animals from West Africa to Kenya. N'dama embryos were obtained from selected donors in The Gambia, frozen and then shipped to Kenya where they were surgically transferred to Boran recipient heifers. These animals will be used at ILRAD to elucidate the mechanisms underlying resistance to trypanosomiasis including a search for associated genetic markers.

INTERNATIONAL CENTRE FOR GENETIC ENGINEERING AND BIOTECHNOLOGY

Since our report in the Animal Genetic Resources Information issue 1/84 on the proposals for setting up an International Centre for Genetic Engineering and Biotechnology, further developments have taken place. At a plenipotentiary meeting of the United Nations Industrial Development Organization held in April 1984, it was decided to set up the centre with locations in Trieste, Italy and New Delhi, India. The Italian Government is providing US$ 400 000 to a UNIDO trust fund to finance a number of preparatory research, training and development activities in addition to its offer of considerable financial assistance in the establishment of the centre.

FROZEN EMBRYOS AS CONTROLS IN A BEEF CATTLE BREEDING PROGRAMME

An interesting experiment has been designed using frozen embryos at the Wokalup Research Station in Western Australia to study the genetic response in a beef cattle selection programme. The first phase of this experiment which involves freezing embryos from 130 cattle of the Wokalup multi-breed and Hereford purebreds is now complete. These embryos will be kept frozen for 10 years and transferred to recipients to obtain calves in 1994. The frozen embryo calves which will be genetically similar to calves born in 1984, when compared with contemporary calves born in 1994 out of normal matings will give an estimate of the selection response during that period.

PRO SPECIE RARA

The foundation "Pro Specie Rara" was formed in December 1982. It has as its aim the maintenance of the cultural heritage of genetic resources of livestock and vegetation. At present its field of action is chiefly in eastern Switzerland. Its first annual report, for the year 1982/83, describes projects on the Stiefelgeiss (Booted goat) of St. Gallen, on the Hinterwälder cattle of Germany, on local sheep breeds (particularly the Tavetscherschaf which was believed extinct), on the Spitzhauben hen and on fruit and vegetables. Conservation herds of Stiefelgeiss and Hinterwälder cattle are maintained. The address for further information is: Pro Specie Rara, Postfach 125, 9003 St. Gallen, Switzerland.

PIG NEWS

Two publications which may be of interest to animal breeders and geneticists working with pigs are: (i) Index of Current Research on Pigs; and (ii) Pig News and Information. Both are published by the Commonwealth Agricultural Bureaux in the UK. The Index is published annually, and the current issue (No. 31) covers the year 1984 and contains more than 6000 entries from 52 countries listing projects in progress and publications from about 450 institutions, including for the first time the People's Republic of China. Pig News and Information is published quarterly and has the pig abstracts from all the CAB abstracting journals, together with reviews and notes from correspondents. Although both publications cover all aspects of pigs, they include, of course, the breeding and genetic aspects.

REPORTS OF MEETINGS

WORKSHOP ON GENETIC MANAGEMENT OF CAPTIVE POPULATIONS

The purpose of this workshop, held at the Smithsonian Institution's National Zoological Park, Front Royal, Virginia, USA, from 7 to 10 August 1984, was to discuss and disseminate information on genetic management of captive populations with particular relevance to populations of zoo animals. It was specifically concerned with several controversial subjects which emerged at the 1982 Man and Biosphere Conference on "The Application of Genetics to the Management of Wild Plant and Animal Populations" (published as Schonewald-Cox et al. (eds.) 1983. "Genetics and Conservation". Benjamin/Cummings Publishing Co.). The topics covered overlap the field of interest of the FAO/UNEP Joint Panel of Experts on Animal Genetic Resources Conservation and Management. A major emphasis was on the genetic management of captive populations of endangered species.

There were 38 invited paricipants at the workshop, representing a mixture of geneticists and zoo personnel. The participants were predominantly from the USA, but included people from Australia, United Kingdom and Federal Republic of Germany.

The meeting consisted of five Current Issue Panel sessions and several Research Reports. Flesness set the scene by describing the "Background and Perspectives" of the workshop.

Under the heading "Coadapted Gene Complexes and Population Boundaries" the first panel dealt with the questions:

How important is local adaptation in vertebrates?
How can we define population boundaries?
What are the probable consequences of management at various taxonomic levels?

A highlight of this session was Templeton's contribution describing methods for distinguishing between outbreeding depression and inbreeding depression.

The second panel considered "Fitness/Genetic Diversity Relationship", addressing the questions:

Is individual fitness a function of heterozygosity?
Is future population fitness a function of the number of alleles preserved?

There was considerable controversy on these points and little in the way of consensus emerged.

"Selection in Captive Populations" was the topic for the third panel. They discussed the questions:

What kind of unconscious selection occurs? What are its effects?
Should we select for inbreeding tolerance? If so, when?
Should we select for genetic diversity?
Should we select for phenotype?
Should we minimize known selection?

A high degree of agreement was reached on these subjects. This was a result of recognizing that genetic management of populations depends crucially on the types of populations being managed and the objectives of the management. Consequently, the answers to the above questions depended on the type of population being considered, whether a common species for display, an endangered species for long term conservation, a rare species for multiplication and immediate release back into the wild, or a species not yet capable of self-sustaining reproduction in captivity.

"The Zoo Ark: Population Size and Time Frame of Consideration" was the topic for the fourth panel. The questions addressed were:

How long is the voyage?
How many animals per cabin?

The main issue here was the vexing problem of setting priorities in assigning space to species in zoos.

"Breeding Plans" was the subject considered by the fifth panel. They discussed the questions:

What breeding plans are available for captive populations?
How do goals affect breeding plans?
How do practical constraints limit breeding plans?

A feature of this session was Lande's reassessment of the population size required to maintain genetic variation. He also recommended that some inbred matings be allowed in order to control the genetic load.

Research Reports dealt with recent evidence relevant to genetic management of captive populations. Ryder spoke about "Mitochondrial DNA and chromosomal analyses", with major emphasis on the use of these techniques to resolve cases of taxonomic confusion. Cothran described "Genetic variation and inbreeding in Standardbred horses" and Murray documented the "Effects of inbreeding in Australian budgerigars". The most novel of the research reports was that by Newman from S.J. O'Brien's laboratory, describing the extremely low levels of genetic variation in S. African cheetahs. Papers of a mainly theoretical nature were given by Dyke, MacCluer, Thompson and Meyers.

The meeting was well organized and stimulating with contributions being of a very high quality. A notable feature of the workshop was the excellent rapport between geneticists and zoo personnel.

The proceedings of the meeting are due to appear in Zoo Biology in mid 1985, probably as a supplementary issue. They should be of interest to anyone with an interest in conservation genetics.

RECENT PUBLICATIONS

PROCEEDINGS OF INTERNATIONAL SEMINAR ON SHEEP AND WOOL, 14-16 March 1982, Islamabad. Pakistan Agricultural Research Council, 1983.

A reference to this seminar has already been made in AGRI 1/83 where the recommendation to collect information on local sheep breeds was highlighted. The proceedings have now been published and they include, in addition to the recommendations, the full text of the technical papers and discussions. The whole range of breeding, feeding, management, health, research, extension and training was covered by the seminar, but the papers of most interest to readers of AGRI are: General patterns of production, breeds, management, disease, nutrition, performance and problems, by Abdul Wahid; Breeding plans, by Helen Newton Turner.

It should be mentioned that a 30-page pamphlet describing the sheep breeds of Pakistan was distributed at the meeting but not included in the proceedings.

CAMEL NEWSLETTER (CNL)

In April 1984, the Arab Centre for the Studies of Arid Zones and Dry Lands (ACSAD) published the first issue of "Camel Newsletter". Apart from introduction and editorial matter the newsletter contains the following material:

1. News and notes. News of five participants at the Camel Workshop held in Khartoum in 1979 and of research in a number of countries.

2. Book reviews. the following recent books are reviewed:

   Bulliet R.W. 1975. The Camel and the Wheel. Harvard University Press, Cambridge, Mass.

   IFS. 1980. Workshop on Camels, Khartoum 18-20 December 1979. Provisional Report. International Foundation for Science (Stockholm) and National Council for Research (Khartoum).

   Mukasa-Mugerwa E. 1981. The Camel (Camelus dromedarius): a bibliographical review. International Livestock Centre for Africa, Addis Ababa, Ethiopia.

   Gauthier-Pilters H. and Dagg A.I. 1981. The Camel: its evolution, ecology, behaviour and relationship to man. Chicago University Press.

   Farid M.F.A. 1981. Camelids Bibliography. ACSAD, Damascus.

   Wilson R.T. 1984. The Camel. Longman, London and New York.

   The last book was reviewed in AGRI 2/84.

3. Work on camels at ACSAD. A study of the potential for development of camels in seven Arab countries has been published in Arabic. Likewise a pre-feasibility study of camel ranching in the Sudan. A study on forage preferences of camels and other animals in three Arab countries has been started. The bibliography mentioned above has been published and will be updated in the successive issues of CNL.

4. Scientific article on camel diseases in northern Kenya.

5. Updating of the Camelids Bibliography. Eightyfour new articles are listed.

6. French and Arabic summaries.

This is an extremely timely addition to the world's publications which should be

in the hands of everyone concerned with or interested in camels. It is to be published twice a year and can be obtained at a price of US$ 5 per year from: The Arab Centre for the Studies of Arid Zones and Dry Lands, P.O. Box 2440, Damascus.

CONSERVATION OF THE KENANA AND BUTANA BREEDS (Consultant's report to FAO).

The FAO/UNEP Technical Consultation of 1980 recommended that Member Governments should include in their development programme a component for the development and conservation of local breeds. One of the first to be included in such a programme is the Kenana cattle breed of the Sudan. Dr. E.P. Cunningham of the Agricultural Institute of Ireland was appointed as a consultant by FAO. The Kenana and Butana are zebu breeds found chiefly in the Kassala, Blue Nile, Gezira and White Nile provinces. This is a low rainfall savanna region which includes some irrigated areas. There are about 3 million Kenana and 1.7 million Butana cattle. The consultant's first decision was that any scheme should be restricted to the Kenana which is more numerous and which is the breed involved in the urban areas and on the main irrigation schemes. Resources should not at this stage be spread over two breeds. The various production systems are classified. At one end of the scale are nomadic and transhumant systems. It is concluded that interference with the breeding patterns in these sectors is neither feasible nor desirable. At the other end of the scale, Kenana cattle are involved in crossbreeding and upgrading programmes related to the developing commercial dairy sector. This section of the breed is therefore not suitable for a conservation programme. The conservation scheme should be concentrated on those sections of the breed which are maintained in relatively settled conditions but which are not involved in commercial milk production. Conservation without improvement is self-defeating so an improvement programme, mainly for milk production, is outlined. The essence of the scheme is an open nucleus breeding stucture, with an annual round of selection in a government station based on careful and extensive recording, and supplemented by an annual round of selection in village herds. The field selection would draft in annually about 20 females to the nucleus herd. The station selection would be based primarily on fat-corrected milk production; that in the field would depend on eye evaluation by an expert inspector combined with body measurement and trial milking. The feeding level at the station must be sufficient to allow an effective selection programme. Such a scheme, if consistently applied, should create a nucleus and a surrounding zone of improved Kenana cattle which would enhance the competitive position of the breed and therefore be a strong guarantee of its conservation in the long term. This scheme could well be a pilot development which could be followed in other developing countries where conditions are similar.

PRODUCTION POTENTIAL OF THE LIVESTOCK INDUSTRY: HAVE GENETIC LIMITS BEEN REACHED?

A symposium with this title was presented at the Canadian Society of Animal Science (Western Branch) on 14 June 1983. Three papers were published in the Canadian Journal of Animal Science, Vol. 64 (1984) as follows.

In "Selection limits: Have they been reached with the dairy cow?" (pp. 207-215), B.W. Kennedy concludes that selection limits for increased milk production have not been reached nor will they be in the foreseeable future. In fact the rate of genetic improvement for milk production is actually accelerating, contrary to genetic theory, apparently due to the increased genetic variability caused by improved management. Genetic antagonism between milk yield and fitness traits could eventually impose a limit to selection for milk production but can probably be overcome by further improvements in management.

In "Selection limits: Have they been reached in the poultry industry?" (pp. 217-221), Peter Hunton points out that selection for growth and conformation in turkeys has been so effective that they can no longer mate naturally. In chickens reproduction has not been so badly affected but there is room for improvement. Increased fat deposition is another unwanted side effect of selection for growth rate. Selection programmes for egg production are concerned with multiple objectives; therefore selection intensity for any one has not been so high as for meat birds. Rate of egg production at time of maximum lay is approaching a physiological limit but not necessarily a genetic one.

Persistency of lay still shows potential for further improvement. No genetic limit has been reached for egg weight, egg interval, or shell quality. Genetic resistance to Marek's disease affords scope for further improvement. In general, genetic variability is not exhausted.

In "Selection limits: Have they been reached with pigs?" (pp. 223-234), H.T. Fredeen states that no insurmountable genetic or physiological limits have been encountered in unidirectional experiments with pigs. While selection limits appear unlikely to compromise within-herd responses to sustained unidirectional selection, the universal adoption of specific criteria of performance merit, by fostering the progressive elimination of individual herds and breeds, diminishes the genetic flexibility of the population and restricts its potential to respond rapidly to changing production requirements.

ASSESSMENT AND CONSERVATION OF ANIMAL GENETIC RESOURCES IN CANADA, by R.D. Crawford. Canadian Journal of Animal Science 64:235-251. (1984)

This review is based on two surveys made by the author, one during 1979-80 of purebred poultry breeding stocks maintained in Canada, the other, in 1980, of rare and feral domestic animal stocks in Canada and the United States. Both have been updated to 1983. Use is also made of the inventory of avian and mammalian breeding stocks held at universities and research laboratories in Canada and published annually by the Canadian Council on Animal Care. A large part of this review is devoted to poultry. The six industrial poultry breeders in Canada in 1979-80 are listed. Two breed ducks, three turkeys and one chickens. Seven middle-level chicken breeders are listed together with one turkey breeder and four breeders of ducks and/or geese. There are many hobbyists with fancy breeds of chicken but they contribute little to conservation since they are more concerned with perpetuation of the phenotype than of the genotype. Loss of poultry genetic resources has been extreme: industrial stocks are dangerously close to being monotypic and middle-level stocks have nearly disappeared. Three conservation collections exist at public institutions - Japanese quail at the University of British Columbia, fancy chicken breeds at the Nova Scotia Agricultural College and middle-level stocks and single-gene mutations at the University of Saskatchewan.

There are three rare breeds of horse - the feral horse of Sable Island, the native Newfoundland pony and the Canadian horse. There are two cattle breeds of interest, namely the Texas Longhorn used as a range sire to reduce the incidence of dystocia in first-calf heifers, and the Canadian breed for which the official policy of the breed society is to grade up to the Brown Swiss. There is tremendous genetic diversity in beef breed resources but erosion of dairy breeds has been extreme and monotypy of Holsteins is approaching. There are many sheep breeds available but the sheep industry is not large. Goats are not numerous but include many unimproved goats and feral populations on islands as well as the Swiss breeds. Among pigs the monopoly of the Yorkshire has been broken but an increasing proportion of breeding animals comes from the industrial breeding companies. Minor breeds such as the Berkshire and Tamworth have become very rare. The Canadian Eskimo Dog has been saved from extinction. Public agencies must assume increasing responsibility for conservation and their interest is shown by the establishment of an ad hoc Committee on Preservation of Animal Genetic Resources.

GOAT PRODUCTION IN THE TROPICS. 2nd edition. C. Devendra and Marca Burns. Commonwealth Agricultural Bureaux, Farnham Royal, Bucks., England. 183 pp. 1983

Since the publication of the first edition of this book in 1970 there has been increasing interest in the goat and a vast amount of research on this species has been published. The extensive bibliography (25 pp), while not excluding important earlier papers, is largely devoted to this more recent material and it is all carefully summarized in the text. However, the book is not merely a review of published papers; it draws heavily on the authors' personal experiences and the chapters on feeding, hubandry, genetics and economics include a series of practical conclusions. The scope of the book is wider than the title indicates - it covers the subtropics as well as the

tropics - and the extent of the subjects included is shown by the chapter headings - Classification, distribution and importance; Breeds; Variation in size; Meat production; Milk production; Reproductive performance; Feeding and nutrition; Skin and hair production; Husbandry for improved production; Genetic improvement; Economic potential and prospects. The chapter on breeds includes short descriptions and photographs of 11 breeds in Africa, 6 in the Near and Middle East, 17 in the Indo-Pakistan sub-continent, 5 in eastern Asia and the Pacific, 3 in tropical America and 4 from Europe which are bred in the tropics. In the subsequent chapters their productive performances are compared. The chapter on economics makes a convincing case for the goat as a more economic animal than the cow for milk production in many tropical situations. Altogether an invaluable reference and textbook.

FUTURE DEVELOPMENTS IN THE GENETIC IMPROVEMENT OF ANIMALS. Edited by J.S.F. Barker, Keith Hammond and A.E. McClintock. Academic Press, Sydney, New York and London. 228 pp. 1982

This book consists of the 12 invited papers presented by 15 invited scientists from Australia, New Zealand, Norway and UK at a symposium held at the University of New England, Armidale, Australia, in February 1982. It also includes short summaries of the discussions. The scope of the papers and discussions is indicated by the titles of the sections of the meeting, namely: A general view of animal breeding, Molecular genetics, Immunogenetics, Reproductive biology, Economic aspects of developing breeding objectives, Mixed model theory, Population size and Electronics. The objective of the symposium was to project, from current knowledge, those areas where the most important developments in the application of genetics and associated disciplines could and should take place. Some exciting possibilities are considered in the various papers and discussions but there are few recipes which can be applied at once in animal breeding programmes. Most of the conclusions suggest important lines of research rather than immediate applications of current knowledge. Areas which show the most immediate promise are: the application of molecular genetics to gene manipulation in the rumen microflora, breeding for disease resistance, selection for specific components of the reproductive cycle, a reconsideration of the effect of population size - more smaller programmes may be preferable to few large ones. Definitely a book for research workers rather than for those concerned with development programmes.

SHEEP AND MAN. M.L. Ryder. Duckworth, London. 846 pp. 1983

This is a truly stupendous collection of facts about sheep in relation to man. It is an encyclopaedic history of domestic sheep from the time of first domestication up to the present and with a glance into the future. The first part ("Ancient Times") is treated chronologically and the four chapters deal with: The biology of sheep and their domestication, Prehistoric sheep, Ancient civilizations and the Early Middle Ages. The second part, which occupies half the book, covers the Middle Ages to modern times. It is dealt with geographically, region by region. The third part which is titled "The association of man with sheep" integrates various topics in the rest of the book under the headings "Sheep husbandry", "Sheep products" and "The sheep legacy". The list of references occupies 28 pages.

The book is lavishly illustrated with over 350 figures including maps, diagrams, photographs and illustrations of sheep in the form of sculptures, MS illuminations, paintings, etc. This last group (or most of them) are listed, together with many not reproduced in this book, in an appendix which gives details of sheep illustrations from prehistory, ancient civilizations and Europe.

With such a wide scope and with such detailed accounts the book is an excellent source of information about breeds of sheep, as well as husbandry methods and trade, in many times and places. Given the author's special field it is naturally strongest on all aspects of fleece and wool. Of course, a few errors have crept in and sometimes the source of information has not been the most recent but it would be churlish to complain about minor details in a work of this magnitude. However perhaps the publisher and printer should be criticized for the poor standard of reproduction of some of the figures.

EVOLUTION OF DOMESTICATED ANIMALS. Edited by I.L. Mason. Longman, London. 1984.

This is a reference book intended to be a companion volume to that on evolution of crop plants. It is an authoritative reference book with contributions from authors of varied interests. There are zoologists, veterinarians, anthropologists, geneticists and animal husbandry specialists among the authors. Although having different interests and backgrounds, the authors have attempted to maintain a certain amount of uniformity in presentation. Thus, the chapters dealing with the major livestock species have sections on taxonomy and distribution of the wild ancestors followed by the archaeology, history, genetics and breeding of the domestic descendants. Naturally the coverage is far more extensive for the livestock species and others of importance to man, such as poultry, dogs, bees and silkworms than for animals of lesser economic importance. Thus of the 69 chapters, mostly on individual species and a few groups, the thirteen chapters on the important species occupy nearly forty percent of the book.

Domesticated animals in the context of this book include a greater variety of animals than those usually relevant in animal production. The criteria considered to characterize domestication were human control of breeding, usefulness to man, tameness and selection away from the wild type. However as the editor points out, not all animals included in the book satisfied these criteria. Regulation of breeding is perhaps the most important aspect of domestication, but in a number of species such as the reindeer, elephant, crocodile or even the cat, there is hardly any control of breeding although with some as in the elephant, some attempts are being made at controlled breeding.

The arrangement of the book with chapters devoted to species within families, orders and phyla does not permit a discussion of the general pattern of domestication or the changes that occur with domestication in species belonging to different orders or even phyla. However, an aspect of domestication that occurred in most species whose breeding was controlled, was that of reproductive isolation of a "founder" group from the wild population. The restriction imposed by sampling limited the genetic variability of the founder group which thus possessed only a complement of the total genetic diversity of the wild population. Selection by man decreased this variability even further which led to the creation of species leading in some cases, such as the dog, to changes very much different from the morphology and behaviour of the wild ancestor.

Another feature that seems to have occurred in the mammalian species that underwent domestication is reduction in size. Thus, one finds a progressive reduction in size of cattle from the Neolithic age through the Copper and Bronze ages to the Iron age. Similar decline in size occurred with the Bali cattle domesticated from the Banteng and the mithan from the gaur. Presumably, the decline in size was a result of selection for animals that were easily manageable and also less demanding in their feed requirements which is important when animals which were freely roaming were kept in captivity.

Conservationists would find it interesting to note that the reasons adduced for an increase or decrease in population of some breeds even during the early days of domestication were economic which is true even today for breeds threatened with extinction. It is sobering to learn that had France and Italy decided to use machinery for traction earlier than they did, their draught breeds would probably have become extinct and we would not have the large beef breeds such as the French Charolais and the Limousine or the Italian Marchigiana and Romagnola which are so much in demand today for terminal crossing in beef breeding programmes. Another interesting example of an animal that is in demand today but was nearly extinct some time ago is the Pietrain pig from Belgium. This lean animal was not valuable commercially when fat was at a premium, as during the second world war. However, it is highly valued today as a crossing sire due to its extremely muscular carcass. Other pig breeds, which though not endangered but possess valuable traits that can be exploited in other regions, are those of central and southern China which are adapted to converting water plants and other vegetables to fat.

The coverage of this book is very wide and most people concerned with animals and their evolution to domestication will find material of interest. Animal scienists will perhaps not find much new material on the general biology of the domestic animals but will find several interesting pieces of information on other species. Each chapter ends with a section devoted to future prospects and it was interesting for the reviewer to

find that genetic engineering techniques have reached an advanced stage in the silkworm moth whose fibroin gene had been successfully cloned in bacterial cells.

The book covers mammals, rodents, birds, reptiles, amphibians, fishes, insects, crustaceans and molluscs. Understandably, most of the book is devoted to mammals with 41 chapters while on birds there are 15, 6 on fishes, 2 each on insects and molluscs and 1 each on reptiles, amphibians and crustaceans. The introductory chapter on "The beginnings of animal domestication" provides an interesting account of the reasons for domestication and also attempts to look into the future. Taxonomy and nomenclature which are confusing at present because of the existence of different scientific names for wild and domestic forms of some animals but not for others are treated in an appendix and some suggestions made.

The book does not have any photographs but there are a number of maps and diagrams illustrating the distribution and migratory pattern of animals. There are two separate indices, one for common and the other for scientific names of animals.

The book may be too expensive for individual pockets. However, it is certainly an important reference book for zoologists, anthropologists and animal scientists and should therefore be available in libraries.

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