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ANIMAL GENETIC RESOURCES INFORMATION

BULLETIN D'INFORMATION SUR LES RESSOURCES GÉNÉTIQUES ANIMALES

BOLETIN DE INFORMACION SOBRE RECURSOS GENETICOS ANIMALES

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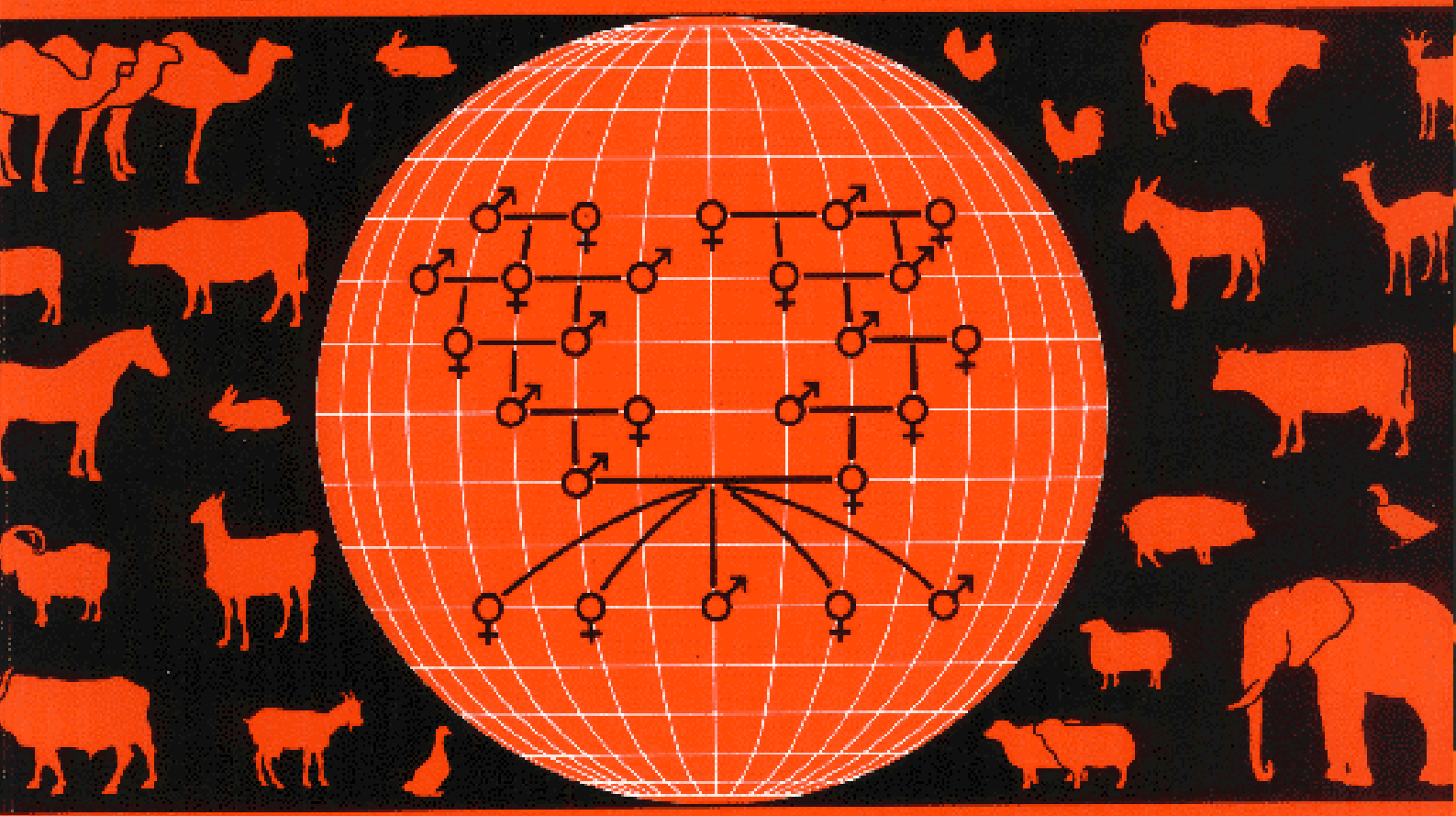

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Organisation des Nations Unies pour l'alimentation et l'agriculture

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CONTENTS

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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 v.

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GUIDE TO CONTRIBUTORS

Animal Genetic Resources Information will be pleased to receive contributions up to 3000 words long in English, French or Spanish. If accepted, they will be published in the original language. Reports, news and notes about meetings, conservation and evaluation activities, and techniques would be appreciated. Manuscripts should be typed in double space and accompanied by a summary of not more than 5 percent of the original length. Photographs are acceptable but only high quality black and white prints. AGRI will also review new books on animal genetic resources. Correspondence is invited.

All contributions should be addressed to:

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Le Bulletin d'information sur les ressources génétiques animales souhaite recevoir des articles en anglais, en français ou en espagnol, de 3000 mots au maximum. Les communications publiées paraîtront dans la langue originale. Les rapports, informations et notes concernant les réunions et les activités de conservation et d'évaluation et les techniques seraient particulièrement appréciés. Les manuscrits devront être dactylographié s en double interligne et accompagné s d'un résumé ne dépassant pas cinq pour cent de la longueur de l'original. Le Bulletin accepte les photographies à condition qu'il s'agisse de bonnes épreuves en noir et blanc. Le Bulletin rend également compte des ouvrages nouvellement parus sur les ressources génétiques animales. Un échange de correspondance est le bienvenu.

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El Boletin de Informaciôn sobre Recursos Genéticos Animales recibirâ con mucho gusto colaboraciones de hasta 3000 palabras de extensiôn en espanol, francés o inglés. Si son aceptadas, las contribuciones se publicarán en el idioma original. Interesa recibir informes, noticias y notas sobre reuniones, actividades de conservaciôn y evaluaciôn, y cuestiones técnicas. Los originales deberân presentarse mecanografiados a doble espacio y acompanados de un resumen que no supere el 5 por ciento de la extensiôn original. Se aceptan fotografias, pero ûnicamente en blanco y negro y de buena calidad. AGRI también publicarâ resenas de libros sobre recursos genéticos animales. Cualquier intercambio de correspondencia serâ bienvenido.

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EDITORIAL

The new Programme for the Global Management of Animal Genetic Resources is in the process of being discussed by FAO Governing Bodies, and it is hoped that its launch can occur during the second semester 1995.

The list of National Technical Focal Points for European countries (Eastern and Western) is not yet completely established. 25 of the 38 solicited countries have already nominated a coordinating national institution, and within this, a Country Contact. These coordinators provide the Nations technical link to FAO Programme and as such are responsible for coordinating all aspects of AnGR activities. As soon as they are known, they are requested by FAO to implement the updating and validation of data already entered for their respective country in the Global Databank for Animal Genetic Resources.

Design of the global information system (DAD-IS) for the Programme is progressing. A new, more user friendly software has been selected (FileMaker Pro) and all the data from the previous Global Database (under DBase III) will be soon converted. Meanwhile work on the other components of DAD-IS is being initiated. For instance, a consultant has just been recruited to design the user interface: the screen from which each of you must be able to enter DAD-IS, not only for consulting the Global Database, but also for accessing all the other modules, such as the training modules, or the aide for design and analysis of research activities. A project document has been prepared and submitted for funding for a pilot phase of DAD-IS in a few countries, presumably in Asia.

The Project Identification Missions on the better management of AnGR are going on regularly. In Central and Eastern European countries, the mission has visited Lithuania, Poland, Czech Republic and Romania, while the French speaking African mission will visit Chad, Mali and Togo. The two fmal workshops are planned, and by the end of April the portfolio of projects proposals will be finalized by these missions, working closely with National Consultants throughout these sub-regions.

Very few of the projected 1200 to 1600 AnGRs globally at high risk have any material stored. To establish guidelines to assist countries through the decision processes for the initiation of an ex *situ* programme, a series of three working groups has been set. The first one, held in December 1995 at FAO HQ, has addressed the genetic basis for such a programme (why to preserve a breed, how to select breeds to be preserved, numbers and type of animals to be sampled...), the present and foreseeable status of cryopreservation, and the health procedures and regulations which need to apply. The second one, to be held in June 1995 at Cicello, Italy, will address all aspects of the conservation of live animals, be it in farm parks or reserves, or via private farmers with or without support from Governments. The third working group, planned for the second semester 1995, will address all the legal aspects (rights and duties of the owner and of the user of a given genetic resource). Reports, conclusions and recommendations of these three working groups will be published as an Animal Production and Health Paper (Red book).

We are completing the series of training courses for the establishment and operation of genebanks and databanks, with a training course for Near East countries to be held in Cairo from 25 April to 3 May 1995.

So, despite all staffing problems, the AnGR Group is progressing.

BIBLIOGRAPHY NOTES

Conservation of Early Domesticated Animals of Southern Africa. Irene Animal and Dairy Science Research Institute. Private Bag X2,1675 Irene. South Africa. 136 pp.

This publication contains the papers presented during a workshop held at the Willem Prinsloo Agricultural Museum in Pretoria in March 1994. The idea behind this subregional conference was to discuss the state of the art of indigenous farm animal populations and their conservation in Southern Africa. The aim was to develop the possibility of establishing a Society with a Constitution to promote and to allow the assessment of the present distribution of endangered breeds and various domesticated local livestock, and sustain the awareness of the need for the conservation of genetic diversity.

An important variety of these early domesticated livestock still seems to be present in Southern Africa. Mostly surviving under difficult, if not poor, envirorimental and management conditions. With the introduction of modern selection techniques pushing towards maximum productivity and the import of highly specialized livestock strains from Europe and North America, the local populations are now marginalized and less and less utilized. The concern over the present demise of these early domesticated local populations is growing and there is overall a major risk of A.G.R. diversity loss.

The conference was opened by the Director General of the S.A. Department of Agriculture and introduced by an invited paper on the prevailing international philosophy and methodology of genetic conservation by Laurence Anderson of Rare Breeds International. Following a most informative review of the archaeological evidence on the existing indigenous livestock on the southern tip of the subcontinent a paper was presented on the prehistory and history of domesticated animals in the region, underlining the need to rescue the existing diversity. A report on the introduction of non-indigenous breeds of livestock completed the session.

Two papers emphasized the methodologies prevailing on matters relating to the identification of animal breeds and the structuring of breeding systems for small populations.

From a practical regional point of view a most valuable report described the experiences and findings of a technical committee, appointed in 1985 to evaluate the contribution made by imported livestock and semen to animal agriculture in South Africa and the desirability of an *in vitro* germplasm bank for Southern Africa. The committee also reviewed the relevant research and technology advances, staff and funding needs. An interesting regional case study underlining the need to follow, simultaneously with a higher productivity policy of imports and sophisticated national selection schemes, a parallel active conservation trend for local A.G.R.

Four case studies completed the plenary sessions, the last one being an interesting approach to profitable and environment-friendly farming systems with local livestock in Southern Africa.

J. Boyazoglu

Genetic Resources in Farm Animals and Plants. S. Adalsteinsson (Ed.). Report from Research Symposium, 27-29 May 1994. Nordic Council of Ministers, Store Strandstraede 18, DK-1255 Copenhagen K (Denmark). TemaNord 1994:603,138 pp. ISBN 929120529X.

Interest in genetic resources of the plant and animal kingdoms has been on active interest in the Nordic countries during the last 25 years. This interest is concretised by the establishment of the Nordic Gene Bank (NGB, Nordisk Genbank), situated in Sweden responsible for conservation of Nordic plant genetic resources, the Nordic Gene Bank for Farm Animals (NGH, Nordisk Genbank Husdyr), situated in Norway, and the Nordic Cooperation Group on Genetics and Breeding of Forest Trees (Nordisk samarbeidsgruppe for skogstraernes genetikk og foredling (NSSGF)).

Five working groups on genetic resources, appointed by the Nordic Council of Ministers , have been at work recently, each producing a report for the Council on specific aspects of genetic resources: The Kolstad Report (1990), on global genetic resources; the Koski Report (1992) on the genetic resources of forest trees in the Nordic countries; the Dermis Report (1993), on strengthening the competence in education and research within the field of genetic resources; the RoaldsØy Report (1993), on an activity programme containing among other issues recommendations for the Dennis Report; and other RoaldsØy Report (1994) on the effect of the Convention on Biological Diversity on Nordic cooperation.

To sum-up the situation a Nordic Symposium on Conservation of Genetic Resources of Plants and Animals was held at the Agricultural University of Norway in late May 1994, on the initiative of the Nordic Council of Ministers. It was organised by the Royal Norwegian Department of Agriculture. The Symposium produced a number of recommendations regarding future conservation policies.

The papers given at the symposium are printed in this publication; they give a broad outline of the type of work carried out in this field, both within the Nordic countries and globally.

The Symposium agreed on a number of recommendations regarding genetic resources activities, which are also presented in the publication. The background on animal genetic resources was in particular discussed by a separate working group during the symposium and the comments made by the group are published as a separate paper.

Overall topics dealt with are: The global conservation of animal and plant genetic resources (two papers); the theoretical aspects of plant and farm animal conservation (two papers); the Nordic scene (two papers); conservation of forestry resources (two papers); methodology of conservation practices (two papers); and an excellent global review of biodiversity using as case study the world s drylands (plants, animals and fish).

This publication is a well prepared to the print summary presentation of the actual state of the art of rural biodiversity conservation with special reference to the Scandinavian countries and their pioneer position in this important segment of agricultural sustainability.

J. Boyazoglu

HISTORY OF THE AUROCHS *(BOS TAURUS PRIMIGENIUS)* IN POLAND

Mieczyslaw Rokosz'

SUMMARY

In the present paper the author submits a short outline of the history of the aurochs in Poland, the country in which that species survived the longest. The last specimen died in the royal forests of Jaktorôw in Masovia at the beginning of the XVIIth century. The sources of the present study are as follows: documents proclaimed by kings, old chronicles, descriptions found in literature, old illustrations, etc. Among the reasons why that species of the relic fauna of the Pleistocene epoch survived so long are those the author draws attention to: i) the special natural conditions, i.e. abundance of forests and climate, offered in Poland, especially in early times, ii) some cultural elements, the latter being of special interest to him. The legal protection extended to the aurochs by the State found its expression in the regale or the king s order concerning hunting of these animals; this was strictly observed, as is pronouncedly recorded in the historical sources which say that in the XIIIth century the aurochs were to be found only in the province of Masovia. The local princes of the Piast dynasty, and later on the kings of Poland, made no concessions of their exclusive right to hunt that animal, not even to the greatest magnates, both ecclesiastical and secular. They themselves never abused the hunting law as far as the aurochs was concerned. Considering the situation of the aurochs in the light of that regale and of the hunting law, the conclusion is offered that the fact of excluding the aurochs from the hunting law and extending to it "a sacred privilege of immunity" which, according to an old custom, only the king was not obliged to obey, was the major factor which contributed to such a long period of survival of that species. This exceptional and almost personal care of the Polish sovereigns for these animals and their intentional will to save them for posterity caused the prolongation of the period of survival of that magnificent species up to the year 1627, in which the last auroch cow died a natural death in her haunts, as is stated in the report of the royal inspection performed in the year 1630.

RESUME

L'article trace en grands traits l'histoire de l'auroch en Pologne; le pays où la survie de cette espèce a été la plus prolongée. Le dernier individu est mort dans les forêts royales de Jaktorôw en Masovie, au début du XVIIème siècle. Les sources bibliographiques utilisées pour cette étude ont été les arrêtés proclamé s par les rois, les vieilles chroniques, les descriptions littéraires, les anciennes illustrations, etc. Parmi les raisons pour lesquelles cette espèce, vestige de faune de l'époque Pléistocène, a pu survivre si longtemps, l'auteur signale: i) les conditions spéciales naturelles offertes par la Pologne, comme l'abondance des forêts et le climat favorable, surtout dans le passé; et ii) quelques aspects culturels qui l'on favorisé, comme la protection légale donnée à l'auroch par l'Etat, sous forme d'arrêté royal en matière de chasse de ces animaux. Cette loi était étroitement observée, ce qui est bien documenté dans les sources historiques qui indiquent qu'au XIIIème siècle l'auroch se trouvait seulement dans la province de Masovia. Les princes locaux de la dynastie Piast, et puis encore les rois de la Pologne, ne concédaient aucun droit de chasse sur cette espèce, ni aux magnats les plus hauts, ni ecclésiastiques, ni séculiers.

' Originally published in Polish in: Chronmv Przvrode Ojczvsta 32(5) p.13-26; translated by Urszula Rayner and commissioned by Charles Maxwell-Smythe, this article was edited by Stephen J.G. Hall (Dept. of Clinical Veterinary Medicine, Madingley Road, Cambridge CB3 OES, United Kingdom).

Eux-mêmes ne faisaient jamais aucun abus de la loi de chasse en ce qui concernait l'auroch. Grâce à cette loi et au "droit sacré d'immunité", droit que seul le roi, suivant un usage ancien, n'était pas obligé à obéir, cette espèce a pu survivre plus longtemps. Les soins exceptionnels et tout à fait personnels offerts par les souverains polonais à ces animaux, ainsi que leur désire de les garder pour la postérité, ont assuré la survie de cette magnifique espèce jusqu'en 1627, quand la dernière auroch femelle est morte dans son antre selon témoignage du rapport de l'inspection royale de l'an 1630.

1.0 INTRODUCTION

The fact of the extinction of the last aurochs *(Bos taurus primigenius)* in the royal forests of Jaktorowski at Mazowsze in Poland at the beginning of the l7th century is well known. It was the last natural reserve of that splendid, once admired animal, in Europe. The original respect for aurochs on the part *of Homo sapiens* is shown in the famous palaeolithic frescoes of Magdalenian Lascaux and Altamira. Detailed and admiring descriptions of this animal are found in the classical writings of Tacitus *(Annales* Il,, 72 and Germania 4-5) Giulius Caesar *(Commentarü de bello Gallico* Il) and Pliny *(Historia naturalis v111,* 38).

Such a lucky long survival of the original species of aurochs in Poland prompts the question "Why?".

Apart from favourable natural conditions, such as the abundance of forest, a favourable climate and so on, there was undoubtedly another equally important cultural factor, namely the legal protection of this state-chosen animal, which has its origin in the deep medieval period.

2.0 THE EARLY TIMES

Early Poland was largely covered with forest and marsh (between two thirds and three quarters, that is 65-75% of the total territory) and was full of all kinds of animals. During this period "the fauna of our country was not only richer in kinds but also incomparably numerous" (Buczek, 1960c). Only after the clearance of large areas of forest connected with the expansion of settlements at the beginning of the l3th century, there was a decrease in the kind and number of the animal population.

It is obvious that already before the l3th century, aurochs were no longer common in Poland (Mankowski, 1904), unlike its close relative the zubr *(Bison bonasus).* According to some researchers, the latter was common all over Poland. Their argument is based on toponymical data derived from zabr=zubr. This seems a weak and risky foundation for supporting the universality of the zubr in Poland. Many of these names could originate from common nicknames of people and not directly from the name of the animal that supposedly lived there (Moszynski, 1959). More critical researchers (Sztolcman, 1926; Heymanowski, 1963) hold the view that the occurrence of the zubr before the l3th century was restricted to a few regions, like Mazowsze and Podlasie.

Aurochs, however, were found only in the Mazowsze region (Masovia), the most afforested part of the country and therefore the least populated one, while "the imagination of our ancestors clothed this forest giant in almost unnatural charm", while some texts compare it to a mythological centaur *(Centaurus seu Bubulis vulgariter aurochs).*

Hunting *(venatio)* as a primary form of exploitation of the primeval forest, together with beekeeping *(melificio),* was probably very important in the economy of early Piast Poland. Anonymous (Gall) in his "Kronica" (Book 1, § 4) reminds us of the well-organized hunting service at the King's Chroby court, which "had ... fowlers and hunters from all walks of life who, each in their own way, caught all sorts of birds and other animals". This picture is typical of the courts of the early-medieval Polish sovereigns.

"Chronicle Kadlubka" (Book IV, § 4) with its account of a draconian system of government

by separate dukedoms under Mieszek III Stary in Krakôw (1173-1177) is convincing proof of the existence of a royal privilege in the Poland of that time. A monarch had the exclusive privilege of hunting a "large animal" on private lands as well as on the sovereign's own lands. In other words, the monarch or prince, or their hunting service, could hunt anywhere exclusively. In practice, the interference of the state was sporadic and limited to some territory, leaving large parts of forest for communal use, although probably only for the hunting of the smaller animals, which could be caught by individual hunters. For example, roe deer were hunted up to the end of the l3th century by the peasants themselves. The royal privilege *(regale)* was respected where a large animal was involved, as this required special hunting skills and organization, and this could not be done in secrecy.

Hunting was regarded as a noble recreation and a preparation for combat, and it also provided a rest from administrative duties and an income for the monarchy (the meat, skin and horns). Animals were protected in some particular cases by the so-called "holly law". This "holly law of inviolability" protected in particular large animals, the noblest and most dignified, and endangered species.

According to medieval documents, the primeval hunting law divided the hunt into *venatio magna or venatio animalium superiorum* and *venatio minuta or venatio* parva. However the aurochs and the zubr, the "principal and patriarchal animals", those "emperors of the primeval forest" as they were so accurately described by Mickiewicz, were excluded from this law (Mankowski, 1904). In Poland these animals were always regarded as being strictly covered by the *regale-ducale* law. Only the monarch could hunt them, which, it seems, was done in moderation.

This hunting custom was probably a legacy from the times before the creation of the state, when it was difficult to hunt individually for a large animal. It needed some organization of people, and leadership. The leader had a right to distribute the bag but also, together with his tribesmen, had a duty to look after the remains of the herd. This primeval custom developed into an observed law in state society, and gave rise to exclusive hunting for the monarch.

In the l3th century, individual provincial princes passed many of their privileges, including hunting privileges, to other nobles. For example, Wladyslaw Odoniec, the Prince of the Wielkopolski region, as seen in the Kronika Wielkolska - a summary of a now lost original document of immunity for the Poznan bishopric from 1232 -, resolved that local bishops "possint venari in quolibet loco episcopatus sui". Similarly, Kazimierz Konradowic, the prince of the Kujawy and Leczyce regions, awarded the local bishop, in the Skierniewicki Documenty of 1250 to the Bishop of Wroclaw, the privilege to hunt all types of animals (ius venari in omnibus silvis ... bestiarum cuiuscumque generis) between Zlotoryja, Ciechocin and Raciaz. In the Welborsk castellany, which according to the law belonged to the bishop, the prince awarded the bishop the full right to hunt all types of animals on the property of the prince, knights or others, in particular in the Sieroslawice forest, where only the bishop was allowed to hunt (specialiter in silvis Syroslave sibi soli Iiceat venari ... bestias cuiuscumque generis) (see Krzyzanowski, 1959; Grodecki, 1959). Lastly, when Henryk IV Prawy in 1290 awarded the Bishop of Wroclaw, Tomasz II, the castellany Nysko-Otmuchôw together with full princely rights they included the right to hunt all kinds of animals. In all the regions mentioned above there were in fact no aurochs. But the princes of the Mazowsze region, where the aurochs took refuge, excluded this animal from the hunting privilege for large animals.

For example, Boleslaw, Prince of Mazowsze, awarded to one of the knights in 1298 the village of Karwowo and Nosarzewo together with hunting privileges *"excepto Pomilione qui dicitur Tur, quem volumus spectare nostrum ad ducatum"* (KDMaz no. XLIII, Mankowski p. 516). Ziemowit Trojdenowicz, prince of Mazowsze, in his Skierniewicki Document of 1359 conferred on the Bishop of Gniezno the freedom to hunt all kinds of animals in the whole region of his principality *"excepta dumtaxat bubula vulgariter tur venacione ...*" (KDW, Mankowski, p. 516).

The prince did not share this *"ducale"* even with the archbishop. Although these are documents from a later period, it can be believed that this was also the case during the earlier reign of Mieszek and Boleslaw.

3.0 THE L5TH CENTURY AND AFTER

The Piast monarchs of Mazowsze so zealously guarded this privilege that they did not share it even with other members of the royal family. For example when Prince Ziemowit in 1359 allowed his aunt Elzbiecia to hunt over the whole territory of his principality, he excluded the aurochs: "Prefatum quoque dominam ducissam venacionem omnium et ferarum solo animali, quod Thuer vulgariter dicitur, dumtaxat excepto..." (KDPol., Mankowski p. 516). Similarly in 1451, when Prince Wladyslaw gave his wife Anna Sochaczewski land and the town of Raciaz together with all legal authority, he reserved for himself the ri ht to hunt aurochs: "venacionibus omnium erarum tam magnarum quam parvarum centauris seu Bubulis vulgariter thur dumtaxat exceptis, quos pro nostris successoribus reservamus" (KDMaz, no. CXCVI). Also, during the Jagiellonian dynasty later, in the Litwa and Podlasie counties, only the monarch had the right to hunt this animal.

These hunting restrictions were designed mainly to protect the interests of the monarch and the state (revenue and food supply). On the other hand, it can be seen that there was a general will on the part of the monarchs to protect these noble and increasingly rare animals for their successors. All the same, the numbers of aurochs and zubr in Poland were decreasing fast, because of general changes in the natural environment. It was the result of the rising economic interference of society, including hunting, as well as a deep passion for hunting on the part of the monarchy.

Kazimierz Wielki's love of hunting is well known from traditional lore that is preserved today and for which there is ample documentary evidence; his hunts in the Niepolomice forest or the traditional autumn deer hunts in the primeval forests by the River Pilica at Przedborze: "from birth he was keen on hunting ... always making sure that nobody could interfere with his favourite hobby ... Those who interfered with his entertainment could never be forgiven". It is enough to look through the Dlugosz itinerarium of Jagiello or through the accounts of the court to see how much time and expense was devoted to that favourite entertainment of the King. But this activity was not purely for entertairiment; it combined pleasure with duty. Before the great war with the Monastery of the Black Cross in 1409, the King organized a great hunt to provide his army with meat. Dlugosz (Annales, 1409) talks about the King's war conference with Prince Witold of Brzesc, and his hunting expedition afterwards to Bialowieza, where while enjoying himself for eight days he killed a lot of animals which were then sent down by the Narwia and Wisla rivers to Plock as provisions. There is a related legend about one of the oldest oak trees in the Bialowieza forest, which was destroyed by the late October hurricane in 1974. The same legend talks about another old tree of the Niepolomiecki forest, also called the King's oak or Jagiello's oak, growing on the so-called Gibiela.

The King distributed much of the spoils of the hunts. For example Kazimierz Wielki, Jagiello, Kazimierz Jagielloncyk, "great hunters as well as famous knights", gave away part of the spoils to the bishops and other people of rank in the Kingdom. Sometimes he sent some of it abroad as a present. In the winter of 1417, at the time of the council in Konstancja, Jagiello ordered three zubr from Litwa (Lithuania) (since there were no more in Malopolska) to be delivered to Krakôw, intending to send them to Konstancja. One was to be a present for King Zygmunt Luksemburski, another for the King of England, and the third for the Polish delegation to the council. It became a sensation, according to one of the members of the council, Ulryk von Richental:

"On Friday 9th February 1417, the King (Zygmunt Luksemburski) received a present, a huge animal captured in Litwa by the King of Poland, who captured three animals like this alive ...

This animal looked like a big, black ox, but with a larger head, fatter neck, wider breasts and two small, pointing horns in a forehead about a foot apart, and a short tail. It was similar to an ox which is known in Poland as an aurochs. They took out its bowels and filled it with fresh roots and herbs. It was sent down the Rhine to the King of England and word was spread so that everyone could see it .. " (Dabrowski, 1923).

From the above description it is obvious that the Europe of that time, except Poland, knew neither aurochs nor zubr. An indirect indicator of the use of spoils for provisions in the Middle Ages is the well documented fact of well-organized transport, called chivalrous transport. It was the fastest means of transportation, uséd particularly for food.

There is another example of the fact that these animals were unknown to Renaissance Europe. Erazm Ciolek, bishop of Plock, a diplomat and humanist, was a representative of King Zygmunt in Rome in 1518-1522. When Pope Leon X watched a bull fight, comparisons were made to the Polish hunt for aurochs. The Pope, who was a keen hunter, took a great interest in it, and even asked for the stuffed animal to be sent to him so that he could see it. Ciolek asked his house poet, Mikolaj Hussowiecki, to write a poem about the aurochs, dedicated to the Pope. The Lithuanian Hussowiecki, probably a son of Alexander Jagiellonczyk (one of the King s officials and responsible for hunting) was trained by the side of his father and knew well all the "old hunting customs" for the large animal, called also "Diana's craft". He wrote the poem "De *statura, feritatea ac venatione bisontis",* based on reflections from his childhood and full of realistic expressions. Unfortunately, the huntsman Pope died before seeing it. Hussowski published it in Krakôw in 1525 and dedicated it to Queen Bona. This was the first Polish printed publication about hunting (Plezia, 1925; Chrzanowski, 1930).

Eight years earlier, in 1517, the Haller publishing house printed a work by the Master of the Krakôw Academy, Maciej from Miechôw: *Tractatus de duabus Sarmatüs Asiana et Europiana et de contentis in eis,* which became a scientific sensation. In the description of the Great Lithuanian Principality we read as follows: "There are large territories covered with primeval forest, completely unpopulated, spreading for 10, 15 and sometimes 25 miles. Only the boundaries of the forest are inhabited. The forest is populated with many wild animals. There are forest oxen, called in the language of Lithuania tury and zumbrony (aurochs and zubr)... etc. (Miechowita, 1974).

This information is imprecise. One can conclude from it, although there is no other written proof, that these animals were found in the Lithuanian forest at the turn of the l5th century (which is not contradicted by Buczek, 1960). However, there may be some information supporting the presence of the aurochs in the bordering forests of Podlesie. These facts reiate to place names. For example, the names Turowisko and Turzycowisko (from tur=aurochs), the name of a range in the Bialowieza forest. On the other hand, there can be another more probable conclusion from the information supplied by Miechowita. It is that these aurochs were in fact only bison.

The fact that both animals were unknown in Europe for a long time contributed to the confusion between them. They were regarded by many to be one and the same animal. However, Zygmunt Herberstein, a diplomat who represented the Emperor Maximilian of Vienna in Moscow ,during 1516-1551 and visited Poland several times and even took part in the Polish monarch s hunts for aurochs, included in his Rerum Moscovitarum Commentarü (about 1556) two drawings, one of the aurochs and one of the bison, underlining the differences. Above the aurochs he writes "Urus sum polonis tur, germanis Aurox. I gnari bisontis nomen dederant (my name is Urus, in Polish I am Tur, in German Aurochs. Ignorants call me Bison). Above the bison he writes "Bison sum, poloni suber, germanis bisont. Ignori turi nomen dederunt" (my name is Bison, in Polish Zubr. Ignorants call me Aurochs) (Gloger, 1903; Brnckner, 1929).

According to Herberstein, the aurochs existed only in Mazowsze (central Poland) in his time,

but the zubr was in Lithuania, Podlesie, Mazowsze around Sochaczewo and Ostroleka, and in the primeval Skawanski forest by the River Skwa. Except for Lithuania and Podlesie, they survived longest in the primeval Kurpiowski forest until the l7th century (Sztolcman, 1926). Proofs of the existence of this animal in the Mazowsze region at the end of the l5th century are the numerous mentions of it (tigris alias zubr) in the account book of Janusz II, prince of Mazowsze, and in bills of the King dated 1478.

The nuncios of the Pope and diplomats to Poland often mentioned these animals in their letters as the greatest attractiori of Poland. Mucante describes King Zygmunt III's reservation, situated about two miles from Warsaw, where he has seen aurochs. Gratiani talks about places in Mazowsze by the River Rava that are full of aurochs herds, and states that it is a capital offence for anyone other than the King to kill an aurochs.

The earlier game laws regulated the protection of animals, particular big game and game in forests belonging to the King. To enforce all these laws there was a large administration overseeing hunting. The inhabitants of the villages nearby were free from some of the obligations to the King in return for protecting the animals. The Spear Act (rule 32) of Zygmunt Augustus (1557) forbids village people to go to the forest, without an official permit. While in the forest nobody, not even a forester, may have a harquibus or dog with him, to stop him from killing an animal. On his own fields a subject could kill only small game and birds (Jablonowski, 1910).

So the King's prohibition or regale on the big animals did not change. Gratiani continues that only the King and some nobility would eat the meat of the aurochs and the zubr. They "put it out into the frost" and its taste is not very different from beef. He describes bison in the following way: "... its appearance and strength more fierce, its neck open and wide, its drooping horns, larger than the aurochs's, its colour black, with small ears, enormous shining eyes, and a gloomy look".

At the turn of the l6th century, the last few herds were left in the Jaktorowski primeval forest. From comparisons made between documents of the Princes of Mazowsze between the l3th and l5th centuries and those of the Kings dating from the second half of the l6th century, the conclusion can be made that there were significantly fewer aurochs in the Mazowsze region. They were found only in the small region between Radziejôwka and Kuklôwka (tributaries of the River Pisa, itself a tributary of the River Bzura), between the three villages of Jaktorôw, Kozlôw, and Wiskidka or Koscielne. The main concentration was near Jaktorôw. The inhabitants of those villages were preoccupied mainly with hunting. They were free of any obligations towards the state except to support the King's hunts and to protect the aurochs. One of their duties was to supply hay for the animals during winter.

4.0 THE END OF THE ROAD

According to inspections from 1564 from the village of Kozl6w, "eight 'wlôk' (old measure of area = 16.8 hectares) were given to village gamekeepers, who do not pay any taxes, but only look after the aurochs. In the Jaktorôw there are many fields where *grass is* grown only for aurochs". Further on we read:

"In the Jaktorowski and Wislicki primeval forests, we found a herd of about 30 aurochs. Amongst them were 22 mature cows, 3 young aurochs and 5 calves. We could not see any mature males, because they had disappeared into the forest, but we were told by the old gamekeepers that there are 8 of them. Of the cows, one is old and skinny, and will not survive the winter. When we asked the keepers why they are skinny and why they do not increase in number, we were told that other animals kept by village people, horses, cows and so on, feed at places for aurochs, and disturb them".

According to the law it was forbidden for the villagers to keep large numbers of domestic animals and to graze them in the forest, "to keep [the forests] free for the aurochs and to prevent them being disturbed by other animals". In 1597 an incident occurred when locals used these

fields for their own flocks. The representative of the King seized them and the villagers had to appear in court.

Another audit of the King's property comes from the Rawski region. The exact figures are given of what was probably the last herd in the Jaktorowski forest. In it we read that in 1602: "There are three males and one female left. The reports say that there were man more but the "illness" spread among them from other cows, and many have died".

Eighteen years later we read that only one female is left. Four males have died; the last of them probably shortly before 1620. Its antlers according to the old custom were set in metal and sent to King Zygmunt. They spanned 46 cm. At present they are in the King's armoury in Stockholm. In 1976 they were shown at the Wawel [the castle in Krakôw] during the exhibition Art of Waza. The sign engraved into the metal ring reads: "Horn of the last aurochs of Sochaczewski primeval forest, sent by the woiwod of the Rawski province, Stanislaw Radziejowski, the starosty of Sochaczewo, in the year 1620".

In 1630, the King's inspector of Jaktorow found out from the local people that the remaining female had died three years earlier in 1627. The inspection of Kozlôw in the same year mentions the local people who in the past used to look after the aurochs.

This is the end of the story of the aurochs.

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GENETIC IMPROVEMENT OF DUAL PURPOSE CATTLE IN LATIN AMERICA

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SUMMARY

In June 1994 a group of Latin American geneticists met in Venezuela to discuss the current state of knowledge and priorities for research in the genetic improvement of dual purpose populations. The group also included specialists in the fields of economics, extension and production systems, so that the views of the geneticists were constantly confronted with the practical realities of the field. This paper summarizes the conclusions and recommendations of the group. The bibliography provides a list of key references which cover the majority of the scientific evidence upon which the conclusions are based. The two main conclusions arrived at concerned education and information dissemination: i) an unacceptably wide gap exists between current knowledge on genetic (as well as other) aspects of dual purpose cattle and the teaching curricula of most institutions of higher education in the region. There is an urgent need to introduce up-to-date information on this topic into the education system at all levels. ü) A serious effort should be made regionally to increase the number and quality of scientific and extension publications in this area, and to encourage the exchange of information between research workers.

RESUMEN

En junio de 1994 tuvo lugar en Venezuela un encuentro entre genetistas de América Latina con el fin de discutir sobre el estado actual de los conocimientos y prioridades para la investigación sobre la mejora genética de las poblaciones de doble propósito. En la reunión participaron también especialistas pertenecientes a los campos de la economía, la extensión y los sistemas de producción; esto permitió enfrentar continuamente los puntos de vista de los gentesitas con la realidad práctica del campo. Este artículo es un resumen de las conclusiones y recomendaciones del grupo. La bibliografía proporciona una serie de referencias clave que cubren la mayor parte de la realidad científica sobre la cual se basan estas conclusiones. Las dos conclusiones principales a las que se llegó se refieren a la educación y la divulgación de la información: i) existe una laguna inaceptable entre los conocimientos sobre los aspectos genéticos (así como sobre otros) de la ganadería de doble propósito y las enseñanzas de la mayor parte de las instituciones superiores de la región. De ahí la necesidad de introducir urgentemente en los sistemas de educación, a todos los niveles, una información actualizada sobre estos temas; y ü) debería realizarse un esfuerzo a nivel regional para incrementar el número y la calidad de las publicaciones científicas y de extensión sobre estos temas, al mismo tiempo que se fomentaría el intercambio de información entre las personas que trabajan en investigació n.

1.0 INTRODUCTION

Dual purpose cattle production systems are of undisputed importance for development in the Latin American tropics. However, the scientific basis for their improvement is inadequate, especially in the area of genetics. In June, 1994, a group of scientists met in Maracay, Venezuela, to discuss the current state of knowledge and priorities for research in the genetic improvement of dual purpose populations. As well as geneticists, the group included specialists in the fields of economics, extension and production systems, so that the views of the geneticists were constantly confronted with the practical realities of the field. This paper summarizes the conclusions and recommendations of the group. The bibliography provides a list of key references which cover the majority of the scientific evidence upon which the conclusions are based.

2.0 DEFINITION OF 'DUAL PURPOSE'

The term 'dual purpose' was defined as the simultaneous production of saleable milk (i.e. extracted from the cow) and of meat derived from males slaughtered as steers or bulls and culled cows.

It was agreed that the term itself has no specific connotations regarding the level of intensity of the system, the genotype of animal or the management practices used.

However, in the Latin American tropics, dual purpose systems are characterized by relatively moderate or low intensities of use of external inputs. Diets are based widely on pastures or fibrous crop residues. Animals are generally crossbred with variable grades of zebu, criollo and European breed inheritance. They are usually milked by hand in the presence of their calves, which are raised by restricted suckling. Males are not necessarily finished on the farms of origin.

3.0 IMPORTANCE IN TROPICAL AMERICA

About 75% of the cows milked in tropical America are estimated to be dual purpose. Their importance is not only numerical. There is also an increasing degree of consensus among specialists in different disciplines that dual purpose systems offer the best prospects of producing milk and meat from local resources at prices which are within the reach of the majority of consumers. The more efficient utilization of crop residues and of pastures including legumes, either alone or in rotation with crops, can play an important role in the improvement of the sustainability of production systems in general. Furthermore, increasing the productivity of pastures on cleared tropical forests in the region would be expected to reduce the pressure for further deforestation.

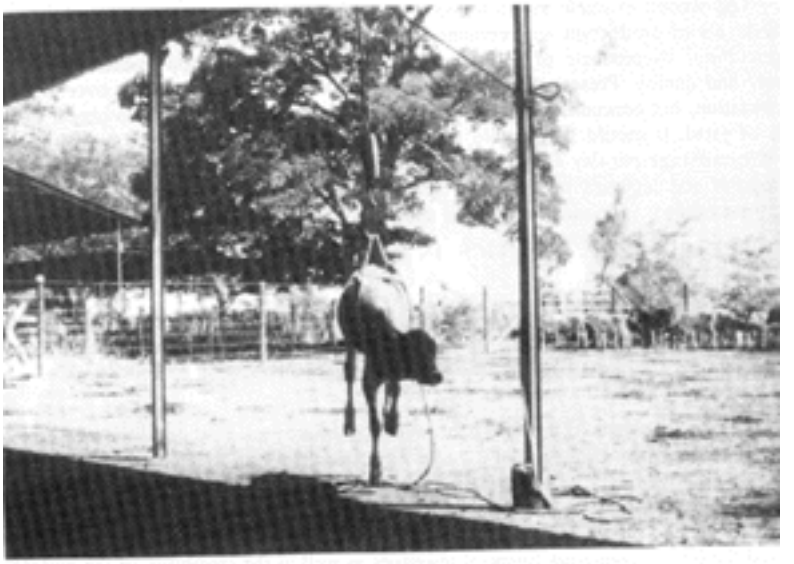
Existing dual purpose systems are highly variable, even within small geographic areas. Flexibility is one of their main advantages. They allow farmers with different physical resources and managerial capacities to respond to fluctuating market requirements as best suits them. Development programs, including the genetic components, should recognize the importance of this variability and encourage it, rather than aim at uniformity.

4.0 OBJECTIVES OF THE GENETIC IMPROVEMENT PROGRAM

The final objective of any genetic improvement scheme for cattle must be to improve the quality of life of the different strata of the human population over the short, as well as the longer,. term. The continuing increase in the proportion of Latin American urban populations which live in extreme poverty makes it essential to take the interests of consumers as well as producers into account.

The importance of generating animals capable of making efficient use of locally available resources was emphasized. The high foreign debts of the majority of Latin American countries, the insufficient supplies of grain for human consumption and the rising pressure on land for agriculture, horticulture and urban expansion must all be taken into account. It was concluded

Cows



Calf weighing

that cattle production systems will continue to be based on grazed pastures and/or agro-industrial by-products in the near future, using feed resources of moderate rather than high nutritive value.

5.0 GOALS

On the basis of the foregoing considerations, two examples of reasonable development goals were put forward. The first refers to mixed production systems, where cattle are kept as a complement to crops such as cereals or sugar, or where they are kept on pastures of poor quality. The mean levels of production in such cases often vary between 500 and 1 000 kg milk/lactation in one milking/day and males reach their final weight at more than 3.5 years of age. It .was proposed that a reasonable goal for such systems would be 1 800 kg milk/lactation with restricted suckling, calving intervals of 14 months and males reaching 450 kg at 3 years old.

The second example refers to systems used under more favourable conditions where higher levels of production are economically feasible. Cattle are kept on improved pastures or agricultural by-products of better nutritive value, with feed supplements which vary in quantity and quality. Present mean levels of production vary from 1 500 to over 2 500 kg of milk/lactation, but concentrate feeds derived from grains are widely used to obtain the higher levels of yield. It should be possible to achieve yields of 2 000 to 2 500 kg milk/cow/year with two milkings per day and restricted suckling, using strategic supplementation based on by-products and legumes rather than cereals. At the same time, average calving intervals should not exceed 14 months and males should be finished by three years of age.

6.0 THE ROLE OF GENETICS IN THE DEVELOPMENT OF PRODUCTION SYSTEMS

Very strong support was expressed for the view that there are always worthwhile measures which can be taken in the area of genetic improvement, whatever the level of development of the population in question. Even the simplest of actions (such as culling unproductive cows) can be highly beneficial.

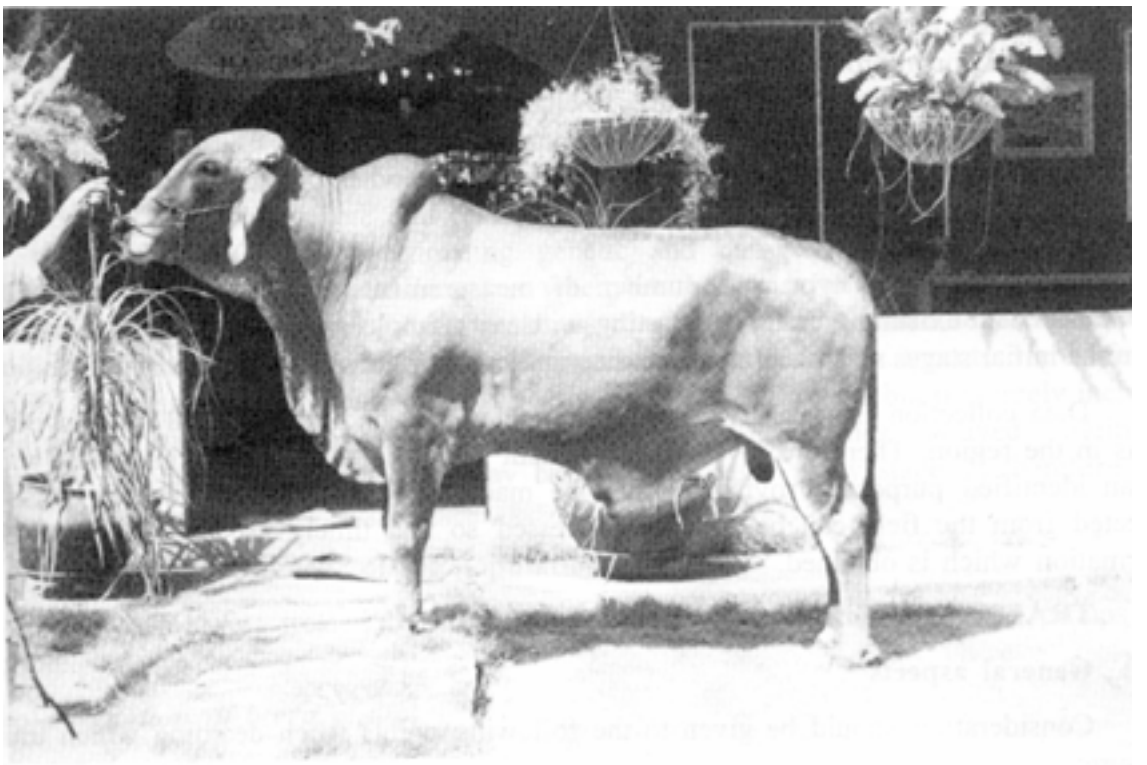
It was, nevertheless, recognized that genetic improvement is only one of the elements essential for progress. Unfortunately, Latin American governments have repeatedly resorted to changing the genotype of local cattle populations in the hope of solving problems which are mainly attributable to feeding, management and health, rather than to genetics. The failure of so many genetic programs in tropical countries is the result of errors of this type. They have involved the loss of enormous financial resources as well as the credibility of the professionals concerned.

The role of genetic improvement must be considered in the specific context of the production system in question, and of local conditions. Progress will depend on how well the genotype of the animals used matches the rest of the system's inputs. Important opportunities were identified for improving the efficiency of the use of existing resources, without massive injections of new capital. Such measures include the better utilization of improved forage species, including legumes; the use of strategic supplementation to optimize the efficiency of utilization of the fibrous basal diet; preventive medicine and the selection of breeding stock.

7.0 PERFORMANCE RECORDING

The complexity, type and number of measurements should be decided in strict accordance with existing conditions, starting with very simple programs in populations which are at the initial stages of development, and complementing them later on as conditions permit.

Data collection is expensive, especially under the conditions typical of dual purpose farms in the region. Therefore, every measurement which is taken in the field must be used for an identi-



Crossbred bull (F_1 Brown Swiss x Red Brahman)

Zebu cows

fied purpose. Provisions must be made to ensure that all records which are collected from the field can be suitably processed so that timely use can be made of the information which is obtained.

8.0 TRAITS TO BE MEASURED

8.1 General aspects

Consideration should be given to the following points when deciding which traits to measure:

- the stage of development of the population in question, and
- the specific purposes of collecting the data

8.2 Objectives

Three possible objectives of performance recording were identified. More than one of these often applies to the population under study:

- herd monitoring, for development and technical assistance purposes,
- research in the area of genetics (or others), and
- genetic improvement of the population

8.3 Herd monitoring

There is consistent evidence that very high variation is found between and within farms, as well as breed groups, for milk yield, fertility, survival and growth. Extremely low levels of performance are frequently observed independently for all these traits. Thus, any one of them alone can jeopardise the economic viability of the whole system. Herd monitoring programs must therefore include measurements on all four traits as a minimum requirement. The value of obtaining economic data in addition to the biological information was also emphazised, even though the difficulty of doing so in many cases was recognized. Gross margin (gross income less variable costs) was considered to be the single most important economic indicator, and efforts should be directed to measuring this as a minimum.

8.4 Research

Reliable information on the genetic and non-genetic factors which affect the four basic biological traits of economic importance in Latin American dual purpose populations is very scarce. Priority should therefore still be given to these traits, particularly to quantifying the sources of variation, and to estimating genetic and non-genetic parameters, including correlations. Opportunities should be taken wherever they arise to generate complementary information on other characters. A particular need was identified for additional information on milk solids content, carcass quality, parasite resistance and economic aspects. Herd life was identified as one of the traits which most directly affects overall merit, but it is rarely included in the routine measurements of survival because of the difficulties involved. Additional information on herd life, and how it may be estimated at an early stage, is therefore also urgently required.

8.5 Genetic improvement of the population

This theme was treated by considering separately evaluation of breed groups and selection.

8.5.1 Evaluation of breed groups

- Basic information

An essential prerequisite for breed group evaluation is that enough general information should be given to allow proper interpretation of the results. There has been an enormous loss of valuable information throughout the region because of inadequate attention to this point. Data generated from one breed group alone are of limited value, however well the environmental conditions are described. Comparative results from two or more breed groups are far more useful. In order to interpret the results, information should be given on the genetic base of each group (i.e. origin, number of sires represented in each group, selection intensity); the extent to which the groups are contemporary; management (with special reference to milking, calf rearing, health and reproduction), and feedirig. Details should be provided on the data editing process, particu-

larly with regard to the numbers and reasons for omitting records from the analysis. It is not necessary for environmental conditions to be the same for all groups, provided differences are clearly described. For example, a comparison may validly be drawn between zebu cows milked with calves present and crossbred cows milked alone, as long as the management information is provided and taken into account in interpreting the results.

- Biological traits

Comparisons between breed groups must include information on the four basic biological traits (milk yield, fertility, survival and growth), because of the very high variation usually observed between groups for all of them. The absence of data on any one of these traits can lead to completely erroneous conclusions about the comparative merits of the groups under consideration. The importance of herd life was indicated above (8.4). Information on this and other characters should be included in comparisons whenever possible.

- Economic measurements

Greater importance should be given to the inclusion of economic data when comparisons are made between breed groups. Information on different groups kept in different production systems is valuable but should not be confused with results obtained from different groups kept together on the same farms. Comparisons of the latter type depend on the correct adjudication of costs to each group in the herd, which is not easy to achieve. Particular care should be taken to record costs of those items which are most likely to be affected by genotype supplementary feed at all stages of life, medicines and veterinary care, labour, bulls and semen, and cow depreciation.

Economic information must always be accompanied by biological data so that it may be interpreted and extrapolated correctly. The major changes in costs and prices which occur in tropical countries (eg: subsidies on concentrate feeds) can easily result in changes in the relative merits of the genetic groups under comparison.

8.5.2 Selection

Selection programs should include the same basic four traits (milk yield, fertility, growth and survival), although their relative importance will vary in each region. It is recognized that this recommendation differs from usual temperate region practice, especially with regard to the inclusion of fertility and survival. However, each trait is of indisputable economic importance and, as indicated above, highly variable. There is sufficient evidence of genetic variation in fertility and survival in tropical American populations similar to those used in dual purpose systems, to warrant their inclusion in selection programs (see also Section 11).

9.0 GENETIC RESOURCES

9.1 General considerations

Genetic improvement plans should use the cattle population which exists in the region as a base, and apply selection and possibly crossbreeding programs to this local foundation. The replacement of the female population by, for example, importation was not regarded as an economically viable option for development schemes.

Great emphasis was attached to genotype environment interactions. The successful choice of breed group will depend on the precision with which field conditions are assessed. However, conditions are highly variable within localities and should tend to improve over time. Consequently, it is a mistake to plan for populations to be racially uniform or static. Rather, at any given moment in time, different genetic options must be available for producers whose herds are at different stages of development.

The acceptability of a given breed group is also dependent on the mating system which is required to generate and improve it. Thus, the choice of group will depend, among other things, on how easily the corresponding mating system can be put into practice by farmers.

The variation in performance traits within breed groups is very high and usually more important than the variation between them. Within reasonable limits, therefore, the precise composition of the breed group is less important than the effectiveness of the genetic improvement program to which it is subjected.

9.2 Zebu populations

Attention was drawn to the important production potential of the undefined zebu type populations which are found throughout the region, and to the fact that their potential is generally underestimated. Their superiority to European crossbreds in terms of a combination of milk yield, fertility and calf weight, has been demonstrated under non-intensive conditions. Although selection is required, these populations should not be replaced without clear evidence that this is justified, particularly in cases where environmental conditions cannot support yields much above 1 000 kg milk/cow/year.

With regard to the zebu breeds which have been selected for milk, such as the Brazilian Gir, very high individual yields have been recorded. However, the probable impact of these breeds on dual purpose populations is unclear. In the first place, despite the outstanding performance of a large number of individual cows, a precise estimate of the merit of the whole population is difficult to make because quoted records are very often selected. Secondly, the high levels of milk yield which are achieved are associated with the heavy use of concentrate feeds. This converts the production system into one which is more intensive than those of most dual purpose farms, and which are probably only sustainable because of the sale of breeding stock. Thirdly, the advantages of these breeds in terms of fertility, survival, growth and age at first calving have yet to be demonstrated. Finally, although genetic evaluation programs for bulls and cows are in operation, populations are small and the problem of availability of breeding stock of known genetic merit at reasonable prices persists. There is an urgent need to demonstrate the true role of these valuable genetic resources in the improvement of dual purpose populations in the region.

9.3 Criollo populations

Very little information is available on the comparative performance of pure or crossbred criollos in dual purpose systems. Data on their survival and growth are particularly scarce. Where numerically important nuclei exist, their role either pure or as crosses for use in dual purpose systems should be established. In general, however, their impact is likely to be limited because of their small numbers. In most parts of the region, *Bos taurus* (European) *x Bos indicus* crosses are far more numerous and will generally provide strong competition as the type of animal preferred by producers.

9.4 European breeds

Abundant biological and economic data are available to show that pure European breed cattle are not suitable for dual purpose systems such as exist now in the Latin American lowland tropics, or are likely to develop in the near future. The high costs of production in the more temperate regions of tropical countries also make it probable that the present tendency will continue to displace milk production from the highlands to the lowlands. Crossbred animals, especially those derived from *Bos taurus x Bos indicus,* are thus likely to become proportionally even more important.

9.5 *Bos taurus* x Bos *indicus* crossbreds

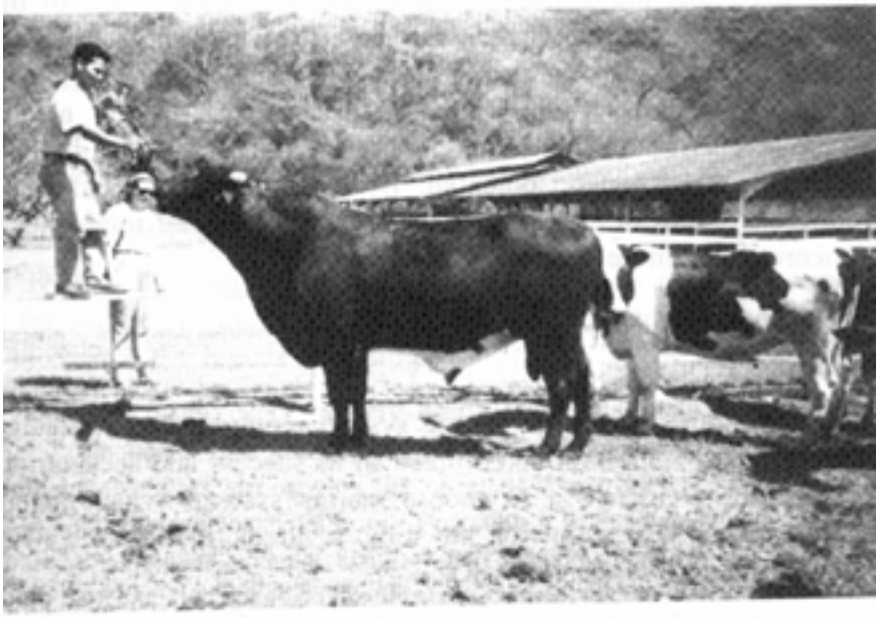
With the exception of non-intensive systems, European x zebu crossbreds have demonstrated their superiority over other breed groups under a wide range of conditions.

The choice of a specific grade of cross will depend on considerations such as those given in 9.1, and cannot be predicted in a generalised way. However, attention is drawn to the outstanding performance of animals of about half European inheritance in systems of varying degrees of intensity.

European x zebu crossbred

F_1 cow

F_1 heifers bred from zebu dams and Holstein sires



Holstein x zebu F_1 bull

The success of a crossbreeding program should be judged in relation to performance of the original, base population, and not to some theoretical 'optimum'. In order to have impact, the program must be implemented by a significant proportion of producers. Some kinds of crossbred, such as F, or rotational crosses derived from more than two breeds, may be genetically 'optimum' in certain circumstances, but require mating systems which are not always easy to put into practice. More impact may be made on the whole population by a crossbreeding program which is theoretically not the best, but which is widely acceptable to farmers.

The degree of heterosis expected from a given mating system should not necessarily be a decisive factor in choosing it. Very few reliable estimates exist of the degree of heterosis obtained from crossing *Bos taurus* and *Bos indicus* animals in tropical dairy or dual purpose systems. Most of the evidence is derived from the reduction in performance observed between successive generations of crosses. But this is not always attributable to the loss of heterosis. The interpretation of data is frequently hampered by small numbers of observations, time effects confounded with generations, and different selection intensities applied to the sires and dams used in the different generations.

It was emphasized that the additive value of the breeds used, and of the individuals within those breeds, is of supreme importance and that effective selection programs can go far to counter the loss of heterosis. It should also be recalled that numerous *inter se* crossbred populations exist in the region. Their levels of performance which are commercially satisfactory given the levels of other inputs and are more likely to be limited by factors such as feeding and health, than by genetic potential. By being functional and widely accepted, these ' less than optimum' types of cross may have a more beneficial total effect on the local population, than theoretically more desirable ones.

10.0 MATING SYSTEMS

10.1 General considerations

As was indicated above (9.1), the mating system required to produce and improve a given genetic group is a most important determinant of its success and acceptation. In the case of dual purpose cattle, the challenge is to choose mating systems which fit easily into the practical reality of the farms. The following are some of the considerations which should be taken into account in making the choice.

The mating system should permit a satisfactory calving rate under the specific conditions of the population in question. Systems which depend on artificial insemination for routine pregnancies are not recommendable in parts of the region where they would depress calving rates. Reductions of between 10 and 20 percentage points due to the use of AI have been documented, which could scarcely be compensated by any genetic advantages. Similarly, systems which depend on the use *of Bos taurus* bulls in natural service may be of limited application for two reasons. The first refers to the difficulty of obtaining bulls of known genetic quality at reasonable prices, and the second to the problems associated with keeping this type of bull healthy and fertile under field conditions.

The chosen system should also lead to reasonable genetic progress over time. In this context, it is useful to di.fferentiate between open and closed mating systems. The closed systems obtain breeding stock from within the population, without introducing new genotypes. They therefore depend entirely on local efforts to achieve genetic improvement, and should only be considèred as a viable option where the proper infrastructure exists to permit an effective selection program. The difficulty of carrying out effective selection under tropical conditions explains the frequent failure of efforts to form new breeds through *inter se* crossing. In contrast, open mating systems permit the continual introduction of genes from other populations. If these populations are subjected to rigorous selection, then the resulting progress can be inserted into the local crossbred

population at very little cost. Thus, open systems offer considerable advantages for populations which are at the initial stages of development.

Mating systems are also classified into 'continuous' and 'discontinuous'. In the first case, replacement females are produced within the system. Rotational crossbreeding has this advantage. In discontinuous systems, the females have to be acquired routinely outside the system. The use of F, animals is a case in point. In general, continuous systems are preferable when reliable sources of replacements are scarce, since the constant introduction of cows into the herd presupposes adequate sanitary and genetic standards on the farms of origin. On the other hand, the production of replacements is an activity which generally gives great satisfaction to the producer and tends to favour the genetic improvement of the herd.

10.2 Specific mating systems

This section includes comments on some of the mating systems which are suitable for crossbred *(Bos taurus x Bos indicus)* dual purpose populations.

- Rotational crossbreeding

In this system, the rotation of the bull breed in each generation can be achieved by keeping bulls (or semen) of the respective breeds in the herd simultaneously, but a simpler alternative is to change the breeds over time.

The system is found very widely throughout the region, usually with zebu and European breed bulls used alternately. Its popularity suggests that farmers are prepared to put up with its disadvantages. In theory, the chief of these may be the fluctuation in levels of performance between generations, depending on which breed of sire was used. The lower level of milk yield to be expected from the daughters of zebu bulls may be compensated for by improvements in other traits, but the comparative overall merit of the different generations has not been documented. Another disadvantage of the system is that it generally requires reliable sources, and adequate field management, of European breed bulls or semen.

With regard to the number of breeds involved, attention was drawn to the fact that the complexity of managing the system increases as the number rises. The difficulty of obtaining a continuous supply of bulls (or semen) of acceptable genetic quality from more than two breeds should not be underestimated. They must be of adequate additive merit for the production of meat as well as milk. Otherwise, adding another breed may reduce overall performance, despite the additional heterosis obtained. The benefits of using more than two breeds is not well documented in the literature, but at present there is no clear evidence that it is justified.

- Continuous production of F, females.

The superior productive performance of F, cows has been demonstrated under a wide range of conditions typical of dual purpose systems throughout the region.

Although few dual purpose farmers can produce their own F, replacements, they are now being produced for dual purpose farms by owners of beef herds in some countries. This option is particularly attractive where the beef herds have effective genetic improvement programs and experience in the use of AI. However, information is still required on the genetic quality of the European breed sires most suitable for use in the system.

Its main disadvantage is that it is discontinuous, and therefore usually depends on the acquisition of replacements outside the dual purpose herd (10.1).

- Continuous production of F, males

In this system, which is similar to the previous one, herd bulls are produced continuously from zebu type cows and *Bos taurus* sires. The F, males are used directly in the crossbred herds. They are also used to absorb zebu herds up to intermediate levels of Bos *taurus, or* to lower the level *of Bos taurus* breeding in pure or high grade European ones.

The system allows advantage to be taken of local efforts to select superior cows as bull dams, as well as of the genetic progress obtained in the *Bos taurus* population of the bull sires. The

possibility of using proven males as bull sires is potentially of great significance, because the likelihood of proving the crossbred bulls themselves in most tropical countries is very small. The system is suitable for the production of bulls for natural service as well as AI, but the use of AI can, if necessary, be restricted only to the bull breeding herds. It does require a constant supply of zebu type dams. If these are not available in dual purpose herds, the possibility of using beef cows of known superiority for fertility and maternal ability, should be considered.

- Inter se crossbreeding and the formation of new breeds

The *inter se* mating of successive crossbred generations has the great advantage of producing its own replacements (i.e. a continuous system). However, it also has the disadvantage of being closed (10.1), and therefore can only be recommended where the local infrastructure is capable of carrying out an efficient selection program for the population in question.

11.0 SELECTION

11.1 General considerations

Currently available information suggests that selection should be based on milk yield, fertility, growth and survival. The correlation between milk yield and fertility is negative and probably has a genetic base. Selection for milk will probably not decrease growth potential, and may favour it. The increase in size which could result from selection for growth was pointed out as a possible disadvantage, but no negative consequences have been reported in tropical American beef populations.

The best way of combining and weighting information on the various traits will vary from place to place. The difficulty of constructing usable selection indices was recognised, due to the lack of basic information on the genetic parameters, and to the unpredictably variable economic data. Simple indices such as 'milk yield per day of calving interval' or 'milk yield to a defined age' could prove useful. Apart from these, independent selection levels for the various traits was considered likely to be the most appropriate method for use under the majority of conditions.

11.2 Females

Milk yield data used for selection purposes should be obtained without changing the cows' milking routine, especially with regard to calf suckling. Total yield per lactation should be estimated on the basis of that extracted by milking, complemented by information on calf weights. Efforts are usually required to ensure uniform criteria for calf suckling within herds, to avoid biases between cows. The optimum frequency of milk recording in herds which are milked with calves present is not known; however, monthly weighings have been shown to lead to important errors when milking is done by hand in the presence of the calf. Emphasis was laid on the importance of including all lactations in data analyses, including those of zero days duration. The frequency of short lactations is too high in these herds, irrespective of the cow's breed group, for them to be considered abnormal.

The best age for measuring calf weights in order to evaluate their dams was not defined. Some experience has been gained from doing so at four months, but it should be done before the calves' consumption of feeds other than milk masks variation in maternal ability. This occurs before the usual age of weaning in dual purpose herds. Weight for age at the start of service is a useful basis for applying selection for growth in females.

Given the present state of knowledge, it is recommended that bull dams should be cows with positive estimated breeding values for milk yield, fertility and calf weight, and whose calves have suivived up to weaning.

11.3 Males

Males used as herd bulls should, as a minimum requirement, be sons of cows identified as superior according to the criteria shown in 11.2. Some mating systems (see 10.2) also make it possible for them to be sons of (European) proven sires. The most suitable genetic quality of bull sires has not yet been defined, but once this is done, the possibility of using proven sires as bull fathers will be an

important advantage, especially where local progeny testing of the bulls themselves is impossible.

The option of submitting bulls to performance tests for growth should be considered more widely. This is being done in the region where crossbred bulls originate in beef herds.

Ideally, dual purpose breeding bulls should be progeny tested. It is, however, essential to determine in each situation whether this method of selection is justifiable in terms of the cost of the annual genetic progress obtained in the populatiori. Complex problems, unlikely to be solved quickly, exist in many parts of the tropics which would lead to long generation intervals, low intensities of selection among the proven bulls, low reliability of the proofs and a limited impact on the population of the sires which are identified as superior. It is therefore most important to distinguish between situations where progeny tests are, and are not justifiable, and give full support to those efforts which have real prospects of success.

The use of nucleus herds and embryo transfer for sire selection is an alternative which merits consideration for tropical dual purpose herds. However, its success will depend largely on how precisely the merit of the females can be evaluated, and on the opportunity costs of the operation.

12.0 DATA PROCESSING

A large variety of programs are available in the region for the biological and economic recording of dual purpose herds. Their exact characteristics depend on the needs of each locality, and it is unlikely that an 'ideal' program exists. However, it was recommended that a regional inventory of such programs should be made, followed by national level workshops to exchange experiences and software which have proven useful.

13.0 RESEARCH PRIORITIES

Emphasis was laid on the need for continued research in the genetics of dual purpose cattle. Some of the priority themes include: methodologies for the measurement of performance traits, including herd life; genetic parameters, including correlations between major traits; comparative evaluation of breed groups, in the context of genotype: environment interactions; selection methods for both sexes; mating systems; the incorporation of genetic progress in other populations into dual purpose ones and simulation procedures.

Greater emphasis should be placed on economic aspects in the biological studies which are undertaken.

The current difficulties of financing classical type genetic studies, with animals kept under controlled conditions, were recognized. Faced with this reality, attention was drawn to the very important potential which exist in many parts of the region for generating data in commercial herds. With careful collection and analysis, such records have been shown to produce extremely useful information at a very moderate cost.

14.0 EDUCATION AND INFORMATION DISSEMINATION

It was concluded that an unacceptably wide gap exists between current knowledge on genetic (as well as other) aspects of dual purpose cattle and the teaching curricula of most institutions of higher education in the region. There is an urgent need to introduce up-to-date information on this topic into the educational system at all levels.

A serious effort should be made regionally to increase the number and quality of scientific and extension publications in this area, and to encourage the exchange of information between research workers.

A 24-month-old F_1 bull bred from a zebu dam and a Holstein sire

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FOUR INTERESTING ENDANGERED BREEDS OF ANIMALS IN CHINA

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SUMMARY

The Zhoushan and Hainan cattle, Hu sheep and Wuzhishan pigs are local domestic populations in China. Their ecospecific characters are unique. Zhoushan and Hainan cattle are different from each other, but both are zebu of the Chinese type, deriving from Indian origins. The distinctive pattern of coat colour for each of these two breeds and some blood serum polymorphisms show to a certain degree common factors with Bali cattle which are descendents of the gaur. Hu sheep are prolific and they are the only breed that shows oestrus cycles all year round in the world. Hu sheep are protected under the *in situ* conservation programme but still are in a critical situation due to the impact of the fast growing rural economics. There are less than 30 Wuzhishan pigs remaining, of which only 3 are boars. All of them are in ex *situ* conservation, but special attention is needed to protect them as a breed.

RESUME

Les bovins Zhoushan et Hainan, les ovins Hu et les porcins Wuzhishan appartiennent à des populations locales chinoises. Leurs caractères écospécifiques sont uniques. Les bovins Zhoushan et Hainan sont différents entre eux, mais tout deux sont des zébus du type chinois, d'origine indienne. La particularité de la couleur de la robe dans les deux races, ainsi que certains polymorphismes dans le sérum du sang, indiquent quelques degrés de facteurs communs avec les bovins de Bali qui descendent du gaur. La population ovine Hu est prolifique et c'est la seule à avoir des cycles d'oestrus pendant toute l'année. Cette population est protégée par un programme de conservation *in situ* mais, èn ce moment, elle se trouve dans une situation critique due à l'impact de la rapide croissance économique rurale. Il existe moins de 30 porcs de race Wuzhishan, dont 3 mâles. Ils se trouvent tous en conservation *ex situ* mais une attention particulière est nécessaire pour les protéger en tant que race.

1.0 INTRODUCTION

Among six endangered Chinese breeds, reported at the Sth World Congress on Genetics Applied to Livestock Production, at the University of Quelph, Toronto, Canada, four are at the very critical state. They are the Zhoushan and Hainan cattle, the Hu sheep and the Wuzhishan pigs. In order to draw attention to the uniqueness of these breeds, some data overview is necessary.

2.0 ZHOUSHAN CATTLE

Zhoushan cattle are found in Dinghai, Putuo and Zhenhai counties which are the island and peninsula areas along the belt on the Zhejiang East Sea Coast. In this plain and hilly area the main crops are rice, cotton, sweet-potatoes, wheat and barley. As a draught animal, the cattle were used for rice paddy cultivation and irrigation, grain pulverising, oil pressing etc. Zhoushan cattle were introduced through trade from the Chuansha and Nanwei counties of the Shangai municipality 300 years ago, where there are Tangjiao cattle, distinguished up to about 10 years ago. Annual rainfall ranges from 1 260 mm to 1 490 mm, average annual temperature ranges from 16-30°C. Animals graze freely all year round.

Zhoushan cattle are mostly black, calves are born with a brown colour, which becomes darker

and black after weaning. Animals have a head with a short forehead, wide in the middle and a big muzzle, with horns development curving to different directions and some of them screwed. Horns are flat, square and thin at the base point and became round along the top. Bulls have a short neck. Both bulls and cows have well developed dewlaps, which are about 30 cm deep under the neck. The hump is high at neck-withers position for bulls, but small for cows. The trunk is deep, shoulders are very well developed, the back is not so wide. The legs are long and slightly sabre-shopped. The tail is of middle length, ending at 2-3 cm below the hocks.

TABLE 1:
Means and standard deviations of weight and body measurements at adult age (1982 off cial data) (in kg and cm)

sex	animals	weight	height	lengt	chest circ.	canon circ.
bulls	50	491.0 ± 70.3	136.8 ± 16.2	147.3 ± 8.7	189.9 ± 9.3	20.5 ± l.3
cows	150	336.4 ± 50.7	122.5 ± 13.9	133.6 ± 8.1	170.3 ± 9.1	17.3 ± 1.1

The animals are good for ploughing paddy fields until 17 years of age, a cow is able to plough half a hectare within 8 hours' work. The population of Zhoushan cattle is estimated at less than 1 000 heads. No details are available in recent years.

The breed does not have any registration system and no measures have been taken to protect the possible loss of this unique breed. The coat colour is changing seasonally; this is a special characteristic of the *Bos banteng* originating from the Gaur.

3.0 HAINAN CATTLE

Hainan cattle are found on Hainan Island, mainly in Lialgshan, Chengmai and Haikou counties. In this tropical-subtropical area rice, peanuts, sweet-potatoes, sugar cane, cassava are the main crops. The average annual temperature is 24.5°C, the highest is 35.7°C, the lowest is 2.2°C. Annual rainfall ranges from 1 600 mm to 2 000 mm. Records in the Quiongzhou annals, show that 2000 years ago cattle were wandering here free, grazing and not afraid of human beings. Now the cattle are important for ploughing and transport, cattle-carriages are the common way of inter-village communications.

Most animals of Hainan cattle are brown-yellow coloured, others are black of varying shades, with black muzzle and ear tips, switch, hooves, eyelids and scrotum, and a very special back middle line as far as the tail end. Bulls are always darker than cows. Some animals have white spotted lines along both sides of the rump, which was reported as one of the coat specificity *of Bos banteng.*

Hainan cattle have a short head and wide muzzle. Bulls' horns are straight or slightly curved. Cows' horns are short or polled. Bulls have a hump, 13 to 17 cm high. Dewlap are well developed but with a few wrinkles. Hainan cattle were recognized as an original strain of the humped cattle in the world.

The Hainan cattle population was some 200 000 in 1992, but the Hainan province, as a special economic zone, has a very fast-growing industry and mechanized agriculture, which caused the number of cattle to drop dramatically. Since the end of the 80's farmers have preferred pig or poultry industries rather than cattle, raising only a few thousand animals considered today as purebred Hainan.

4.0 HU SHEEP

Hu sheep are found around the Taihu lake at a border area between the Zhejiang and Jiangsu provinces neighbouring Shanghai and other major industrial developing zones. In comparison with other animal sectors in this area, Hu sheep, lamb skin producers have become less and less important for farmers' operations. The annual average temperature ranges from 15°C to 18°C. In January the average is around O°C, in July it is about 28°C. Yearly average rainfall ranges from 1 200 mm to 1 400 mm, relative humidity is 80%/o. In this region water-ponds occupy one fourth of the surface. There is no pasture available for sheep, all animals are kept and raised under cover.

Hu sheep are white, with some individuals being black or yellow, with pigmented eyelids and lower parts of the legs. Sheep have a long but narrow head with convex nose, eyes are prominent, ears are drooping. Both rams and ewes are hornless. The neck is long and the body has a long, level back, narrow chest, tall rear part. The legs are thin. Hair is rare at the abdomen. The udder is well developed. The tail is fat and of an oblate form with up-forward tail-tip. Body size is as follows:

TABLE 2:

Means and standard deviation of weight and body measurements at adult age (average data in kg and cm)

sex	weight	height	length	chest circ.	canon circ.
rams	65.8 ± 4.2	70.9 ± 5.6	82.6 ± 4.7	8.2 ± 0.6	48.6 ± 8.2
ewes	36.5 ± 5.7	61.4 ± 2.8	66.2 ± 4.1	79.5 ± 4.8	6.9 ± 0.7

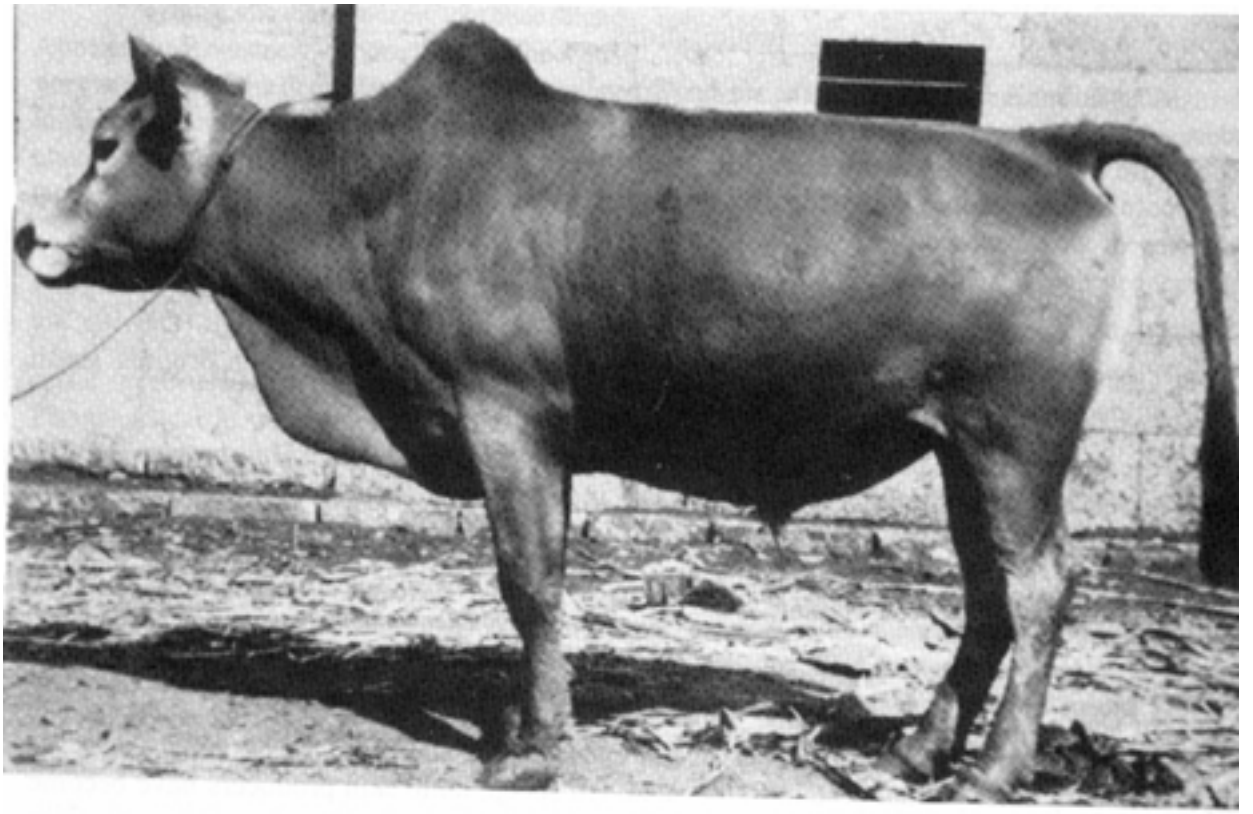
The Hu sheep lamb-skins of 1-2 day old lambs are light with white colour, wavy and tight fitted. The wavy patterns vary depending on size. They are divided by categories: small (1.0-2.0 cm long), middle-small (2.1-2.5 cm long), middle (2.6-3.0 cm long) and large (3.1-3.5 cm long).

Ewes are able to give birth twice a year, 228.9% of lambing rate for one pregnancy. The top record for a single birth is 8 lambs. Ewes show oestrus all year round, a unique reproductive ability among sheep of the world. The pregnancy duration is 147.7 days on average. Spring and autumn are the best seasons for lambing. The Hu sheep population is going down dramatically due to crossing with mutton types of sheep. In the conservation flock, supported by the Government, only about 222 ewes and 10 rams are kept.

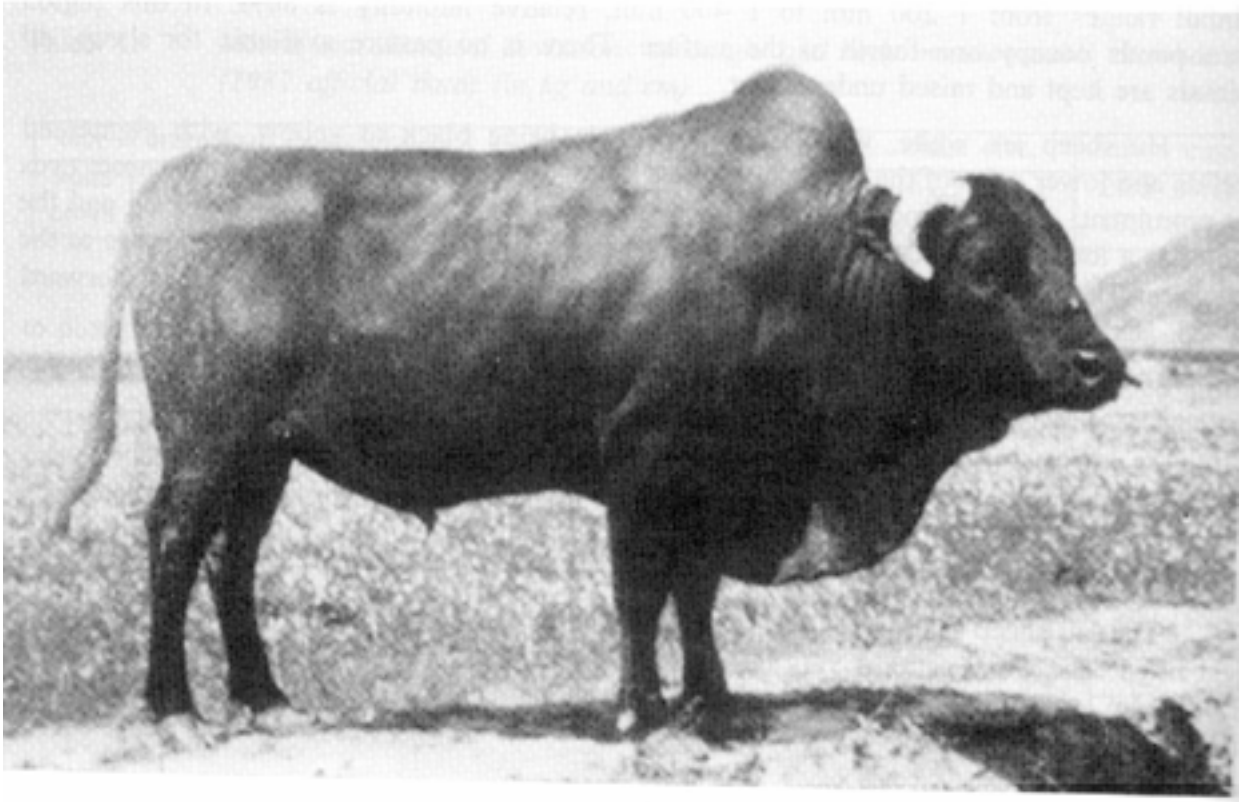
This traditional breed is especially interesting for its reproductive capacity, prolificity and all year round oestrus ability, but also for good quality lamb skin. The conservation Bock was established by the provincial authorities, but the breed is still in danger and less and less funds are available to keep the minimal size of the population. Some rams were used to cross with the Xinjiang fine wool sheep in order to improve the prolificity of litters. But such utilization is not enough for the necessary financial support in breed conservation.

5.0 WUZHESHAN PIGS

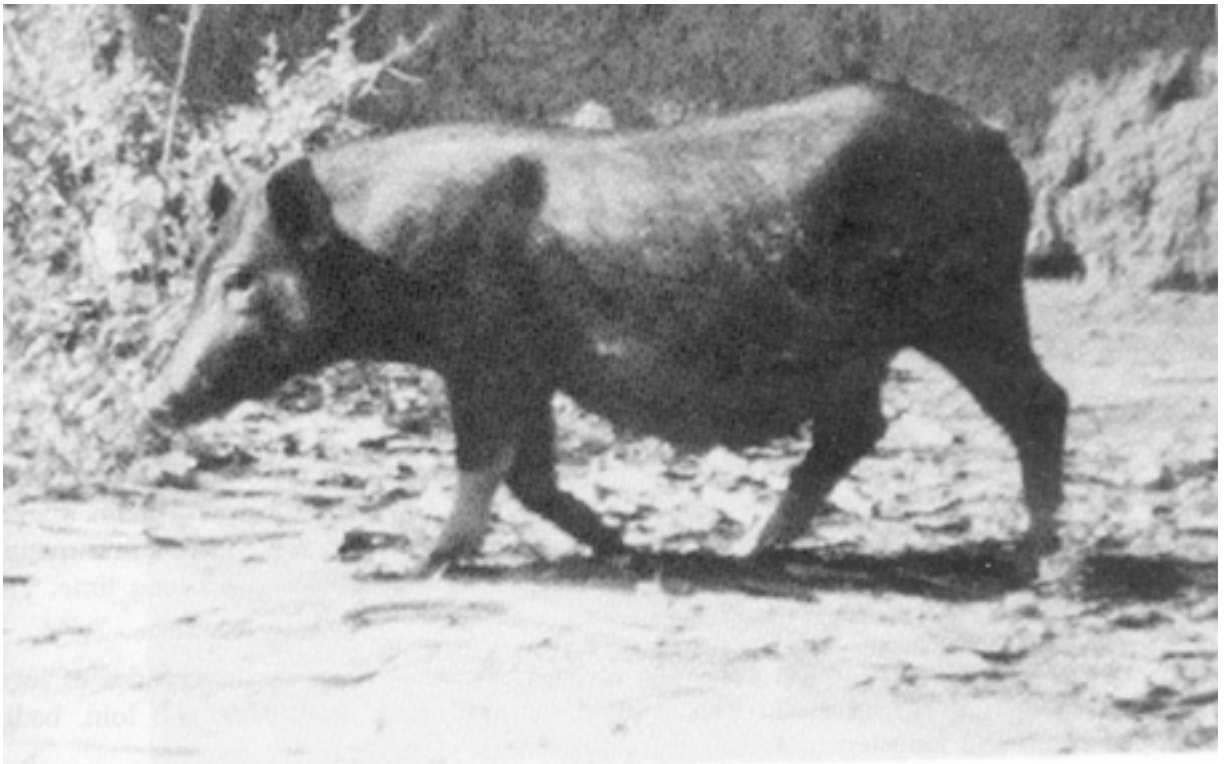
Wuzheshan pigs are the local breed of the province of Hainan; the tropical mountainous region of this island, a geographically isolated space. Pigs are not used as a main market supply, private farmers used them for self consumption. Boars were killed after first mating with little mates and mother-sows as well. Inbreeding has taken place for a long time. The climate is the one described for the Hainan cattle.



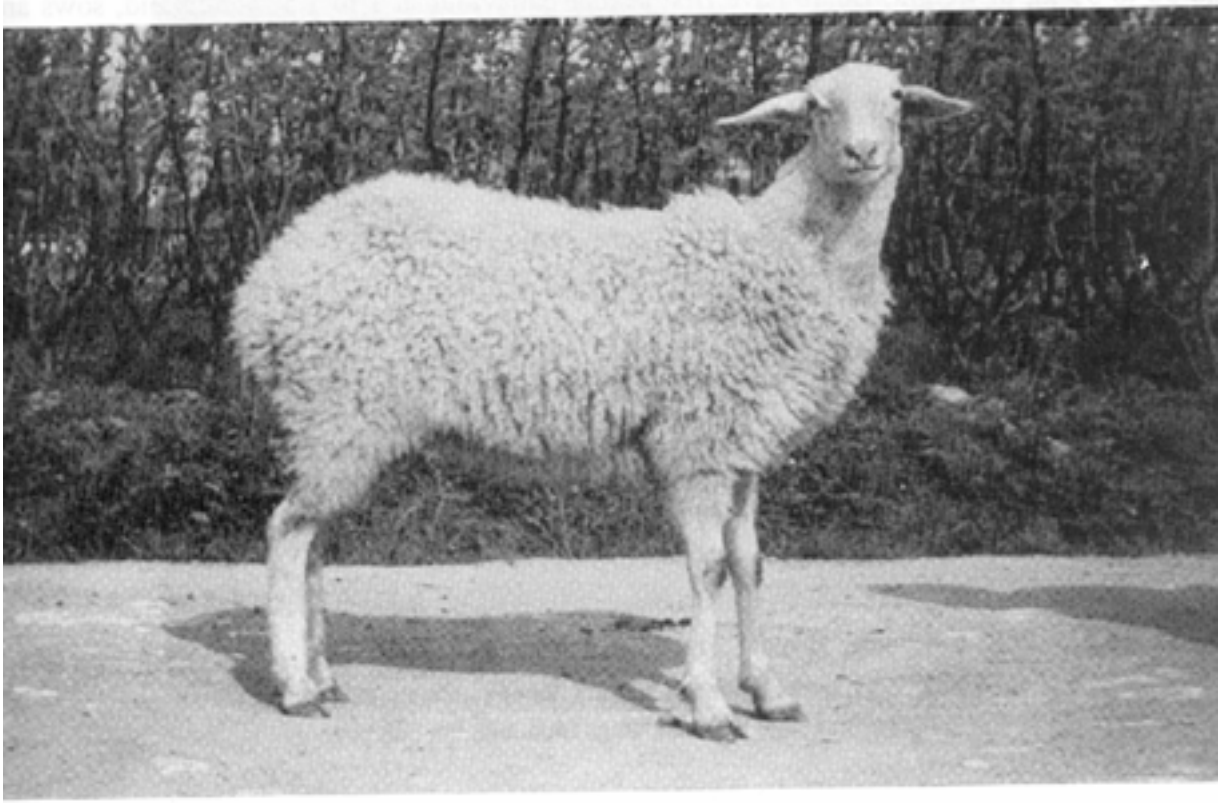
Hainan



Zhoushan



Wuzhishan



Hu

Wuzheshan pigs are black, but white at the abdomen and on the inner sides of legs. Pigs have a small head, long and tipped snout, narrow chest, level-back and loin, badly developed rump and long legs.

Adult sows are 50 cm to 70 cm long, 35 to 45 cm high, 65 to 80 cm around the chest and 30 to 35 kg in weight. Boars have first sexual behaviour at 1 to 1.5 months old, sows are pregnant at the age of 3 to 4 months and give one or two births a year. Due to the fast introduction of exotic pig breeds in the region hardly any people raise pigs of this breed for producing purposes. The pigs are now *at ex situ* preservation; 3 boars and less than 30 sows are raised.

Wuzheshan pigs are extremely small. The animals have strong recovering ability after surgical embryo transfer operations, used for better *ex situ* preservation. This breed is an appropriate laboratory animal and is investigated internationally as an interesting germplasm.

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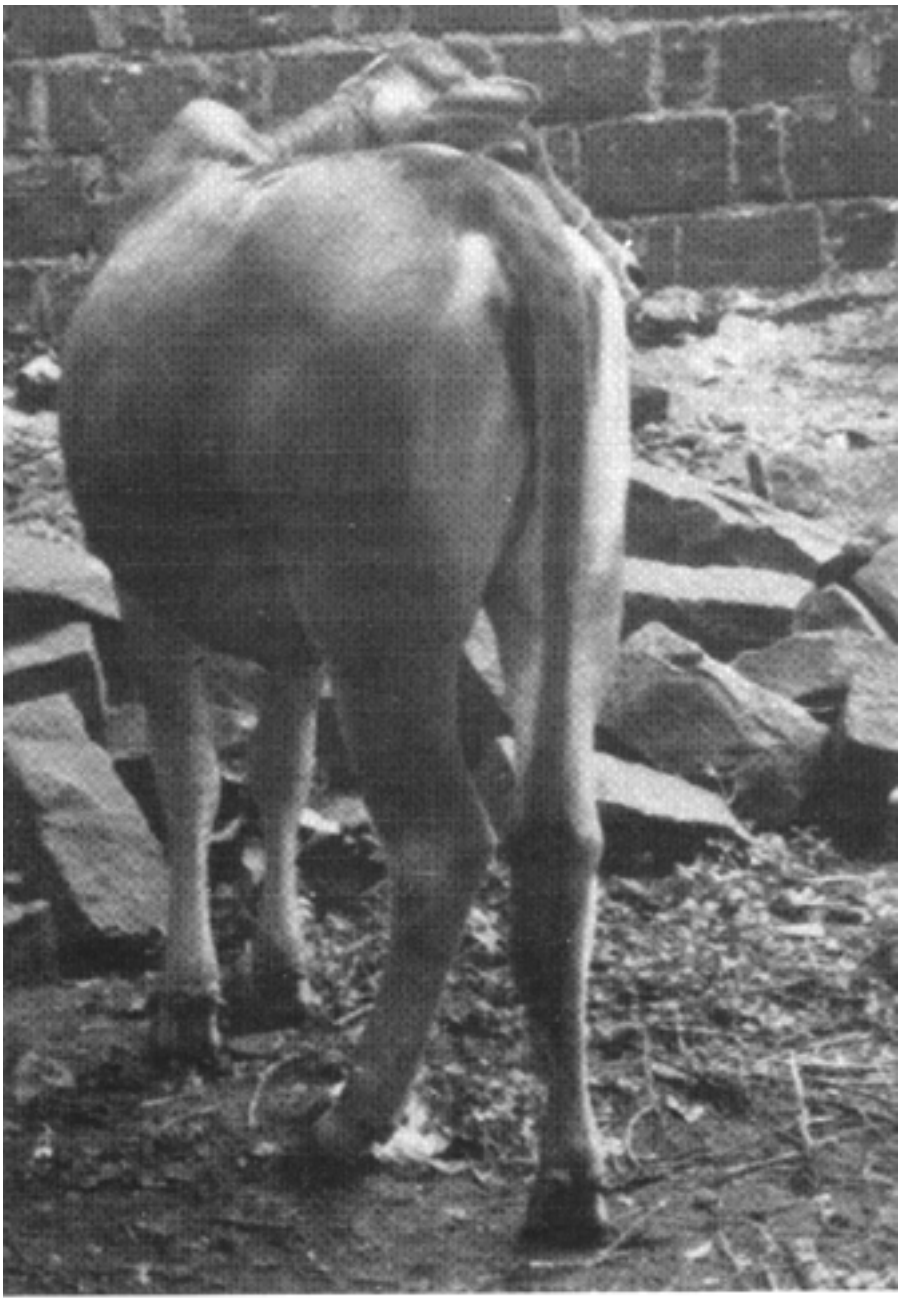

Hainan cattle. White round inner side of rear end, specific of the Bati type cattle (Bos banteng)

LIVESTOCK PRODUCTION AND ANIMAL GENETIC RESOURCES IN CROATIA

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SUMMARY

This paper describes the organization of livestock production in Croatia and briefly outlines the contribution of the various species of domestic livestock to the national economy. In the final part, the animal genetic resources of Croatia are described and the status of domestic animal diversity described.

RESUME

Cet article décrit l'organisation de la production animale en Croatie et brièvement la part de l'élevage de certaines espèces dans l'économie nationale. Dans une deuxième partie il présente les ressources génétiques animales de la Croatie et la situation de la diversité animale.

1.0 INTRODUCTION

Croatia had a population of 4 700 344 in 1991, covers about 56 750 km^2 and has 2 028 km of land frontiers with other states. It is bounded to the west by the Adriatic Sea, where it has a common frontier with Italy, to the northwest by Slovenia, to the northeast by Hungary, to the east by Serbia and to the south by Bosnia-Herzegovina (Fig. 1). There are three main regions: the Mediterranean or Adriatic region to the west; the mountainous region in the centre; and the Pannonian region in the east (Klemencic, 1993).

2.0 LIVESTOCK SYSTEMS

In 1989 about half of private farmers owned cattle but only 4.2 per cent had more than five cows; 52.0 per cent kept pigs but only 5.3 per cent had five or more sows; eight per cent kept sheep, 2.6 per cent owning more than 20 head; and 76 per cent kept poultry with less than one per cent having fIocks of more than 100 birds. By far the largest numbers of cattle , pigs and sheep were kept on “average” size farms of about 3 ha but an increasing number of more commercially viable livestock farming units is emerging in the private sector.

There is some private sector summer sheep grazing in the Central Mountains and Continental Upland agroecological zones and some backyard poultry production. With these exceptions, most livestock production in both sectors involves year-round grain feeding in stalls. In the private sector, home-grown maize is the main feed, supplemented with wheat bran, oilseed cakes, beet pulp, brewers grains or other agroindustrial by-products and grass hay. Many larger private farms with more than 10 ha of land now use maize silage. Most animals have little opportunity for exercise, being continuously tethered in stalls in the case of cattle, held in small pens if pigs and loose housed in the case of in wintered sheep. There are obvious repercussions on animal welfare and health. Limited fenced areas currently restrict opportunities for grazing meadows or pastures in mainly arable areas.

With the exception of pigs, livestock numbers decreased between 1961 and 1990 (Fig. 2). In the period 1985-1991 pig numbers decreased from their peak but poultry and sheep populations increased marginally (Ralik, 1993). The populations decrease has generally been accompanied by a progressive improvement in productivity per head in most sectors.

Livestock offtake rates and slaughter weights, and egg and milk yields on a per head basis increased between I985 and 1990 (Table 1). The cattle population decreased by 8.8 per cent in this period, possibly in part due to an increase in offtake from 30.3 per cent to 34.7 per cent. Cattle live weight rose marginally, resulting in a 12 per cent increase in beef production. Swine numbers fell by almost 20 per cent but total pork production rose by 7.8 per cent due to small rises in live weight at slaughter and of carcass yield per sow. Poultry meat production rose by about five per cent, due primarily to an increase in flock size, especially of the commercial ex-social sector, but 1990 production was down almost 16 per cent on the 1988 production peak. The number of eggs laid per hen in the national flock remained roughly constant at 130-135 eggs.

Istrian Podolic cow and bull

Figure 1: *Croatia geographic map*

3.0 ANIMAL GENETIC RESOURCES

3.1 Cattle

The cattle genetic resource now has very little diversity and what remains is probably being reduced still further. In contrast to many neighbouring and other European countries, where the emphasis is on "black and white" cattle and on outright "holsteinization", Croatia's main breed is the Simmental. This breed, regularly bolstered by bull and semen mainly from Austria, accounts for some 80 per cent of the national herd.

Ex-social sector farms own 94.4 per cent of the nation's Holstein-Friesians, 2.3 per cent of Simmental and 3.3 per cent of crossbreeds. The average national yield of 4 811 Holstein-Friesian cows was 5 650 kg per 305-day lactation at 3.5 per cent fat in 1993. A total of 7 812 Simmental cows had average yields of 3 688 kg at 3.72 per cent fat. The weighted average annual yield of all Croatian cows (recorded and unrecorded) is estimated at 2 470 kg per year at 3.75 per cent fat.

A "Program on Cattle Raising in Croatia" sees genetic improvement being achieved by pure breeding. Simmental, Holstein-Friesian and "Brown" cattle will be the three principal breeds. It is also planned to improve desired characteristics by using Jersey and Red Holstein for milk. In order to obtain higher meat output, and in areas where cow-calf system can be developed or is developing, Charolais, Limousin and Aberdeen Angus bulls will be used. Very little effort is being devoted to conserving the native breeds of Croatia. The Agricultural Centre of Croatia-Centre for selection' has the nominal responsibility for this task and for maintaining herdbooks and for *in situ* and *ex situ* conservation.

In the case of the Istrian Podolaz (Croatian = Istarsko govece) it does have a stock of semen from three bulls. Istrian Podolaz were developed as heavy draught animals and are noted for their quietness, pulling power and ease of calving: growth rates are slow and milk yield is low although it is high in fat and protein. This breed, of the Grey Steppe type and said to be descended from and related to the Maremma cattle of Italy (French et al., 1966), is critically endangered. In 1986 there were 15 bulls and 500 cows of the Istrian Podolaz still extant: 50 females were registered in the herdbook, only 70 per cent were mated pure and effective population size was 25 (Simon and Buchenauer, 1993). Attempts are being made by a few farmers, constituted as a local Non-governmental Organization (NGO), to conserve a very small herd of cattle in its area of origin. In June 1994 this herd comprised two bulls, about 10 cows and 1 ox.

A small conservation herd of one bull and about 9 cows with 6 growers and 4 calves of the Slavonian Grey Steppe type, or Slavonski Podolaz, is being kept at Krizevci Lemas under the auspices of the National Breeding Centre (not to be confused with the Agricultural Centre of Croatia-Centre for Selection, which is a totally different organization). This herd was owned by various farmers before being gathered on the Djakovo agrokombinat. During the recent war the animals spent some time in Slavonia in eastern Croatia, then moved to Serbia before being moved to Istria and finally to their present site. The reasons for collecting this small group together, which is largely supported by Finvest (a Croatian forestry company), are to remove them from the war zones and to save them from being sent for slaughter and due to a sense of enthusiasm by a small number of people. The aim is to multiply the animals, by the use of semen and embryo transfer and to save it for posterity.

In contrast to the very limited efforts at conservation of the Grey Steppe breeds there appear to be none at all for the Busa (Croatia = Hrvatska busa). Mainly distributed in the southwest of the former Yugoslavia (Mason, 1988), there were small populations in the hilly karst hinterland of southern Dalmatia until very recently. Descended from the ancient Illyrian cattle indigenous to the area, the purebred Busa is a very small animal, bulls weighing not more than 400 kg with

‘ Poljoprivredni Centar Hrvatske-Stocarski Selekcijski Centar

a withers height of about 120 cm, and cows averaging about 250 kg with a withers height barely exceeding 100 cm. The original triple purpose (traction-milk-meat) vocation of these animals and its small size have stood it in little stead in the modern world and there are now very few purebred animals left in Croatia.

3.2 Pigs

A pig production plan is in the course of preparation. The programme is primarily based on Swedish Landrace and Large White and production of their crossbreeds. A smaller hybrid programme intends a three-line and four-line mating system with Piétain, Belgian Landrace, German Landrace, Duroc and Hampshire serving as terminal breeds. The production of 3.6 million fattening pigs from 182 500 breeding sows is foreseen under the new economic environment and through the application of modern management.

Pig production in the formal sector is thus based entirely on foreign blood. A few free-ranging, almost semi-wild, white and black spotted, indigenous Turopolje pigs (Croatian = Turopoljska svinja) survive in the flood plains of the Sava river south of Zagreb. The Turopolje originated from the Siska of southern Yugoslavia (itself a primitive, grey, prick-eared pig said to be extinct 1982) and Berkshire blood at the end of l9th Century (Mason, 1988). The population of this lard-type pig was estimated at 10 boars and 250 sows in 1986 with an effective population size of 19. These figures may be an underestimated as its native tract is one that was not subject to much collectivization of agriculture and therefore largely ignored by the former Yugoslav Government.

3.3 Sheep and goats

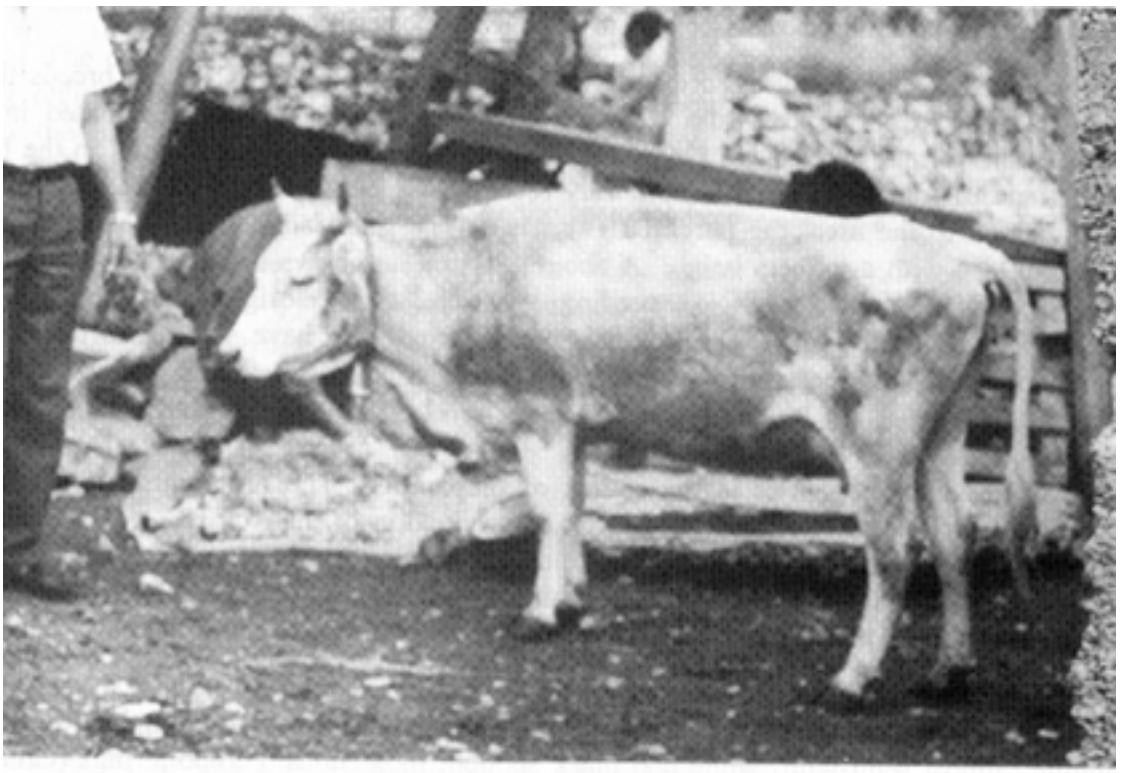
The official goal for sheep production emphases milk production in Istria and on some Adriatic islands, especially Pag, which in known for its long tradition of cheese production. This is to be achieved by crossing the indigenous Pramenka with milk breeds. Production of meat will be promoted in other parts of Croatia using lean-breed sires on Pramenka ewes.

Most sheep in Croatia are still mainly indigenous breeds or descended from early importations from other Mediterranean countries. A recent source (Simon and Buchenauer, 1993) lists two Croatian sheep breeds, the Lick Ovca and Paka Ovca, as potentially endangered and one, the Ruda Dubrovacka, as endangered. Both are ecotypes of the widespread and variable native Pramenka, a breed belonging to the Zackel group that is widespread in southeastern Europe (Mason, 1966). The open-fleeced triple purpose Pramenka has been extensively infiltrated in the recent past by Wiirtemberg and Suffolk for milk production, Merino for wool and Sardinian, Friesian and Awassi for milk. Many of the crossbreeds and mixtures thus produced are now seen to be ill adapted to Croatian conditions, especially to the semitranshumant flocks in the private sector on the Mountain region and many breeders are now selecting back to the Pramenka type.

The so-called Balkan goat (Croatian = Balkanska Koza) is really a mixture of several local types and has been traditionally used as a dual purpose meat and milk animal. While probably never a particularly distinctive type in Croatia it has virtually ceased to exist due to crossing with the Saanen and Alpine breeds.

3.4 Poultry

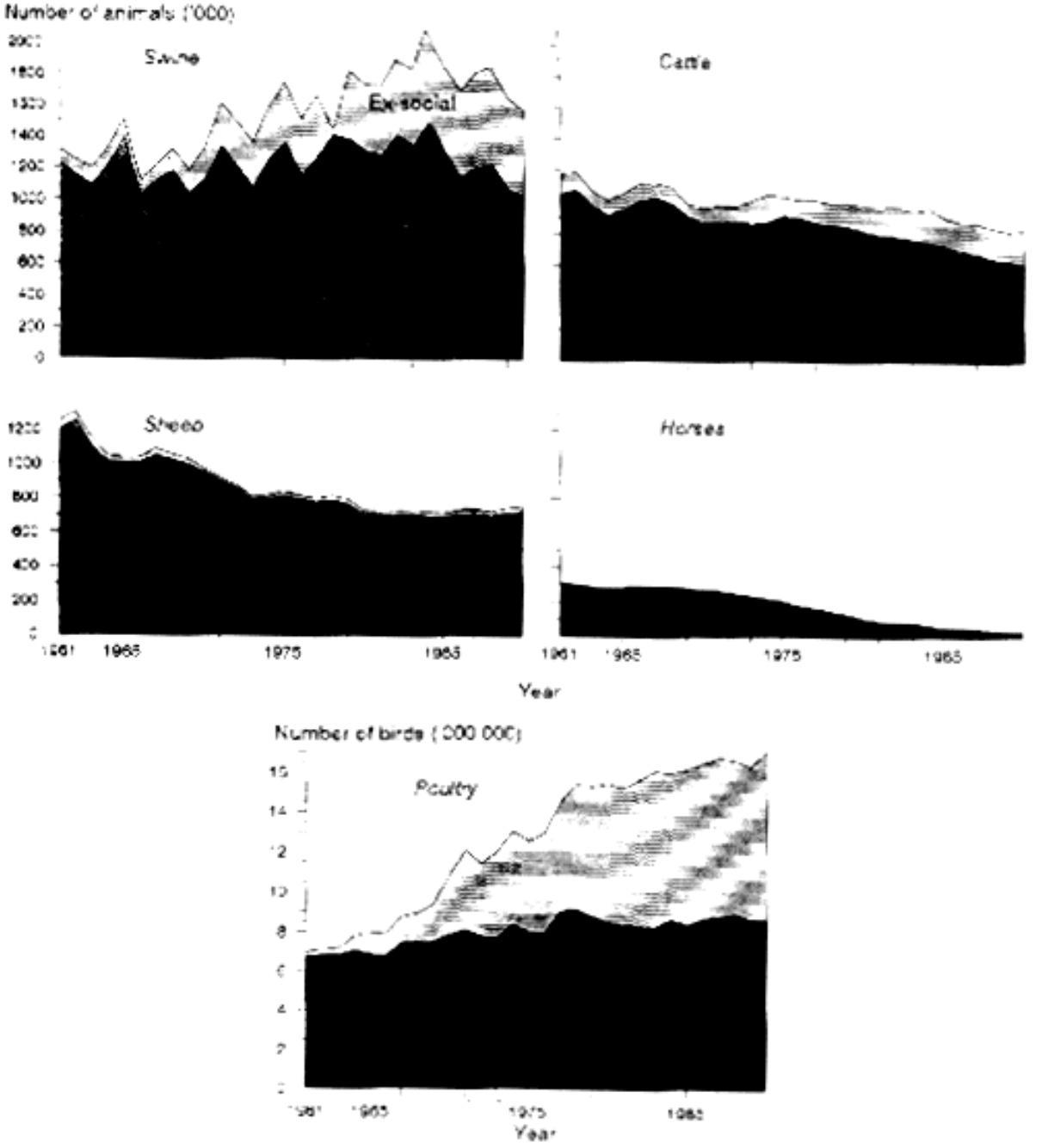
Poultry numbers are almost at parity between the ex-social and private sectors, the former having 49 per cent of the national flock while the latter has 51 per cent. Production is very intensive in the ex-social sector and very extensive in the private sector. Some ex-social sector farms, and especially some now privatized veterinary practices, import parent stock as day-old from the main hybrid poultry producers in Western Europe to produce eggs for sale within Croatia. The commercial domestic fowl sector does, in fact, comprise mainly imported hybrids. There is a mix of degenerate hybrids and traditional breeds (including a bare-necked variety known in Croatian as Golurratke kokos) for farmyard production.



Croatian Busa

Pramenka ram

Figure 2: *Animal population number changes (1951-1990)*



3.5 Horses

Horses are now of relatively minor importance as work animals but in the new economic climate there is renewed interest in the private for sport and leisure. The preferred breeds being the Lipitsa (Lipica) which has a stud at Dakovo in Slavonia, and various strains of Trotter, Thoroughbred and Trakehner. Official policy sees horse husbandry based on existing breed composition. In economic terms, the Croatian Draught Horse or Cold-Blood (Hrvatski hladnokrvunjak) is considered suitable for production and export of meat.

Numbers of the Croatian Draught were estimated at 55 stallions and 100 mares in 1986 with an effective population size of 97. Its recent status is considered "minimally endangered" (Simon and Buchenauer, 1993) but the reality is probably much more serious. The breed has, for very many years, been "improved" by Belgian stallion, mostly of the Ardennes type. Indiscriminate crossbreeding with all other types, mostly light carriage and riding strains, of horses in Croatia is a major problem. A conservation herd is belatedly being established at Krizevci Lemas with mares rescued from war areas and bought or loaned by farmers. There is as yet no stallion and there are no semen or embryo banks.

There are remnants of a Posavina breed of a draught horse around Sisak (Kovac, 1994). This virtually and known horse has survived in this area for the same reasons as the Turopolje pig: official interest in a non-collectivized area was virtually nil and the breed was subject to little interference. The future for this horse is now perhaps brighter with the recent creation of a breeders society and the establishment of a herdbook under the auspices of the Agricultural Centre of Croatia-Livestock Selection Centre.

The Bosnian Pony maintains a precarious foothold in parts of Dalmatia but its future survival, in the absence of interest and conservation programmes, must be in serious doubt.

3.6 Dog

The Croatian sheepdog (Hrvatski ovcar) is a small, black, curly haired dog with erect ears turned over at top and an erect tail. It is used by the Pramenka sheep breeders as a flock and guard dog, mainly in the central Mountains area. In spite of some indiscriminated breeding it is not seemingly in danger.

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Posavina stallion

TABLE 1:
Croatian livestock populations and productivity, 1985-1990

Item	Year 1985	1986	1987	1988	1989	1990
Carcass weight at slaughter (kg)						
- Beef	219	224	218	209	216	214
- Pork	76	77	76	75	76	73
- Sheep	12	12	13	12	11	11
- Poultry	1.4	1.4	1.4	1.3	1.4	1.4
Other production parameters						
- Cow annual milk yield (1)	1884	1867	2003	1992	1941	1931
- Annual egg production/hen	132	131	134	136	136	133

RESSOURCES GENETIQUES ANIMALES DU CAMEROUN

PASSÉ, PRÉSENT ET AVENIR: LE CAS DES RUMINANTS

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SUMMARY

The authors presented in this article a well documented review of the local cattle, sheep and goat populations in relation to the possibility of conservation planning. While the zebu and zebulike cattle populations are in the majority, it is possibly the *Bos taurus* populations that are of particular interest as they represent only about 1 % of the cattle population but are reputed to be trypanotolerant. Sheep and goats are kept in small family units (approximately 5 animals) mainly for slaughter purposes on special occasions (national and religious feasts) and for cash flow purposes. A short presentation of the prevailing local breed selection schemes and the introduction of non-indigenous genetic material, mainly for cross breeding purposes are also given.

RESUME

Les auteurs présentent dans cet article une révision détaillée des populations locales de bovins, ovins et caprins en relation avec les possibilités de programmes de conservation. Bien que les populations de zébus et de zébus similaires soient plus nombreuses, c'est sûrement les populations *de Bos taurus* qui présentent un intérêt tout particulier. Cette population représente seulement 1% de la population bovine mais a l'avantage d'être trypanotolérante. Les ovins et caprins sont élevés dans les familles en petit nombre (5 animaux approximativement), le plus souvent pour l'abattage lors des célébrations spéciales (fêtes nationales ou religieuses) ou comme monnaie d'échange. On trouve également une briève présentation des schémas nationaux de sélection de race et d'introduction de matériel génétique exotique utilisé la plupart du temps pour le croisement.

1.0 INTRODUCTION

Comme dans beaucoup de pays de l'Afrique Sub-saharienne, l'agriculture joue un rôle de premier plan dans l'économie du Cameroun, participant à hauteur de près de 22% dans le Produit Intérieur Brut (PIB). Le secteur de l' élevage quant à lui contribue 16% de la production agricole et nourrit près de 30% de la population rurale (MINPAT, 1986). La population camerounaise, estimée à près de 11 millions, consomme environ 16 kg de viande par an et par habitant, soit une demande de près de 165 000 tonnes pour une production estimée à 105 000 tonnes (tableau 1). Le reste doit donc être importé soit sous forme d animaux vivants en provenance du Tchad et de l'Afrique Centrale, soit sous forme de viande ou de poisson (Europe, Argentine, Afrique de Sud, etc). La production doit donc être augmentée afin que soient réduites la dépendance vis-à-vis des importations et la fuite des devises.

Le Cameroun couvre une superficie de 475 000 km^2 et est subdivisé en 6 zones agroécologiques: Soudano-sahel Provinces du Nord et de 1 Extrême-Nord), Savane Province de 1 Adamaoua), Haute et Moyenne Altitude (Provinces de l'Ouest et du Nord-Ouest), Forêt Humide (Provinces du Littoral et du Sud-Ouest), Forêt Sub-humide (Provinces du Centre et du Sud), Savane Sub-humide et Forêt (Province de l'Ouest) (Teuscher, Bahm et Salah, 1992). L'élevage est pratiqué à des degrés divers dans toutes ces zones (tableau 2). Les facteurs limitants de cette activité sont essentiellement les maladies, le manque de pâturages, la transhumance, la faible productivité des troupeaux, le manque de races améliorées à distribuer aux éleveurs, des cixcuits de commercialisation inexistants, la disparition à terme de certaines races qui étaient pourtant adaptées au milieu, etc. La recherche, particulièrement en ce qui concerne 1 amélioration génétique et la reproduction, a un rôle vital à jouer dans la mise en place de solutions durables à certains problèmes rencontrés.

2.0 LE CHEPTEL NATIONAL

A défaut d'un recensement exhaustif du cheptel camerounais, nous retiendrons les chiffres donnés par le MINPAT (Ministère du Plan et de l'Aménagement du Territoire) en collaboration avec le MINEPIA (Ministère de l'Elevage, des Pêches et des Industries Animales). La population estimée et la distribution des diverses espèces domestiques par province se trouve au tableau 2. Il en ressort que, en 1986, le nombre de bovins était de 4,36 millions de têtes contre 2,36 millions d'ovins, 2,91 millions de caprins, 0,80 million de porcins et 14 millions de volailles. Les ruminants sont donc prépondérants. Il n'existe pas de données fiables quant aux autres espèces domestiques (ânes, chameaux, buffles, lapins, etc.), en raison soit de leur faible importance numérique ou économique, soit pour d'autres raisons (difficulté de recensement, fluctuation très importante des effectifs, incessants déplacements des animaux dans le cas de l' élevage nomade). Il ne sera donc fait mention ici que des bovins, ovins et caprins.

2.1 Les races bovines

Le Cameroun possède un assortiment assez varié de races bovines indigènes aux différentes zones agro-écologiques, allant des zébus *(Bos indicus)* aux taurins *(Bos taurus) en* passant par les divers produits de métissage.

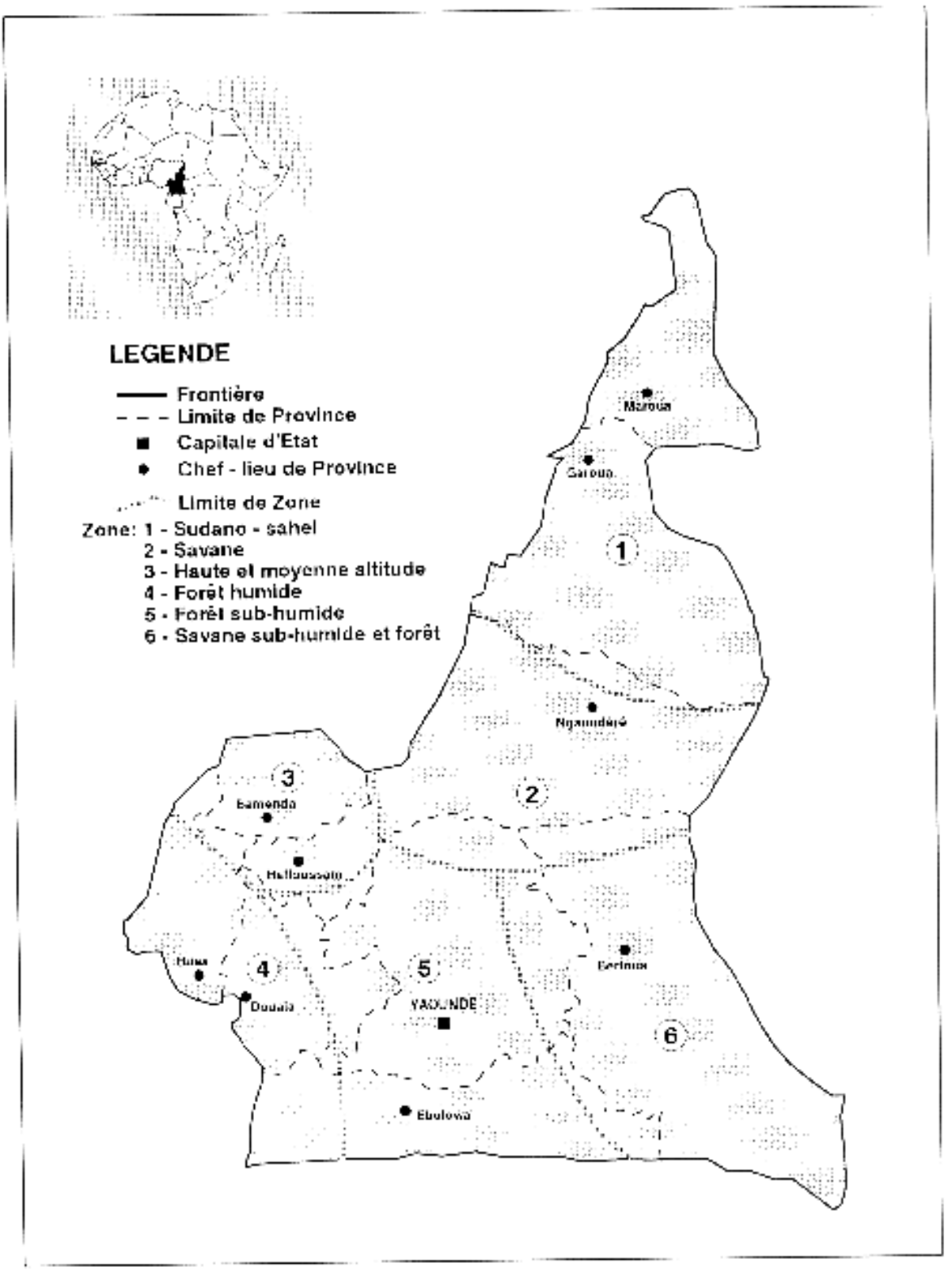

LEGENDE
Frontière
Limite de Province
Capitale d'Etat
Chef - lieu de Province
Limite de Zone
Zone: 1 - Sudano - sahel
2 - Savane
3 - Haute et moyenne altitude
4 - Forêt humide
5 - Forêt sub-humide
6 - Savane sub-humide et forêt
Maroua
Garoua
Ngaoundéré
Bamenda
Bafoussam
Buea
Douala
YAOUNDE
Bertoua
Ebolowa
1
2
3
4
5
6

TABLEAU 1:
Production totale de viande au Cameroun en 1986/1987

	TYPE DE VIANDE (Tonnes)					
PROVINCE	**BOEUF**	**MOUTON**	**CHEVRE**	**PORC**	**VOLAILLES**	**TOTAL**
E.-Nord	13408	4378	2931	346	1333	22396
Nord	5492	727	780	344	534	7877
Adamaoua	25360	375	303	38	194	26270
Est	3795	465	608	1798	478	7144
N.-Ouest	11640	718	328	2140	2142	16967
Ouest	3991	628	1729	1852	912	9111
S.-Ouest	93	73	153	923	275	1517
Sud	6	251	424	395	269	1345
Littoral	55	12	9	1983	2118	4176
Centre	514	192	432	1365	5745	8248
Total	64358	7818	7695	11184	14000	105052
%	61,3	7,4	7,3	10,6	13,3	100

Source: Teuscher et al. (1992)

TABLEAU 2:
Cheptel estimé du Cameroun par zone agro-écologigue en 1986/1987

	ZONE AGRO-ECOLOGIQUE						
ESPECE ANIMALE	**Soudano-Sahel**	**Savane**	**Haute et Moyenne Altitude**	**Foret Humide**	**Foret sub-humide**	**Savane sub-humide et forêt**	
	I	**II**	**III**	**IV**	**V**	**VI**	**TOTAL**
Bovins	1657400	1587500	777300	16000	46300	276000	4361500
Ovins	1362600	139000	406000	34200	166300	250000	2358100
Caprins	1507300	84000	695000	56000	307100	267200	2917500
Porcins	53000	2000	400000	190000	95000	60000	800000
Volaille	1867000	194000	3054000	2393000	6014000	478000	14000000

Source: Teuscher et al. (1992)

Parmi les zébus les plus importants, on distingue le Goudali de l'Adamaoua (avec les variétés Goudali de Ngaoundé ré ou Peuhl ou Foulbé, de Banyo et de Yola ou Mayne), le Mbororo (à robe rouge ou Red Fulani ou Djafoun ou Rahadji, et à robe blanche ou White Fulani ou Akou), le Massa, l'Arabe Choa et d'autres zébus du Nord et de l'Extrême-Nord. Les taurins sont représentés par le N'dama dans la zone forestière, le Moutourou (Bakweri) et le Bakosi (Kosi) dans le Sud-Ouest, le Namchi (Doayo, Poli) dans le Nord, le Kapsiki et le Kouri dans l'Extrême-Nord, le Ketekou dans le Nord et l'Extrême-Nord, et quelques Baoulé dans l'Adamaoua. Par ordre d'importance numérique, on pourrait classer les races bovines présentes au Cameroun ainsi qu'il suit: Red Fulani (28,8%), White Fulani (25%), Zébus sahéliens (21,4%), Goudali de Ngaoundéré (15,3%), Arabe Choa (5%), Goudali de Banyo (3,6%), Ketekou (0,4%), Namchi (0,2%) et les autres (y compris Kouri, Wakwa, Moutourou, Kapsiki et N'dama, 0,5%). Les bovins laitiers (Holsteins, Jerseys et les produits de leurs croisements avec les zébus locaux, les croisés Montbéliard x Goudali) représentent moins de 1 % (Mbah et al.,1988b).

Les taurins indigènes, qui ne font qu'environ 0,9% de la population bovine totale, sont généralement présentés comme trypanotolérants. Ils seraient de ce fait probablement les mieux adaptés pour les zones de trypanosomiase endémique au Cameroun s'il était prouvé que leur trypanotolérance est un caractère héréditaire. Toutefois, en raison de leur petite taille, ces animaux sont généralement méprisés par les éleveurs, d'où la tendance au croisement avec les zébus afin d'obtenir des animaux de plus grand format (Dineur et Thys, 1986) et le danger d'extinction couru alors par les races pures. Déjà, selon Hall (1992), une race taurine (Bamiléké) indigène de l'Ouest Camerouu est considérée comme éteinte et quatre autres figurent sur la liste dangereuse (Bakossi, Bakweri, Kapsiki et Namchi). I1 apparaît donc important que des spécimens de ces races soient collectés, préservés, conservés et multipliés en même temps que leur potentiel serait évalué aussi bien dans leur milieu d'origine que dans les zones infestées par la mouche tsé-tsé. Ce travail a déjà été entrepris, quoique timidement, en raison des contraintes financières, par l'I.R.Z.V. (Institut de Recherches Zootechniques et Vétérinaires).

2.1.1 Description de que(ques races bovines du Cameroun

La plupart des races bovines du Cameroun sont nommées d a rès les affiliations ethniques des éleveurs qui s'y intéressent le plus (Mbororo, Foulbé, etc.) et n ont pas souvent de caractéristiques uniformes en raison d'un métissage parfois assez poussé. Peu d'entre elles ont été décrites en détail, il s'agit essentiellement du Goudali, du Wakwa, du Kapsiki et du Mbororo.

Le Goudali: C'est le zébu par excellence de l'Adamaoua, du type West African Shorthorn. Il serait apparenté au Goudali de Sokoto, et est plus localement connu sous le nom de Foulbé ou Peuhl, nom des éleveurs traditionnels. Les animaux sont de taille moyenne avec une bosse en général assez développée et tombante. La tête est assez longue et étroite, le fanon assez développé et le fourreau pendant (Lhoste,1969). La robe est le plus souvent tachetée de rouge, la répartition de rouge étant assez variable et allant des types presque blancs avec seulement quelques mouchetures, à des types unis rouge ou brun. Le noir se rencontre rarement. On distingue trois variétés:

TABLEAU 3:
Reproduction de races bovines à Ia Station IRZV de Wakwa

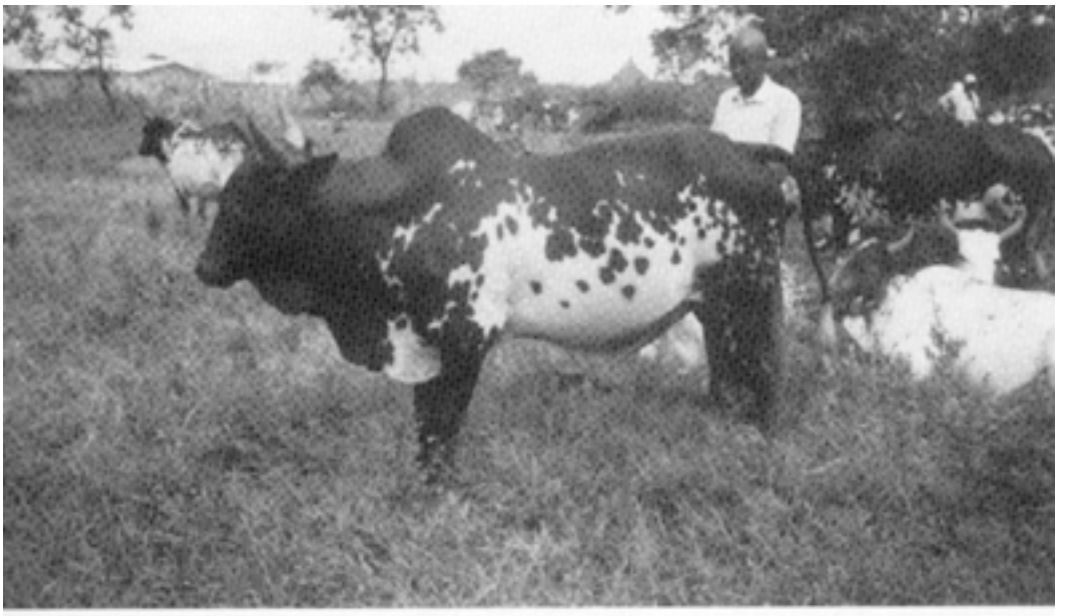
RACE[a]	Age au ler vêlage (mois)	Taux de vêlage (%)	Intervalle de vêlage (jours)	Durée de gestation (jours)	Taux de sevrage (%)
Goudali (G)	53,0 ± 8,5	56,6 ± 1,7	536,0 ± 14,7	299,3 ± 23,1	49,0 ± 2,2
Wakwa	-	57,6 ± 2,2	-	293,0	48,0 ± 3,0
Holstein (H)	31,0 ± 5,4	74,1 ± 12,2	383,0 ± 17,6	-	-
H1G1	26,0 ± 6,5	90,4 ± 6,4	399,0 ± 24,3	-	-
H3G1	-	72,2	-	-	-
MIG1 (F,)	37,8	82,5 ± 4,6	-	-	-
MlG1 (F_z)	35,2	77,0 ± 7,g	-	-	-
MlG1 (F_3)	-	-	-	-	-
M3G1	-	72,2	-	-	-

[a]*M= Montbéliard; HlGl, H3Gl, MlGl, M3G1 sont des produits de croisements entre taurins (H, M) et le Goudali*

TABLEAU 4:
Reproduction de races bovines à la Station IRZV de Bambui

RACE[a]	Age au ler vêlage (mois)	Taux de vêlage (%)	Intervalle de vêlage (jours)	Durée de gestation (jours)
Goudali de Banyo (GB)	48,0	75,3 ± 0,6	511,6 ± 123,5	293,0
White Fulani (W)	-	67,3 ± 7,5	*444,0*	-
Red Fulani (R)	-	50,0	-	-
Holstein (H)	31,7 ± 7,3	70,3 ±7,5	471,7 ± 0,6	-
Jersey (J)	30,4 ± 4,4	75,7 ± 8,2	420,5 ± 0,5	-
Goudali Ngaoundéré (G)	48,0	53,5 ± 3,6	511,5 ± 101,2	290,0
HlG1 (F,)	-	75,2	-	-
HlR1 (F,)	30,5 ± 5,4	84,5 ± 9,6	403,9 ± 3,4	-
H3R1	-	100,0	-	-
JlW1 (F,)	35,4 ± 7,4	80,3 ± 5,7	412,8 ± 7,3	-
J3W 1	-	55,0	517,7	-

HlGl, HlRl, H3Rl, JlWl, J3W1 sont les roduits de croisement entre des taurins J, H et des zébus (G, R, W)



Ngaoundéré Goudali

TABLEAU 5:
Performances de lactation de races bovines aux Stations IRZv de Wakwa et Bambui

RACE[a]	Taille de l'échantillon	Durée de lactation (jours)	Production totale (kg)	Production moyenne/jour (kg/j)
Wakwa				
Goudali Ngaoundéré	14	140,0 ± 12,6	373,7 ± 49,4	2,57 ± 0,19
Holstein	34	298,5 ± 4,2	3450,6 ± 51,2	11,53 ± 0,12
HlG1	49	282,3 ± 5,4	1838,2 ± 59,9	6,50 ± 0,10
H3G1	2	262,0	850,9	3,40
MlG1 (F,)	28	258,3 ± 7,4	1693,2 ± 63,3	6,60 ± 0,23
MlG1 (F_Z)	53	256,8 ± 7,5	1502,6 ± 66,7	5,50 ± 0,13
MlG1 (F3)	7	304,0 ± 2,6	1845,5 ± 0,2	6,00 ± 0,06
M3G1	4	322,0	1318,4	4,10
Bambui				
White Fulani	8	175,5 ± 38,6	536,5 ± 114,3	3,23 ± 0,13
Red Fulani	14	114,0 ± 16,5	341,0 ± 47,3	2,99
Holstein	78	301,1 ± 3,7	3483,9 ± 153,2	10,70 ± 0,51
Jersey	65	275,1 ± 4,2	2454,1 ± 76,9	8,83 ± 0,15
HlG1 (F,)	24	152,7 ± 19,2	1155,1 ± 168,7	7,24 ± 0,18
HlR1 (F,)	14	227,1 ± 12,3	1572,5 ± 196,1	6,64 ± 0,47
H3R1	-	172,0	1583,0	9,20
JlW1 (F,)	54	198,4 ± 4,8	1109,3 ± 57,7	5,49 ± 0,16
J3W1	-	189,0	789,4	4,18

[a] *HlGl, H3Gl, MlGl, M3Gl, HIRl, H3Rl, JlWl, J3W1 sont des produits de croisements entre taurins (H, M, J) et zébus (G, R, W)*

Banyo Goudali

Kouri-Nord Cameroun

White Fulani

Red Fulani

- Le Foulbé de Ngaoundéré, le mieux conformé pour la viande. Il est assez musclé p , lutôt ramass é avec une robe typique tacheté e de rouge. Ces animaux peuvent atteindre un poids adulte de plus de 550 kg chez les mâles (et même 700 à 800 kg), et 350 à 550 kg chez les femelles.
- Le Foulbé de Banyo a une stature, un squelette et un cornage plus forts que pour le type Ngaoundé ré, quoique le rendement carcasse paraisse moins bon. La robe est typiquement pie-rouge ou brun, avec un visage tacheté de blanc et une bosse plus ferme et souvent dressée.
- Le Foulbé de Yola se rencontre aux environs de Tignère, vers la frontière avec le Nigéria. Il est de format moyen, inférieur à celui des deux types précédents. Les cornes sont courtes, le fanon moins développé et la bosse plus légère. La robe, variable, est le plus souvent tachetée de rouge.

Le Wakwa: Produit du croisement en 2ème génération (au moins) entre les femelles Goudali de Ngaoundéré et les mâles zébus Brahman américains importés sur pied ou sous forme de semence (la première génération a été dénommée Pré-Wakwa). C'est un animal bien conformé, à la robe variant du fauve au beige, aux oreilles tombantes et à la bosse assez développée. Le mufle, le bout des oreilles et les alentours des yeux sont noirs. Le Wakwa allie la rusticité et l'adaptation au milieu de la race Goudali locale à la productivité de la race Brahman. Quoiqu'ayant un taux de vêlage (55%) qui ne diffère pas beaucoup de celui du Goudali et un taux de mortalité des veaux (5,6%) plus élevé, le Wakwa sèvre plus de kilogrammes (89,4 contre 75,0) de veau par vache et par an (Mbah et al., 1988b). Très appréciés par les éleveurs auprès desquels ils ont été diffusés malgré leur plus grande susceptibilité à la dermatophilose, les Wakwa ont été tellement croisés avec les individus de la race locale que la proportion de sang Brahman est de l'ordre du 1/16e ou du 1/32e. Cette situation va aller s'aggravant, d'autant plus que les troupeaux de multiplication au niveau de la Station Zootechnique (MINEPIA) de Wakwa ont disparu.

Le Mbororo: C'est un animal de grand format, de grande taille, aux membres et à la tête longs. Le cornage, long et puissant, présente en général une forme de Iyre haute. L'encolure est longue et peu musclée, la croupe inclinée et peu couverte, la poitrine étroite mais profonde (Lhoste,1969). Ces animaux ont une conformation bouchère médiocre avec un faible rendement carcasse, de l'ordre de 40-42% (Mandon, 1957; Lhoste, 1969). Ils peuvent atteindre un poids adulte de 500-520 kg pour les mâles contre 335-368 kg pour les femelles (Pradere,1976). Ce sont des animaux rustiques adaptés à la marche et aux longs déplacements que leur imposent les éleveurs nomades Mbororo. On distingue les zébus Mbororo rouges ou Djafoun des Mbororo blancs ou Akou.

Le type Djafoun se caractérise par sa robe acajou uniforme. Le cornage et le squelette sont forts. Le type Akou quant à lui présente une robe blanche plus ou moins pigmentée de noir, le mufle et les oreilles sont généralement noirs.

Le Kapsiki: Est *un Bos taurus* indigène au Cameroun, il se rencontre aux alentours des Monts Mandara. De petite taille, il a de courtes cornes (16-24 cm) et un fanon réduit. La couleur de la robe varie du brun foncé au pie-noir. Le poids adulte est 326,6-382 kg et 233243 kg respectivement pour les mâles et les femelles (IRZ Yagoua, 1984). De petite taille, la hauteur au garrot varie de 107 cm pour les femelles à 114 pour les taureaux (Dineur et Thys, 1986).

Kapsiki à Wakwa, Ngoundéré, Cameroun

TABLEAU 6:
Reproduction et croissance de quelques races ovines dans les zones semi-arides du Cameroun

CARACTERISTIQUE	RACE OVINE		
	Massa	**Foulbé**	**Djallonké**
Reproduction			
Age au ler agnelage (j)	*344 ± 45*	*448 ± 13*	336
Intervalle d'agnelage (j)	204 ± 36	222 ± 42	209 ± 26
Fertilité (%)	154	118+ - 132'	136
Prolificité (%)	134	108+ -125*	142
Fécondité (%)	231	151' -166'	221
Croissance			
Poids naissance (kg)			
- M	1,98	3,01	2,00
- F	1,83	2,64	1,80
Moyenne	1,91	2,82	-
GMQ à 150 jours (g)			
- Naissances simples	73,6	97,50	63,20
- jumeaux/multiples	65,50	85,00	60,70
Poids adulte (kg)			
- M	31,80	43,10	28,60
-F	25-30	30-40	25-30

' Zone sahélienne, ' zone soudanienne

Sources: Deciry (1987), Mbah et al. (1988a), Rapport Annuel IRZ Yagoua (1985-1987)

2.1.2 Quelques utilisations des bovins

Les bovins sont élevés essentiellement pour la production de viande. Toutefois, quoique réputés faibles producteurs de lait, ils constituent une source non négligeable de protéines et de revenus pour les populations qui les élèvent (consommation familiale et vente sous forme de lait frais ou caillé, beurre). De plus, les peaux des animaux abattus sont utilisées en maroquinerie (artisanale par les peuplades soudano-sahé liennes, ou industrielle) et dans 1 alimentation humaine (peaux brûlées ou "Nkanda" consommé es par les peuplades des hauts plateaux de l' Ouest et du Nord-Ouest). Dans les zones septentrionales en général, et de plus en plus dans les zones méridionales non fortement infestées par les glossines, les bovins sont aussi employé s comme animaux de trait (labour, portage, etc.). Une utilisation très secondaire des bovins mais dont 1 im ortance n est lus à démontrer est la fertilisation: de plus en plus d agriculteurs recourent au bétail pour fertiliser leurs champs grâce aux feces déposés par ces animaux lorsqu'ils exploitent les résidus de récolte de maïs ou de sorgho. De même, les personnes qui font du maraîchage utilisent la bouse déposée dans les "waldé" où les animaux passent leurs nuits. L'aspect social des bovins n'est pas à négliger dans la mesure où le statut dans certaines tribus s'évalue à la grandeur du cheptel bovin de l'éleveur; il en est de même lors des cérémonies de mariage ou de funérailles dans la société traditionnelle (cas des animistes ou Kirdi de l'Extrême-Nord). Enfin, dans certaines tribus consommatrices de vin de palme (palmier à huile ou palmier raphia), seuls l'âge ou la qualité de notable confère le privilège de boire dans une corne de boeuf.

2.2 Les races ovines et caprines

2.2.1 Description de quelques races ovines et caprines du Cameroun

Charray et Tsangueu (1987), dans le cadre d'une description succincte, ont réduit les effectifs rencontrés à un type sahélien et un type guinéen. Cette description, quoiqu'elle réponde à un souci de simplification, ne reflète pas la diversité des types d'ovins et de caprins rencontrés au Cameroun. I1 n'existe certes pas d'études détaillées et approfondies sur les différents types d'ovins et de caprins camerounais mais il est possible de distinguer parmi les ovins, le Djallonké (Bikoi Ntep et Njwe, 1989), le mouton nain des savanes (Grassland Dwarf Sheep) (Ndamukong et al., 1989), le Pulfali ou Peuhl ou Foulbé (Ngo Tama et Rippstein, 1989), le Kirdi (Dumas,1977), le mouton de Maroua (Bardoux, 1986), etc. Les races caprines mentionnées dans la littérature sont la chèvre naine des savanes (Grassland Dwarf Goat) (Ndamukong et al.,1989), la chèvre sahélienne (Dumas,1977; Charray et al.,1980), la chèvre Kirdi (Bardoux, 1986) et la chèvre rouge de Sokoto. En général, on observe un gradient décroissant de la taille des petits ruminants de la zone sahélienne vers la zone forestière: les animaux rencontrés dans le Nord et l'Extrême-Nord sont plus grands et plus hauts sur pattes que leurs homologues des zones méridionales.

Les Ovins

Doutressoule (1947) a décrit le Djallonké, qu'on rencontre dans la plupart des régions du Cameroun. En fait, on le trouve dans tout le Golfe de Guinée (Vallerand et Brankaert, 1975). C'est un animal court sur pattes (0,4 à 0,6 m à l'encolure) et peu lourd (20 à 30 kg).

Le mouton nain des savanes a des oreilles dressées et pointues avec une queue longue et fine. Le pelage est fait de poils courts et fins, et la couleur de la robe varie du noir au blanc avec divers degrés de moucheture (IRZ Mankon, 1986).

Le mouton Peuhl se rencontre dans les provinces septentrionales (Nord et ExtrêmeNord), et aussi au Tchad où il a été décrit par Dumas (1977). Les cornes sont peu développées chez le mâle et les oreilles sont longues. Le blanc prédomine dans la variété Waila. La hauteur peut atteindre 85 cm et le poids adulte 45 kg. Ce serait un parent proche de l'Oudah bicolore (noir et blanc) que l'on rencontre en majorité chez les éleveurs Mbororo, 1ui aussi haut sur pattes avec des oreilles longues et fines.

Le mouton Bornou Foulani est assez haut sur pattes. Son pelage est court et, d'habitude, blanc ou blanc avec des taches noires (IRZ Yagoua, 1986).

Le mouton Kirdi, qu'on rencontre surtout le long du fleuve Logone et dans les Monts Mandara,

est gardé par les populations animistes (ou Kirdi) de ces zones qui sont essentiellement des agriculteurs. Dumas (1977) l'a décrit au Tchad comme le mouton du Sud. Les oreilles sont plus courtes que celles du mouton Peuhl, avec un pelage variant du blanc au noir quoique le noir tende à prédominer. La taille moyenne adulte est de 50 cm et le poids plus de 25 kg.

Le mouton de Maroua n' a pas été décrit per se. Il serait apparenté aux ovins de l' Ouest du Mayo-Kebbi au Tchad (Dumas, 1977). Selon Bardoux (1986), sa hauteur maximale est de 70 cm. Il serait le résultat de croisements avec le mouton Peuhl.

En plus des races indigènes, il y a eu des introductions de races exotiques (Dorset, Suffolk, Katadhin) dans les Stations de Recherche (IRZ Mankon, 1986) pour des études d'adaptation et de probables croisements avec les races locales.

Les Caprins

Le Grassland Dwarf Goat se rencontre surtout dans les Provinces de l' Ouest et du Nord-Ouest. Les deux sexes sont cornus, avec des oreilles dressées, des pattes relativement courtes et un pelage à poils courts et à coloration variable.

La chèvre sahélienne, qu'on trouve dans la Province de l'Extrême-Nord, est élevée par les Arabes Choa du Logone et Chari. Elle a une petite tête et de longues oreilles. La taille varie de 60 à 80 cm (Bardoux, 1986).

La chèvre kirdi est très représentée dans l'Extrême-Nord, allant aussi loin que le 1 lème parallèle. Elle a des cornes spiralées très développées et sa couleur varie du noir au blanc. Elle peut atteindre 45 à 55 cm.

La chèvre rouge de Sokoto, comme son nom l'indique, a un pelage court de couleur rouge brun. Rencontrée surtout dans la Province du Nord, elle aurait été introduite du Nigéria.

Quelques races exotiques (Chèvre Nubienne, Toggenbourg, Saanen) ont été introduites et sont étudiées à la Station IRZV de Mankon.

2.2.2. Quelques utilisations des ovins et caprins

Dans la majeure partie des cas, les petits ruminants sont détenus par de petits propriétaires. Selon Charray et Tsangueu (1987), 55% des éleveurs de caprins et 61% des éleveurs d'ovins possèdent au plus 5 têtes. C'est donc surtout un élevage tire-lire dont les décisions de vente sont liées à des besoins monétaires plus ou moins pressants (Vallerand, 1979) ou à des événements sociaux d'importance (mariages, funérailles et autres fêtes traditionnelles).

Les petits ruminants sont élevés essentiellement pour leur viande qui est très prisée lors des fêtes civiles (Nouvel An) et religieuses (Tabaski, Noël, Pâques) et au cours de festivités diverses. Seules les populations Arabes Choa du Département du Logone et Chari dans la Province du Nord paraissent traire leurs chèvres dont le lait constitue un apport substantiel au niveau micro-économique (environ un litre pour cinq chèvres, à raison de 100 à 125 FCFA le litre). Les peaux des petits ruminants sont aussi prisées en maroquinerie, comme ornement aussi bien que comme symbole de rang dans la hiérarchie traditionnelle.

3.0 DESCRIPTION DES PROGRAMMES EN COURS OU PREVUS

3.1 Caracté risation des races

L'Institut de Recherches Zootechniques et Vétérinaires a entrepris depuis un certain nombre d'années la collecte et la caractérisation de toutes les races existant sur le territoire national. Beaucoup reste encore à faire dans ce domaine et; en raison des restrictions budgétaires liées à la conjoncture économique, le travail entrepris a été fortement ralenti et parfois même abandonné.

La description des races entreprise jusque-là est basée sur des données purement phénotypiques et sur la génétique quantitative. Il n'existe aucun programme destiné à la description plus détaillée (par exemple, la génétique moléculaire) permettant de distinguer avec certitude si les types décrits sont des races à part entière ou des variantes au sein d'une même race. De même, il n'existe pas encore de banques de données, aucune étude dans ce sens n'ayant été faite.

Selon certaines estimations, il se dégagerait une baisse quasi constante des effectifs dans certaines races, au point que certaines d'entre elles sont considérées comme étant menacées. C'est ainsi que les taurins Bakweri et Bakosi figurent dans la World Watch List (Loftus et Scherf, 1993) dans la catégorie des races en danger de disparition tandis que le Namchi et le Kapsiki méritent une attention particulière (Sauveroche et Thys, 1994). Un intéressant plan de préservation est proposé par ces auteurs, avec des actions à mener aussi bien dans le milieu traditionnel auprès des éleveurs (sensibilisation en vue de la préservation de noyaux de race pure) que hors de ce milieu (en station et auprès des néo-éleveurs dans les régions de savanes infestées de glossines).

3.2 Amélioration génétique

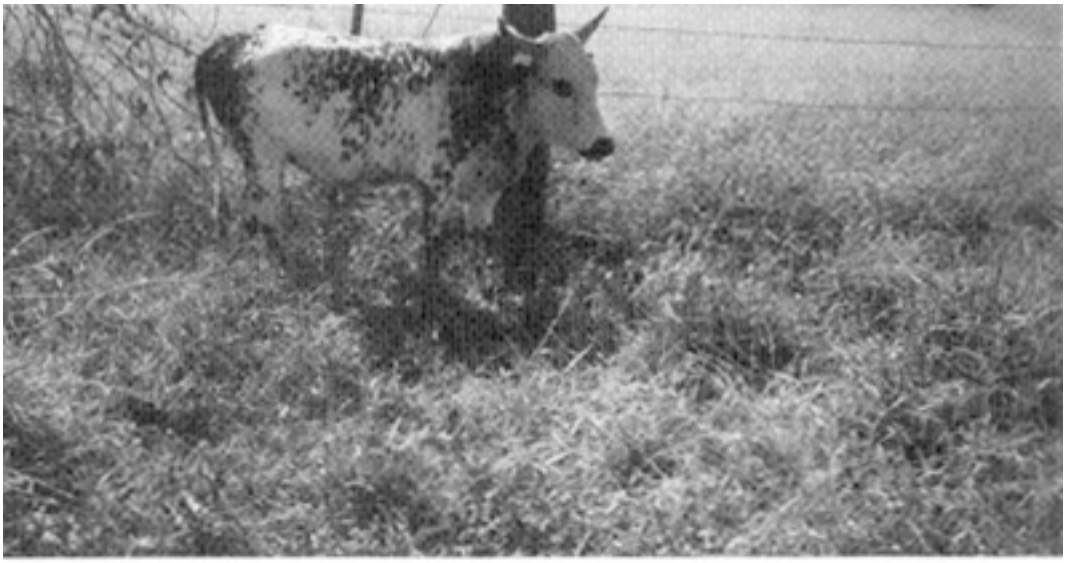
Des programmes d'amélioration génétique ont été mis en place dans toutes les zones agro-écologiques, et plus particulièrement à Wakwa dans l'Adamaoua et à Bambui dans le Nord-Ouest en ce qui concerne les bovins. Cette restriction est imputable à la main d'oeuvre et aux financements qui font défaut.

3.2.1 Sélection des races locales

L'une des mesures destinées à améliorer génétiquement le Goudali de Ngaoundéré a été la sélection. Les travaux de sélection ont débuté à Wakwa en 1965 (Lhoste, 1977) avec pour but la production de lignées améliorées plus performantes. La sélection des jeunes mâles et femelles est basée sur leur indice de croissance de la naissance à un an par rapport à leurs contemporains. Les animaux adultes quant à eux sont reformés sur la base de leur inaptitude à la reproduction, la croissance de leur descendance, leur conformation et la fertilité (habilité à produire au moins un veau tous les deux ans) des femelles. Quoique en général il ait été constaté une nette amélioration au fil des ans en ce qui concerne la croissance, les paramètres de reproduction ont peu ou pas suivi la même évolution. D'importants paramètres phénotypiques (Tawah et al., 1993) et des tendances génétiques et phénotypiques inconsistantes (Tawah et al., 1994) ont même été signalés.

3.2.2 Croisements améliorateurs

Des travaux entrepris à Wakwa entre 1934 et 1969 ont montré que malgré leur adaptation à leur environnement, les zébus Goudali, en raison de leur lente croissance et de leur faible fécondité, n'étaient pas outillés pour la production bouchère à grande échelle et encore moins pour la production laitière (CRZW, 1967-1986; Munji, 1973; Lhoste et Pierson 1974, 1976; Tawah et Mbah, 1989). La sélection pour les qualités bouchères et laitières désirées étant un long processus qui nécessité plusieurs générations avant qu'une quelconque amélioration durable puisse être notée (Mahadevan, 1965; McDowell, 1977), les croisements améliorateurs sont apparus comme le moyen le plus rapide pour accroître la production de viande et/ou de lait. C'est dans cette optique que l'importation d'animaux de races taurines exotiques aux qualités bouchères et/ou laitières confirmées (Montbéliard, Tarentais, Salers, etc.) a été entreprise dans les années '30 mais a connu un échec en raison de l'inadaptation de ces races aux conditions climatiques et à leur grande susceptibilité aux maladies locales. De même, l'importation de taureaux zébus Brahman des U.S.A. en 1952 (Mandon, 1957) en vue de leur croisement avec les Goudali n'a pas mieux réussi. I1 a fallu recourir à l'insémination artificielle avec de la semence importée congelée. Des croisements entre des races taurines exotiques (Holstein, Jersey, Charolais, Montbéliard, Aberdeen-Angus) ou zébus (Brahman) et les zébus locaux se font donc par insémination artificielle depuis des années à Wakwa et à Bambui pour la production laitière ou bouchère. Les croisements Brahman x Goudali ont donné lieu en F, au Pré-Wakwa, très susceptible à la streptothricose. Le croisement des Pré-Wakwa entre eux a permis la "stabilisation" d'un demi-sang appelé Wakwa, moins susceptible à la dermatophilose. Ces animaux se sont avéré plus performants que les Goudali: croissances pré- et post-sevrage supérieures, meilleur rendement carcasse, etc. De même, les croisés entre Goudali et taurins se sont avéré de loin plus performants que le parent zébu (Mbah, Mbanya et Messine, 1987; Saint-Martin et al., 1988). Ces résultats



Namchi

Femelles Ngoundéré Goudali de 3 ans

sont en partie à l'origine de l'implantation dans la zone de Ngaoundéré du Projet Laitier Pilote Canado-Camerounais, et des coopératives laitières de Bamenda et Tadu dans le Nord-Ouest.

4.0 CONCLUSION

Les travaux sur la caractérisation, la sélection et, éventuellement, les croisements des animaux à potentiel boucher et/ou laitier vont continuer. Le niveau des importations de viande et de lait et de leurs dérivés montre qu'il y a nécessité d'augmenter la production. Le Cameroun, de par sa diversité agro-climatique, possède en plus des potentialités énormes de productions animales que d'autres pays voisins n'ont pas, d'où la nécessité de mettre l'accent sur 1 amélioration énéti ue des races locales. De 1 autre côté, la collecte, la conservation, la multiplication et l' évaluation du potentiel des races bovines menac ées de disparition et soupçonnées de trypanotolérance constituent des axes de recherche très importants. Ces races sont à préserver pour des raisons culturelles, scientifiques et économiques (Sauveroche et Thys, 1994).

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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'Eleveurs, et nombreux d'entre eux qui utilisaient des systèmes de production et des techniques d'élevages moins intensifs préferent 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 re istered in "World Watch List" (FAO, 1993) as "endangered" (pages 219 and 230).

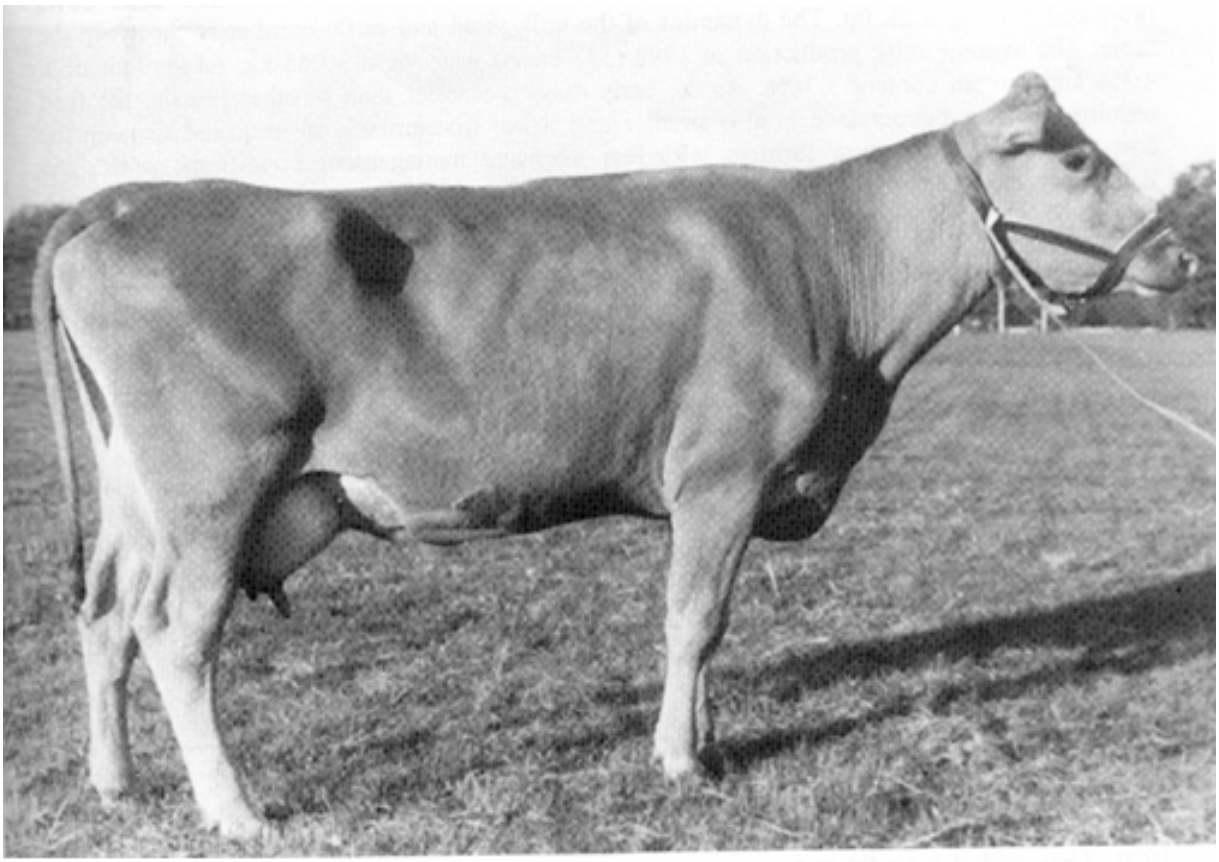
2.0 THE ESTONIAN NATIVE CATTLE BREED

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%/o 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 l4th 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.S^{a}/o) and protein content (3.3-3.4%). Polled cows are preférred. 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 k 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:

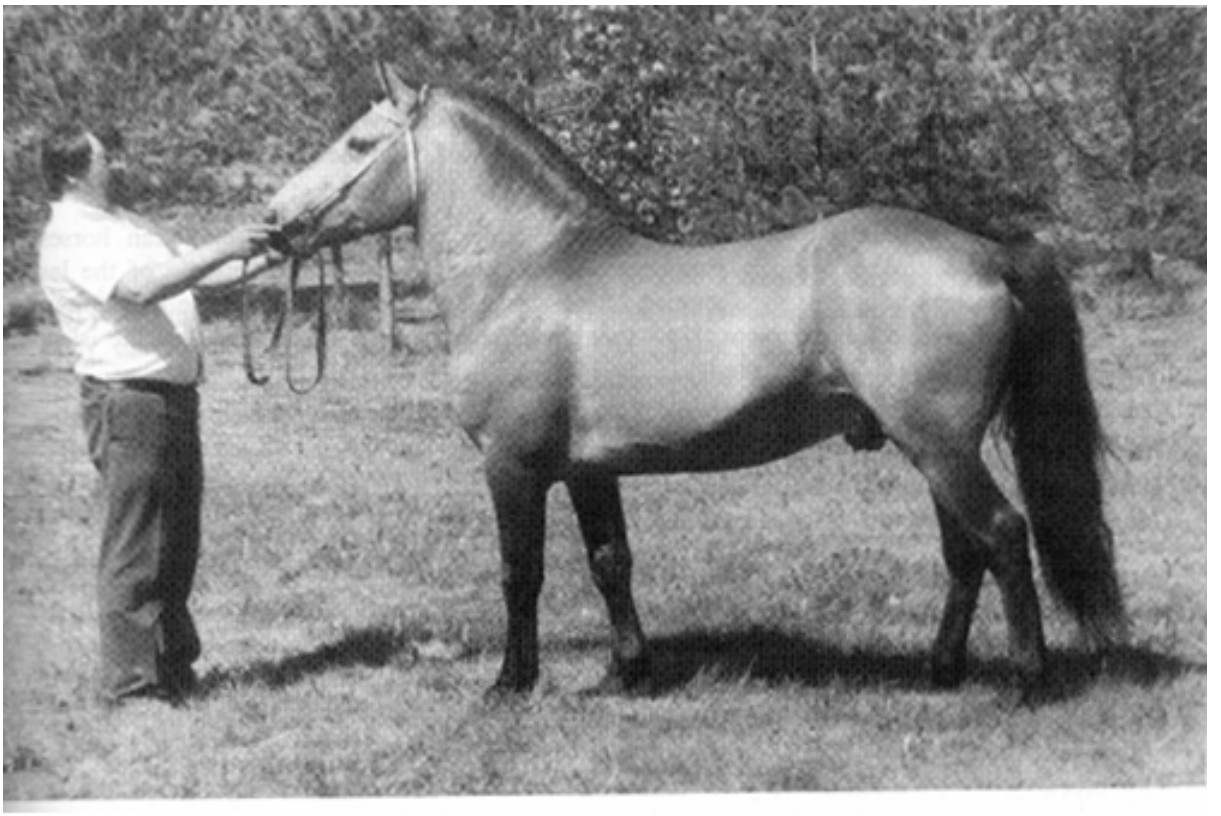
- to increase the number of cows to 2 000. Introduction of embryo transfer is needed to achieve this goal;
- to inseminate all breeding females with the best controlled Finnish Native bulls (about 1 000 doses of semen are needed);
- in order to get tested bulls for insemination the potential dams (with 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 l8th 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.

Ât 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 obtained 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.

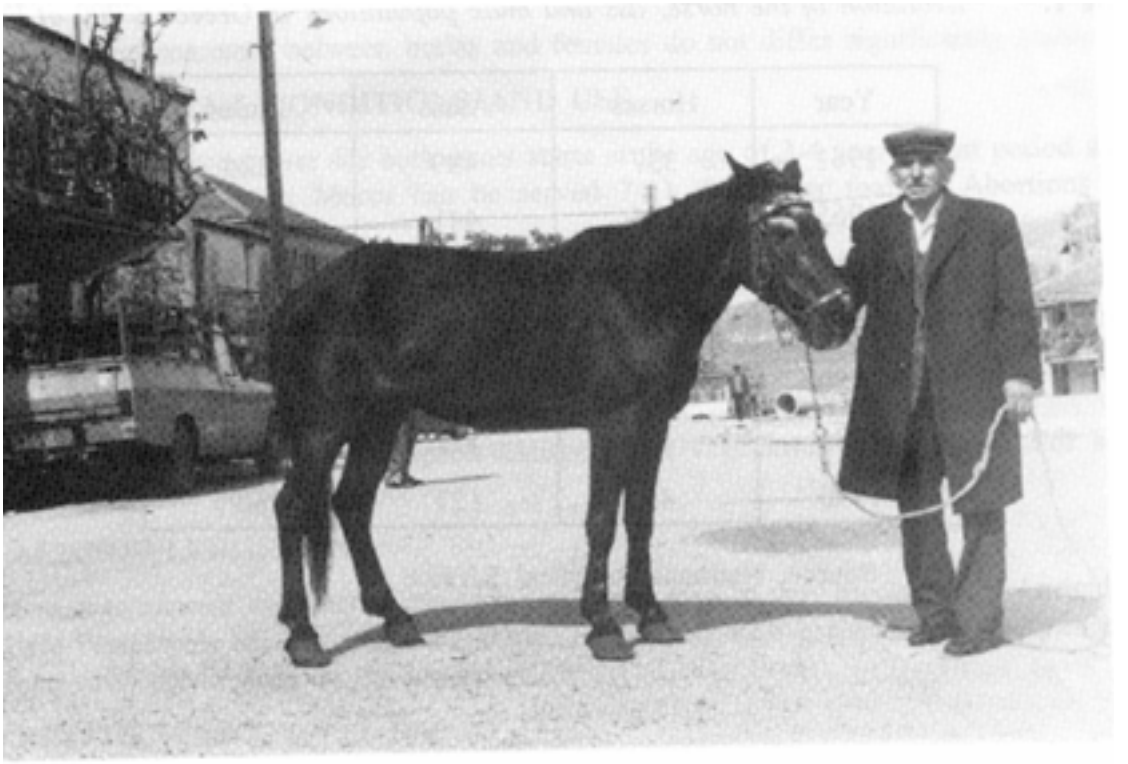
Its area of distribution is the Pineia region, a small mountainous region in the eastern part of the Ileia Prefecture (western Peloponese).

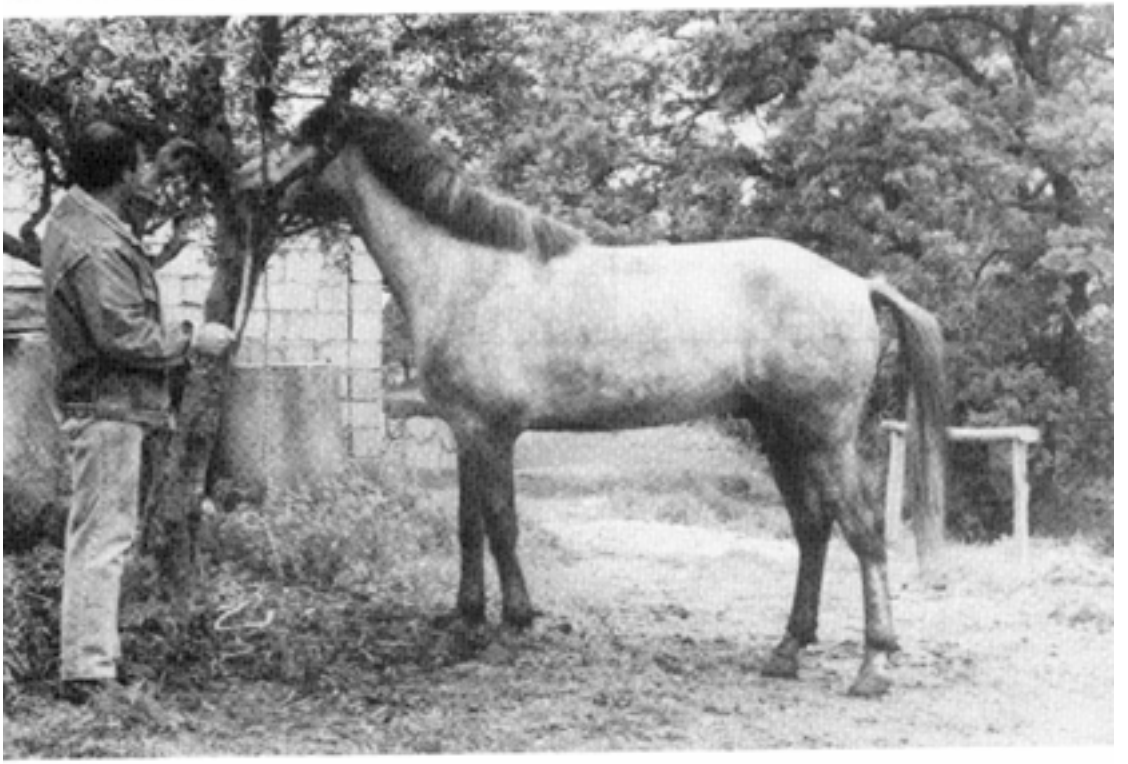
3.0 CHARACTERISTICS OF THE BREED

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 envirorment 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 L:
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 ± S. E.)

	Males (n=17)	Females (n=9)
Wither height	140.53 ± 1.53	138.44 ± 1.09
Girth circumference	161.06 ± 2.13	157.56 ± 1.55
Cannon bone circumference	17.71 ± 0.24	17.44 ± 0.18
Body length	145.41 ± 1.21	143.33 ± 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 Rajastha. 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 Rajastan. 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±0,88;12,9±0,71; 16,4±0,71; 21,0±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+0,04 à 0,88±0,03 et la regression du poids dans les mesures corporelles est de 0,63+0,02 à 0,98±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 a1. (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 ftock 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 a d 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, l, 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.* , I 981; Singh *et a1.* , I 984 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 a1., 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 a1.* (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 a1.* (1981) and Kaushish *et al.* (1990), on 3 and 6 month weight by Singh *et a1.* (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 a1. (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 a1. (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 a1. (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 a1. (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, l, 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 a1. (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.

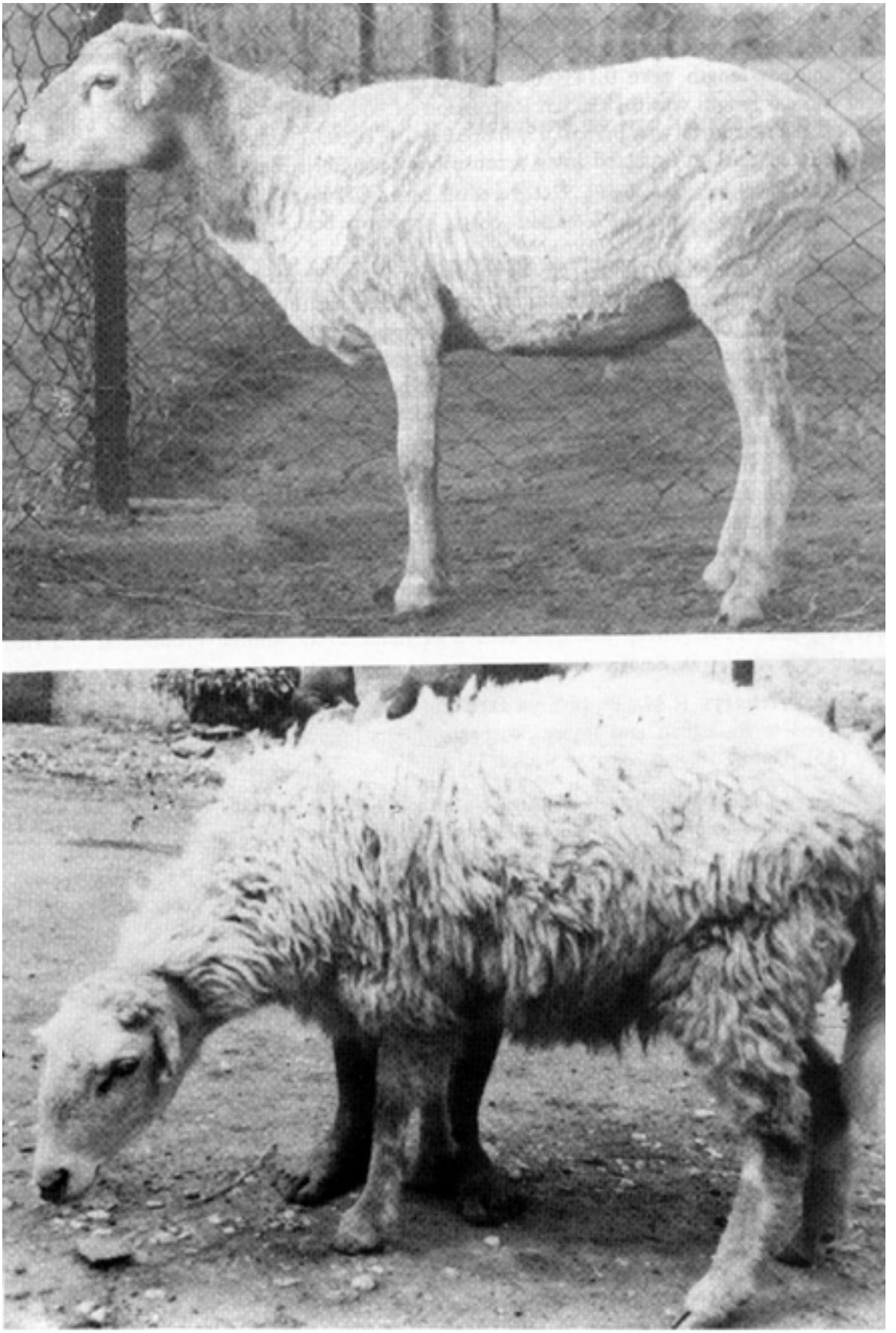
Significant effect of sex was observed on body weight, height, body length and chest girth at the 8 teeth stage with males being superior to females for all these traits, indicating that only selected males (on the basis of body size) are kept for breeding and are provided with better care and nutrition 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

CONSERVATION OF THE SONADI BREED OF SHEEP IN INDIA

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SUMMARY

A study was carried out to estimate the population of the Sonadi breed of sheep in the Chittorgarh district of Rajasthan (India), which is part of a major breeding tract of the Sonadi breed. A total of 2 443 sheep from 59 flocks of 18 villages belonging to three different tehsils of Chittorgarh were covered in this survey. The population data on sheep from livestock census (1992) were collected and the figures were extrapolated for the purpose. The population of Sonadi sheep in their natural habitat was estimated to be 603 984 while the total sheep population of the tract was 1 792 050. The estimated number of breeding rams available in the natural habitat were 45 907 out of which only 1 I 802 were of the Sonadi breed. There was a higher proportion of crossbred sheep and an even higher proportion of crossbred rams in the breeding tract as compared to the purebreds. It has been postulated that a proportion of cross bred sheep would further increase which coûld be a threat to the Sonadi breed in a real sense. It has been emphasized that steps for conservation are warranted.

RESUME

Une étude a été réalisée pour estimer la population ovine Sonadi dans le district de Chittorgarh du Rajastan (Inde), qui est la zone principale où se trouve cette race dans la région. Dans cette enquête on a relevé un total de 2 443 ovins appartenants à 59 troupeaux de 18 villages de trois zones différentes du Chittorgarh. On a repris les données de la population ovine du recencement (1992) et les résultats on été extrapolés pour cette recherche. La population ovine de Sonadi dans son habitat est estimée aux alentours de 603 984, tandis que la population totale est de 1 792 050. Le nombre estimé de moutons disponibles dans leur habitat naturel est de 45 907, dont seulement 11 802 appartiennent à la race Sonadi. Il existe une grande proportion de brebis croisées et une assez grande proportion de moutons croisés dans les districts en comparaison avec le nombre de race pure. On a estimé que si la proportion de races croisées continue à augmenter, ceci ira au détriment de la race Sonadi. On souligne l'importance des mesures à envisager dans le but de conserver cette race.

1.0 INTRODUCTION

Sonadi is one of the triple purpose breeds of Rajasthan producing a fairly good amount of milk, meat and wool. However, the wool quality is very poor. The wool is very coarse with a percentage of medullated fibres as 88.15±2.1% and fibre diameter 52.65±1.77 μ (Acharya, 1982). It has been considered as one of the 8 strains of the earlier known Bikaneri breed (Arora et al.,1977). The breed has been described on the basis of physical appearance, habitat, etc. by Narayan (1956). Later Arora et al. (1977) described the breed on the basis of biometrical measurements, survival rate, reproductive efficiency, wool yield and wool quality. Significant contributions on various aspects of production have also been made by several research workers (Chandiramani, 1973; Nivsarkar, 1979; Parida, 1979).

The major breeding tract of the breed encompasses the Udaipur, Rajsamand, Chittorgarh and Dungarpur districts of Rajasthan, whereas the minor breeding tract consists of Bhilwara district of Rajasthan and part of North Gujarat (Acharya,1982; Basuthakur, 1988).

The figures for the quinquennial census of sheep population are available from the year 1919-20 to 1992. However, no efforts to enumerate the population breedwise were made. In a few extremely sketchy reports population of certain breeds have been predicted (Acharya 1982, Basuthakur, 1988, Tantia et al. 1993.)

This study makes an endeavour to establish the population of the Sonadi breed of sheep and the number of Sonadi rams available in their natural breeding tract. The population of crossbred sheep and number of crossbred rams available in the breeding tract were also estimated. This was done to determine if the crossbreeds posed any threat to the native sonadi animals. The whole issue has been discussed from the perspective of preservation and conservation of animal genetic resources of the country.

2.0 MATERIALS AND METHODS

The study was conducted in the Chittorgarh district of Rajasthan which is a part of a major Sonadi breeding tract and minor breeding tract of the Malpura breed of sheep. Without any prior knowledge of the status of sheep breeds and total sheep population, randomly three tehsils (Barisadri, Doongala and Chhotisadri) were selected. From these three tehsils a total of 2 443 sheep from 59 flocks belonging to 18 villages were randomly chosen for the survey. Individual animals of each flock were meticulously judged for the typical features of the breeds according to the breed characteristics described (Acharya, 1982).

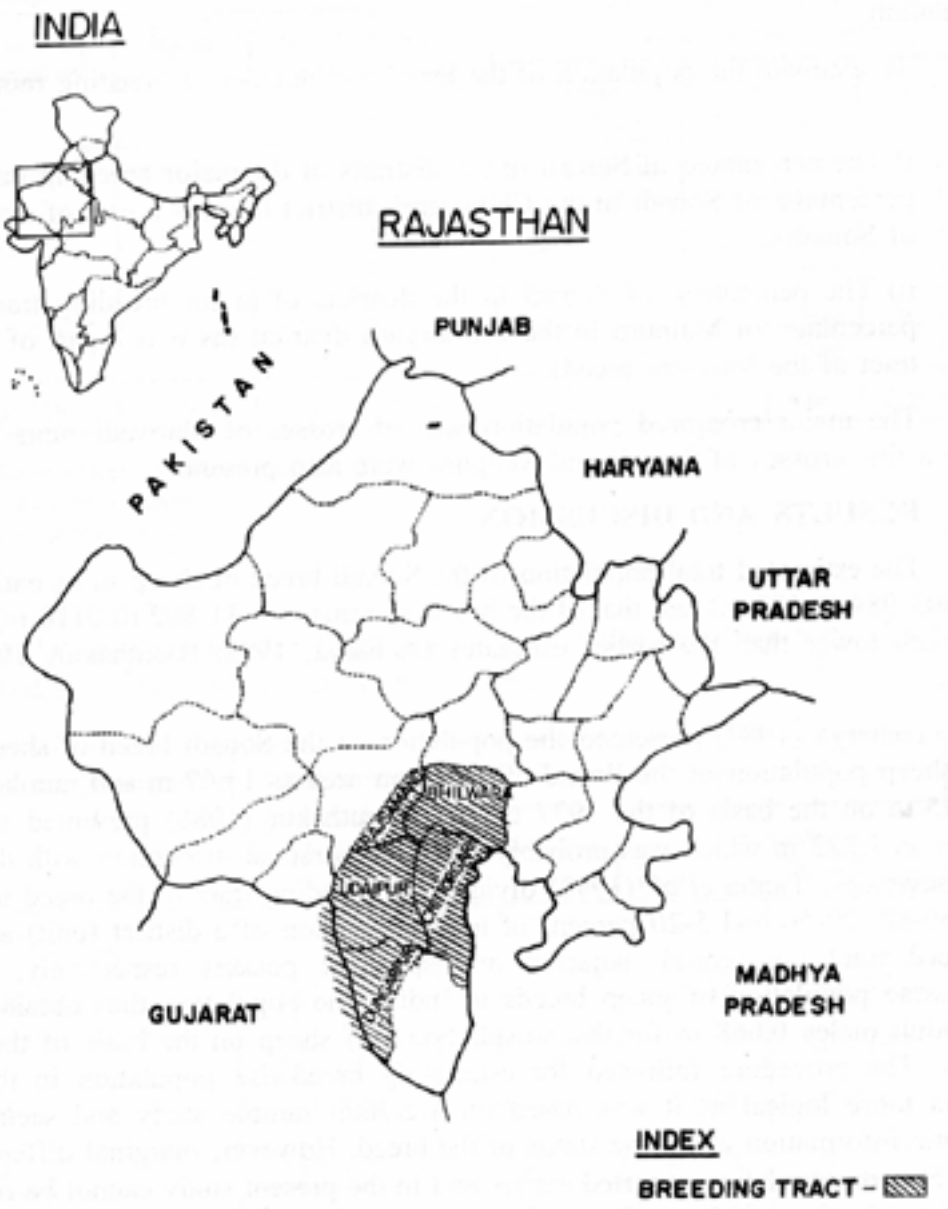
The sheep population data of 1992 for each village, tehsil, district and state was collected from the State Revenue Dept. The figures for each breed and number of breeding rams were extrapolated, using percentage, at each level i.e. at village, tehsil and district level, to find out the breedwise population of sheep breeds and number of breeding rams available in the tract. However, for Northern Gujarat, the sheep population was extrapolated on 1988 census figures after taking into consideration the last ten years' growth rate in the sheep population. This was required owing to absence of 1992 data.

The extrapolation involved following assumptions for the reasons described hereunder.

Since the figures were extrapolated on 1992 livestock census information, while the study was executed in June-July, 1994. For the present purpose, it was assumed that during the last two years there was random mating with no selection or migration in the sheep population.

To estimate the population of the breed and number of breeding rams, it was assumed that:

i. The percentage of Sonadi in the districts of the major breeding tract as equal to the percentage of Sonadi in the Chittorgarh district (as it is a part of major breeding tract of Sonadi).
ii. The percentage of Sonadi in the districts of minor breeding tract as equal to the percentage of Malpura in the Chittorgarh district. (as it is a part of a minor breeding tract of the Malpura breed).



Distribution of the Sonadi breed

The major crossbred population was of crosses of Marwadi rams with native ewes while a few crosses of Sonadi and Malpura were also present.

3.0 RESULTS AND DISCUSSION

The estimated total population of the Sonadi breed of sheep in its native breeding tract was 603 984 (0.603 m) and that of the breeding rams was 11 802 (0.0118 m) (Table 1) which are much lower than the earlier estimates (Acharya, 1982; Basuthakur, 1988; Tantia et al. 1993).

Acharya (1982) presented the population of the Sonadi breed of sheep in the form of total sheep population of the Sonadi distribution area as 1.667 m and number of adult males as 0.15 m on the basis of the 1977 census. Basuthakur (1988) presented the population of Sonadi as 1.222 m which was probably based on personal discussion with the farmers in the early seventies. Tantia et aI. (1993) divided the breeding tract of the breed in three parts and took 50-80, 20-50 and 5-20 percent of total population of a district (unit) as per three parts of breed tract i.e. central, adjacent and specified pockets respectively, to estimate the breed-wise population of sheep breeds in India. The population thus obtained was 1.044 m with adult males 0.068 m for the Sonadi breed of sheep on the basis of the 1987 livestock census. The procedure followed for estimating breedwise population in the present study appears more logical as it was based on a certain sample study and seems to give more authentic information about the status of the breed. However, marginal differences in the size of the Sonadi population reported earlier and in the present study cannot be ruled out because of the introduction of Marwadi rams for upgrading the native sheep population. This obviously resulted in the decrease in the number of Sonadi breed and increase in number of crossbreeds.

It is evident from Table 2 that tehsil 2 had a minimum proportion of crossbreeds (21.02%) as compared to the tehsil 1 (40.9%) and tehsil 3 (44.39%). This is possible because tehsil 2 does not fall on the main migratory route of the Marwadi breed. The sheep population of this tehsil was also remarkably more than that of the other two tehsils. This had its impact on the figures estimated by extrapolation for the breedwise sheep population in the Chittorgarh district, which were 42.03, 27.39 and 30.57 percent for Sonadi, Malpura and crossbreeds respectively, showing a slightly higher percentage of purebreds than expected. The higher percentage for purebreds thus obtained were used as such, without any correction factor, because the same figures, were used for the Udaipur, Rajsamand and Dungarpur districts of Rajasthan for which Sonadi is the only native breed of sheep, in contrast to the Chittorgarh district which is the home for two breeds of sheep i.e. Sonadi and Malpura.

Similarly for the rams available for breeding, out of 55 rams covered in the survey, 22 were Sonadi, 2 were Malpura and the remaining 31 were crossbred. The figures estimated by extrapolation for. the number of breeding rams available in the Chittorgarh district were 54.74% Sonadi, 3.69% Malpura and 41.57% crossbreeds. Again for the similar reasons (discussed earlier) the percentage obtained were recorded as such without involving any correction factor, to estimate the breedwise population of breeding rams available in the tract. (Tables 1 and 2).

The proportion of crossbred rams available for breeding was much higher than the proportion of crossbred sheep in the tract. This indicates that in following years, the proportion of crossbreeds will further increase replacing the purebreds.

Moreover, the route for migration of Marwari sheep from the Pali, Nagaur, Jalore and Jodhpur districts passes through Chittorgarh district. The sheep breeders of Chittorgarh, thus, have an easy access to the Marwari rams which are not only hardy but are also superior to Sonadi as regards the wool production traits. Gradually more and more farmers are adopting Marwadi rams for breeding their native ewes. Therefore, it can be concluded that the population of crossbred sheep will further increase at a higher rate unless some preventive measures are taken. .

The population estimation has been done by extrapolation involving certain assumptions. The extrapolated figures may not be the actual population of the breed, but we believe that these

TABLE 1:

Population dynamics-I. Breed wise population and breeding rams available at Tehsil Ievel in Chittorgarh district of Rajasthan (India)

Tehsil (code)	Total sheep popul-ation*	No. of villages surve-yed	No. of flocks cove-red	No. of sheep cove-red	Breed-wise population**						Total rams
					Sonadi		Malpura		Crossbred		
					Rams	Popul.	Rams	Popul.	Rams	Popul.	
Barisadri (1)	6690	10	36	1065	65	2352	23	1602	116	2736	204
						(35.1)		(23.9)		(40.9)	
Doongala (2)	13381	3	11	352	228	6597	-	3971	103	2813	331
						(49.3)		(29.6)		(21.0)	
Chhotisadri (3)	4248	5	12	1026	48	1273	-	1089	40	1886	88
						(29.9)		(25.6)		(44.3)	
Total	24319	18	59	2443	341	10222	23	6662	259	7435	623

Fig. in parenthesis indicate percentage (%)

** 1992 Livestock census figures*

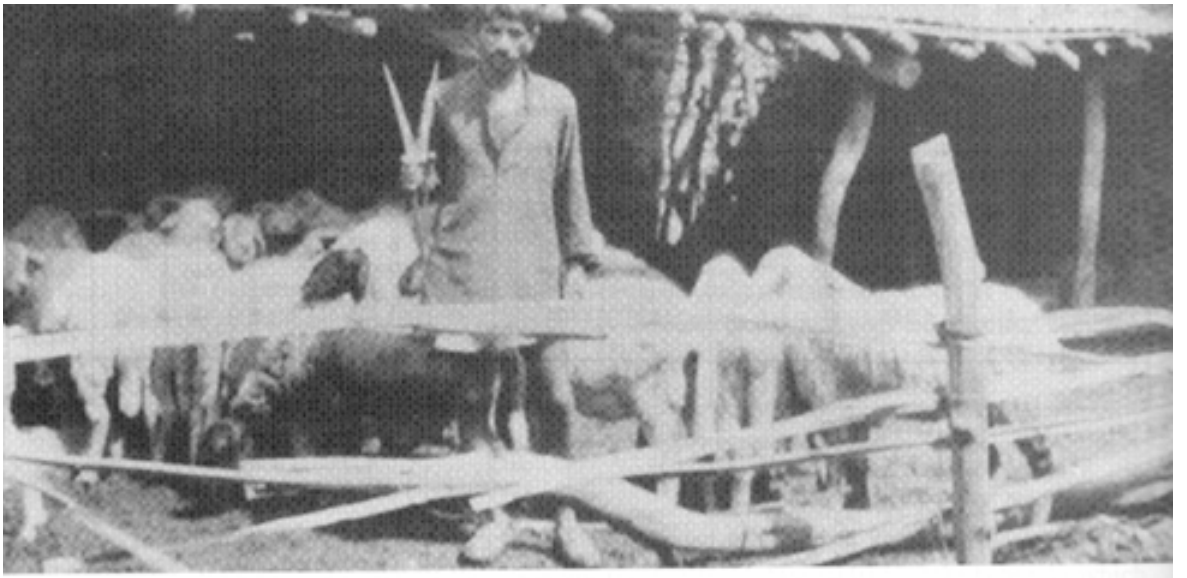
*** Extrapolated figures (see text)*

TABLE 2:

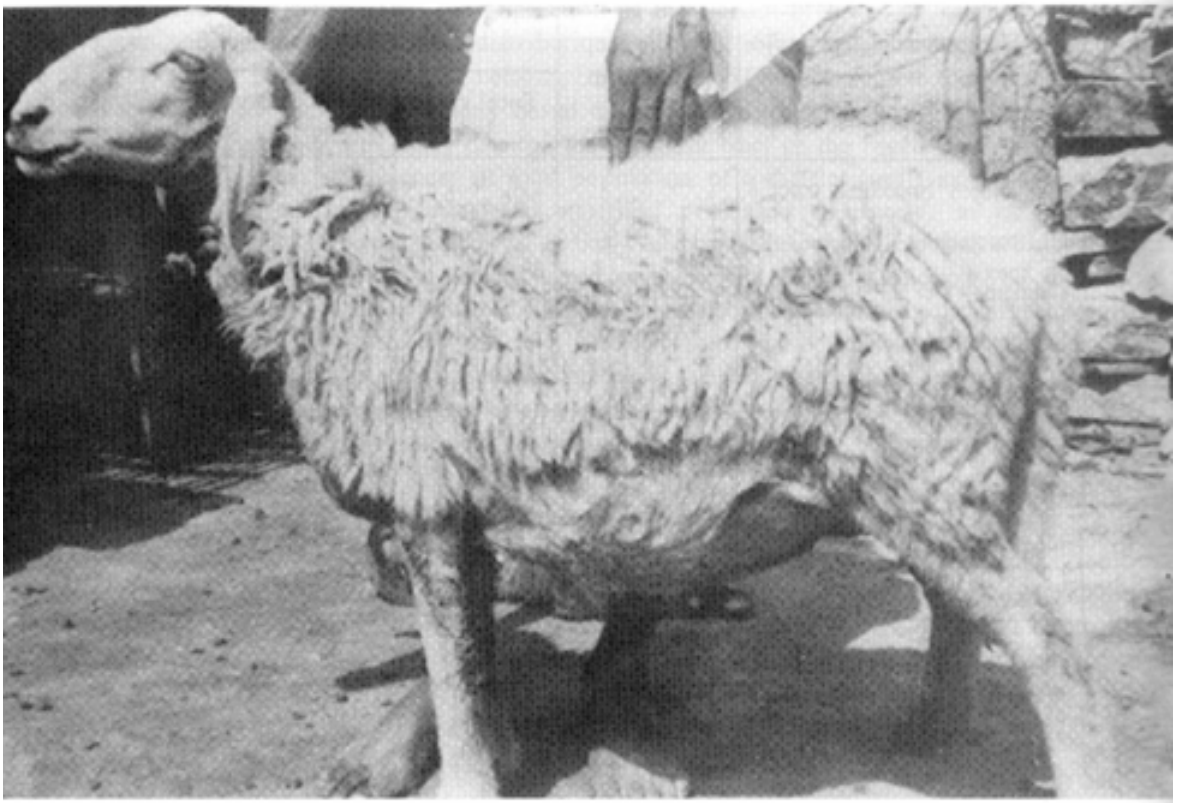
Population dynamics-11. Tota1 population of Sonadi sheep with number of breeding rams available in the home tract

Breeding tra ct (districts)	Total sheep population (1992)	Estimated population**		
		Total rams	Sonadi	
			Rams	Population
(A) Major breeding tract				
Chittorgarh	157915	4045	2214	66372
Udaipur	259914	6658	3645	109242
Rajsamand	208809	5349	2928	87762
Dungarpur	146170	3745	2050	61435
(B) Minor tract				
Bhilwara	959544	24581	908	262819
Northern Gujarat	59698	1529	57	16354
Total	1792050	45907	11802	603984

** Extrapolated figures (see text)*



Crossbreds with native sheep in a conventional sheep house



Sonadi ram in farmer's flock

estimates are very close to the actual population as all possible efforts have been made to project the real scenario of the Sonadi breed of sheep in its natural habitat.

There is a general apathy and neglect of the breed. If concrete measures are not taken, it is likely that Sonadi breed would come under an endangered category in not too distant a future.

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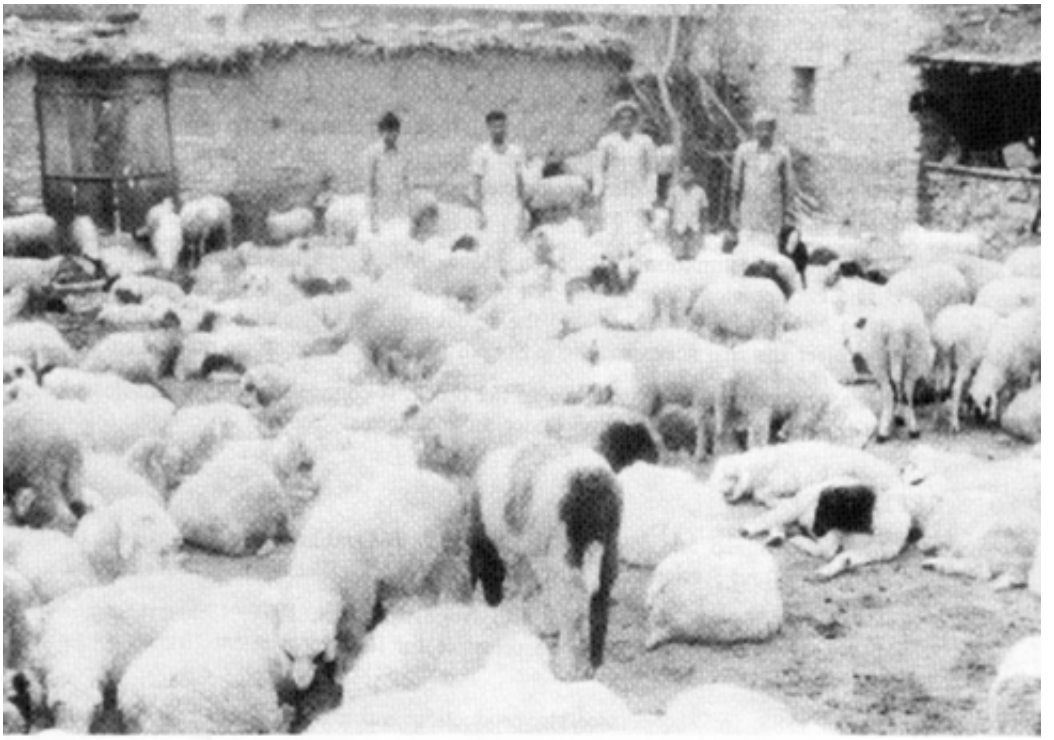

Mixed flock Marwari crosses with native Sonadi and Malpura sheep

DESCRIPTION DE CERTAINES POPULATIONS TRADITIONNELLES DE CAPRINS D'ALBANIE: PERFORMANCES LAITIERES ET CROISSANCE DANS LES NOYAUX DE RACE EN MILIEUX DIFFICILES

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SUMMARY

The authors describe in this article the characteristics of eight distinct Albanian goat populations that have been managed and bred under what can be considered regional isolates for many generations; from the plain of Shkodra (± I50 m from sea level) to the hillsides of Vlora (_+ 350 m) and the high mountains of Tropoja (± 1 400 m). The great variability of conformation and average milked yield per lactation (from around 100 kg for the Dukat breed up to 360 kg for the Relipoje) and the daily weight gain is presented and discussed by the authors.

RESUME

Les auteurs présentent dans cet article les caractéristiques de 8 populations de chèvres d'Albanie élevées dans des conditions d'isolement pendant plusieurs générations; des plaines de Shkodra (+_150 m sur le niveau de la mer) aux collines de Vlora (±350 m) et aux montagnes de Tropoja (_+1 400 m). Ils présentent la grande variabilité dans la conformation et la moyenne du rendement de production par lactation (de 100 kg pour la race Dukati à 360 kg pour la race Velipoja) et le gain moyen quotidien pour chaque population.

1.0 INTRODUCTION

La variété des conditions géoclimatiques de l'Albanie, ainsi que l'action continue de l'homme au cours des siècles, ont eu comme résultat la création de plusieurs populations traditionnelles de caprins. La nécessité de connaître à fond les caractéristiques de ces populations a poussé l'Institut de Recherches Zootechniques à élaborer un programme d'étude des ressources génétiques des animaux en Albanie.

Dans le but de conserver et améliorer ce fonds génétique, l'Institut a formulé un programme d'amélioration génétique se basant sur les résultats des études préliminaires. Ce programme est formulé sur la base des noyaux fermés de race. Dans ces noyaux sont tenus les reproducteurs mâles pour l'insémination naturelle, pour être ensuite distribués aux troupeaux commerciaux.

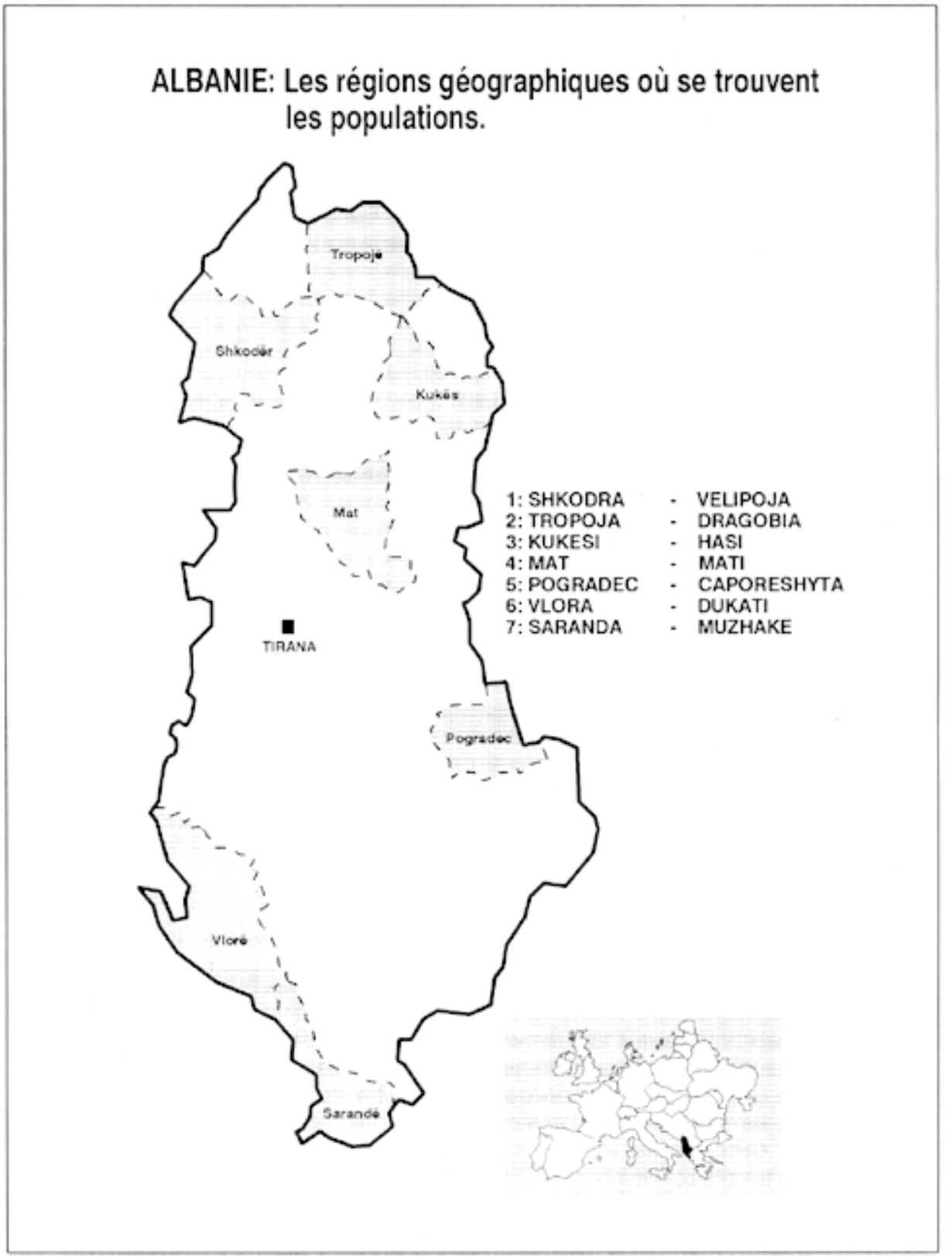
2.0 DESCRIPTION DES PRINCIPALES CARACTERISTIQUES DES POPULATIONS

Afin de donner une image presque complète du fonds génétique autochtone de caprins en Albanie, nous allons présenter les huit populations principales. Ces populations se trouvent dans différentes régions de l'Albanie (fig.1), avec des conditions géoclimatiques et végétales différentes (tableau 1).

Dans les communications précédentes (Bajrami, Z. et al. 1992; Kume, K. 1994) nous avions donné les arguments pour démontrer que les caractéristiques génétiques des populations traditionnelles de caprins en Albanie avaient été bien conservées au cours des siècles. La grande variabilité entre les populations de caprins est due, en majeure partie, à la sélection naturelle. Les animaux se caractérisent par une très bonne capacité d'adaptation aux conditions de milieux difficiles, avec des niveaux de production le plus souvent faibles. L'élevage se caractérise par un système de production extensif. Les animaux pâturent toute la journée dans les zones de maquis ou de bois et ceci durant toute l'année. En hiver, et surtout pendant la période de mise-bas, on distribue une faible compl émentation en aliments concentré s et feuillages secs. L'alimentation des chevreaux jusqu'au sevrage, qui a lieu 60 jours après la naissance, consiste en lait maternel qu'ils tètent librement. L'effectif moyen de femelles par bouc est de 20-25 et les accouplements sont contrôlés et naturels. La durée moyenne de la gestation est de 155-162 jours et le rythme de reproduction est d'une mise-bas par an. La traite des chèvres s'effectue à la main deux fois par jour. La période de lutte est courte pour toutes les populations, environ IS-25 jours, et les mises-bas sont groupées selon les races comme il suit: Dragobia et Hasi 20-30 avril, Velipoja 25 février-5 mars, Mati 5-12 mars, Capore et Shyta 25 mars-10 avril, Dukati et Muzhaka 22 janvier-4 février (Dema, A. 1985; Foto, I. et a1. 1986).

Si l'on observe les principales caractéristiques morpho-physiologiques, les chèvres d'Albanie peuvent être classées parmi le groupe de race à laine rêche et production de lait et de viande.

Les valeurs pour les différents caractères de conformation, croissance, production et reproduction, sont présentées par race au tableau 3.


ALBANIE: Les régions géographiques où se trouvent les populations.
Tropoje
Shkodër
Kukës
Mat
TIRANA
Pogradec
Vlorë
Sarandë
1: SHKODRA - VELIPOJA
2: TROPOJA - DRAGOBIA
3: KUKESI - HASI
4: MAT - MATI
5: POGRADEC - CAPORESHYTA
6: VLORA - DUKATI
7: SARANDA - MUZHAKE

3.0 PERFORMANCES LAITIERES ET DE CROISSANCE DANS LES TROUPEAUX NOYAUX DE RACE

Les troupeaux noyaux de race sont des dispositifs mis en place pour la sélection et l'amélioration génétique des caprins. Les reproducteurs sont gardés dans ces noyaux et sont utilisés par les éleveurs pour améliorer les performances de production dans leurs troupeaux.

Afin d'évaluer les performances laitières et de croissance dans ces noyaux, et pour juger de l'influence de certains facteurs sur les variabilités observées, nous avons fait des analyses de variance selon les modèles suivants:

A. Production laitière

$$Yijkn=Li+Mj+Ak+d.Dijkn+eijkn$$

Yijkn - moyenne générale des valeurs de la variable y
Li - nombre de la lactation
Mj - mode de naissance (j=1 simple, j=2 double)
Ak - troupeau
d - régression partielle de Yijkn sur Dijkn
Dijkn - durée de traite
eijkn - variable aléatoire résiduelle

B. Poids des chevreaux et GMQ

$$Yijkn=Li+Mj+Ak+Sl+eijkn$$

Dans ce modèle la note correspond aux facteurs déjà mentionnés et Sl représente l'effet du sexe.

L'analyse de la variance s'effectuera selon la méthode des "moindres carrés".

4.0 RESULTATS

4.1 Production de lait

Les résultats de l'analyse de la variance effectuée sur la production de lait sont présentés au tableau 2.

Au tableau 4 on présente les moyennes des "moindres carrés" correspondants au modèle 1 pour la production de lait, ainsi que les moyennes pour la durée de la traite.

Mis à part la population Hasi, la production moyenne de lait est influencée par la durée de la traite. La relation entre ces deux caractères est presque linéaire. Les chèvres dont le temps de traite est plus long sont, en même temps, les plus productrices. Cette relation est plus évidente dans les populations traditionnelles qui ont une production moyenne de plus de 150 kg de lait. Cette situation est presque semblable à celle déjà étudiée dans les populations de caprins des troupeaux commerciaux (Kume, K.1993; Dema, A.1985). Le facteur "nombre de la lactation" est plus important; la production de lait trait dans toutes les populations est fortement influencé e par ce facteur. En général, cette production augmente jusqu' à la 2ème-3ème lactation et puis diminue (fig. 2).

Dans la plupart des populations le facteur "troupeau" a une influence significative sur la variabilité de la production de lait, bien que cette influence soit faible. Cette situation est différente par rapport à la situation qui caractérise les troupeaux commerciaux. Ceci est lié étroitement avec le mode de conduite des animaux dans les troupeaux noyaux de race.

Tableau 1: *Les données climatiques et de la couverture végétale selon les régions géographiques*

Région géograph.	Température moyenne à surface de terre	Précipit. moyenne annuelle (mm)	Jours de soleil (y)	Période de neige (y)	Temp. moyenne annuelle	Altitude	Partie de la forêt dans la surface totale	Structure de la couverture végétale (%)				
								Hêtre	Chêne	Feuille large	Conifère	Maquis
Tropoja	13	2 105	165	120-130	11,2	1 200-1500	0,414	36	40	17	3	4
Kuksi	14,4	946	152	100-110	11,8	1 100-1400	0,477	14	52	15	9	10
Shkodra	17,5	2 065	196		14,8	100- 200	0,374	25	23	17	11	24
Mati	17	1 803	182	60- 70	13,3	1 000-1100	0,516	26	38	3	12	21
Pogradec	15	789	173	20- 25	11,6	1 300-1400	0,393	38	48	6	6	2
Vlora	19	1 351	215		16,5	200- 500	0,312		13	31	14	42
Saranda	20	1 294	225		16,9	200- 300	0,301		11	37	13	39

Tableau 2: *Analyse de variance: modèle 1*

Source de la variation	Dragobia		Hasi		Mati		Velipoja		Capore		Shyta		Dukati		Muzhaka	
	dl	F	dl	F	dl	F	dl	F	dl	F	dl	F	dl	F	dl	F
Covariance	1	3,15*	1	1,92	1	3,76*	1	4,15*	1	3,06*	1	3,21*	1	2,97	1	3,06*
Lactation	4	4,87**	4	5,12**	4	4,61**	5	5,12**	4	3,16*	4	5,67**	4	4,71*	5	4,01*
Mode de naissance	1	1,16	1	1,32	1	1,82	1	1,86	1	3,16*	1	4,72**	1	3,16*	1	1,62
Troupeau	2	2,71*	2	1,62	3	1,69	1	1,17	2	3,72	2	3,02*	1	2,16*	3	2,96*
Erreur	312	2412	296	2318	387	3159	176	3812	212	1874	168	1931	176	1972	282	2867

* $P < 0.05$ ** $P < 0.01$

Dragobia

Fig. 2 Relation entre le numéro de la lactation et la production de lait trait

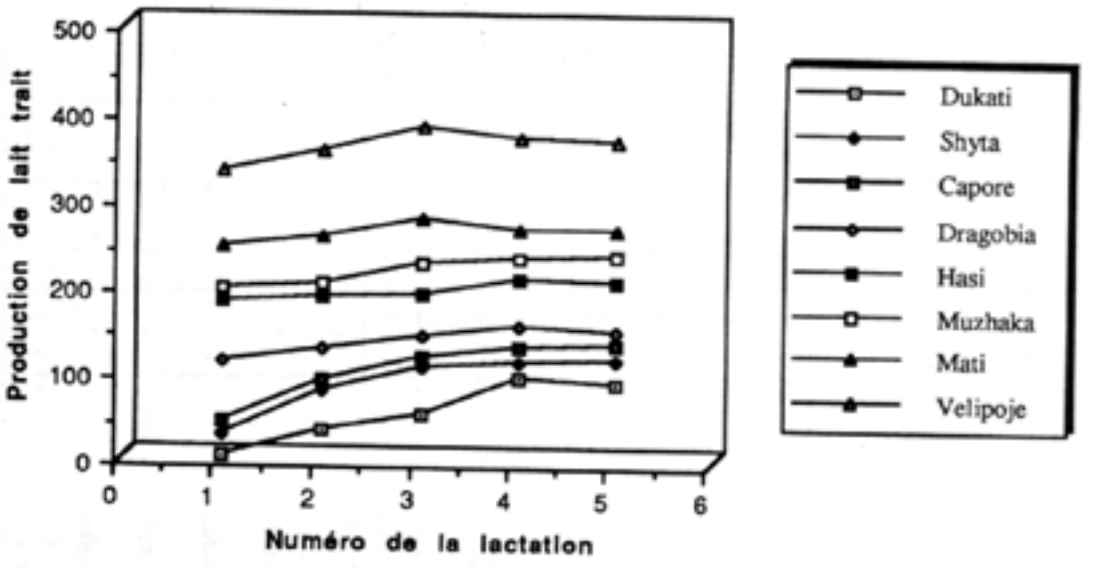


Tableau 3: *Les intervalees des valeurs au niveau de la population pour les différents caractères (en kg et cm)*

CARACTERES	POPULATIONS							
	Dragobia	Hasi	Velipoja	Capore	Shyta	Mati	Dukati	Muzhaka
Hauteur au garrot	56-68	58-73	57-72	53-71	54-70	57-73	51-63	54-68
Périmètre de poitrine	80-88	80-89	83-91	74-88	79-86	77-87	69-78	70-81
Périmètre du tibia	8,2-9,6	8,5-9,8	8,7-10,1	6,5-7,2	6,8-7,5	7,1-8,0	6,3-7,6	6,5-8,1
Périmètre de mamelle	25-30	18-24	26-32	22-28	21-27	20-28	17-23	19-26
Longueur de tête	4,3-5,4	4,6-5,5	6,2-7,4	5,2-6,9	5,1-6,5	5,8-6,3	3,0-4,4	3,4-4,9
Longueur du corps	68-79	66-73	69-79	62-69	63-71	67-77	58-67	59-70
Poids de la chèvre	48-56	49-58	44-55	41-52	44-53	43-52	25-32	29-37
Poids du bouc	76-89	87-97	68-79	65-76	67-80	68-81	40-46	43-52
P. vif à la naissance ♂	1,9-2,6	1,9-2,7	2,1-3,1	1,6-2,1	1,7-2,2	1,9-2,9	1,2-2,0	1,4-2,6
P. vif au sevrage ♂	10-13	12-16	12-15	7-10	7-9	10-13	5-8	6-10
P. vif à la naissance ♀	1,6-2,2	1,6-2,6	2,0-3,0	1,5-2,0	1,5-2,0	1,9-2,0	1,0-2,0	1,1-2,4
P. vif au sevrage ♀	9-12	11-14	10-13	6-9	6-8	9-12	4-8	5-10
Production de lait trait	100-220	90-210	130-240	120-200	110-190	105-240	80-190	80-230
Reproduction (%)	100-112	95-110	105-115	90-105	90-105	105-120	100-105	100-105

Velipoja

Capore

Muzhaka

Tableau 4: *Les valeurs moyennes ajustées pour la production de lait et les temps moyens de traite*

CARACTERES	Dragobia	Hasi	Mati	Velipoja	Capore	Shyta	Dukati	Muzhaka
Production de lait (kg)	135,2±3,1	197,4±3,0	265,8±4,2	365,4±6,1	110,1±3,0	106,8±3,2	90,3±2,9	217,6±3,6
Temps de traite (j)	209,3	211,2	226,2	204,8	158,2	160,2	176,2	200,4

Tableau 5: *Les moyennes des "moindres carrés" correspondants au poids à la naissance, poids au sevrage et gain moyen quotidien*

CARACTERES	Dragobia	Hasi	Mati	Velipoja	Capore	Shyta	Dukati	Muzhaka
Poids à la naissance	2,911±0,02	3,012±0,02	3,0925±0,03	2,865±0,02	2,112±0,01	2,012±0,01	1,713±0,01	2,905±0,02
Poids au sevrage	11,092±0,21	14,010±0,24	14,161±0,31	13,516±0,29	8,214±0,21	8,061±0,19	7,061±0,02	12,501±0,18
GMQ	136±5,2	183±4,3	184±5,0	178±3,7	101±3,1	100±3,7	89±1,6	160±1,8

Un autre facteur qui semble influencer la quantité de lait est le “mode de naissance”. Cependant, dans le cas étudié on remarque que toutes les populations ne réagissent pas de la même façon. Dans les populations à faible production, les chèvres qui mettent bas deux chevreaux produisent plus de lait que celles qui donnent naissance à un seul chevreau. Cette différence n’est pas significative dans les populations traditionnelles plus productives. Les chèvres des populations Capore, Shyta et Dukati avec deux chevreaux produisent, respectivement, 8,3; 7,6 et 7,01 kg de lait de plus que celles qui ont un seul chevreau, alors que les productions pour les populations Velipoje, Hasi et Mati sont de 6,2; 5,8 et 5,9 kg de lait, respectivement. D’un point de vue pratique ces écarts ne présentent pas un grand intérêt et confirment l’idée que le nombre de chevreaux élevés ne peut avoir qu’une faible influence sur la quantité de lait trait. Ces résultats sont confirmés par l’étude réalisée dans des troupeaux commerciaux.

Si on compare les niveaux de production de lait des troupeaux noyaux de race avec les troupeaux commerciaux, on peut dire que la capacité productive des chèvres des populations traditionnelles en Albanie n’est pas très basse. Soulignons, en outre, que ces niveaux de production sontatteint dans des conditions de milieux difficiles et avec un système d’élevage, même pour les noyaux de race, très extensif.

4.2 Le poids des chevreaux à la naissance et au sevrage, et le gain moyen quotidien entre 0-60 jours

Les moyennes des “moindres carrés” correspondants au poids des chevreaux à la naissance et au sevrage et le gain moyen quotidien, évaluées selon le modèle 2, sont présentées au tableau 5.

Le phénomène classique de l’effet du sexe sur le poids des chevreaux se vérifie également dans notre cas. Le poids des mâles à la naissance est plus élevé que celui des femelles. L’écart de poids entre les deux sexes est plus grand pour les chevreaux de la population Capore (0,315 kg) et plus petit pour ceux de la population Hasi (0,112 kg). Les chevreaux, mâles et femelles, avec le poids plus élevé à la naissance appartiennent à la race Mati (respectivement 3,010 kg et 3,186 kg). La raison principale de cette supériorité vient du fait que la chèvre de cette population est de plus grande taille que les autres.

Un autre facteur déterminant pour le poids des chevreaux à la naissance est le “mode de naissance”, les simples sont toujours plus lourds que les doubles.

Contrairement à la situation observé e dans les troupeaux commerciaux, le facteur “troupeau”, en générale, n’a pas d’effet significatif sur les performances de croissance dans le cas des noyaux de race.

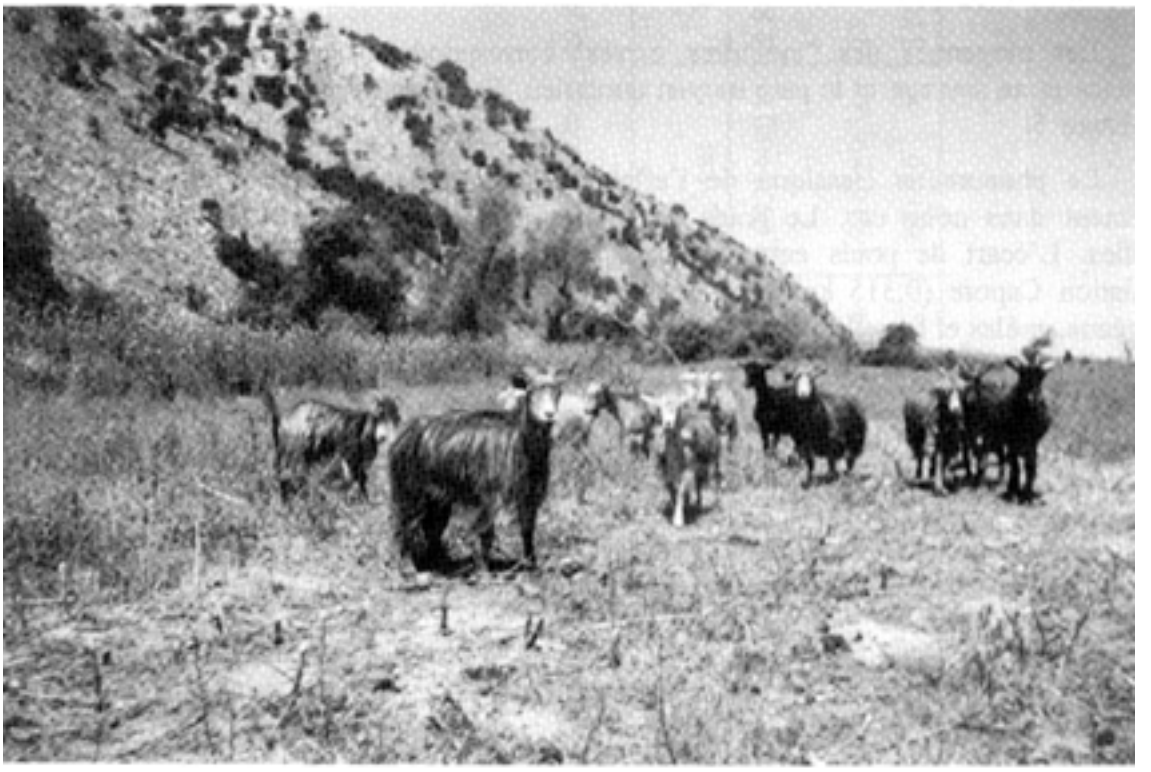
L’ effet du facteur “nombre de la lactation” n’ est pas le même dans les différentes populations. Pour les populations Dragobia, Hasi, Mati et Muzhake on observe un effet significatif. En général, d’après nos données, on peut dire que les chevreaux de la première mise-bas sont plus légers que ceux des mises-bas successives.

La variabilité du poids au sevrage dépend aussi, de façon générale, des mêmes facteurs qui agissent sur le poids à la naissance. Les différences de poids entre mâles et femelles augmentent au cours de l’ âge. En particulier, les mâles arrivent au sevrage plus lourds que les femelles. La plus grande différence entre les deux sexes est observée pour les populations Capore, Dragobi et Dukat avec un écart, respectivement, de 1,096; 0,892 et 0,617 kg. La différence entre les deux sexes pour les populations Hasi et Velipoja est non significative.

La taille de la portée influence également le poids des chevreaux au sevrage. Les simples sont lus lourds que les doubles. La différence entre eux est plus grande pour les populations tradit ônnelles qui produisent peu de lait. D’après nos données, les facteurs “nombre de la lactation” et “troupeau” ont en général un effet faible, et presque non significatif sur la variabilité du poids au sevrage.

Les facteurs qui influencent sur la variabilité du gain moyen quotidien entre 0-60 jours, sont, en règle générale, les mêmes que ceux qui jouent un rôle significatif sur le poids des chevreaux.

Muzhake



Typical grazing environment

Ainsi, les chevreaux mâles de toutes les populations présentent un GMQ plus grand que les chevrettes. On observe aussi des différences dans le rythme de croissance parmi les chevreaux nés de mise-bas simple ou double. On ne constate pas, en général, un effet significatif dû au facteur “nombre de la lactation” et “troupeau”.

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