
NATIVE CATTLE AND HORSE BREEDS IN ESTONIA

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SUMMARY

The authors describe the history, evolution and actual situation of Estonia's two only remaining autochthonous breeds of farm animal namely the Estonian Native Cattle (577 cows in milk production in 1992) and the Estonian Native Horse (271 purebred horses). This is actually mainly found in the island of Saaremaa, where a nucleus of 211 purebred horses exists. The interest in the Estonian Native Cattle breed is growing since the creation in 1989 of an active Breeders' Association and many farmers applying less intensive production systems and farm management techniques prefer now this breed to the more productive Black and White and Estonian Red cattle. The situation of the Estonian Native Horse is much more fragile, as a clear breeding and conservation programme is needed to save this unique genetic material.

RESUME

Les auteurs présentent l'histoire, l'évolution et la situation actuelle des deux seules races domestiques autochtones qui restent en Estonie: la race bovine d'Estonie (577 vaches en production laitière en 1992) et la race équine d'Estonie (271 chevaux de race pure), qui se trouve actuellement surtout sur l'île de Saaremaa, où il y a un noyau de 211 chevaux de race pure. L'intérêt pour la race bovine d'Estonie s'est accru après la création, en 1989, de l'Association d'Éleveurs, et nombreux d'entre eux qui utilisaient des systèmes de production et des techniques d'élevages moins intensifs préfèrent maintenant cette race à celles plus productrices comme la Black and White et la Rouge d'Estonie. La situation de la race équine d'Estonie est beaucoup plus délicate et il est donc nécessaire d'élaborer un programme de conservation pour sauver ce matériel génétique unique.

1.0 INTRODUCTION

According to the recent FAO publications (K. Hammond, 1994; D. Steane, 1993; J. Hodges, 1991, 1992; E. L. Hanson, 1992; J. Rune, 1992, 1993; E.P. Cunningham, 1992; K. Maijala, 1992), the number of animal breeds is decreasing with each subsequent year. That also indicates the decrease of the genetic diversity of domestic animals. According to the FAO Global Domestic Animal Data Bank there are more than 220 breeds in danger of being lost. Most of them are cattle and horse breeds. The endangered breeds are mainly minor local breeds, having lower productivity, but good resistance to local unfavourable management conditions, diseases, parasites and hard climatic conditions. The preservation of those breeds is important from the practical point of view (better adaptation), but also considering gene conservation (in future these genes could be needed for breeding).

Of the Estonian local (native) breeds only two have survived till the present time: the Estonian Native Cattle and the Estonian Native Horse. Both are registered in "World Watch List" (FAO, 1993) as "endangered" (pages 219 and 230).

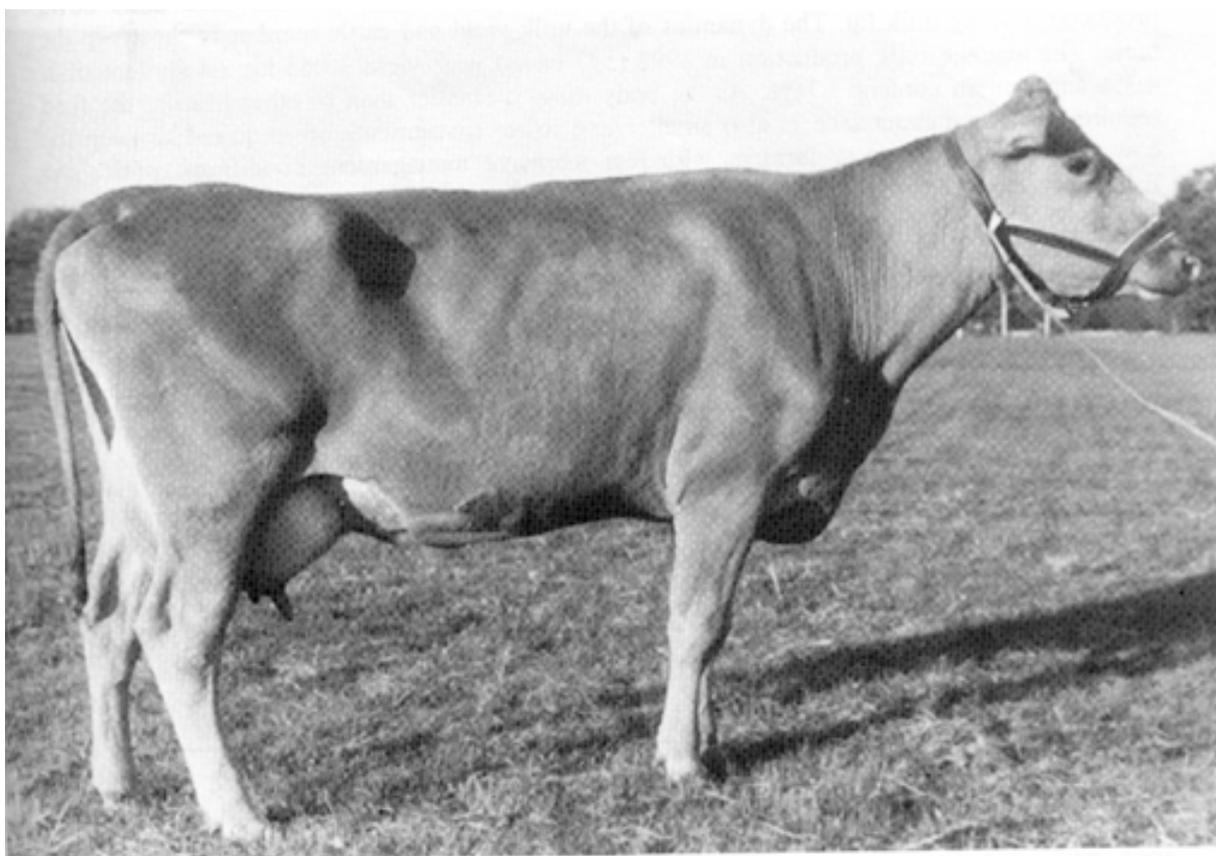
2.0 THE ESTONIAN NATIVE CATTLE BREED

This breed has been found in Estonian territory from time immemorial. This cattle was used as a basis for the development of the other Estonian cattle breeds (Estonian Black and White, Estonian Red). Directional selection, however, began from April 20th, 1920, when the Association of Estonian Native Cattle Breeders was established. During a relatively short period (1920-1940) a well adapted breed was developed for the Estonian climatic conditions. It was economical for small farmers - with 100 feed units (equal to 100 kg of barley) the cows gave 4.8 kg milk fat, this is 0.4 kg more than the Estonian Red cows and 0.5 kg more than the Estonian Friesian cows. In the years 1940/41 the record cow of Estonia was "Moira" of the Estonian Native Breed, with milk yield per control lactation of 6 336 kg, 4.48 per cent fat and 284 kg milk fat.

During the Soviet period in Estonia this small-size breed (body mass 400-480 kg) was opposed, mainly because of its national origin and due to its comparatively low milk yield. Milk fat production and good feed conversion were not considered. The number of cows rapidly decreased and on January 1 st, 1994, there were only 567 dairy cows recorded, which constituted 0.2 per cent of the total recorded cow number in Estonia. The total number of cows is approximately 600-700. In 1945 the number of cattle was 12 799 (8.4% of the total number of cattle).

After regaining independence and after the restitution of the Republic of Estonia, breeding of the Estonian Native Cattle was started up again. It was realised that preservation of this unique breed was indispensable. On the 14th of October, 1989, the Association of Estonian Native Cattle Breeders was restituted.

The short-term breeding goal was established: to increase the number of cows to 2 000. Great interest in keeping this breed was shown by new farmers. The reason for this is resistance to diseases and parasites, ability to produce in unfavourable feeding and management conditions, high milk fat (4.4-S^a/o) and protein content (3.3-3.4%). Polled cows are preferred. Cows do not have leg and hoof defects. The longevity of cows is good, compared with other breeds. The frequency of mastitis is very low, as is that of leucosis. Calving is very easy. The breed research data from 1945 showed that feed conversion in the production of milk fat was better than other Estonian breeds: with 100 feed units cows produced 5.47 kg milk fat. The dynamics of the milk yield and cattle number is shown in the table. The average milk production in 1992 (577 cows) was: yield 3 065 kg fat content milk 4.3% and protein content 3.36%. As the body mass is smaller than in other breeds, the feed requirement for maintenance is also smaller and lower investments are required to keep the cow. Therefore many new farmers with less intensive management conditions, prefer the Estonian Native Breed.



Cow of the Estonian Native Breed

TABLE 1:
The milk production of the Estonian Native Cows

Year	Number of Cows	Average Production		
		milk (kg)	milk fat (Kg)	fat (%)
1965	877	2948	122	4.14
1970	1131	3003	129	4.28
1975	1198	3168	138	4.36
1980	984	3394	145	4.27
1985	945	3631	162	4.47
1990	566	3430	152	4.43
1992	577	3065	132	4.30

Estonian Native Cattle have been crossed with other similar breeds, such as Jersey and Finncattle. The Jersey bulls were used to introduce new genes (single cross) in 1955, 1961 and 1990. They added high fat and protein percentage genes. However, the body mass of cows decreased.

The future selection programme considers the use of Finncattle only. This breed is more closely related to the Estonian Native Cattle and 6 bulls were imported in 1961, 1965 and 1983. From 1965 to 1983 a total of 83 heifers were imported. To a lesser extent Swedish and Norwegian native breeds can be used for a single cross. The selection goal is to increase milk yield and to preserve the breed type traits, as well as the high fat percentage of milk.

To summarise the main breeding goals in the selection programme, we want:

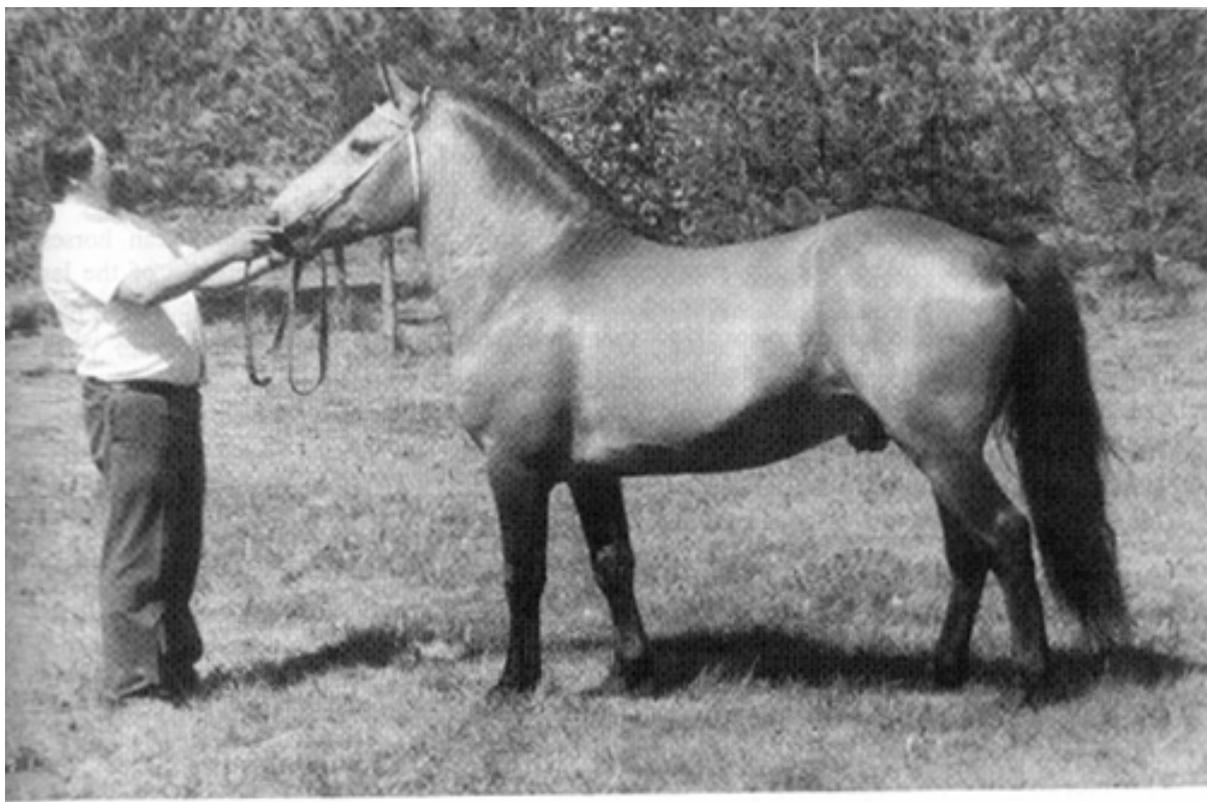
- to increase the number of cows to 2 000. Introduction of embryo transfer is needed to achieve this goal;
- to inseminate all breeding females with the best controlled Finnish Native bulls (about 1 000 doses of semen are needed);
- in order to get tested bulls for insemination the potential dams (with minimum yield 5 000 kg of milk with 5% fat) must be inseminated with the semen from the best Finnish Native bulls (about 40 doses of semen must be purchased).

3.0 THE ESTONIAN NATIVE HORSE

This breed migrated to the Estonian territory with our distant ancestors. The horses were used in land cultivation, transport and wars. Until the 18th century, this small horse was the only horse bred in this area. It was highly estimated because of its good pulling power, resistance and adaptation to poor local management conditions. The horse was used in wars by the Swedes and Peter I, as being very tenacious, compared with other breeds. In 1867 at the Paris World Exhibition the Estonian stallion “Vapsikas” won the first prize. The Estonian Native horse can be considered as a part of our national culture and creative work.

Genealogically, the Estonian Native Horse comes from the Asian-Mongolian horses, but it is mixed with the Northern-European Forest (Wild) Horse. In the middle of the last century the withers height of the Estonian horse was 133-151 cm, with variable hair colour. The horse had a good temperament. Now this horse has mainly been preserved in the island Saaremaa (265 horses, 211 purebreds).

The characters of the Estonian Horse were only slightly influenced by the stallions of the Arabic, Orlov, Danish and Spanish horses. To protect the Estonian Horse from crossing, the Tori Horse Breeding Station was established in 1856. Later on, the new Tori Breed was developed there, using the local Estonian Horse as a basis for breeding.



Stallion of the Estonian Native Horse Breed

The directional selection of a horse was started in 1920, when the breed association was founded. The herdbook was started in 1921.

At present, the average withers height of the Estonian Horse is: stallions 146 cm, mares 143 cm. A lighter type is favoured. The horses are resistant and not too particular about feeding and management conditions. The bay and chestnut colour are prevailing (30% each), black (11 %) and grey (10%). Their constitution is strong and longevity good: they can be used for breeding until the age of 25 years and until almost 30 years for working.

At present the total number of horses is 334, including 271 purebreds. In the herdbook 150 mares and 20 stallions, belonging to 8 genealogical lines are registered.

The breeding goal was established: to keep pure breeding (without crossing) as far as possible. The average inbreeding coefficient is 15%, but no negative consequences have been noticed (decrease in reproduction or performance abilities). The resistance and adaptation to local conditions must be maintained. It is mainly the farm horse, especially for transport on small-size new farms, but also as a sport horse for children and for farm tourists. A State-owned breeding station is needed, where the best breeding animals can be reproduced and distributed from. The computerised field performance recording must also be kept by the breeding station. As the Estonian Horse is mainly located on the island of Saaremaa, the breeding station must be established there. Furthermore a kind of reservation area can be founded on seashore pasturelands and islets.

The detailed breeding programme and gene conservation plan and actions are urgently needed, otherwise this unique breed will become extinct during the next couple of years.

4.0 CONCLUSION

It is clear that the Estonian Native Cattle and Native Horse Breeders' Associations, as well as farmers interested, cannot finance the whole work, which is needed for the conservation of these two breeds. Here we hope to obtain the support and advice from FAO. We have also applied to join the Global Animal Genetic Resources programme.

THE PINEIA HORSE

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SUMMARY

The Pineia horse is a rather small horse bred in a limited population size (373 mares and 6 stallions) in the Western Peloponnese (Greece). It is descended from the Greek mountain pony crossed by anglo-arab, anglo-norman and nonius stallions at the beginning of this century. It is characterized by a robust conformation, a lively temperament and a perfect adaptation to difficult mountainous environments. It is used for vegetation management and pack transport and as a stepping pacer it offers a comfortable ride.

RESUME

Le cheval de Pineia est un animal plutôt petit, élevé en nombre restreint (373 juments et 6 étalons) en Péloponnèse occidentale (Grèce). Il descend du poney de la montagne grecque, croisé avec des étalons des races anglo-arabe, anglo-normande et nonius au début de ce siècle. Il se distingue par sa robustesse, son tempérament vivant et son adaptation à un environnement difficile. On l'utilise comme bête de charge et pour les travaux aux champs. Son allure en amblant offre une monte confortable.

1.0 ORIGIN AND HISTORY

Ileia was famous for its horses. In XIth book of Homer's Iliade King Nestor crows about his victory over the army of Elis (ancient Ileia) and describes the pillage that took place as follows:

“And what a lovely haul.

What plunder we rounded up and herded off the plain!

Fifty herds of cattle, as many head of sheep,
as many droves of pigs and as many goat-flocks
ranging free, a hundred and fifty horses too.

Strong and tawny broodmares every one
and under the flank of many, nursing foals.”

(Trans. Robert Fagles. Edit. Penguin)

Horses have been bred in Ileia from ancient times up to the present day. At the beginning of our century there were two breeds in Ileia: the Andravida horse and the Pineia horse. The former is a rather big horse belonging to the Greek plain horse type and is now almost extinct. The second is a rather small horse and is still being bred.

The origin of the Pineia horse is not certain because of the lack of sources of information. It is considered to belong to the mountain variation of the Greek pony which is descended from the Balkan pony (J. Menegatos, 1985). However, it is a fact that the Pineia horse, as we know it today, is the result of crosses among the native mountain pony and different exotic breeds. It is known that at the beginning of this century both the Ileia horse breeds (Andravida and Pineia) were crossed by anglo-arab, anglo-norman and nonius stallions (Ath. Spiropoulos, 1978; Zafrakas, 1993).

2.0 POPULATION NUMBERS AND DISTRIBUTION

The extension of mechanization in agriculture has greatly contributed to the decrease of the equine population in Greece after the Second World War (table I).

This general tendency has had the same effects on the Pineia horse population. Today, some 700 horses are bred. Among them, 326 are males and 373 are mares. The great majority of the males are castrated. There are only 6 stallions.

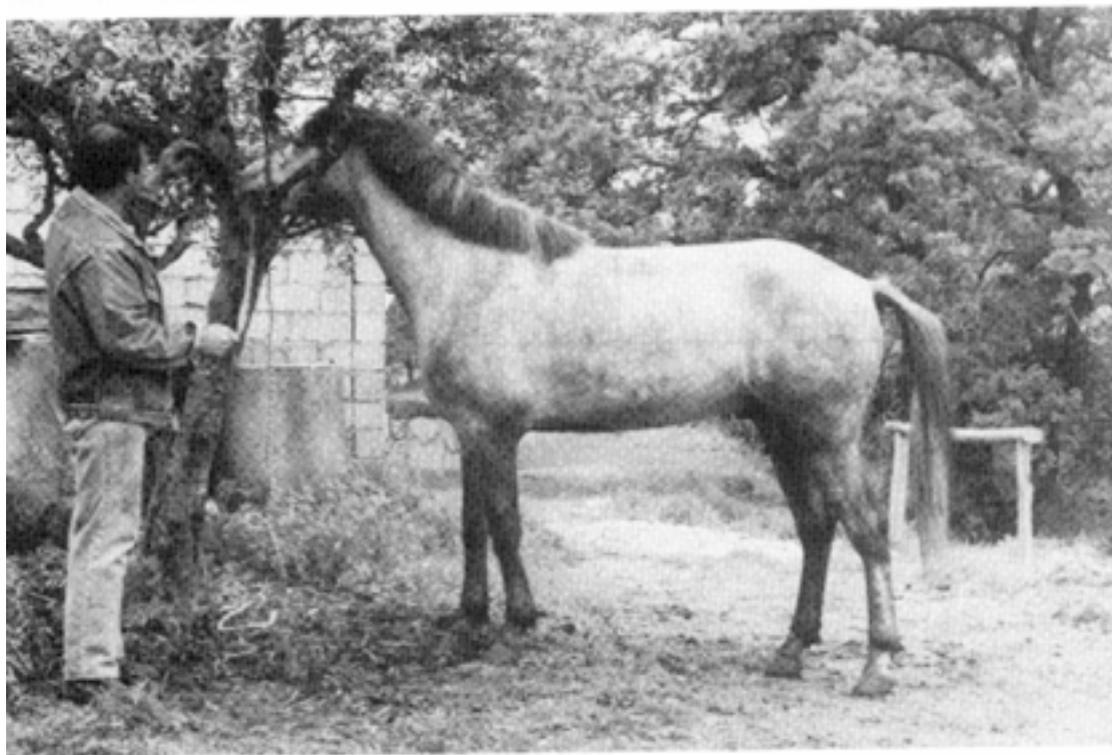
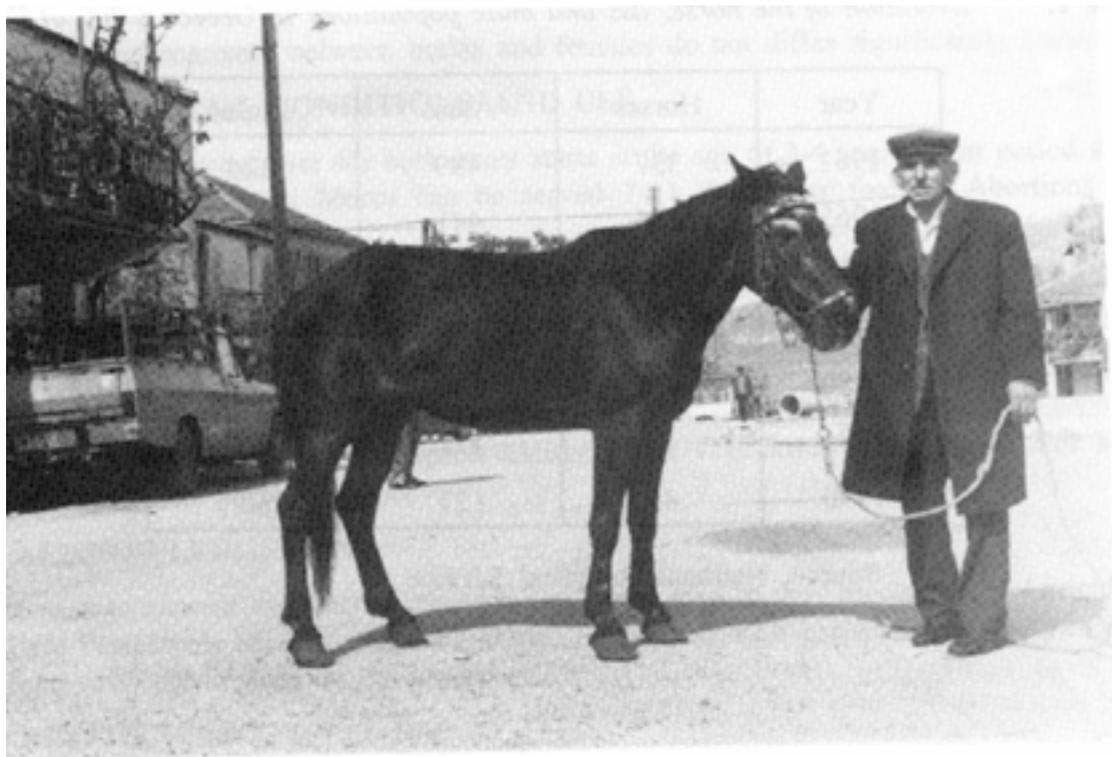
Its area of distribution is the Pineia region, a small mountainous region in the eastern part of the Ileia Prefecture (western Peloponese).

3.0 CHARACTERISTICS OF THE BREED

The Pineia horse is characterized by its vivid temperament and its robust conformation. It is intelligent and is perfectly adapted to the harsh conditions of the environment where it is bred.

It is a rather small animal. It has a well-set head, a long neck that runs back into a good sloping shoulder, a wide chest, powerful quarters and joints and short, strong and clean legs with small hooves (see pictures).

The most frequent coat colours are: grey, roan, bay and chestnut.



The Pineia Horse

TABLE 1:*Evolution of the horse, ass and mule populations in Greece ('000 of heads).*

Year	Horses	Asses	Mules
1961	337	489	226
1965	294	441	213
1970	255	376	183
1975	166	296	147
1980	116	240	116
1985	67	177	84
1990	45	127	60

*Source: National Statistical Service***TABLE 2:***Body measurements in cm (mean \pm S. E.)*

	Males (n=17)	Females (n=9)
Wither height	140.53 \pm 1.53	138.44 \pm 1.09
Girth circumference	161.06 \pm 2.13	157.56 \pm 1.55
Cannon bone circumference	17.71 \pm 0.24	17.44 \pm 0.18
Body length	145.41 \pm 1.21	143.33 \pm 1.31

The stepping pace is another characteristic of this horse breed. Such pacers offer a comfortable ride.

Body measurements between males and females do not differ significantly (table 2).

4.0 MANAGEMENT CONDITIONS AND USE

The reproductive career for both sexes starts at the age of 3-4 years. Heat period starts in March and ends in June. Mares can be served 7-11 days after foaling. Abortions and stillbirths are rare.

From October to March the horses are fed with alfalfa and oats hay (10-12 kg/day). During spring and summer their unique source of feeding is grazing. Only in case when it is not sufficient (especially in summer) do farmers add some concentrates and a little hay to the horse's ration.

The Pineia horse is used for pack transport and vegetation management. For some farmers breeding this horse is a hobby.

5.0 ACKNOWLEDGEMENT

I wish to express my sincere thanks to the agronomist of the Directorate of Agriculture in the Ileia Prefecture, Mr Christos Panagiotou, for his technical assistance, as well as to all the farmers who participated in the inquiry.

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CHARACTERIZATION AND CONSERVATION OF THE MALPURA SHEEP BREED

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SUMMARY

Observations were recorded on morphological characteristics, body weights and body measurements of 344 Malpura sheep belonging to nine age groups during a survey conducted in 18 randomly selected villages of three blocks of the Chittorgarh district of Rajasthan. The body weights at birth, 1, 3, 6 and 9 months and adult weight averaged 3.3, 6.7 ± 0.88 , 12.9 ± 0.71 , 16.4 ± 0.71 , 21.0 ± 1.00 and 31.4 kg respectively. Height, body length, chest girth, paunch girth, face length, face width, tail length and ear length of adult Malpura sheep averaged 63.6, 66.8, 77.1, 80.9, 20.7, 9.8, 30.3 and 6.3 cm respectively. Sex of the animal had significant effect on weight, height, body length and chest girth at 8 teeth stage. Phenotypic correlations of body weight with height, chest girth and paunch girth ranged from 0.76 ± 0.04 to 0.88 ± 0.03 and regression of weight on these body measurements ranged from 0.63 ± 0.02 to 0.98 ± 0.05 .

RESUME

On a enregistré les observations sur les caractères morphologiques, le poids corporel et les mesures de 344 ovins de race Malpura appartenants à neuf groupes d'âges. Cette enquête a été menée parmi 18 villages sélectionnés dans le district de Chittorgarh au Rajasthan. La moyenne du poids corporel à la naissance, à 1, 3, 6 et 9 mois, et le poids adulte est de 3,3; $6,7\pm 0,88$; $12,9\pm 0,71$; $16,4\pm 0,71$; $21,0\pm 1,00$ et 31,4 kg, respectivement. La moyenne de hauteur et longueur du corps, la circonférence du torax et du bassin, la longueur et largeur de la tête et la longueur de la queue et des oreilles chez la race Malpura est de 63,6; 66,8; 77,1; 80,9; 20,7; 9,8; 30,3 et 6,3 cm, respectivement. Le sexe a une influence significative sur le poids, la hauteur et la longueur du corps et sur la circonférence du torax au stage 8 dents. Les valeurs pour les corrélations phénotypiques entre le poids corporel et la hauteur, et la circonférence du torax et du bassin vont de $0,76\pm 0,04$ à $0,88\pm 0,03$ et la régression du poids dans les mesures corporelles est de $0,63\pm 0,02$ à $0,98\pm 0,05$.

1.0 INTRODUCTION

The Malpura sheep breed is very similar to the Sonadi in morphological characteristics but is superior in wool production and quality and in body size. This breed may have evolved from the Sonadi either by natural or deliberate selection for certain desirable characteristics. It is found in East Rajasthan comprising of mainly the Jaipur, Tonk and Swaimadhopur districts but a good number of animals of this breed are also found in the Chittorgarh and Bhilwara district of Rajasthan. Since this area falls under the migratory route of the Marwari breed which is superior in wool yield and hardiness to the Malpura, Marwari inheritance has been introduced initially unknowingly but subsequently by farmers themselves considering the superior wool yield and hardiness qualities of Marwari sheep. This, as well as crossbreeding to some extent with exotic inheritance has reduced the population of this breed. This trend, if not checked, may lead to the endangerment of this breed. Narayan (1956) classified this breed on the basis of habitat, physical appearance and later on Arora et al. (1975) and Acharya (1982) described this breed but all these studies are based on the information recorded under intensive management conditions. So far no effort has been made to study the characteristics of this breed under field conditions. This study was, therefore, undertaken to evaluate the characteristics of Malpura sheep under field conditions and suggest some guidelines for its conservation.

2.0 MATERIALS AND METHODS

A sample survey was conducted during June-July, 1994 in 18 randomly selected villages of three blocks (Barisadri, Doongla, Chhotisadri) in the Chittorgarh district of Rajasthan (India), which is a part of minor breeding tract of the Malpura breed, for recording information on morphological characteristics, body weights and body measurements of animals kept under field conditions. Fifty nine flocks were surveyed and data was collected from 344 Malpura sheep of nine age groups. The flock owners were interviewed to provide information on the breeding of the sheep. It was observed that almost all farmers adopt natural breeding and usually there is one major lambing season (spring) and one major breeding season (autumn), though breeding and lambing throughout the year is not uncommon. A number of observations recorded at birth and at one month of age were less because the survey was conducted in off lambing season. Average flock size was 42 and comprised of Malpura, Sonadi and crossbreeds in the proportion of 24, 35 and 41 percent respectively. The age of the animal was determined by observing the teeth of the animal as well as by making enquiries from the farmers. Information was recorded on the physical characteristics, body weight, height, body length, chest girth, paunch girth, face length, face width, tail length and ear length of the animal. Observations were recorded in the morning before the animals were let out for grazing. Care was taken to exclude the pregnant ewes while taking the body weights and measurements.

The data was analyzed separately for each age group by least squares maximum likelihood method of Harvey (1987) and the model included fixed effect of sex of the animal. The phenotypic correlations among different traits were estimated as product moment correlations. Regression of body weight on height, body length, chest girth and paunch girth was estimated.

3.0 RESULTS AND DISCUSSION.

3.1 Morphological characteristics

Malpura animals are fairly well built with long legs. The body colour is white while the face is light brown in colour. Approximately 94 percent (85-99%) of the body is white in colour and the remaining part is light brown. Ears are short, pendulous with a small cartilaginous appendage on the dorsal side in 7-9 percent of the animals. The tail is thin and medium in length. Both sexes are polled. Fleece is white, extremely coarse and hairy. Face, legs and belly are devoid of wool.



Distribution of the Malpura breed

3.2 Body weight

Body weight of Malpura sheep averaged 3.3, 6.7 ± 0.88 , 12.9 ± 0.71 , 16.4 ± 0.71 , 21.0 ± 1.00 , 27.2 ± 0.84 , 26.1 ± 0.71 , 32.7 ± 2.74 and 37.9 ± 1.86 kg at birth, 1, 3, 6 and 9 months, 2, 4, 6 and 8 teeth stages, respectively (Table 1). Information on body weight available in literature ranged from 2.02 ± 0.85 to 3.2 kg at birth (Dewanji, 1970; Tiwari et al., 1973; Bohra et al., 1979; Nivsarkar et al., 1981; Singh et al., 1984 and Kaushish et al., 1990), from 3.29 ± 1.52 kg to 6.4 kg at one month (Dewanji, 1970; Bohra et al., 1979 and Nivsarkar et al., 1981), from 9.14 to 15.5 kg at 3 months (Tiwari et al., 1973; Bohra et al., 1979 and Sehgal and Singh, 1982) and from 12.57 ± 0.264 to 22 kg at 6 months (Tiwari et al., 1973; Basuthakur et al., 1980; Prasad et al., 1981; Singh et al., 1984; Parida et al., 1985 and Kaushish et al., 1990). Body weights from 9 months to the 8 teeth stage obtained in this study were slightly higher than those available in the literature (Arora et al., 1975; Acharya, 1982 and Kaushish et al., 1990). Male animals had higher body weights as compared to those of females at birth, 3 months, 6 teeth and 8 teeth stages but the differences were significant only at the 8 teeth stage. A non-significant effect of sex of animals on birth weight was also reported by Singh et al. (1984), at one and 3 months of age by Bohra et al. (1979) and at 6 months by Kaushish et al. (1990). On the contrary, significant effect on birth weight was observed by Bohra et al. (1979), Nivsarkar et al. (1981) and Kaushish et al. (1990), on 3 and 6 month weight by Singh et al. (1984) and on 9 month weight by Kaushish et al. (1990).

3.3 Body measurements

Body measurements of Malpura sheep at different ages are presented in Table 1. Average height of the lambs at birth was 35.5 cm, ranging between 44.3 ± 1.86 cm to 58.1 ± 1.11 cm from 1 month to 9 months of age and between 60.8 ± 0.54 cm to 68.5 ± 1.86 cm from 2 teeth to 8 teeth stages. Arora et al. (1975) reported similar heights of Malpura lambs at the 6 teeth stage but slightly more at 2 and 4 teeth stages than those obtained in the present study. Acharya (1982) reported similar heights for the adult Malpura animals. Rams were significantly higher than the ewes only at the 6 and 8 teeth stages.

Body length averaged 31.5 cm at birth, 40.7 ± 2.96 cm at 1 month, 50.1 ± 1.06 cm at 3 months, 55.4 ± 0.84 cm at 6 months, 60.2 ± 0.95 cm at 9 months, 64.2 ± 0.56 cm at 2 teeth, 63.0 ± 0.61 at 4 teeth, 67.7 ± 2.09 cm at 6 teeth and 70.9 ± 2.08 at the 8 teeth stage. The estimates of body length obtained at 2, 4 and 6 teeth ages agreed with the findings of Arora et al. (1975) and at adulthood with that of Acharya (1982). Sex of the animal had significant effect on the body length only at 6 teeth and full mouth stages with males having longer bodies than the females.

Chest girth measured 35.0 cm at birth. Average chest girth at 1, 3, 6 and 9 months was 43.7 ± 4.10 , 57.2 ± 1.24 , 62.2 ± 1.12 and 68.5 ± 1.03 cm respectively. From the 2 teeth to the 8 teeth stages ranged from 73.5 ± 0.73 cm to 83.4 ± 1.67 cm. However, lower estimates chest girth at 2, 4 and 6 teeth ages were reported by Arora et al. (1975) and at adulthood by Acharya (1982) in Malpura animals maintained under intensive management conditions. Rams were significantly wider in chest as compared to ewes ($P < 0.01$) at full mouth stage.

The average paunch girth of Malpura sheep ranged from 31.5 cm at birth to 86.0 ± 3.59 cm at 8 teeth age. The estimates of paunch girth at 2, 4 and 6 teeth stages obtained in this study were higher than those reported by Arora et al. (1975). Males had more paunch girth than females at all ages except at 9 months but the differences were non-significant.

Average face length was 9.5 cm at birth. From one month to the 8 teeth stage, it ranged between 12.0 ± 0.58 cm to 22.1 ± 0.85 cm. Rams had significantly longer faces as compared to the ewes at the 8 teeth stage (25.0 ± 1.69 vs 19.1 ± 0.23 cm).

Average face width from birth to 8 teeth ranged from 6.0 cm to 10.0 ± 0.73 cm for males and from 5.0 cm to 10.1 ± 0.09 cm for females. Differences between males and females for face width were non-significant.

Table 1: Means of body measurements (cm) and body weight (kg) of Malpura sheep

Age	Sex	No.	Body weight	Height	Body length	Chest girth	Paunch girth	Face length	Face width	Tail length	Ear length
Birth	M	1	4.5±0.0	36.0±0.0	32.0±0.0	38.0±0.0	35.0±0.0	9.0±0.0	6.0±0.0	13.0±0.0	4.0±0.0
	F	1	2.0±0.0	35.0±0.0	31.0±0.0	32.0±0.0	28.0±0.0	10.0±0.0	5.0±0.0	13.0±0.0	2.0±0.0
	P	2	3.3±0.0	35.5±0.0	31.5±0.0	35.0±0.0	31.5±0.0	9.5±0.0	5.5±0.0	13.0±0.0	3.0±0.0
1 month	M	3	6.7±0.88	44.3±1.86	40.7±2.96	43.7±4.10	44.7±2.33	12.0±0.58	7.0±0.29	22.3±0.67	4.5±0.29
3 months	M	12	14.3±1.07	51.6±1.60	50.8±1.64	58.8±1.87	64.0±2.13	15.5±0.56	7.7±0.21	25.8±1.22	5.7±0.38**
	F	16	11.5±0.93	48.6±1.39	49.1±1.42	55.6±1.62	59.5±1.84	14.5±0.49	7.8±0.18	25.7±1.06	4.6±0.33
	P	28	12.9±0.71	50.1±1.06	50.0±1.09	57.2±1.24	61.8±1.41	15.0±0.37	7.7±0.14	25.8±0.81	5.1±0.25
6 months	M	5	16.8±1.25	54.4±1.91	54.6±1.47	61.2±1.97	68.4±2.81	17.0±0.63	9.1±0.30	28.8±1.18	6.2±1.16
	F	17	16.1±0.68	54.4±1.04	56.2±0.80	63.2±1.07	67.9±1.52	15.9±0.34	8.8±0.16	27.4±0.64	5.4±0.63
	P	22	16.4±0.71	54.4±1.09	55.4±0.84	62.2±1.12	68.2±1.60	16.4±0.36	9.0±0.17	28.1±0.67	5.8±0.66
9 months	M	6	21.0±1.73	58.5±1.93	60.0±1.65	67.3±1.79	69.3±2.06	16.9±0.71	9.6±0.75	27.8±1.55	5.8±0.56
	F	18	21.0±1.00	57.9±1.11	60.4±0.95	69.6±1.03	72.9±1.19	17.6±0.41	8.8±0.43	27.5±0.89	6.2±0.33
	P	24	21.0±1.00	58.1±1.11	60.2±0.95	68.5±1.03	71.1±1.19	17.3±0.41	9.2±0.43	27.7±0.89	6.0±0.33
2 teeth	F	57	27.2±0.84	60.8±0.54	64.2±0.56	73.5±0.73	80.1±1.02	20.4±1.23	9.6±0.12	29.3±0.53	6.2±0.23
4 teeth	F	55	26.1±0.71	59.8±0.52	63.0±0.61	73.2±0.63	77.2±0.92	18.9±0.30	9.7±0.11	28.6±0.57	6.0±0.22
6 teeth	M	1	38.0±5.45	68.0±3.67**	72.0±4.15**	80.0±4.90	81.0±7.81	23.0±2.11	10.0±0.87	30.0±4.33	7.0±1.19
	F	87	27.3±0.58	60.5±0.40	63.5±0.45	74.5±0.53	79.2±0.84	19.1±0.23	9.8±0.09	29.2±0.46	6.1±0.13
	P	88	32.7±2.74	64.3±1.84	67.7±2.09	77.2±2.47	80.1±3.93	21.1±1.06	9.9±0.44	29.6±2.18	6.5±0.60
8 teeth	M	1	48.0±3.69*	76.0±3.69	77.0±4.13*	91.0±3.32*	92.0±7.12	25.0±1.69*	10.0±0.73	38.0±3.83*	6.5±1.21
	F	64	27.8±0.46	61.0±0.46	64.8±0.52	75.8±0.41	80.0±0.89	19.3±0.21	10.1±0.09	29.1±0.48	6.0±0.15
	P	65	37.9±1.86	68.5±1.86	70.9±2.08	83.4±1.67	86.0±3.59	22.1±0.85	10.0±0.37	33.5±1.93	6.3±0.61
Adult (2-8 teeth)		265	31.4	63.6	66.8	77.1	80.9	20.7	9.8	30.3	6.3

M = Male; F = Female; P = Pooled; Differences between males and females significant * P <= 0.01; ** P <= 0.05

Tail length averaged 13.0, 22.3±0.67, 25.8±0.81, 28.1±0.67, 27.7±0.89, 29.3±0.53, ±, ± .± 28.6 0.57 29.6 2.18 and 33 5 1.93 cm at birth 1, 3, 6 and 9 months, the 2, 4, 6 and 8 teeth stages, respectively. However, Arora et al. (1975) reported on the relatively short tail of Malpura sheep at the 2, 4 and 6 teeth ages. Sex of the animal influenced significantly ($P<0.05$) its tail length only at the full mouth stage (38.0±3.83 cm for males vs 29.1±0.48 cm for females).

At birth, 1, 3, 6 and 9 months, and 2, 4, 6 and 8 teeth stages, ear length averaged 3.0, 4.5±0.29, 5.1±0.25, 5.8±0.66, 6.0±0.33, 6.2±0.23, 6.0±0.22, 6.5±0.60 and 6.3±0.61 cm respectively. Similar estimates of ear length at 2, 4 and 6 teeth were also reported by Arora et al. (1975). Though males had longer ears than the females at all the ages except at 9 months, the differences were significant ($P<0.05$) only at 3 months of age.

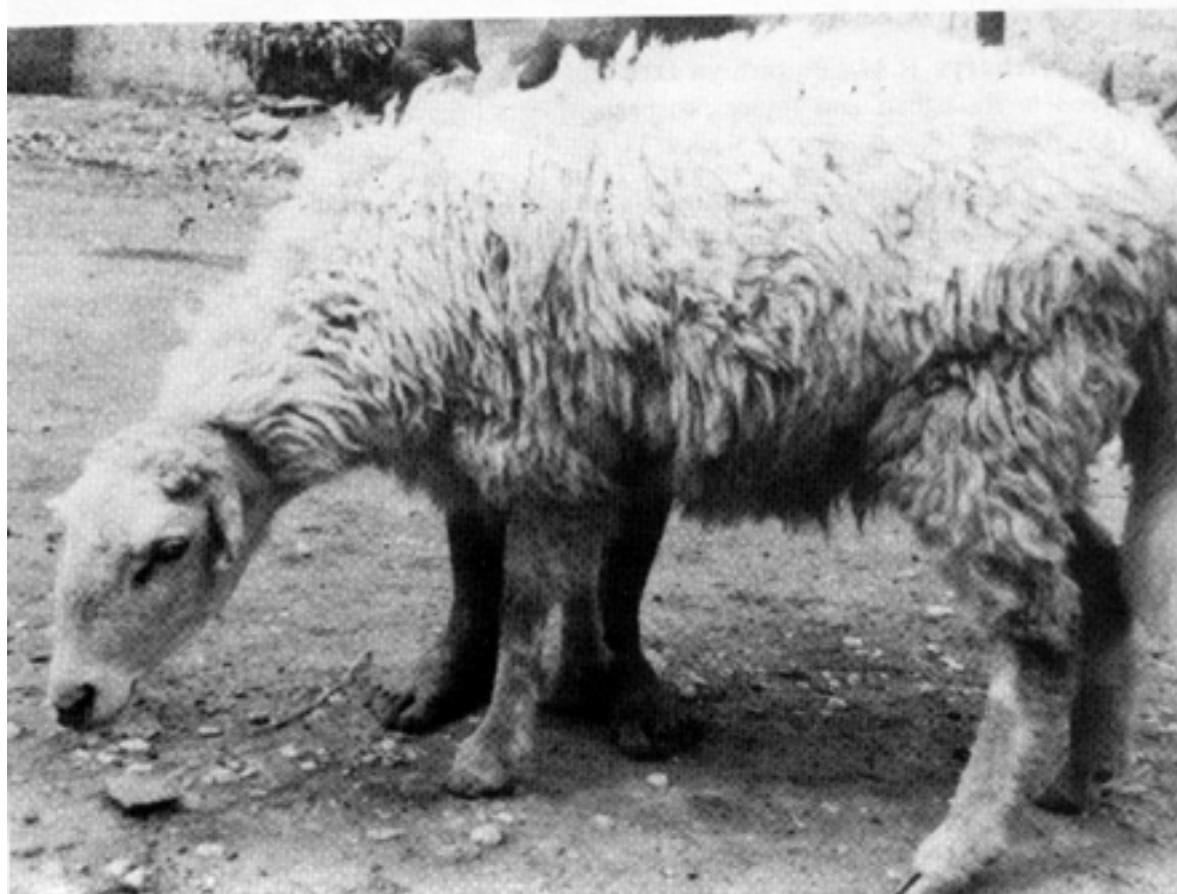
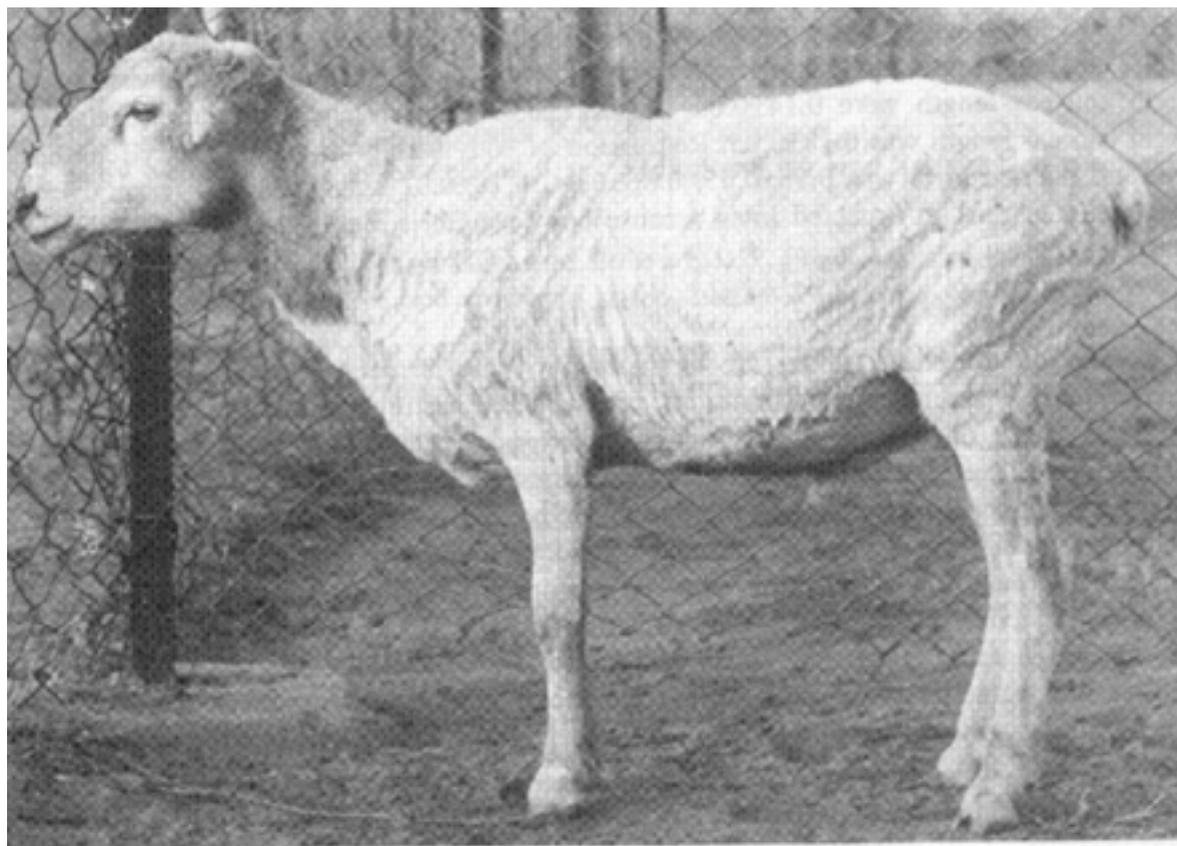
Significant effect of sex was observed on body weight, height, body length and chest girth at the 8 teeth stage with males being superior to females for all these traits, indicating that only selected males (on the basis of body size) are kept for breeding and are provided with better care and nutrition by the farmers. In addition, physiological differences between two sexes may also be responsible for the better body size of males than that of females.

3.4 Phenotypic correlation and regression

As expected, phenotypic correlations of body weight with height, body length, chest girth and paunch girth were very high and ranged from 0.76±0.04 to 0.88±0.03. Phenotypic correlations of body weight with other body measurements like face length, face width, tail length and ear length were medium and ranged from 0.29±0.05 to 0.49±0.05. Correlations of height with other body measurements ranged from 0.34±0.05 with ear length to 0.83±0.03 with body length. Almost similar estimates of correlations were obtained between body length and other measurements (range 0.28±0.05 to 0.81±0.03). Chest girth had phenotypic correlations ranging from 0.31±0.05 to 0.90±0.02 with the other body measurements. Correlation of paunch girth with face length, face width, tail length and ear length ranged from 0.31±0.05 to 0.43±0.05. Face length had correlations of 0.14±0.05, 0.23±0.05 and 0.14±0.05 with face width, tail length and ear length respectively. Phenotypic correlation of face width with tail length and ear length were 0.14±0.05 and 0.21±0.05 respectively. Correlation between tail length and ear length was 0.18±0.05. Regression of body weight on height, body length, chest girth and paunch girth was 0.98±0.05, 0.86±0.04, 0.78±0.02 and 0.63±0.02 respectively. All these estimates are on expected lines because body weight is highly dependent on these body measurements.

4.0 CONCLUSIONS

Though the sheep flocks are maintained by the farmers without scientific breeding under extensive management conditions on depleted pastures without any supplementary feeding for want of resources, these animals performed exceedingly well and were found to be superior to or at par with the animals maintained under intensive management conditions on farms., This speaks of efforts of the farmers in paying individual attention to these animals by grazing them from 9 am to 7 pm and providing them with best (within their resources) management, health care, nutrition etc. The performance of these animals can be improved further by selecting the superior rams from the farmers' flocks and distributing them in the field for propagating the breed. Sustained efforts are needed for providing enough market facilities and remunerative prices of the wool and other sheep products. This will create farmers' interest in rearing this breed in its present form and ensure *in situ* conservation.



Malpura ram and ewe

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Mixed flock of Malpura, Marwari and Sonadi ewes