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REPORT ON THE
DEVELOPMENT OF GOATS IN ASIA

by

C. Devendra

Malaysian Agricultural Research and Development Institute
(MARDI), Serdang, Selangor, Malaysia

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A. TERMS OF REFERENCE

The concept that maximising food production in the Asian region is dependent on full exploitation of all domestic animals is consistent with the functions and aspirations of the Regional Animal Production and Health Commission for Asia, the Far East and the Southwest Pacific (APHCA).

Accordingly, the Development of Goats in Asia was initiated as one of several action-oriented programmes and approved by the Executive Committee in 1976. The project involved three phases. The first phase involved an assessment of the status of goats in the countries of the Region and the second phase convening of the Seminar in India, successfully completed in March 1979. The third phase remains to be initiated based on the recommendations of the Seminar.

In order to undertake and participate initially in the first two phases of the project, a consultancy was financed by USAID. The first phase was completed during Oct. - Nov. 1978. The terms of reference of this consultancy were as follows:-

- 1) undertake a detailed review of the current status of goat production in the countries of the APHCA Region;
- 2) advise on appropriate means of developing the value, contribution and research on the species;
- 3) consider training programmes of various categories at the national and regional level; and
- 4) assist the Government of India in planning the scope and depth of the proposed Seminar.

In undertaking the mission, the consultant visited 1) Bangladesh, 2) India, 3) Indonesia, 4) Iran, 5) Malaysia, 6) Nepal, 7) Pakistan, 8) Philippines, 9) Singapore and 10) Sri Lanka. The sections following present the main findings, the final conclusions and the recommendations of the Seminar and a comprehensive statement of the country positions.

B. STATE OF ART

GOAT PRODUCTION IN THE ASIAN REGION: CURRENT STATUS, AVAILABLE GENETIC RESOURCES AND POTENTIAL PROSPECTS⁺

C. Devendra

(Malaysian Agricultural Research and Development
Institute, Serdang, Selangor, Malaysia)

I. Introduction

Accelerating animal production for maximum food production in the Asian region assumes, in concept, that all domestic animals will be fully exploited. Among ruminants, while cattle and sheep have received considerable attention, essentially because of their importance in temperate regions, and more recently, buffaloes have attracted enlightened interest, the situation regarding goats is one of near total neglect. The reasons for this are varied, but together have had the general effect of perpetuating a status of general unimportance and low priority in animal production throughout the Region.

Relatively recently however, there has been a consistent renewed interest in the species not only in the Region, but elsewhere in Africa, Latin America and the U.S.A. This interest has been largely stimulated by two major developments: recognition of the important value and contribution of the species especially in smallholder and peasant farming systems, and the need therefore for a better understanding of the species. The enlightened interest is consistent with the fact that goats form a valuable component of the available animal genetic resources in the Region. The realisation of this Seminar represents therefore a significant forward step concerning the development of goats in the Asian Region.

⁺Paper presented at the Seminar on the Development of Goats in Asia, 5-11th March 1979, National Dairy Research Institute, Karnal, India.

This paper describes the current status of goats and their contribution, assesses the available genetic resources and the potential prospects for increasing productivity from them in the Asian Region. Reference is made throughout the paper to production systems in individual countries and the opportunities for increasing the contribution from goats. A previous publication (Devendra and Nozawa, 1976) discussed the status of production of goats in the South East Asian region.

II. Background data

It is relevant to keep in perspective some pertinent data concerning the countries in the APHCA region; these include all those countries east of, and including Iran. These together will henceforth be referred to as the Region. Table 1 presents this background data. Excluding Australia and Papua New Guinea, the total human population in the Region is about 1,176 millions and represents 50.1% of the total human population of Asia. About 60% of the total population was economically active in agriculture (F.A.O., 1977). The total arable land was about 340,760 ha which constitutes 70.9% of the total arable land in Asia. The arable land as a percentage of the total land was about 31%.

The gross national product per capita (GNP) was \$206 US, calories per capita 2,186 and animal proteins per capita 11.8 g. It is significant to note that the percentage contribution of proteins from animals was only 21.5%. The per capita protein consumption is low relative to other regions, and reflects both a shortage, and therefore the need for more animal proteins in the future.

III. Population and distribution of goats

The Region has an estimated goat population according to F.A.O. (1977), of about 129.7 millions, which represents about 56% of the total goat population in Asia. The highest populations are found, in order of importance, in India, Pakistan and Iran which

TABLE 1

BACKGROUND DATA OF THE COUNTRIES IN THE APHCA REGION

(Statistical Yearbook 1976; F.A.O., 1977)

Country	Total Population 10 ³	GNP per capita (\$US)	Calories per capita (cals)	Animal protein per capita (g)	Per cent protein from animal (%)	Total arable land (ha)	Arable land as % of total land (%)
Afghanistan	19,796	83	2,022	6.9	11.1	14,450	22.3
Australia	-	-	-	-	-	-	-
Bangladesh	75,529	59	2,023	6.6	14.6	10,112	75.5
Burma	31,992	73	2,214	9.4	16.2	10,762	16.5
India	628,608	94	1,971	5.5	11.4	179,750	60.6
Indonesia	139,635	70	2,128	5.6	12.8	28,475	15.7
Iran	33,957	352	2,367	12.1	21.7	27,490	16.8
Malaysia	10,393	345	2,203	8.5	18.7	2,965	22.5
Nepal	12,877	73	2,093	7.5	14.7	4,000	29.0
Pakistan	72,859	163	2,132	12.8	22.3	24,450	31.4
Papua New Guinea	-	-	-	-	-	-	-
Philippines	45,920	164	1,963	17.4	37.7	8,555	28.7
Singapore	2,284	870	2,839	38.0	51.0	8	14.0
Sri Lanka	14,282	166	2,018	6.9	16.8	2,418	37.3
Thailand	43,490	167	2,360	13.3	26.6	16,388	33.0
Vietnam	44,412	-	2,267	14.5	25.5	10,440	31.8
Average	1,176,034 ⁺	206	2,186	11.8	21.5	340,763 ⁺	31.1

⁺ These represent the total population and arable land respectively.

together accounted for 82.6% of the total population in the Region (table 2). The population of 129.7 million goats represents 25.6% of the total grazing ruminants in the Region.

Since sheep are often run with the goats, and for purposes of comparison, table 2 also includes data on sheep. It is interesting to note that India, Pakistan and Iran also had correspondingly the highest sheep populations of 35.4% of the total sheep population in Asia. The overall ratio of goats to sheep was 1:2, however, it is significant to note that in 12 out of the 18 countries in the APHCA Region, the goat population exceeded the sheep population. Notable among these are India, Indonesia, Malaysia, Nepal, Pakistan, Philippines and Sri Lanka (table 2).

It is pertinent to draw attention to the fact that discussions in a number of countries about the current population of goats suggest that the present F.A.O. data may not be an altogether accurate reflection of the situation. Notable in this context are the current populations in those countries with dense goat populations such as India, Pakistan and Iran. The F.A.O. (1977) data suggest (table 2) that the goat populations were 70.0, 22.7 and 14.4, whereas country submissions indicate these to be 72.7, 23.8 and 18.0 millions respectively, suggesting that there is a substantial increased population of goats. On the other hand, relatively lower values than that of F.A.O. data are also evident, and include countries such as Indonesia, Philippines and Sri Lanka.

Within the Region, it is obvious that there is wide distribution of goats, from the semi-arid region in Iran and Pakistan to the super humid tropics of countries in South East Asia like Indonesia and Malaysia. This distribution is consistent with the value and contribution of goats.

The major range types and ecozones in the Region that influence this distribution are also diverse, and include desert

TABLE 2
THE POPULATION OF GOATS AND SHEEP IN THE APHCA
REGION
 (F.A.O., 1977)

Country	Goats (10 ³)		Sheep (10 ³)		Ratio of Goats: Sheep
	Population	%	Population	%	
Afghanistan	3,000	2.3	22,000	8.0	1 : 7.3
Australia	-	-	135,350	50.0	-
Bangladesh	8,000	6.2	12,000	4.4	1 : 1.5
Burma	587	0.5	206	0.1	1 : 0.4
India	70,060	54.0	40,352	15.0	1 : 3.0
Indonesia	6,112	4.7	3,286	1.2	1 : 0.5
Iran	14,375	11.1	35,441	13.1	1 : 2.5
Malaysia (Peninsular)	337	0.3	46	0.0	1 : 0.1
Sabah	31	0.0	-	-	-
Sarawak	9	0.0	-	-	-
Nepal	2,410	1.9	2,330	0.9	1 : 0.9
Pakistan	22,722	17.5	19,749	7.3	1 : 0.9
Papua New Guinea	15	0.0	-	-	-
Philippines	1,400	1.1	31	0.0	1 : 0.0
Singapore	2	0.0	-	-	-
Sri Lanka	570	0.4	30	0.0	1 : 0.1
Thailand	31	0.0	52	0.0	1 : 1.7
Vietnam	38	0.0	13	0.0	1 : 0.3
Total	129,699 ⁺	100.0	270,886 ⁺⁺	100.0	1 : 2.1

+ Represents 56.1% of the total population of 231.5 million goats in Asia.

++ Represents 96.0% of the total population of 282.3 million sheep in Asia.

shrub and woodland shrub ranges such as is found in parts of South West Asia, arid savannahs, desert shrub, temperate highlands and sub-humid to tropical ecozones. The rainfall is therefore variable and ranges from less than 100 mm in the semi-arid areas to over 1,500 mm in parts of South East Asia, where some parts can exceed 8,000 mm annual rainfall. The rainfall in turn affects the nature of the available vegetation which can be utilised. In general however, goats prefer the drier areas with an annual rainfall of about 250 to 400 mm, where also the soil is light and sandy. Interestingly enough, it is here that goats and also sheep are the dominant livestock species. The wet tropics with high rainfall and high humidity are less preferred. This broad classification is also consistent with the distribution pattern apparent in table 2: about 84% of the goats are found in the desert shrub and arid savannahs, with the remainder being found in the temperate highlands, sub and super humid tropical zones. The preference for the drier ecozone is also favoured by the presence here of various shrub plants, which also sparse, are sought after by goats. These plants are nutritious, provide variety in the diet and are often able to meet the dietary requirements of energy, nitrogen and minerals.

IV. Population trends

Over the period 1961-65 to 1977, there was a positive rate of increase in the goat population (+21.5%) compared to sheep (+6.0%). The major increases were recorded in those countries with high goat populations, notably India, Iran and Pakistan (table 3). This net increase over the period is about 3.5 times the growth of the sheep population, and represents an annual increase in the goat population of about 1.3% per year.

This increase is remarkable when it is remembered that the period also saw situations such as in Pakistan where there was legislation for the extermination of goats, and elsewhere a campaign by foresters to disfavour the goats. There was reservation on the

TABLE 3
POPULATION TRENDS OF GOATS AND SHEEP IN THE
APHCA REGION
 (F.A.O., 1977)

Country	Goats (10 ³)			Sheep (10 ³)		
	1961-1965	1977	% Change	1961-1965	1977	% Change
Afghanistan	3,757	3,000	- 20.0	17,940	22,000	+ 22.6
Australia	-	-	-	148,643	135,350	- 9.0
Bangladesh	8,342	8,000	- 4.1	547	12,000	+ 20.0
Burma	490	587	+ 19.8	114	206	+ 80.7
India	62,334	70,060	+ 12.4	40,936	40,352	- 1.4
Indonesia	7,506	6,112	- 18.6	3,540	3,286	- 7.2
Iran	13,006	14,375	+ 10.5	30,410	35,441	+ 16.6
Malaysia (Peninsular)	301	337	+ 12.0	38	46	+ 21.1
Sabah	20	31	+ 55.0	-	-	-
Sarawak	10	9	- 10.0	-	-	-
Nepal	2,023	2,410	+ 19.1	2,086	2,330	+ 11.7
Pakistan	7,786	22,722	+191.8	11,210	19,749	+ 75.2
Papua New Guinea	18	15	- 16.7	-	-	-
Philippines	561	1,400	+149.6	22	31	+ 40.9
Singapore	2	2	-	-	-	-
Sri Lanka	530	570	+ 7.6	44	30	- 31.8
Thailand	36	31	- 13.9	14	52	+271.4
Vietnam	36	38	+ 5.6	4	13	+225.0
Total	106,758	129,699	+ 21.5	255,548	270,886	+ 6.1

development of goats, and this is reflected over the same period in very few countries in the Region really developing goat programmes in support of their importance or projected future potential. As a generalization, the growth rate and increased goat population reflects therefore a natural increase in the various ecosystems whereby the goats more or less managed themselves, contributing simultaneously to a variety of products and functions of value especially to smallholders, peasants and landless labourers.

V. Functional importance of goats

Goats perform a variety of important functions in the Region. Foremost in these are the products: meat, milk, skins and hides, and a number of miscellaneous functions.

(i) Meat production

This is the most important function of goats in all the countries in the Region with the exception of Iran and Australia where milk is more important. In the Philippines and Sri Lanka both meat and milk are important food products from goats.

Goat meat production only accounted for about 570,000 tonnes (table 4), the major contributors being India, Pakistan and Iran, which together accounted for 82.5% of the total Regional production. The bulk of the meat produced is used for domestic consumption and only limited exports are apparent. On the other hand, there is a relatively large trade of live animals mainly from Australia into the Region mainly to Singapore, Malaysia, Sri Lanka and markets in the Middle East. Table 4 also gives the average carcass weight of goats in individual countries with a range of between 9 to 17 kg; the mean carcass weight of goats (11.9 kg) is lower than that of sheep (13.9 kg).

In many instances, the demand for meat far exceeds supplies, and this situation has had two detrimental effects:

TABLE 4
AVERAGE CARCASS WEIGHT AND MEAT PRODUCTION OF
GOATS AND SHEEP IN THE APHCA REGION
 (F.A.O., 1977)

Country	Goat		Sheep	
	Carcass wt. (Kg/animal)	Production (MT X 10 ³)	Carcass wt. (Kg/animal)	Production (MT X 10 ³)
Afghanistan	17	25	15	93
Australia	-	-	17	551
Bangladesh	10	28	10	2
Burma	15	3	15	1
India	9	275	9	117
Indonesia	10	26	10	12
Iran	13	61	18	176
Malaysia (Peninsular)	9	1	16	1
Sabah	10	-	-	-
Sarawak	10	-	-	-
Nepal	9	10	10	7
Pakistan	11	134	12	102
Papua New Guinea	15	-	-	-
Philippines	12	6	13	-
Singapore	13	-	27	3
Sri Lanka	9	1	7	-
Thailand	15	-	15	-
Vietnam	15	-	15	-
Total	11.9 ⁺	570 ⁺⁺	13.9 ⁺	1,065 ⁺⁺⁺

+ These are the mean average values.

++ Represents 53.1% of the total production of 1.08 million metric tons of goat meat produced in Asia.

+++ Represents 75.6% of the total production of 1.41 million metric tons of mutton produced in Asia.

firstly, high prices for goat meat compared to other meats, and secondly, substitution of the goat meat by sheep mutton. In Malaysia for example, the price of goat meat is about \$8.20/kg and increases even higher during festivals. A parallel situation is also found in Pakistan, Philippines and Sri Lanka. In Iran, the price of goat meat is about 40% higher than that of beef and veal prices. Some idea of the extent of imports of live sheep and goats into Singapore and also neighbouring countries is indicated in table 5. Only about 5 - 18% of the total import of sheep are exported.

(ii) Milk production

Table 6 shows that goats are more important than sheep for milk production, and particularly significant quantities of milk are produced in India, Pakistan, Bangladesh and Iran, which together produced 94.7% of the total Regional production. Again the milk is used mainly for domestic consumption. In Iran and Afghanistan the milk from sheep is more important than the milk from goats.

The milk is mostly consumed fresh or as yoghurt. Except in Australia and also the Philippines, there is no real commercial milk production. The milk is therefore consumed by mainly the peasants, and in semi-arid areas, goats milk often provides the only source of animal proteins. This uncommercialised milk production is significant in that not only is domestic requirements met, there is no competition with commercial dairy production using buffaloes or cattle.

(iii) Fresh skins

Fresh skins form an important commodity production in a number of countries. The total production of goat skins is about 131,000 tonnes which accounts for about 63.5% of the total

TABLE 5

THE IMPORT AND EXPORT OF LIVE SHEEP AND GOATS INTO SINGAPORE

(Ministry of National Development, 1973)

Year	IMPORT				EXPORT	
	Sheep		Goats		Sheep	Goats
	From Australia	From other countries	From Australia	From other countries	To all countries	To all countries
1968	129,797	119	734	944	20,696	36
1969	136,463	444	2,935	1,107	26,224	97
1970	148,171	-	1,531	1,694	25,778	100
1971	155,256	-	1,469	725	29,570	13
1972	170,792	100	835	225	33,695	20
1973	99,189	-	973	155	9,985	2
1974	93,800	-	131	-	14,137	40
1975	110,170	6	-	-	19,888	-
1976	142,005	4	752	-	25,010	6
1977	129,982	-	920	-	21,495	-
1978 ⁺	53,869	-	595	-	7,763	-

+ For the period January - June only.

TABLE 6
MILK PRODUCTION FROM GOATS AND SHEEP IN
THE APHCA REGION
 (F.A.O., 1977)

Country	Goat milk (MT X 10 ³)	Sheep milk (MT X 10 ³)
Afghanistan	46	218
Australia	-	-
Bangladesh	306	15
Burma	5	-
India	708	-
Indonesia	-	-
Iran	222	640
Malaysia (Peninsular)	-	-
Sabah	-	-
Sarawak	-	-
Nepal	30	-
Pakistan	316	30
Papua New Guinea	-	-
Philippines	-	-
Singapore	-	-
Sri Lanka	6	-
Thailand	-	-
Vietnam	-	-
Total	1,639 ⁺	903 ⁺⁺

+ Represents 54.2% of the total production of 3.03 million metric tons of goat milk produced in Asia.

++ Represents 29.1% of the total milk production of 3.11 million metric tons of sheep milk produced in Asia.

production of goat skins in the Asian region (table 7).

India, Pakistan, Iran and Bangladesh produced most of the by-product skins, accounting for 89.4% of the total amount produced. Unlike goat meat and milk, goat skins are exported from a number of countries, notable of which are India, Pakistan and Bangladesh. These exports are a source of revenue.

(iv) Contribution of meat and milk to domestic consumption

It is perhaps relevant to examine in some depth the extent of the contribution of goat meat and milk relative to other meats and milk. For this purpose, the situation in selected countries has been assessed, and is reflected in table 8.

In India, Nepal and Pakistan, the contribution to meat production was 47.6, 25.6 and 23.9% respectively, which is quite significant. The contribution to milk production was however, less conspicuous, with relatively high values found in Bangladesh (28.0%) and Iran (10.3%) to zero contribution in Malaysia and the Philippines; in the latter two countries meat is more important.

(v) Impact on rural health and nutrition

The greatest value of the contribution of goat meat and milk is towards the impact on rural health and nutrition. The value is especially significant to the peasants who live on the poverty line and to the vulnerable groups, the pregnant and nursing mothers and the young. This supply of animal proteins in the form of meat and milk, although small, represents a consistent supply. Quite often the supply makes the difference between adequate nutrition and malnutrition to many of these peasants who cannot afford to buy these products, or alternatively, are unable to produce these by rearing cattle and buffaloes.

TABLE 7

PRODUCTION OF FRESH SKINS FROM GOATS AND SHEEPIN THE APHCA REGION

(F.A.O., 1977)

Country	Goat (MT)	Sheep (MT)
Afghanistan	3,750	15,500
Australia	-	94,719
Bangladesh	8,980	750
Burma	352	162
India	70,200	35,550
Indonesia	5,100	2,400
Iran	9,808	29,310
Malaysia (Peninsular)	123	147
Sabah	20	-
Sarawak	1	-
Nepal	2,850	2,590
Pakistan	28,180	23,892
Papua New Guinea	9	-
Philippines	1,372	23
Singapore	4	341
Sri Lanka	200	14
Thailand	31	65
Vietnam	50	17
Total	131,030 ⁺	205,480 ⁺⁺

+ Represents 63.5% of the total production of 206.6 thousand metric tons of fresh goat skins produced in Asia.

++ Represents 76.1% of the total production of 270.2 thousand metric tons of fresh skins produced in Asia.

TABLE 8
THE RELATIVE CONTRIBUTION OF GOATS TO MEAT AND
MILK PRODUCTION IN SELECTED COUNTRIES
IN THE APHCA REGION⁺

Country	As % of the total production of :	
	All meat ⁺⁺	All milk ⁺⁺
Afghanistan	13.7	5.2
Bangladesh	15.1	28.0
India	47.6	2.3
Iran	17.4	10.3
Malaysia	9.1	0.0
Nepal	25.6	4.3
Pakistan	23.9	3.6
Philippines	4.2	0.0
Sri Lanka	4.3	3.0

+ Calculated from F.A.O. (1977).

++ Include the product from buffaloes, cattle, goats and sheep.

(vi) Miscellaneous functions

These include investment, insurance against the failure of crops, ownership, slaughter during festive occasions, recreation supply of manure as a source of fertiliser and also as an experimental animal. In India alone, goats produce an estimated 340 million tonnes of manure. Goats have also been used in transportation in Nepal, Bhutan and Sikkim. Goats also supply horns, hooves, blood for serum, blood and bone meal, all of which have commercial value.

VI. Ownership

In Asia, it has been estimated that out of a total human population of about 2,961 million in 1973, 1,154 millions or 39% of the agricultural population depended on 2 ha or less land for their livelihood (F.A.O., 1975). Out of this about 100 millions practice shifting cultivation, and it is further estimated that as much as 400 millions belong to the poverty line of US\$50 annual per capita income. In India alone, there are approximately 100 million landless agricultural labourers.

According to the World Census of Agriculture (1971), 60 to 71% of the sheep and goats in Asia were found in up to 5 ha of land (table 9), reflecting the pressure on the use of alternative purposes. This pressure will continue by virtue of Asian agriculture being typically one of emphasis on crop production.

The situation regarding ownership of land is much less smaller than 5 ha, as a recent survey, for example in the ASEAN region suggests. In all the countries, with the exception of Singapore, the percentage of goats and sheep on farm sizes of less than up to 2 ha is in excess of 90%. This suggests that only small flocks are common, so that with very few exceptions, small scale subsistence production is typical throughout the Region,

TABLE 9
DISTRIBUTION OF LIVESTOCK BY SIZE OF FARM SIZES
IN SOME REGIONS
(F.A.O., 1971)

Region	No. of countries reported	Animal population	1-5 Ha (%)	5-10 Ha (%)	10-20 Ha (%)	20-100 Ha (%)	/ 100 Ha (%)
<u>GOATS</u>							
Africa	3	7,823,319	7.6	1.0	0.6	5.3	85.2
Asia	6	29,020,627	71.2	14.3	8.6	5.0	0.6
South America	4	6,521,938	64.3	9.3	10.0	10.2	5.9
<u>SHEEP</u>							
Africa	4	45,148,928	4.4	0.7	0.8	2.1	91.7
Asia	3	31,518,507	60.0	16.0	13.8	8.7	1.2
South America	5	39,534,545	25.0	4.6	4.6	7.0	59.0

In the ASEAN region flock sizes are 3 to 5 up to 1 ha of land, 4 to 8 up to 3 ha of land and 4 to 9 up to 4 ha of land. Large flocks (20 to 50 heads) are fewer and uncommon, the largest units do not exceed 400 heads (Devendra, 1979a). In Pakistan, the Livestock Census of 1976 revealed that of the 21.7 million goats reared by 3.3 million families, 78.6% owned up to 5 goats, 20.1% owned less than 50 goats and 1.3% owned more than 50 goats each. Goat production on small farms in South East Asia has been discussed previously (Devendra, 1976).

The small size of goat flocks reflects in general the uncommercialised, secondary nature of goats in those environments that place primary emphasis on crop production. This is characteristic in most countries, particularly in high rainfall, humid environments such as those in the ASEAN region. Thus quite often, goats form an adjunct, but nevertheless important integral component of the integrated crop-livestock pattern of agriculture. The emphasis on cropping necessitates that the characteristics of the smallholders be kept in perspective:

- (i) the farmers are usually crop-oriented subsistence peasants with low incomes and living close to the bread line.
- (ii) landless peasants may or may not grow crops or rear animals; in the latter they are hired to shepherd the goats for extensive grazing and return them to the owners.
- (iii) they may or may not own cattle or buffaloes (usually not more than one to two heads), but most smallholders invariably possess goats or sheep or both.
- (iv) rearing goats involves minimum management attention, is a source of investment, has low risk and is a definite source of income.

- (v) in a predominantly crop environment where crop by-products are varied and abundant, rearing goats is a means of converting these residues to useful animal product, and represents therefore an important component of efficiency in the use of existing resources.

VII. Production system

The production systems identifiable in the Asian region can be classified into five categories:

- (i) Tethering
- (ii) Extensive production
- (iii) Intensive production
- (iv) Semi-intensive production
- (v) Integration into cropping systems

These systems have been described and discussed in detail (Devendra, 1979b).

It is relevant to stress in the context of these production systems that the Region as a whole has the unique distinction of embracing four important ecozones. Several factors affect the application of these production systems, and they therefore have been evolved commensurate with the available resources and socio-economic factors. An attempt has been made to classify the prevailing production systems according to ecozone and more particularly, as it affects individual countries. The broad classification (table 10) is by no means complete, and inevitable overlapping does occur, as for example in the extensive production system, which although is really suited to semi-arid and arid zones, can do apply to the sub-humid and humid zones.

The ecozones in the Asian region embrace four principal rangelands: tropical savannah, tropical forests, desert bush and temperate highlands. Within the tropical savannahs, goats are found

TABLE 10

CLASSIFICATION OF PRODUCTION SYSTEMS RELATIVE TO ECOZONES
BY COUNTRIES IN THE ASIAN REGION

Production system	Ecozone	Annual rainfall (mm)	Countries concerned
(i) Tethering	Sub-humid Humid	} } \leq 1200	South India, Indonesia, Malaysia, Papua New Guinea, Philippines, Sri Lanka and Thailand.
(ii) Extensive production (highlands)	Arid	\leq 500	Afghanistan and Nepal.
Extensive production (lowlands)	Semi-arid	500-1200	North India, Afghanistan, Australia, Bangladesh and Iran
(iii) Intensive production	Sub-humid Humid	} } \leq 1200	South India, Indonesia, Malaysia, Papua New Guinea, Philippines, Sri Lanka and Thailand.
(iv) Integration with cropping systems	Semi-arid Sub-humid Humid	} } \leq 1200	South India, Indonesia, Malaysia, Papua New Guinea, Philippines, Sri Lanka and Thailand.

in the lower rainfall areas; the long alternate wet and dry spell attracts more goats than the tropical forest with no prolonged dry spell. The desert bush zone extends from the north east plains of India through Pakistan and Afghanistan. The vegetation is sparse, but the variety of the browse plants available and low rainfall enables goats to flourish in this region. The temperate highlands refer to the Himalayas and the other mountain ranges that border the entire region east of Afghanistan and Pakistan and run all the way to Nepal and west of it.

(i) Tethering

Tethering is more common in the sub-humid and humid zones, where probably because of intensive cropping, tethering has become a convenient means of rearing goats from the stand-point of control, minimal labour input and utilisation of feeds in situ. It is thus a sedentary system. A variation of this method is combining tethering with grazing up to 5 goats at a time led by ropes held by women and children.

(ii) Extensive production

Extensive production involves low carrying capacities in situations where land is marginal and is plentiful. It is characterised by low rainfall and various browse plants. The system is used by nomadic and transhumant peasants, usually in very low rainfall areas or during the winter months when crop residues are available. In this situation camels, goats and sheep are run together, the camel providing the main means of transportation. Transhumance enables the utilisation of specific grazing lands between summer and winter grazing areas, and is the most important system of management in Iran, Afghanistan and Nepal. The winter grazing in the lowlands represents the home base, and with spring immigration to higher ground begins. The retreat to the lowlands occurs in late autumn with the advent of colder weather.

(iii) Intensive production

Intensive production on cultivated pastures for meat and milk production is relatively new, probably because land was a limiting factor or was more valuable for alternative agricultural use. For this reason, the intensive production of goats on grass pasture is limited, but it might perhaps be of interest to note that in Jamaica, intensive goat production on irrigated Pangola grass (Digitaria decumbens Stent) pastures with a carrying capacity of 37 to 45 goats/ha has been demonstrated (Devendra, 1971). Additionally, limited interest has also been directed at the intensive use of various agricultural by-products. While this method can be more explored, the intensive utilisation of agricultural by-products can be very much more exploited to convert the crop residues to useful animal products. This method is indeed in practice, and is particularly evident in South India, north Sri Lanka, Philippines and Java in Indonesia. In the latter, goats are stall-fed intensively with little or no access to grazing. Tree leaves for example, from jackfruit (Artocarpus heterophyllus) and cassava (Manihot esculenta Crantz) are very commonly fed to goats.

The greatest advantages of the method is effective conversion of the residues, control of goats and therefore no damage to the environment, and use of cheap unpaid family labour at low opportunity cost.

(iv) Semi-intensive production

This method represents varying degrees of compromise between extensive grazing and intensive production and is largely dictated by the availability of land.

(v) Integration with cropping systems

This method is not really a new method, but realisation that it has economic potential represents a new initiative (Devendra, 1978a). In Fiji, 70% of the goat population is found in the sugarcane

growing areas. In Sri Lanka, Malaysia, Indonesia and the Philippines, goats undergraze coconut, oil palm or rubber plantations. The advantages of the system are: increased fertility of the land by return of dung and urine, control of waste herbage growth, reduced loss of nutrients supplied by fertilisers, easier management of the crop and possibilities of increased crop yields and greater economic returns.

VIII. Available genetic resources

The region as a whole represents an important reservoir of important goat breeds for meat, milk, fibre and skin production. Some of these are well known and others are less well known. Most of the breeds have however, not been thoroughly exploited, so that in many instances, the true productive potential of individual breeds have not been adequately documented. This has in turn affected a detailed description of the breeds, also their genetic potential and their more extensive use in development programmes.

It is estimated that there are approximately 22 breeds of goats in the Region, the majority of which are found in Pakistan, Bangladesh and India. These breeds are diverse and often difficult to classify into breed groups for lack of descriptive data. Certain significant features are however widespread: black colours are dominant as also brown over white. Horns are usually of the scimitar-type, and often there is little differentiation between meat and milk breeds. As a general rule, there is very little controlled breeding but rather, uncontrolled breeding is common. This seeks expression especially in crossbred goats, a range of colours, ears and horns shape, unknown function and a general non-descriptive situation which further reduce the value of goats. This is evident throughout the Region, especially in extensive grazing situations. The real increases in population reflected in table 3 largely account for this state of affairs.

It is possible that the real distinctive breeds of goats in the Region are very much less, in view of the fact that although there are variations between them, these are not all that marked. There is also the point that quite often breed names have been derived due to habitat or locational origin. The differentiation of real breed differences can only be established by studies on breed features, blood typing and comparative performance.

Table 11 gives an indication of the milk producing capacity of prominent indigenous dairy breeds in the Region. Considerable variation in lactation milk yields are apparent, but in general average about 1 kg/day. Relatively higher yields are found in the Dera Deen Panah and Kamori breeds from Pakistan. The lactation milk yields are however low when compared to milk yields of about 3 to 5 kg/day of goat breeds in a temperate environment. These differences in milk yield are mainly due to breed, level of nutrition, size, age and management methods.

Extending the value of individual breeds in the future necessitates identification of the characteristics of individual breeds consistent with controlled breeding and definite production objectives. Increased contribution of goats using appropriate production systems and managerial efficiency must therefore be identified with breeding better quality animals and improved management practices. In view of the potential possibilities of increasing productivity from goats, the more important improve breeds that are likely to make a greater contribution within the Asian region are listed in table 12.

IX. Constraints to production

There are several constraints to goat production in the Asian region, all of which are worthy of discussion. Increasing the productivity and therefore contribution from goats necessitates that these constraints are reduced or eliminated. So long as the constraints continue to be neglected or ignored, low productivity and the relegation of goats as unimportant animals will continue.

TABLE 11

TYPICAL LACTATION MILK YIELDS OF PROMINENT INDIGENOUS
DAIRY GOATS IN THE ASIAN REGION⁺

Breed	Location	Milk yield (Kg)	Lactation length (Days)	Av. daily milk yield (Kg)	Butterfat %
Beetal	India	200.1	208	1.0	5.2
Barbari	India	118.0	183	0.6	3.9
Jannapari	India	182.0	168	0.9	4.5
Beetal	Pakistan	146.8	186	0.8	4.9
Barbari	Pakistan	100.0	100	1.0	4.1
Bikaneri	Pakistan	75.0	100	0.8	5.1
Chopper	Pakistan	75.0	105	0.7	5.2
Dars Deen Panah	Pakistan	204.5	130	1.6	4.9
Damani	Pakistan	106.8	105	1.0	-
Kacri	Pakistan	227.3	120	1.9	4.7
Malabar	India	180.6	180	1.0	5.1

+ These data were adapted from Mishra (1978), Singh and Sengar (1970), unpublished reports and personal communications.

TABLE 12
SUGGESTED IMPROVER BREEDS IN THE ASIAN REGION

Speciality	Breed	Country of origin	
Milk	High yield	Anglo-Nubian ¹	Temperate, tropical, dry
		Saanen ¹	Temperate, sub-tropical, wet
	Medium yield	Barbari	India, tropical, dry
		Beetal	India, tropical, dry
		Damani	Pakistan, tropical, dry
		Dera Deen Panah	Pakistan, tropical, dry
		Jamnapari	India, sub-tropical, dry
		Kamori	Pakistan, sub-tropical, dry
		Marwari	India, tropical, dry
Meat	Anglo-Nubian	Temperate, tropical, dry	
	Fijian	Fiji, tropical, humid	
	Jamnapari	India, sub-tropical, dry	
	Kambing Katjang	Indonesia, Malaysia tropical, humid	
	Ma T'ou	China, sub-tropical, humid	
	Sirohi	India, tropical, dry	
Prolificacy	Barbari	India, tropical, dry	
	Black Bengal	Bangladesh, India, tropical, dry	
	Malabar ¹	India, tropical, humid	
	Ma T'ou	China, sub-tropical, humid	
Mohair	Angora	Sub-tropical, humid	
Skin	Black Bengal	India, tropical, dry	

¹ Indicates breed is polled.

The present constraints to production are as follows:

(i) Bias towards goats

Bias towards the species represents a major constraint to production. This bias stems from inadequate understanding of the attributes of goats and belief that goats are destructive. The latter issue becomes a real problem however, when feed is in short supply and when goats are not controlled. Planners and civil servants are often far too prone to level accusations against goats, and in some instances such as in Pakistan, this has even led to legislation to exterminate goats. It might perhaps be significant to stress that there is little or no experimental proof to suggest that goats are destructive if they are controlled, and on the contrary become very useful animals in the clearance of bush such as in Africa and Texas. The reasons together have had the net effect of little or no development being initiated by planners and animal husbandrymen.

(ii) Technical constraints

The technical constraints represent important constraints to production. These include inter alia:

- (a) Inadequate breeding of better quality animals
- (b) Lack of definition of the production objectives:
meat, milk, fibre and skins or combinations of these
- (c) Low level of nutrition and managerial efficiency
- (d) Limited attention to increase the size, number of kids born and lengthening the productive life span
- (e) Control of numbers
- (f) Inadequate exploitation of the characteristics of the species including high digestive efficiency for cellulose
- (g) Limited use of outstanding improver breeds, both indigenous and exotic, for defined production objectives.

Due to a combination of these factors, the present level of productivity is low. Of these however, inadequate nutrition is particularly important and is the major constraint to increasing productivity from goats and sheep (Devendra, 1979b). This calls for knowledge on feed resources, nutritive value and feeding potential.

Table 13 represents evidence for the significance of nutrition on productivity of goats by sheer attention to feeding and management. Of the parameters that were measured, live weight at slaughter, hot carcass weight, dressing percentage and weight of meat were improved by as much as 53.8, 79.3, 7.1 and 47.1% respectively. Total saleable weight was improved by 34.1% (Devendra, 1979a).

Additionally, it is pertinent to know the annual requirements of metabolisable energy (ME) and digestible crude protein (DCP) of goats in the Region. Table 14 presents an assessment of the annual energy and protein requirements of goats. This assessment is important from the standpoint of whether these requirements can be met. When these annual requirements are related to similar requirements for the other ruminants (buffaloes, cattle and sheep in the Region), the total needs are staggering, and clearly suggest that the feed requirements cannot be met presently.

Even if goats used all existing marginal land and most of the crop residues, a deficit in feed supply appears imminent. This conclusion suggests that feed supplies will be a major constraint to goat production in the future, and necessitates that development strategies will have to take cognisance of the requirements. Additionally, there is also a need for parallel research on current availability, feed evaluation, nutritive value and efficient systems of feeding. Concerning agro-industrial by-products in South East Asia, the situation has recently been examined in detail (Devendra and Raghavan, 1979).

(iii) Control of diseases and parasites

Inadequate control of diseases and parasites is a major

TABLE 13
MAGNITUDE OF IMPROVEMENT FEASIBLE IN INDIGENOUS
KAMBING KATJANG GOATS DUE TO IMPROVED
NUTRITIONAL MANAGEMENT IN MALAYSIA

(Devendra, 1979b)

Parameter	Rural goats	Experimental goats ⁺	Improvement feasible
Live weight at slaughter (Kg)	19.6	29.6	53.3
Hot carcass weight (Kg)	9.2	14.7	79.3
Dressing %	44.2	51.3	7.1
Weight of meat (Kg)	5.5	8.1	47.3
Meat : bone ratio	4.1	4.9	19.5
Forequarter (Kg)	1.2	2.9	108.3
Hind leg (Kg)	1.2	2.2	83.3
Total edible weight (Kg)	3.2	13.2	36.9
Total saleable weight (Kg)	17.9	24.0	34.1

⁺ Adult goats about 3 years of age.

TABLE 14

ANNUAL METABOLISABLE ENERGY (ME) AND DIGESTIBLE CRUDE
PROTEIN (DCP) REQUIRED BY GOATS (1977)

Nutrient	Goats
ME (Mcal x 10 ⁹) ¹	46,683.5
DCP (MT x 10 ⁴) ²	5,073.5

1 Calculated according to: average live weight of goats is 25 kg, maintenance requirement/day = 500 Mcal, requirement for meat 11 Mcal/kg and requirement for milk 1.2 Mcal ME/kg.

2 Based on a DCP requirement for maintenance of 61 g/day and 68 g DCP/kg milk.

constraint to production. The economic losses, especially in the rural areas is very high, and are serious in these areas due primarily to inadequate veterinary services and supplies, poor housing and sanitation which lowers the resistance to diseases due to inadequate nutrition.

Throughout the Region, gastrointestinal parasitism was very common, together with respiratory diseases. In general, external parasites were not a major problem. Contagious ecthyma was however, also common. In Bangladesh for example, 82.2% of 214 kids born died during six months of age, of which respiratory disorders, gastrointestinal parasitism and contagious ecthyma were the main causes. In adults, a 47.8% mortality was also due to gastrointestinal parasitism and respiratory disorders (table 15).

TABLE 15
CAUSES OF MORTALITY OF GOATS IN BANGLADESH
(Abdur Rahman, Ahmed and Mia, 1976)

Cause	Kids ¹	Adults ²
Respiratory disorders	43.8	36.2
Gastrointestinal parasitism	25.0	43.5
Contagious ecthyma	18.8	7.3
Digestive disturbances	2.3	1.8
Miscellaneous (undiagnosed)	10.1	11.2
Total	100.0	100.0

1 Total mortality was 82.2% out of a total of 214 kids born.

2 Total mortality was 47.8% out of a total of 115 adult does.

(iv) Need for accelerated research

Implicit in the general neglect of research on goats is the fact that goats are until recently, unimportant animals in mainly temperate countries. Consequently, very little research has been conducted in temperate regions which can benefit the tropics. Given this situation, there is need for accelerated research and development on goats in Asia. In this context, it is relevant to draw attention to Byerley (1977) who considers that in order to maintain or increase per capita supplies of ruminant meat and milk, the world as a whole will have to increase support for research and development by at least 45% over the next 25 years. Devendra (1979b) has in this context, examined the priorities for research concerning production systems, major contributing disciplines in appropriate target zones in the less developed countries.

(v) Marketing

Throughout Asia, the marketing of products from goats

is haphazard, and organised marketing is very limited. This has led to unscrupulous exploitation by middlemen and migratory traders who often pay only a small percentage of the total value of goats. Feasibility studies that assess market potential and possible outlets must therefore take cognisance of marketing patterns and opportunities at the national and international level. For example, current statistics suggest that the demand for goat meat, consistent with high prices is quite enormous in the OPEC countries.

X. Strategy for development

The primary task is to eliminate the various constraints so as to increase the contribution from goats. A basic necessity in this context is the need for a reorientation of livestock policy, especially as it relates to goats. Mere suggestions of support for improving existing systems, and lip service about the value of goats is totally inadequate. It requires instead a bold and ambitious research and development effort to promote the value of the species.

The plea is for a balanced development programme of the animal resources, using the concept of a systems approach which enables a complete examination and programming of the effort. Priorities are however necessary, within the balanced development programme of the total animal resources so that all animal categories are simultaneously given attention. This approach has two main advantages:

- (a) complete exploitation of the animal resources, and
- (b) efficiency in the utilisation of the total resources.

Few countries in the Region currently support goat production programmes commensurate with their current importance or future potential. This is reflected in very few countries providing as much as 20% annual financial allocation for goat programmes. Notwithstanding this generalisation and apparent neglect, a few countries have initiated firm national action programmes on goats.

Notable in this context is India, with the setting up of the Central Goat Research Institute at Mathura, consistent with the well coordinated all India programme on goats for individual products at the following centres: for milk at Karnal (Haryana) and Trichur (Kerala); for meat at Avikanagar (Rajasthan), Ranchi (Bihar) and Gauhati (Assam); for poshnina at Mukteswar (Uttar Pradesh) and goats for mohair at Rahuri (Maharashtra). The strategy is commendable because of the anticipated demand for goat meat in the future, and inadequate supplies of milk produced by buffaloes and cattle especially for the rural people (National Commission on Agriculture, 1976). Pakistan is also putting emphasis on the development of goats in their development programmes. Sri Lanka has recently initiated a large scale development programme on dairy goats in the hill country zone. Fiji has a programme on the development of goats for meat.

Within the ASEAN region, ambitious efforts are also evident particularly in the Philippines and Indonesia. In the former, the Bureau of Animal Industry, has as its objective the improvement of peasant level nutrition of farm families and self-sufficiency in the "barangays" (villages) in goat meat and milk. The project is complementary to the National Job Generation Program of the Ministry of Human Settlements. The target concerns 30,000 barangays, and anticipates an annual income generation of about US\$70 per family owning two does (Esquedero, 1978). In Indonesia, increasing production of goat meat is envisaged through a combination of imports and improved systems of management over the period 1977 to 1983 (Soehadji et al., 1977). Outside these country examples, there appear to be no large scale development effort in other countries in the Asian region, although the potential prospects for doing so is justified.

Coupled with development effort, the strategy for increasing the contribution in the Region necessitates additional consideration of the following action oriented factors:

- (1) A more positive attitude towards the species: since goats are least understood and neglected, but have proven useful, they should be given attention and priority. Planning for maximum productivity from goats requires a consideration of the attributes that are factually known about the species.
- (2) Increased resource use: poor infrastructure and inadequate financial support have been serious limitations. The financial allocation is usually very inadequate, probably because of low priority and a negative attitude towards the species.
- (3) The development of strong infrastructure and goat programmes can stimulate sub-regional and regional effort, and the injection of appropriate technical assistance from developing countries and international agencies including F.A.O., specifically for goats. Perhaps the creation eventually of an Asian Goat Research Institute (AGRI) may lend stability to the development thrust and future importance of goats in the Region.
- (4) Developing the avenues of production: plans should be developed to utilise all the resources in such avenues as integration with crops, extensive use of marginal land wherever available, intensive management on cultivated pastures, fodders and crop residues under stall feeding conditions. Particular priority should be given for developing the development of production systems of goats of smallholder level in Asia. This will not only ensure efficiency but also alleviate the poverty and health of the peasants.
- (5) Accelerate research on goats within the Asian region into the following avenues inter alia: breed characteristics, genetic potential, feed resources, nutrition and feeding, physiology, breeding and genetics, improved management practices, prevention and control of diseases, carcass quality and processing. A strong institutional framework and infrastructure can be achieved by strengthening the available services.

- (6) **Linkages:** an interdisciplinary approach based on a systems procedure is important and desirable. This should in turn stimulate the development, from different disciplines, towards a regional and international network for promoting the value of goats. Continuing linkages between cooperating institutions at all levels needs to be encouraged so that there will be a free flow of information and scientists.
- (7) **Manpower training at all levels of husbandry practice:** currently, this is a limiting factor in almost all countries in the Region. Making available sufficiently trained manpower is therefore an important prerequisite in the development strategy.

XI. Exploiting the characteristics in goats

Exploiting the characteristics peculiar to goats is an important aspect of the development strategy and embraces the following features:

(i) Small size

Small size is significant (Devendra and Burns, 1970) for three reasons:

- (a) Economic: low individual values means lower cost, small initial investment and correspondingly small risk of loss by individual deaths.
- (b) Managerial: both species are cared for by unpaid family labour (women and children), occupy little housing space, and supply both meat and milk in quantities suitable for immediate family consumption. This has the important advantage of overcoming problems of storage.
- (c) Biological: with minimum land, or marginal land with a low level of feed availability, goats are more likely to survive than buffaloes or cattle.

(ii) Digestive efficiency

Recent advances on this subject based on evidence from several laboratories suggest goats are a superior ability compared to other ruminants in utilising the fibre in coarse feedingstuffs (Devendra, 1978b). This characteristic also explains in part their wide distribution in the various ecozones in Asia. As it concerns the utilisation of waste vegetation, browse plants and roughages, goats are thus extremely efficient in converting these materials to useful animal products (meat, milk, hair and skins).

(iii) Reproductive efficiency

Indigenous goats exhibit a high reproductive efficiency, and several goat breeds in Asia demonstrate this. Good examples are the Black Bengal goat in Pakistan, India and Bangladesh, and the Kambing Katjang goat breed in Malaysia and Indonesia. The components of this efficiency are high fertility (kidding %) and a short generation interval (interval between kiddings). It is also relevant to indicate that goats display a higher reproductive efficiency than sheep. In Malaysia for example, Kambing Katjang goats have an average kidding % of 140 to 150% compared to 110% in indigenous sheep. Similar evidence has also been reported in Sudan (Wilson, 1976) and Nigeria (Matthewman, 1977).

(iv) Objectives of production

It is essential to have a clear definition of production objectives in exploiting the contribution from goats. The following aspects are relevant:-

(1) Characteristics of the product

(a) Meat

Quantity - Total amount of lean meat in the carcass (measured by live weight before slaughter).

Growth rate, in the case of kids, is related to efficiency of production. Total number of animals available for slaughter; this is likely to be more important than amount of meat in each animal.

Quality - Quantity and distribution of fat (excess undesirable).

(b) Milk

Quantity - Lactation milk yield per head.

Quality - Average butterfat %.
Solids not fat.

(2) Characteristics of the goat

(a) Reproduction rate - Litter size per kidding and per year.

(b) Efficiency of feed conversion to product:
- Rapid growth rate in kids.
- Weight of kid weaned per unit of feed consumed.

In the Asian context, the definition of production objectives will have a significant effect on increased animal protein supply. This is in turn advantageous, in an environment where the energy supply from cereals and roots is high. Additionally, the exploitation of goats, consistent with production objectives is also justified by the ingredients - germ plasm, feed resources and labour at low opportunity costs. Considered together, the problems are interesting, multidisciplinary and are challenging for goat production in the Region.

XII. The future

There is no doubt that with the growth of human population, and the demand for more food from goats in Asia, the species will be expected to make a much higher contribution in the future than in the past. Attendent to this growth demand, the goat population will also increase, possibly steeply than in the past if there is increased resource use and development effort in the future. The development thrust will therefore be expected to stimulate greater productivity from goats than in the past.

Table 16 demonstrates the human population and that of goats and sheep in the year 2000 based on the United Nations medium projected population increase in per capita consumption of goat meat and mutton associated with increased disposal of income.

TABLE 16
PROJECTED HUMAN, GOAT AND SHEEP POPULATIONS IN ASIA¹ (10⁶)
(F.O., 1977)

<u>Category</u>	<u>1977</u>	<u>2000</u>	<u>% increase</u>
Human	2349	3964	68.8
Goat	232	342	47.4
Sheep	282	397	40.8

1. U.N. population projections, medium variant.
2. Projections for 2000 assume no changes in the present level of productivity and pattern of consumption.

The human population in Asia is expected to increase by an average of 2.2% per year, and assuming that the 1977 carcass yield data, current production and consumption data do not change (table 4), it is estimated that the goat and sheep populations in

the year 2000 will be 342 and 397 millions respectively, corresponding to an increase of about 47.4% and 40.8% over the population in 1977. The increases are enormous and calls into question whether the existing resources, present and potential, can support this growth. Present indications are that this support is doubtful, as is also evident in table 15.

Clearly, increased productivity from goats must come from intensification in the use of resources and renewed exploitation of the species. The case for this approach is also justified by the fact that goats are currently in low productivity. Associated with this approach, a reduction in the number of breeds in general use is desirable to allow for the more extensive use of chosen improver breeds listed in table 12. This will necessitate careful and controlled evaluation of the comparative performance of the many breeds and their crosses in specific environments.

XIII. Concluding comments

In the last five years, there has been a tremendous upsurge on interest on goats as farm livestock. This enlightened interest stems primarily from a fresh appreciation of the versatility and attributes of the species, especially in smallholder situations in the less developed countries of the tropics. There is not only national interest, but regional and international interest. This Workshop is one manifestation of this enlightened interest.

It is my personal hope therefore that this timely Workshop, the first of its kind in Asia, will serve as an instrument of definitive development of the species, bringing with it increased availability of animal protein foods and higher standards of living especially for peasants. Through deliberations and consensus, there is a need to shape and develop appropriate strategies that can be sustained and will seek expression in increased contributory importance of the species for many millions of smallholders. Some

of these tasks are those of the planner, and others fall in the purview of the scientist. The joint task however, is our individual responsibility, and in which connection I have tried to convey the underlying philosophy involved.

XIV. Summary

A report is presented on the state of art concerning goat production in the Asian Region. It includes observations based on an appraisal mission to 11 countries, namely Bangladesh, India, Indonesia, Iran, Malaysia, Nepal, Pakistan, Philippines, Singapore, Sri Lanka and Thailand.

The goat population in the APHCA region in 1977 was about 126.7 millions and is increasing at the rate of 1.3 percent annually. This population produced 570×10^3 MT of goat meat, $1,639 \times 10^3$ MT of milk and 131,030 MT of goat skins, accounting for 53.1, 54.2 and 63.5 percent of the total production in Asia. By the year 2000, it is expected that the goat population based on present growth rates and level of consumption will have increased by 47.4 percent to 342 millions. The available genetic resources include 22 goat breeds, a number of which are potentially important.

The main findings of the state of art are as follows:

- 1) With very few exceptions goats are low in priority within the livestock development programmes throughout the Region.
- 2) Few countries in the region currently support goat production programmes commensurate with their importance and future potential.
- 3) The infrastructure and resource use for goat development is weak, and is further reflected in the sparse base of knowledge on the species.
- 4) Research on goats is also limited to only a few countries, and the variety of problems needing attention suggests that this area should be given special attention.

- 5) The population of goats is increasing (about 1.3% annually) and there is also evidence that country data are higher than current statistical data.
- 6) Meat production is of primary importance and the demand for meat in almost all countries exceeds the supply. Additionally, the high demand for meat is reflected in relatively high prices for the meat. Considerable export potential for meats exist in the OPEC countries.
- 7) Milk production is uncommercialised and is of secondary importance. Considerable export potential exists with fresh skins.
- 8) Ownership of small flocks (about 5) is common and large herds are uncommon. The goats are usually owned by smallholders and/or peasants whose main preoccupation is crop production.
- 9) Goats are usually secondary to the emphasis on crop production, and improved production system needs to consider the value of goats within integrated process, and the characteristics of smallholders.
- 10) There is no doubt that the present level of production is low, and two important constraints to production are inadequate feed supplies, disease and parasites.
- 11) The Region has at least 22 valuable goat breeds but not enough is known about the potential productive capacity of most of the breeds. Extending their use necessitate a better understanding of their characteristics and comparative performance.
- 12) Definition of production objectives is not always apparent, and is partly caused by inadequate understanding of the genetic resources, especially the attributes of the species.
- 13) The marketing patterns are weak, disadvantageous to farmers and limited organised marketing is apparent.

- 14) Limited trained manpower and inadequate training programmes are apparent. These aspects need strengthening to increase research and development of goats. Associated with this existing linkages are also weak.
- 15) Throughout the Region, there is a positive interest on the value of the species in all countries. This interest needs to be stimulated by appropriate programmes which need to be sustained.

Taking cognisance of these circumstances, there are enormous opportunities to exploit goats in the Asian Region towards increased production. Considered together, the problems are interesting, multidisciplinary and challenging. The future for developing the value of goats is therefore associated with appropriate strategies and sustenance of the development thrust in the context of efficiency and maximisation of productivity from them.

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REFERENCES

- Abdur Rahman, Ahmed, M.U. and Mia, A.S. (1976). Studies on the diseases of goats in Bangladesh: mortality of goats under farm and rural conditions. Trop. Anim. Hlth. Prod., 8, 90.
- Byerley, T.C. (1977). Ruminant livestock research and development. Science, 195, 450-456.
- Devendra, C. (1971). Goat production in Jamaica. Z. Tierz. ZuchtBiol., 88, 69-78.
- Devendra, C. (1976). Goat production on small farms in South East Asia. Rpt. F.A.O. Expert Group meeting on Livestock Programmes for Small Farmers and Agricultural Labourers, 31st May - 6th June, 1976, Bangkok, Thailand, Vol. 11, p. 176-210.
- Devendra, C. (1978a). A model for the integration of goats with cropping systems in the ASEAN region. Preprint No. 8, Seminar on Integration of Animals with Plantation Crops, 13 - 15 April, 1977, Penang, 13 pp.
- Devendra, C. (1978b). The digestive efficiency of goats. Wrld. Rev. Anim. Prod., 14, 9-22.
- Devendra, C. (1979a). Goat and sheep production potential in the ASEAN region. Wrld. Anim. Rev. (F.A.O.) (In press).
- Devendra, C. (1979b). The potential of sheep and goats in world food production. J. Anim. Sci. (In press).
- Devendra, C. and Burns, M. (1970). Goat production in the tropics. Tech. Commun. No. 19, Cormorw. Bur. Anim. Breed. Genet., Commonwealth Agricultural Bureau, xii + 184 pp.
- Devendra, C. and Nozawa, K. (1976). Goats in South East Asia: their status and production. Z. Tierz. ZuchtBiol., 93, 101-120.
- Devendra, C. and Raghavan, G.V. (1979). Agricultural by-products in South East Asia: availability, utilisation and potential value. Wrld. Rev. Anim. Prod. (In press).

- Esquedero III, Salvador H. (1978). Kambing pangkabuhayan.
Bureau of Animal Industry, Manila, 7 pp.
- F.A.O. (1971). Report of the World Census of Agriculture,
Rome: F.A.O., Part V.
- F.A.O. (1975). Statistical directory of Asia and the Far East,
Rome: F.A.O., 296 pp.
- F.A.O. (1977). Production Yearbook, Vol. 31, Rome: F.A.O.,
291 pp.
- Matthewman, R.W. (1977). A survey of small livestock production in
forest and dry savannah zones of southern Nigeria.
M.Sc. Thesis, University of Reading.
- Mishra, R. (1978). Goats at National Dairy Research Institute,
Karnal, India, 38 pp.
- Ministry of National Development, Singapore (1978). Personal communication.
- National Commission on Agriculture (1976). Report of the National
Commission on Agriculture, Part VII, Govt. of
India.
- Singh, S.N. and Sengar, O.P.S. (1970). Investigations on milk and
meat potentialities of Indian goats.
Tech. Rpt., Dept. of Anim. Hush. and Dairying,
RBS College, Bichpuri, Agra, India.
- Soehadji, Wri Dadi Wiryozuhanto, Andreas Warkidi, Supodo Budiman
and Radja Gerkguk (1977). Ranchangan makro dan mikro kebijaksanaan
pengembangan usaha ternak kecil di Indonesia
(1977 - 1983), Direktorat Bina Program,
Direktorat Jendral Peternakan, Jakarta, 51 pp.
- Statistical Yearbook (1976). New York: United Nations, 490 pp.
- Wilson, R.T. (1976). Studies on the livestock of southern Darfur.
IV. Production traits in goats.
Trop. Anim. Hlth. Prod., 8, 221-226.

C. SEMINAR ON THE DEVELOPMENT OF GOATS IN ASIA

1. Objectives of the Seminar

1. To examine the various systems and patterns of goat production, including available genetic resources in the different countries in the Region;
2. To assess the constraints to development, incentives and available supporting services;
3. To identify the possibilities of improvement of the existing system, including adaptation of appropriate technologies;
4. To formulate action-oriented goat development programmes at the national level and also regional/sub-regional cooperation;
5. To indicate the overall socio-economic benefits of such programmes, especially to small farmers and agricultural labourers.

2. Anticipated value

1. Exchange of experience among participants on goat production;
2. Formulation of action programmes on goat development in the countries in the Region.
3. Stimulation of the interest of APHCA countries in goat development.
4. Increased goat production at small farmers' level, thus augmenting the income of the small farmer and improving the nutrition of his family.

3. Programme

The Seminar constituted 4 sessions: 1) Country Statements, 2) Goat Production and Economics, 3) Goat Breeding and 4) Goat Physiology, Nutrition and Health.

Ten country statements were made and included Australia, Bangladesh, India, Indonesia, Malaysia, Nepal, Philippines, Sri Lanka, Thailand and Laos. In addition, a total of 16 individual papers were presented at the Seminar. The U.S.A. was an observer at the meeting.

IV. CONCLUSIONS AND RECOMMENDATIONS

The Seminar having noted the importance of goats in the region, and after considering the necessity to promote the future of the species to improve the standard of small farmers recommended:-

- 1) that there be a continuity of effort for the development of goat production through regular meetings of specialists.
- 2) that an Advisory Committee be established to advise on the coordination of the overall development of programmes. This Committee should be composed of one member from each of five A.P.H.C.A. countries. The Chairman should be chosen from amongst the members. Membership of the Committee should change by rotating membership within the A.P.H.C.A. countries. Every two years two members should stand down and be replaced by members from other countries. The membership at any given time should give due recognition to activity, ecological and production considerations (Foundation membership of the Committee is shown at Appendix (1)).
- 3) that the training of personnel at graduate, technical and extension levels be aligned to the future development of the programmes.

- 4) that the charter for specific regional programmes be the responsibility of each APHCA country which should submit country projects in keeping with their particular requirements. These submissions should contain both short and long term programmes to be reviewed by the Advisory Committee in order to establish priorities and further the interchange of information identified as having the most desirable impact on the overall programmes.
- 5) that the formulation of country projects be initially based on the action programmes from this Seminar. This procedure should establish each country's autonomy and provide the material to be reviewed by the Advisory Committee. The ensuring summary should be used as a guide to the formulation of country projects since it reflects the major issues discussed during the Seminar. These include the following:-

(A) Breeding

The improvement of meat, milk and fibre production through selection would require the establishment of the elite nucleus flocks of important native breeds. Information on the productivity, and management systems of these breeds together with their marketing systems should be collected through well organized surveys while establishing these flocks.

Subsequent introduction of improved breeds may be used for crossbreeding under defined management conditions. While undertaking large scale breeding programmes a concomitant improvement in nutrition, disease control, management and the marketing of the products should be encouraged.

Progeny testing for selection of sires may subsequently be done in the nucleus flocks to achieve further genetic improvement. Having made this genetic improvement, the free exchange of breeding material available in APHCA countries should be developed. This may include the use of frozen goat semen.

(B) Nutrition and Physiology

Clear identification of the feed resources in individual countries (including grasses, leguminous forages, tree leaves and agro-industrial by-products) and the determination of their nutritive values for goats should be undertaken.

The development of specific feeding systems including integration with cropping systems and their economic ramifications need assessment by individual countries especially at small-holder level. The utilization of by-products and tree leaves should be given priority.

Research on nutrient requirements at specific stages of growth and production should be undertaken. This should include general information regarding the energy, protein and mineral

requirements as well as specific studies of the conversion of energy and protein to meat, milk and fibre. More studies on the digestive physiology with special reference to nitrogen recycling, rumen fermentation and microbiology in goats are indicated.

The magnitude of physiological and behavioral components of the adaptation of goats should be evaluated by each country. This should promote an understanding of the relative importance of cardinal physiological responses, water turn over rates, feed intake, shelter engineering and management.

Investigations on the physiology of female reproduction under field conditions should be included. Deep freezing of goat semen for conservation and propagation of germ plasm will be required.

(G) Health

It was recognised that exotic goats are particularly susceptible to diseases and should receive special attention. It is apparent that there is an urgent need in both imported and indigenous goats for the identification of specific causes of reproductive disorders and causes of mortality (with special reference to kids) in both.

Specific strategies need to be developed to prevent parasitic diseases. Similar strategies are necessary for developing vaccination programmes for the more important prevailing infec-

tious diseases, such as, goat pox, caprine contagious pleuro-
pneumonia, contagious ecthyma, brucellosis, foot-rot and entero-
toxaemia.

APPENDIX I

The following membership of the Advisory Committee .
was recommended:-

1. Australia - Temperate - Technical support
2. India - Large goat population, research foundation -
Meat, Milk, Fibre - Technical support.
3. Malaysia - Humid tropics - Meat
4. Nepal - Temperate - Fibre
5. Philippines - Humid tropics - Milk.

Although it is recognized that countries will themselves
nominate delegates to the Committee, the Seminar hopes that to
ensure continuity of organizational effort, Malaysia may nominate
Dr. C. Devendra as its delegate, and that Dr. Devendra would be
Chairman of the Foundation Committee.

D. COUNTRY POSITIONS

I. BANGLADESH

The estimated goat population in 1977 was 6.84 million. In most cases, goat farming is a component of mixed farming. About 38.4 per cent of agricultural holdings have goats of which 93.4 per cent is owned by farm holders. Goats are mainly kept for meat production. Goat meat constitute about 5 per cent of the total meat produced. Goats are kept under poor feeding and management systems on free-range, on roadsides, rail track and marginal lands. No feed supplements are given to goats.

There are two types of goats. The native type known as Black Bengal which is found throughout the country. Black Bengal is famous for its meat and quality skin. Milk production is low with daily milk yields of about 0.25 - 0.50 kg. The other type is found in Chittagong district known as Chittagong Black. This type is famous for milk production, with an average daily yield of 0.75 - 1.0 kg milk.

Since the Black Bengal goats are well suited for the country, the Directorate of Livestock Services, Government of Bangladesh has taken the initiative to launch a selective breeding programme to upgrade the flock through setting up breeding farms in different regions and supplying bucks from such farms to the public. Simultaneously, artificial insemination facilities will be provided.

The main constraints to goat production in Bangladesh among other things are diseases and low level of feeding. There is considerable evidence to suggest that parasitic infestation is one of the most important causes of mortality in Bangladesh. Considerable research into animal health and diseases has been recently undertaken by the University of Mymensingh.

II. INDIA

India has the largest goat population in the world. In 1977, the population was 70.4 millions, and over the last 25 years the population has increased at the rate of 1 million goats per year equivalent to 2 per cent per annum. This growth is relatively high in comparison to other livestock species.

In terms of distribution and functional importance of goats, India may be divided into 4 categories:-

- (i) Northern India (Ladakh and Himachal Pradesh). This region covers five contiguous valleys which are Zaskar, Rupshu and Chane Thang (all in Ladakh, Lahul and Spiti (in Hamachal Pradesh. This region is the home of Pashmina goats which are imported for the production of valuable Pashmina. The mean summer temperature in the region is about 40°C , and during winter this may fall to as low as -40°C .
- (ii) North-Western zone. This zone includes Haryana, Punjab, Rajasthan and Western Uttar Pradesh and extends into Gujarat, Himachal Pradesh and Kashmir. In this area mainly milk goats are found. The breeds include Jamnapari, Beetal, Barbari and Alwari.
- (iii) Northern-Eastern zone. This zone comprises Bihar, Orissa, Bengal, Assam, Himachal Pradesh, Meghalaya, Manipur, Tripura, Nagaland and Sikkim. The zone is characterised by hot humid summers and cold-wet winters. In this area mostly meat breeds are found and include the Assam hill and Black Bengal goat breeds.
- (iv) Southern zone. The Southern zone includes most of the rest of India, stretching from Hyderabad to Kerala. The area is characterised by hot and humid conditions. The breeds of goats here tend to be meat and milk types. In Kerala the Malabari goat breed is outstanding for milk production.

Goats produced in India about 48 per cent of the total volume of meat produce from buffaloes plus cattle plus goats plus sheep, and about 2.8 per cent of the total volume of milk produce from the same species. Currently, there is increasing demands for both products, especially goat meat.

The following are the main policies being pursued by the government in promoting goat production in the country:-

- (1) Upgrade Pashmina in the Ladakh and Himachal Pradesh Valleys by crossing them with Pashmina goats from the U.S.S.R., particularly the Goro-altiokaya and priodoskaya breeds.
- (2) Upgrade range goats in the dry Western zone and replace them by stall-fed improved goats. For this purpose, upgrading of native breeds using the Saanen and Alpine are being recommended.
- (3) Selection within the breed in the Southern zone for dual purpose functions, and include the Black Bengal goat breed for meat, prolificacy and possibly also skins, and the Assam hill goats in the North-East zone for meat.

Cognisant of the situation, the Indian Council of Agricultural Research has launched since 1972, a fairly large programme of research for increasing productivity of the goats for milk, meat and fibre production at different centres within the country. The centres for studies on milk production are at Karnal (Haryana State) and Trichur (Kerala State). Centres for fibre production are at Rahuri (Maharashtra State), Mukteswar (UP State) and Leh (J and K State). Centres for meat production are at Khannapara (Assam, State), Avikanagar (Rajasthan State), Ranchi (Bihar State) and Agra (UP State). The above mentioned project has a multi-disciplinary approach to study the managerial aspects of nutritional requirements, the causes and

aetiology of mortality in different breeds, physiological behaviour and other related aspects to improve productivity of this species.

Perhaps the most significant development in India, not found in any other country, is the establishment because of the special status of goats in the rural economy of the Central Goat Research Institute (C.G.R.I.) in Mathura. The Institute has the twin objectives of devising efficient goat farming system with or without crop integration and to evaluate their economic benefit in different agro-ecological situations. This Institute will maintain germplasm of important breeds of goats within the country and will have also regional stations in different locations especially in the coastal areas and hilly or mountainous region. The Institute will conduct research in the field of genetics, reproduction and nutrition of this species. It will impart training on all aspects of goat production and will extend the technology developed at the Institute to rural and tribal areas for the benefit of weaker sections of the society.

III. INDONESIA

Goat rearing in Indonesia is a traditional enterprise. It is mainly undertaken as a component of mixed farming to supplement the income of smallholders. According to the 1973 Agricultural Census the population of goats was 9.9 million. The 1975 Agricultural Survey reported a figure of 10.4 million. Over the period 1969-1977, there was a decrease in the population of goats. Of the total population approximately 83 per cent of the goat are found in Java and the remainder outside Java.

Four types of goats are identifiable: Kambing Katjang, Marica, Kambing Etawah (Jamnapari) and Kambing Gembrong. Of these types, the Kambing Katjang is numerically the most important.

The main value of goats is in meat production, however, goats are also reared for milk production especially in West Java,

Central Java and Yogyakarta. Generally speaking, the productivity of goats in terms of milk and meat is poor.

The Five-Year Development Plan (Repelita) which was launched in 1969, and is continuous till 1984, has the following objectives:-

- 1) Encourage increasing the productive capacity of livestock farmers.
- 2) Increase the livestock populations.
- 3) Encourage production of livestock product with the view to meet the domestic demand for an increased consumption of animal proteins, assist the growth of national industries and encourage export potential.
- 4) Provide greater employment opportunity in the livestock sector.

The following are proposed programmes for goat development:-

- 1) Supply of improved goat breeds
- 2) Training for demonstrators to upgrade their knowledge and skills, training for farmers in demonstration areas and advisory assistance.
- 3) Disease control and treatment facilities.
- 4) Assistance with the provision of grass seeds to encourage village pasture production.
- 5) Increase extension facilities.
- 6) Make available more credit facilities especially from banks.

It is envisaged that in the future, the development of goats will be substantially stimulated by this intensified effort.

IV. MALAYSIA

The goat industry in Malaysia is small. The Livestock Census of 1976 indicated a population of 332,600 for Peninsular Malaysia, 17,000 for Sabah and 8,570 for Sarawak. In Peninsular Malaysia, goats are concentrated mainly in the states of Kedah (21.6 per cent), Johore (17.2 per cent), Perak (12.8 per cent), Negeri Sembilan (9.6 per cent) and Kelantan (9.5 per cent).

Goats are kept almost exclusively for meat production and local goat meat together with mutton meets only 20 per cent of total consumption. The demand for goat meat is high as indicated by relatively high prices compared to imported mutton or lamb. Some milk, mainly fresh, is consumed in the estates and urban fringe areas while skins are used in the leather trade.

There are three types of goats. These are the indigenous Kambing Katjang, the imported breeds mainly Anglo-Nubian, Saanen, Toggenburgh, Alpine and Jamnapari, and the crossbred goats. The imported breeds have been used for upgrading the quality of local goats.

The main constraints to the development of the goat industry are disease problems, nutrition, poor management practices, lack of knowledge on the economics of goat farming and lack of appreciation of the nutritious value of goat milk.

Under the Third Malaysia Plan the following development programmes are being undertaken:-

- (i) The establishment of three multiplication units in the following states:-
 - 1) Kluang Veterinary Institute, Johore
 - 2) Gajah Mati, Kedah
 - 3) Pantai, Negeri Sembilan

In these multiplication units, purebred, exotic breeds of goats will be maintained. These selected goats will be imported from overseas. The progeny of these pure breeds will be distributed to the farmers to upgrade the indigenous goats. The units will also serve as demonstration centre for the farmers. The centre would be able to provide service on goat management and improvement.

- (ii) Intensify the veterinary health and extension services to goat farmers to reduce mortality and improve the performance of the goat.
- (iii) Encourage the planting of mixed legume/fodder grasses and leguminous trees for the feeding of goats.
- (iv) Undertake research on various aspects of goat production. The Malaysian Agricultural Research and Development Institute (MARDI) has in this connection, research programmes on breeding, feeding and management. Exotic goat breeds have also been imported to assist in the research programmes.
- (v) To promote artificial insemination with frozen buck semen for breeding goats.
- (vi) Impose total ban on the slaughter of females.
- (vii) Intensify the goat (pawah) scheme, particularly in smallholder rubber, oil palm and coconut estates.

V. NEPAL

Goats in Nepal like sheep, yaks and chauri are reared mainly in higher hills (above 3,000 M latitude). According to the 1970 Census of the Central Bureau of Statistics, the goat population was about

2.3 million which represents about 15.6 per cent of total livestock population in the country. The value of goats to the Gross Domestic Product (GDP) is about 0.8 per cent which is very small. Of this 2.3 million population, 62.3 per cent is concentrated in the middle and lower hills (1,500 - 3,000 M in altitude) 21.6 per cent in the Terai region (below 300 M altitude) and only 16 per cent in the higher hills. This distribution by altitude is consistent with the fact that goats are reared where there is grazing available in the jungles.

Goats are valuable for meat and fibre production. Currently, the demand for goat meat is far greater than supply and about 60,000 goats are imported annually from neighbouring country to help meet this demand. The common breeds of goat are Changra (Pashmina or Cashmere), Sindharl, local Hill and Terai breeds. Of these, the last three breeds are more important for meat production and the first for fibre production. The average yield of Pashmina is about 125 to 200 gm. Exotic goats have also been introduced into the country and include the Saanen from Israel and Jamnapari and Barbari from India.

There is considerable nomadism and migration of goats. In the latter system, flocks are shifted to Alpine pastures above 3,000 M in altitude during summer. They stay there for almost 4 months and then retreat to the lowlands as winter approaches. There is very little or no intensive production of goats in Nepal. Marketing of goats and goat products has recently been assisted by the initiation of local cooperatives by His Majesty's Government. There is no organised slaughter of goats in the country.

VI. PAKISTAN

According to the livestock census of 1976, there are 21.7 m goats. These were owned by 3.3 million families of which 78.6 per cent owned up to 5 goats; 20.5 per cent owned less than 50 goats; 1.4 per cent owned more than 50 goats.

Over the period 1972-1976, the goat population increased at the rate of 9 per cent per annum. It has been suggested by the authorities that this rapid rate of increase is largely due to popularity or prolificacy of Black Bengal goat breed which is found throughout Pakistan but particularly in Northern district of Punjab and Azab Kashmir.

Both milk and meat breeds are found. The dairy breeds are located in irrigation areas or around urban population where there is available fodder and also some grazing. The more important breeds are Black Bengal, Beetal, Dera Din Panah, Kamori, Barbari, Kaghani and Nachi. Anggora goats were imported from U.S.A. to improve fibre production by crossbreeding with indigenous breeds. This programme has been underway for about 10-12 years.

Goats produced approximately 25 per cent of total volume of meat produced (goats + sheep + cattle + buffaloes + poultry). Similarly, goat produced 3.6 per cent of the total volume of milk produced in the country. The most important constraints to production are nutrition and disease control. Since about 70 per cent of the total land area in Pakistan are range land, goats have to subsist on poor quality grazing for most of the year. Feed shortages are critical and affect productivity from goats seriously.

The following development strategy is being considered by the Government to improve goat production in Pakistan:-

- (i) Putting surplus and uneconomical animals on feed lot for fattening by utilizing industrial and agricultural wastes and by-products.
- (ii) Improving fodder productivity of land by adopting high yielding varieties of fodder crops and by developing unutilized waste range lands for goat production.

- (iii) Development of existing range lands by adopting modern techniques for improving nutrition and productivity of goats.
- (iv) Conducting research on different aspects of breeding, feeding and management and feeding solutions to farmers/producers for increased production.
- (v) Utilization of molasses and pith into marketable products for stock feeding in feed lot operations.
- (vi) Strengthening disease control measures especially prophylactic vaccination against contagious diseases and by provision of drenching and dipping facilities for controlling worm infestation which would reduce losses through mortality and will improve productivity of goat.

VII. PHILIPPINES

In 1976, the estimated goat population was 758,000. Of this population, 99 per cent was found in small farms. The goat population is distributed fairly widely throughout the 12 regions of the country but more particularly in the region of Central Visayas, Ilocas, Southern Tagalog, Western Visayas and Central Luzon.

The country is already self-sufficient in pork, poultry and eggs. As a consequence, the present drive of the Government towards self-sufficiency in food is now in the production of animal protein foods from ruminants, notably from cattle, Carabaos and goats.

With this in view, 4 objectives are being pursued:-

- (i) Increase meat and milk production through improved quality and quantity of goats and by better goat management practices.

- (ii) To help effect better nutrition through increased goat milk consumption, especially among the vulnerable age groups.
- (iii) To increase income in the rural areas through goat production.
- (iv) To increase utilization of idle resources in the farm.

The targets of the Bureau of Animal Industry (B.A.I.) are two-fold:-

- (1) To establish/strengthen three one-hundred doe farm or the equivalent, in each of the 12 BAI regions in 3 years' period to support the grade goat dispersal scheme.
- (2) To establish four one-hundred doe herd purebred buck mother farms (2 in Luzon, 1 each for Visayas and Mindanao).
- (3) To import 150 purebred goat breeder stock.

The development strategy consists of opening goat breeding farms, dispersal schemes of does and bucks, training and extension, research and supervised credits. The project is complementary to the National Job Generation Programme of the Ministry of Human Settlements and the target concerns 30,000 barangays and anticipates that there will be an income generation of about US\$70 per family owning two does.

VIII. SRI LANKA

The population of goat in Sri Lanka in 1978 was about 290,000 compared to 556,000 in 1970. It is clear that the goat population is decreasing. This is also evident from the 1973 Livestock Census which estimated the presence of 284,000 goats.

The country in geographical terms is divided into 4 zones: Dry Zone, Coconut Triangle, Mid Country and Hill Country. In the Hill and Mid Country, 22-24 per cent of the goat is found in 2.4-4.8 ha and in the Northern region in Jffna, 23 per cent of the goat is found in 2.4-3.6 ha. The number of goats per holding in the Dry Zone, Hill and Mid Country and Wet Zone was 2.6, 3.5, 4.9, respectively.

Three types of goat keeping systems are identifiable:-

- (1) Backyard goat keeping of 1 to 3 heads purely for milk,
- (2) Semi-intensive system where 10-25 heads are kept for meat and
- (3) Intensive system where 25 to about 200 heads are kept for meat and dung production.

There are two types of goats - indigenous and exotic animals. The indigenous goats are non-descript and mainly of South Indian origin. The exotic goats include the Jamnapari and the Saanen.

The development programme for goats in Sri Lanka is directed at increasing the output of both meat and milk. Recently, the Government is taking a special interest in developing suitable programmes for dairy milk production in the Hill Country Zone. Consideration is being given in this zone with a mean monthly temperature of between 10.0 - 23.2°C to explore possibilities of introducing imported Saanen goats for milk production. This programme needs to be developed, concurrent with making available the necessary environment to ensure that the goats will perform successfully.

IX. THAILAND

The present population of goats as of 1977, is estimated to be about 31,000, found mainly in the Southern region of Thailand. The most important breed is the indigenous goat which is kept in small numbers by the poorer farmers with no special care for maintenance

and breeding. Goat meat is not relished in urban areas to the same extent as pork or beef. Milking is not practised.

The Government has in recent years set apart a very large budget for livestock development in the rural areas in which improved goat rearing is included. In the highland regions, some attempt has been made to introduce goats as part of an integrated farming system. The Government intends to use exotic breeds to upgrade the native goats in areas where there is traditional interest in goat farming. Studies conducted in these areas indicated that goats make a useful contribution to the smallholder income.

The main constraints to goat production are:-

- (i) lack of knowledge at the farmer's level,
- (ii) limited resources and expertise, and
- (iii) peoples' attitude to the rearing of goats.

LIST OF INDIVIDUALS AND PERSONS VISITED
IN INDIVIDUAL COUNTRIES

1. Bangladesh

Dr. Allauddin Ahmed	Director General Directorate of Livestock Production Dacca
Dr. Abdul Aziz Sharkar	Veterinary Officer Directorate of Livestock Production Dacca
Prof. Moslehuddin Ahmed Choudhury	Vice Chancellor Agriculture University Mymensingh
Mr. Muhammad Sayeduzziman	Veterinary Officer Directorate of Livestock Production
Mr. Shabir Ahmed	Junior Officer Directorate of Livestock Production Dacca
Dr. S.M. Altaf Hossain	Agronomist Graduate Training Institute Mymensingh
Mr. Tarun Kanti Chakma	APHCA Liaison Officer Directorate Livestock Production Dacca

2. India

Dr. M.S. Swaminathan	Director General Indian Council Agricultural Research (ICAR) Krishi Bhavan New Delhi
Dr. B.K. Soni	Deputy Director General Indian Council Agricultural Research (ICAR) Krishi Bhavan New Delhi
Dr. G. Ghosswami	Assistant Commissioner (L & AH) Ministry of Agriculture New Delhi

Mr. P.S. Appu	Additional Secretary (Livestock and Reform) Ministry of Agriculture New Delhi
Dr. G.M. Ghaneckor	Assistant Commissioner (L & AH) Ministry of Agriculture New Delhi
Dr. V. Sundaresan	Director National Dairy Research Institute (NDRI) Karnal
Dr. R. Nagacenkar	Head, Division of Dairy Cattle Genetics National Dairy Research Institute (NDRI) Karnal
Dr. K.L. Sahni	Officer in Charge Central Goat Research Institute IVRI, Makhdoom, Mathura
Dr. P.G. Nair	Dean Vet. & Animal Sci. College Mannuthy, Trichur Kerala
Dr. B.R. Krishnan Nair	Assoc. Professor Vet. and Anim. Sci. College Mannuthy, Trichur Kerala
Dr. N. Kunji Kutty	Assoc. Professor Vet. and Anim. Sci. College Mannuthy, Trichur Kerala
Dr. Shri. N. Koleswaran	Vice Chancellor Vet. and Anim. Sci. College Mannuthy, Trichur Kerala
Dr. E. Matnur	Asst. Professor Vet. and Anim. Sci. College Mannuthy, Trichur Kerala
Dr. C.A. Rajagopalanaja	Asst. Professor Vet. and Anim. Sci. College Mannuthy, Trichur Kerala

Dr. D.G. Rajagopalan Assoc. Professor
Vet. and Anim. Sci. College
Mannuthy, Trichur
Kerala

Dr. P.K. Namkari Director, Animal Husbandry
Trivandrum
Kerala

Dr. N.P. Fair Deputy Director Livestock
Trivandrum
Kerala

3. Indonesia

Mr. N. Hughes Program Officer
F.A.O.
Jakarta

Prof. Dr. J.H. Hutasoit Director General of Animal Husbandry
Direktorat Jendral Peternakan
Jakarta

Dr. Soamarno Head, Animal Production Dept.
Sub-Directorate
Jakarta

Dr. Dawan Sugandi Faculty of Anim. Husbandry
Univ. of Bogor
Bogor

Dr. Eddie Gurnadi Faculty of Anim. Husbandry
Univ. of Bogor
Bogor

Dr. Imam K. Abdul Ghani Faculty of Anim. Husbandry
Univ. of Bogor
Bogor

Dr. Yuttiwah Rassadan Provincial Head
Livestock Directorate
West Java

Mr. Erwin Soetirno
Kartadihardja Livestock Officer
Dept. of Animal Husbandry
Jakarta

Dr. Sri Dedi Wiryosuharto Livestock Officer
Dept. of Animal Husbandry
Jakarta

Dr. Dedan R. Reksalagoss Livestock Officer
Dept. of Animal Husbandry
Jakarta

4. Iran

Dr. M. Baharsefat	Director Veterinary Organisation Ministry of Agriculture and Natural Resources Teheran
Dr. H. Maljaie	Head, Investigation Dept. Ministry of Agriculture and Natural Resources Teheran
Dr. M. Behzadi	Veterinary Officer Poultry Investigation Unit Ministry of Agriculture and Natural Resources Teheran
Dr. V.D.M. Rokmedin Rokni	Veterinary Officer Vet. Investigation Services Ministry of Agriculture and Natural Resources Teheran

5. Nepal

Mr. Nepali	Director of Agriculture Dept. of Agriculture Harihan Bahwan Lalitpur
Mr. K.R. Keshary	Deputy Director General Livestock Division Dept. of Agriculture Harihar Bhawan Pulchowk Lalitpur
Mr. S.N. Pradahh	Livestock Officer Livestock Development Division Khumultar
Mr. L. Manta	Project Manager (Sheep, Goat and Wool Project) Livestock Development Division Khumultar
Mr. K.K. Pandey	Animal Husbandry Officer Livestock Development Division Khumultar

6. Pakistan

Dr. Abdus Salem Akhtar	Animal Husbandry Commissioner Livestock Division Ministry of Food and Agriculture Islamabad
Dr. Mohamed Anwar Khan	Deputy Animal Husbandry Commissioner Livestock Division Ministry of Food and Agriculture Islamabad
Dr. Abdul Waheed	Asst. Animal Husbandry Commissioner Livestock Division Ministry of Food and Agriculture Islamabad
Dr. M. Zafarullah	Asst. Animal Husbandry Commissioner (Nutrition) Livestock Division Ministry of Food and Agriculture Islamabad
Dr. E.H. Siddiqui	Deputy Animal Husbandry Commissioner (Disease) Livestock Division Ministry of Food and Agriculture Islamabad
Dr. Usman Haider	Asst. Animal Husbandry Commissioner (Milk & Meat) Livestock Division Technical Unit Islamabad
Dr. S.M. Salahuddin	Vet. Research Institute Lahore
Dr. N.A. Cheema	Superintendent Kherimurat Livestock Farm Distt. Attock.

7. Philippines

Dr. Salvador H. Escudero III	Director Bureau of Animal Industry Manila
Dr. E. Baconowa	Deputy Director Bureau of Animal Industry Manila

Dr. C.R. Campos	Bureau of Animal Industry Manila
Dr. Jesus de Guzman	Bureau of Animal Industry Manila
Mr. Eustaquio Avitan	Bureau of Animal Industry Manila
Dr. L.S. Castillo	Director, Dairy Training Research Institute Los Banos
Dr. C.E. Perez (Jr.)	Dean, U.P. College of Agriculture, Los Banos
Mr. M. De Guzman	Dept. of Animal Science U.P. College of Agriculture Los Banos
Dr. E.Q. Javier	Director, Plant Breeding Institute U.P. College of Agriculture Los Banos
Mr. E. Isidoro	President Carnation & Co. Ltd. Manila
Dr. J. Escano	Carnation & Co.. Ltd. Manila
Mr. W.T. Hiller	Carnation & Co. Ltd. Manila

8. Sri Lanka

Dr. A. Bandaranayake	Director of Agriculture (Animal Production and Health) Dept. of Agriculture (Animal Production and Health) Peradenya
Dr. K. Shamugalingam	Veterinary Officer Dept. of Agriculture (Animal Production and Health) Peradenya
Dr. O. Fernando	Veterinary Officer Dept. of Animal Production and Health Peradenya

Dr. M.E. Pereira	Deputy Director Dept. of Animal Production and Health Peradenya
Dr. N. Balasubramaniam	Asst. Director of Health Dept. of Animal Production and Health Peradenya
Dr. A. Maheswaran	Regional Vet. Officer Animal Quarantine Station Colombo
Mr. Rajaguru	Head, Dept. of Animal Husbandry Faculty of Agriculture Peradenya
Dr. Upal Perera	Regional Vet. Officer Hatton
Dr. T. Varumalingam	Regional Vet. Officer Nawalapitya
Dr. K.V. Ravindran	Vet. Surgeon Mannar
Dr. R. Rajeswaran	Vet. Surgeon Vavunya
Dr. K.K. Krishnanthasivam	Vet. Surgeon Vet. Investment Centre Jaffna

9. Thailand

Dr. La-aid Duangdee	Director General Department of Livestock Development Ministry of Agriculture and Cooperative Bangkok
Dr. C. Wongsongsarn	Department of Livestock Development Ministry of Agriculture and Cooperative Bangkok
Dr. T. Bhansiri	Deputy Director General Department of Livestock Development Ministry of Agriculture and Cooperative Bangkok
Dr. S. Kubavantha	Veterinary Officer Department of Livestock Development Ministry of Agriculture and Cooperative Bangkok

Dr. Suntraporn R. Napuket Dept. of Livestock Development
Ministry of Agriculture and Cooperative
Bangkok

Dr. Charan Chantalakhana Dept. of Animal Science
Kasetsart University
Bangkok

10. APHCA Secretariat (Bangkok)

Dr. C.P. Pillai Regional Veterinarian

Dr. L.B. Marcello Livestock Officer

Dr. C.G. Sivadas Information Coordinator

11. USAID (Bangkok)

Mr. R.R. Brown USAID Office
Bangkok

Mr. W.D. Fleming USAID Office
Bangkok