

LIVESTOCK RESOURCES OF PAKISTAN: PRESENT STATUS AND FUTURE TRENDS

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ABSTRACT

Pakistan is endowed with diverse livestock genetic resources. In fact it is postulated that one of the centres of animal domestication lay in this part of the world. Pakistan has a large livestock population, well adapted to the local environmental conditions. Current population of farm animals in Pakistan consist of 23.34 million buffaloes, 22.42 million cattle, 24.24 million sheep, 49.14 million goats and 0.77 million camels. Pakistani buffaloes are riverine type and belong to two breeds i.e. Nili-Ravi and Kundi. Nili-Ravi is the best dairy buffalo breed of the world. There are ten distinct breeds of cattle found in Pakistan. However, these breeds probably only make up 30 percent of the population and the rest of the population is generally classified as non-descript. Cattle breeds of Pakistan are Sahiwal, Red Sindhi, Cholistani, Dhanni, Tharparker, Bhagnari, Djal, Lohani, Rojhan and Kankrej. There are 30 local breeds of sheep in the country. Important sheep breeds are Bucchi, Lohi, Thalli and Salt Range in Punjab; Bumbi, Kachhi and Kooka in Sindh; Balkhi, Damani and Kaghani in NWFP and Baluchi, Bibrik, Harnai and Rakhsani in Balochistan. For goats, 37 breeds have been described. The important goat breeds include Beetal, Dera Din Panah and Teddy in Punjab, Barbari and Kamori in Sindh, Kaghani and Jatal in N.W.F.P. and Khurassani, Lehri and Pahari in Balochistan. Twenty-one breeds of running, baggage and dairy camels have been described.

Analysis of livestock population trends show that buffalo population increased 392%, cattle 219%, sheep 299%, and goats 650% in the last 45 years (1955-2000). Livestock-production system is mostly mixed crop-livestock farming. Production systems of cattle and buffaloes are subsistence small-holdings, market oriented small-holdings, rural commercial farms and peri-urban dairy farms. Farming systems of small ruminants and camels are nomadic, transhumant and sedentary-household. Systematic genetic improvement programmes for livestock have been limited and half hearted. Some of these are land grants, herd-book scheme, provision of pedigree bulls, establishments of government livestock farms,

provision of artificial insemination service, progeny-testing programme for Nili-Ravi buffalo and Sahiwal cattle, import of exotic stock and crossbreeding. These programmes have been addressing productivity-issues and have been limited to a few breeds of animals. It is feared that if proper research and development efforts are not carried out, many of the livestock genetic resources (breeds) will be lost. Survival of a breed in the farming system will depend on its economic utility.

Important areas of research and development in animal genetic resources are; development of low-cost performance-recording system, evaluation and strengthening of on-going progeny-testing programmes, starting of progeny-testing programmes for important breeds, phenotypic characterization of breeds to identify specific traits of economic importance, development of beef breed, genetic characterization of different breeds of livestock and development of molecular markers for economic traits.

INTRODUCTION

Livestock are natural factories to convert roughage (grasses, shrubs, etc) into quality-food i.e. milk and meat. It is an established nutritional fact that animal proteins are superior to vegetable proteins for the supply of essential amino acids. Livestock also provide raw material for industries and create markets and capital. For a large population of rural household in rain-fed agricultural production system, livestock provide security against crop-failure. For the poor in the villages, it is a form of social security, cashing it at the time of need. Livestock are also used in sports and entertainment and are also considered a symbol of prestige in certain areas of Pakistan.

Livestock is an important sub-sector of agriculture and accounts for 37.5 percent of agricultural value-addition and about 9.4% of the Pakistan GDP. Its net foreign exchange earnings were approximately 53 billion rupees in 2000-2001, which is almost 12.3% of all the export earnings of the country [Government of Pakistan, 2002]. Livestock sector provides employment to a large number of rural households

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and about 35 million people are engaged in livestock-related activities, earning about 40% of their income from it [Government of Pakistan, 2002].

Pakistan has a large livestock population, well adapted to the local conditions and has some of the best tropical dairy breeds. Current livestock-population (2000-2001) of the country include 23.34 million buffaloes, 22.42 million cattle, 24.24 million sheep, 49.14 million goats and 0.77 million camels (Table-1). These produce 32.695 million tonnes of milk, 1.010 million tonnes of beef, 0.666 million tonnes of mutton, 39.2 thousand tonnes of wool and 46 million skins and hides [Government of Pakistan, 2002]. The present article describes main characteristics of livestock-breeds, livestock population trend, production systems, government efforts to improve livestock genetic resources and future research-agenda for the improvement of animal genetic resources in Pakistan.

LIVESTOCK BREEDS AND THEIR PRODUCTION CHARACTERISTICS

Pakistan is endowed with rich livestock genetic resources. Pakistani buffaloes are riverine type and mainly belong to two breeds i.e. Nili-Ravi and Kundi.

Production characteristics of Pakistani buffaloes are given in Table-2. Nili-Ravi is the best dairy buffalo-breed of the world [Shah, 1991]. Buffaloes are mainly found in Punjab (60.9%) and Sindh (31.8%). In fact in the 60's and 70's, very few buffaloes were found in NWFP and Balochistan. However, over the years, buffalo population has increased significantly in these areas, particularly in NWFP.

There are ten distinct breeds of cattle found in Pakistan [Wahid, 1975; Naqvi and Jafar, 1989; Bhutto et al, 1993]. Their production characteristics are given in Table 3. However, these breeds probably make up only 30 percent of the population and the rest of the population is generally classified as non-descript. Cattle were originally kept for draught purpose but, with mechanization gaining momentum, cattle are being kept for dairy and meat purposes. Crossbreeding of local cattle with exotic semen (particularly Holstein-Friesian and Jersey) for improved milk-production has become popular and more than 2 million crossbred cattle are present in Pakistan [Khan, 1994]. Although no specific breed of beef-cattle is present in Pakistan, some local breeds have the potential for beef production and many farmers keep cattle to sell on Eid ul Azha, a muslim festival following the annual pilgrimage to Mecca (Hajj), for sacrificial purpose.

Table - 1: Livestock Population of Pakistan (2000-2001)

	(000 heads)				
Province	Cattle	Buffalo	Sheep	Goat	Camel
NWFP	4813	1462	3223	8587	63
Punjab	9677	14201	5887	18251	143
Sindh	6490	7415	4418	11685	228
Balochistan	1444	257	10708	10616	333
Pakistan	22424	23335	24236	49139	767

Table - 2: Main Characteristics of Buffalo-Breeds of Pakistan

Breed	Type	Areas of Concentration	Adult Weight (Kg)		Age: Maturity (days)	Milk Yield (Lit) per Lactation	Remarks
			Male	Female			
Nili Ravi	Milch	Lahore, Sheikhpura, Faisalabad, Toba Tek Singh, Sahiwal, Okara, Multan, Vehari, Bahawalpur	800	597	915-970	2300	Best dairy buffalo breed of the world.
Kundi	Milch	Dadu, Hyderabad, Karachi, Larkana, Nawabshah, Sanghar and Thatta.	600	375	1230	2000	

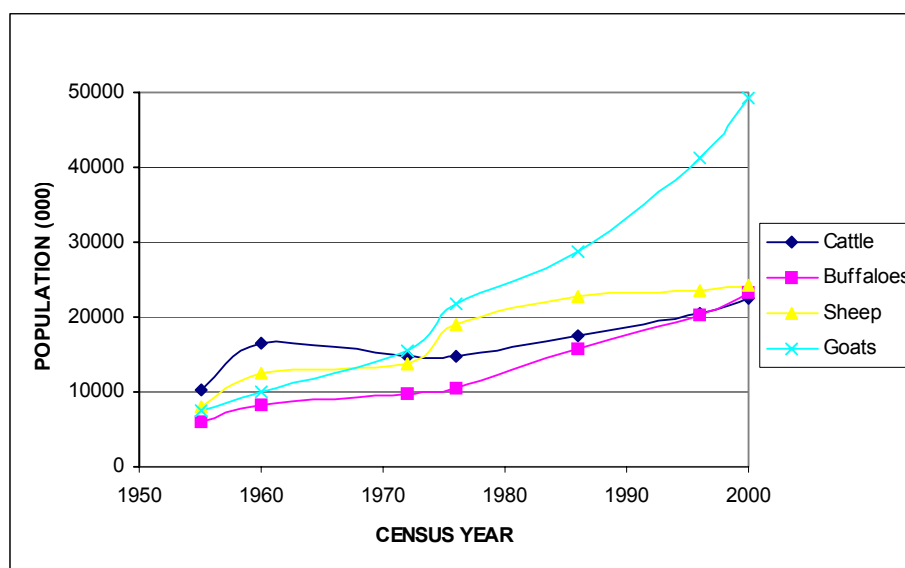


Figure - 1: Livestock Population Trend in Pakistan

There are 30 local breeds of sheep in the country [Husnain, 1985; Bhutto et al, 1993; Ishaque, 1993; Isani and Baloch, 1996]. The production characteristics of these breeds of sheep are shown in Table-4. Important sheep breeds are Bucchi, Lohi, Thalli and Salt Range in Punjab; Dumbi, Kachhi and Kooka in Sindh; Balkhi, Damani and Kaghani in NWFP and Baluchi, Bibrik, Harnai and Rakhsani in Balochistan. Sheep farming is an important economic activity in Balochistan and more than 44 percent of the total sheep are raised in Balochistan.

There are 37 breeds of goats reported in Pakistan [Bhutto et al, 1993, Isani and Baloch, 1996]. The production characteristics of these breeds are given in Table-5. The important goat breeds are Beetal, Dera Din Panah and Teddy in Punjab, Barbari and Kamori in Sindh, Kaghani and Jatal in N.W.F.P. and Khurassani, Lehri and Pahari in Balochistan Goat production is almost evenly distributed among all regions of the country.

Camels are mainly raised for draught and baggage purposes and the population is more in areas where road-infrastructure is less developed. Dairy camels of Pakistan are also very famous. More than 43 percent of camel-population is present in Balochistan only. There are a few studies on the breeds of camels in Pakistan and recently a study [Isani and Baloch, 2000] has described 21 breeds of camels (Table-6). However,

some of these described breeds may not be true breeds and may be just off-shoots of the others.

TRENDS OF LIVESTOCK POPULATION

Population of all major species of livestock (cattle, buffaloes, sheep and goats) has been constantly increasing over the years. However, growth-rate is different for various species. Growth-rate of buffalo is higher than that of cattle (Figure-1). In fact, in 1955, when the first livestock-census was carried out, cattle population was much higher than of buffaloes. Cattle in Pakistan have mainly been used as draught-animal, in addition to milk production and, with mechanization gaining momentum in 60s and 70s, cattle-population increased at a nominal rate. Introduction of crossbreeding for improved milk-production resulted in increased interest in cattle-raising in the 80s and 90s. In contrast, the buffalo is the main dairy-animal of Pakistan, and its population continued to grow at almost 1.75 times the growth-rate of cattle. Thus, whereas population of cattle in 1955 was 172% more than buffaloes, the buffalo-population is currently higher than cattle. Buffalo milk contains higher butter-fat and total solids and has a richer taste, and it is preferred by Pakistani people who have developed a taste for it. In fact, cow milk is sold at a cheaper price than buffalo milk in most parts of the country.

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In small ruminants, the growth-rate is much higher in goats than sheep. At the time of first livestock-census in 1955, the numbers of sheep were higher than goats. However, now the situation is absolutely different; goats outnumber sheep and are even more than twice the number of sheep in Pakistan. Goat's meat is preferred by customers in Pakistan and is usually sold at a higher price in most parts of the country.

Camel population has shown a static or decreasing trend over the years. Development in areas of camel-production is resulting in better road-access and mechanical transport, thus the utility of camels as means of transport of men and baggage is decreasing. Furthermore, camel-milk is not cherished in Pakistan and there is practically very little market for camel's milk and meat.

HERD-STRUCTURE IN LIVESTOCK

Majority of national livestock-herd is distributed in small units throughout the Pakistan [Agricultural Census Organization, 1998]. Small holders keep a major share of population in large ruminants, and 60% buffaloes and 55.5% cattle are raised by farmers with less than 6 animals per family (Table-7). Large-scale farming is limited in Pakistan and only 6% buffalo and 9.8% cattle

population is kept by farmers with more than 20 animal per household. However, the trend of keeping medium (7-20 animals) and large herd-sizes (> 20 animals) is increasing in recent years.

The trend of keeping small ruminants is different from large ruminants and the distribution of herd-sizes for goats and sheep vary significantly. Small holders (<30 animals/household) raise only 35.5% sheep, but make a lion's share of goat-raising i.e. 66.2% [11]. Similarly, larger flocks (>100 animal/flock) for sheep constitute 36.5% of population, but only 14% of goat population. One of the reasons for this discrepancy is that larger herd-sizes are kept in Northern areas, NWFP and Balochistan, where sheep-raising is more popular than goat husbandry.

ANIMAL-PRODUCTION SYSTEMS IN PAKISTAN

Except for nomadic sheep, goats and camels, and peri-urban dairying, production of livestock is closely integrated with crop-production. Most farms are fully integrated mixed units, with cattle, buffaloes and sometimes sheep or goats or both. Traditionally, cattle were kept as draft animals, with milk as a by-product and buffaloes as milking animals. With the mechanization of agriculture, however, cross-bred cattle

Table - 3: Main Characteristics of Cattle-Breeds of Pakistan

Breed	Type	Areas of Concentration	Adult Weight (Kg)		Age at Maturity (days)	Milk Yield/ 305 days	Lactation length (Days)
			Male	Female			
Red Sindhi	Milch	Western Sindh and Lasbela in Balochistan	530	325	852	1675	270
Sahiwal	Milch	Sahiwal, Okara, Multan and Faisalabad	544	408	861	1852	283
Bhagnari (Kachhi)	Draught	Bhag Territory in Kalat and Northern Sindh	650	480	966	950	262
Dhanni	Draught	Attock, Rawalpindi, Chakwal and Jhelum	412	285	910	800	204
Lohani	Draught	Loralai and D.I. Khan	315	253	900	613	163
Rojhan	Draught	Suleman Range of Mountains, D.G. Khan, D.I. Khan, Kohat and Bannu	370	267	-	735	192
Tharparkar	Dual	Thatparker and surrounding areas	470	285	891	1584	277
Cholistani	Milch	Cholistani area	470	341	609	1471	285
Kankreg	Dual	South West part of Tharparkar	591	432	-	1200	-
Dajjal	Draught	Dajal area of D.G. Khan	587	400	-	900	257

are replacing the low-producing breeds.

Dairy Production

There are four main types of system [FAO, 1987; Afzal, 1998] for the production of milk from cows and buffaloes in Pakistan:

- Rural subsistence smallholdings, producing milk for the family at minimal cost. The average subsistence-unit consists of three buffaloes, including one or two adults. Grazing provides more than half of the feed-requirement. Some green fodder and straw is provided and a small quantity of concentrate is given to milking cows. This traditional system makes heavy demands on family labour.
- Rural, market-oriented smallholdings, with satisfactory access to milk-markets, producing milk in excess of family-requirements for sale. These farmers usually keep better-quality animals. A typical unit consists of fewer than six buffaloes and cattle, with two or three in milk. Milking animals are generally stall-fed with seasonal green fodder, straw and concentrate while dry cows and herd followers are grazed. There is usually no adult bull in the herd. Calves are retained during lactation, and then the males are disposed of while females are kept as replacements. This system is the main source of milk in Pakistan.
- Rural commercial farms, with more than 40 animals, 90% buffaloes and 10% cattle, on mixed crop-livestock farms or specialized farms for breeding and milk production. Fodder crops are grown and straw may be home-grown or purchased. Concentrates are fed and dry females and heifers are, if possible, grazed. There is usually a bull for natural mating and the government artificial insemination service is also used. These farms are well organized and kept good records, but their contribution to the total milk supply is small.
- Peri-urban commercial dairy farms, around all big cities, the largest being at the Landhi Cattle Colony, Karachi, where more than 250,000 milking animals are kept. Most herds in this sector have 15 to 50 animals and more than 90% are buffaloes, mostly adult lactating females. Turnover is very high. Animals close to calving or in calf are purchased, the calf is allowed to suckle for a few

days and is then sold, generally for slaughter. Dry females are either sold for slaughter or returned to the rural areas for breeding. Most cows are not mated, as pregnancy reduces milk-yield. Green fodder is purchased, but feed consists mainly of concentrate and straw. Since this is a high-cost system, only high-potential animals are kept.

In the cities, families sometimes keep one or two animals and sell the surplus milk, usually to neighbours.

Sheep and Goats

The vast majority of small ruminant-flock owners are small-scale farmers, sometimes landless. Mixed flocks are common, although separate flocks of sheep or goats can also be seen. The production-systems [Ishaque, 1993; Afzal, 1998] are:

- *Nomadic*, found mostly in parts of Sindh and Baluchistan. These flocks, with more than 100 animals, move constantly throughout the year in search of grazing. Most of the lambs and kids are born between January and April, when flocks are at lower elevations. Females are retained for flock-replacement or enlargement, but males are sold before they are one year old. Grazing is mainly free, but in some areas grazing or fodder may have to be purchased. Sheep are mostly shorn twice. There is some milking, to provide for family-consumption and for sale in the local market.
- *Transhumant*, where flock-owners have a fixed base, but move with their families to another grazing-area for a major part of the year. This system is prevalent in tribal areas in parts of the North West Frontier Province, in parts of Sindh and Baluchistan and throughout the Northern Areas. Average flock-size is about 100 animals. Grazing is mainly on rangeland or crop residues, and sometimes areas have to be rented. The flock-owners have easy access to the market and sell the male progeny, often at low weight. Sheep are shorn two or three times each year. There is some milking for family consumption or for the sale of milk or milk products.
- *Sedentary – household*, where flocks remain in the same locality throughout the year and are taken out to graze during the day and brought back in the evening. Flocks are small, usually

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Table - 4: Main Characteristics of Sheep-Breeds of Pakistan

Sheep Breed	Type	Areas of Concentration	Adult Weight (Kg)		Daily Milk Yield (Lit)	Fleece Weight (Kg/Year)
			Male	Femal		
Dumbi	Mutton	Dadu, Shahdad kot, Jacobabad in Sindh and Sibi in Balochistan	36	30	0.4-0.7	1.38
Kachhi	Mutton, Milk and Wool	Dadu, Shahdadkot, Jacobabad, Hyderabad Larkara & Naw abshah	40	29	1.09	2.03
Kooka	Mutton and wool	Dadu, Shahdadkot, Jacobabad, Hyderabad, Larkana, Naw abshah	26	23	0.4	2.13
Buchi (Bahaw alpuri)	Wool and Mutton	Bahaw alpuri, Bahawalnagar, Rahim Yar Khan, Multan and Muzaffarabad	26	23	0.3	3.12
Kajli	Wool and Mutton	Sargodha, Khushab, Mianwali and Gujrat	46	34	0.1-0.25	2.49
Balki	Meat	Tribal areas and adjoining areas in NWFP	54.6	38	0.4	1.28
Balochi	Meat and Wool	Kalat division and suburb of Quetta down to Sibi	38	32	0.1-0.9	2.25
Baltistani	Meat and Wool	Baltistan in Northern areas	30	24.8	0.87	1.5
Bibrik	Meat & Wool	Marri-Bugti tract of Sibi and Loralai	37	32	0.23-0.68	1.55
Cholistani	Meat and Wool	Cholistani and adjoining areas of Rahim Yar Khan, Khanpur and Bahawalpur	36	30	-	3.2
Dumbi	Mutton	Dadu, Shahdad kot, Jacobabad in Sindh and Sibi in Balochistan	36	30	0.4-0.7	1.38
Kachhi	Mutton, Milk and Wool	Dadu, Shahdadkot, Jacobabad, Hyderabad Larkara & Naw abshah	40	29	1.09	2.03
Kooka	Mutton and wool	Dadu, Shahdadkot, Jacobabad, Hyderabad, Larkana, Naw abshah	26	23	0.4	2.13
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Bibrik	Meat & Wool	Marri-Bugti tract of Sibi and Loralai	37	32	0.23-0.68	1.55
Cholistani	Meat and Wool	Cholistani and adjoining areas of Rahim Yar Khan, Khanpur and Bahawalpur	36	30	-	3.2
Rakshani	Meat	Rakshani valley including Jangal, Jang Kharan, Makran and Kalat	32	28	0.5-0.7	0.93
Salt Range or Latti	Meat and Wool	Jhelum, Rawalpindi, Attock, Mianwali and Sargodha	35	30	0.25-0.5	1.9
Sipli	Meat and Wool	Bahawalpur and Bahawalnagar	32.8	29	0.2-0.4	5.6
Thali	Meat and Wool	Bahawalpur, Bahawalnagar, Rahim Yar Khan, Multan and Muzaffargarh	35	30	0.3	1.8
Tirahi or Afridi	Meat and Wool	Tribal areas of Tirah and Kurran valley	37	33	0.7	1.9
Waziri	Meat	Waziristan and Bannu	40	30	0.7	1.38
Wool type=	Fleece weight >1.5 kg/year					
Milk type=	Milk production >1.0 lit/day					

between 20 and 40 animals, and graze on stubble, roadsides, canal banks, waterlogged areas, rangeland and weeds. Women frequently keep a few animals, mostly goats, near the house and feed them on household scraps, weeds and nearby grazing.

- Before the feast of Eid-ul-Azha, at the end of the annual pilgrimage to Mecca, some entrepreneurs purchase 50-100 male sheep and goats, which they fatten and sell at a high price.

Camel Production

- Camels are generally raised for draught-purpose, with milk, meat and hair as secondary products. Camel-production systems can generally be classified [Jasra and Isani, 2000] as:
- *Nomadic*, found mainly in mountainous areas of Balochistan and, to a greater extent, in sandy deserts. Nomadic herds are diversified and include other species of livestock, mostly sheep and goats. Lack of grazing-forage and shortage of water is the push-factor for roaming from place to place. Three to four nomad families keep their livestock together. Each nomad family have about 15 to 35 camels of various ages, with mostly (about 2/3) female in the herd.
- *Transhumant*, move between specific locations and follow a fixed route for migration. They move seasonally, due to shortage of fodder and forage. Within transhumant communities, camels are mostly owned by small farmers, peasants and landless labourers or pastoralists. Transhumant herds are mixed, with camel numbers ranging from 1 to 5, with small ruminants. This production-system is mainly seen in Cholistan and parts of Balochistan.
- *Sedentary*, seen mainly in irrigated plains and South Western mountains of Balochistan. Camels are rarely moved away from their base area. Camels are generally reared by small farmers, peasants or landless pastoralists. These animals are supplemented with cheap stall-feeding. Herd size is generally small.

GENETIC IMPROVEMENT PROGRAMMES

A limited number of genetic-improvement programmes in livestock have been undertaken by the government. This has primarily been due to long incubation period

of the selective breeding and government's desire to sponsor projects that yield quick and visible results. Livestock-breeders themselves have tried to improve the breeds of their interest. In the absence of production- records kept at the farms, the breeders mainly selected animals on the physical breed characteristics, like colour of eyes, coat colour, tail length and shape of horns, etc. Major government-sponsored genetic improvement programmes are given below:

- I.. **Supply of Bulls:** Pedigreed or selected bulls from elite mothers were supplied to the interested farmers in certain localities by the government. These bulls or bull calves were either selected from the government livestock-farms or purchased from some progressive farmers. At places, these bulls were also kept in the veterinary hospitals for free breeding-services to the interested farmers. Similarly, bulls were also maintained in some of the villages through Lumbardari schemes. In these schemes, the Lumbardar (village head) was granted some land for the maintenance of bull for the purpose of breeding village buffaloes and cattle. These programmes have been discontinued.
- II. **Land-Grant Schemes:** In pre-partition India, the British government granted large pieces of land on long lease as "Land Grants" to the farmers for conservation and propagation of livestock-breeds. The significant example is the establishment of Bahadurnagar Farm, by leasing 3049 acres of land in 1916 to a private farmer to maintain 400 cattle of Hissar breed that was replaced with Nili and Ravi buffaloes in 1936. These schemes have also been discontinued.
- III. **Herd-Book Schemes:** Government started herd-book scheme for Sahiwal cattle and Nili-Ravi buffaloes in their home tract, to encourage keeping of proper animal production records. The scheme was run under the supervision of government livestock-department and the participating farmers were given land and veterinary aid, as incentives. The most important example is the Shergarh Herd-Book Scheme in Sahiwal district.
- IV. **Provision of Artificial Insemination Services:** Artificial insemination was started in Pakistan in late 50s. However, the pace has been slow and, still, only 5% of breedable buffaloes and 7% of breedable cattle are bred through artificial insemination. Currently, there are 189 A.I. Centres

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Table - 5: Main Characteristics of Goat-Breeds of Pakistan

Goat Breed	Type	Areas of Concentration	Adult Weight (Kg)		Daily Milk Yield (Lit)	Hair Production Kg/year
			Male	Female		
Barbari	Milk and Meat	Dadu, Sukkur, Naw abshah & Mirpur Khas in Sindh. Sahiw al, Lahore, Jhang, Faisalabad & Sargodha in Punjab.	40	25	1.00	
Chappar or (Kohistani or Jabli)	Meat	Dadu, Jacobabad, Naw abshah, Tharparkar, Karachi and Lasbela	27	23	0.65 – 9	
Kamori	Milk and Meat	Hyderabad, Naw abshah, Larkana	60	50	1.8-2.2	
Sindh Desi	Milk and Meat	Dadu, Shikarpur, Sukkur Naw abshah	27.2	22.2	0.9-1.8	
Beetal	Milk and meat	Multan, Sahiw al, Lahore, Faisalabad, Sargodha, Jhang, Okara, Jhelum, Gujranwala, Gujrat and Sialkot.	55	45	1.8-2.7	
Nachi (Bikaneri)	Meat and hair	Bhaw alpur, Multan, Sahiw al	38	32	0.60-0.90	0.81
Dera Din Panah	Milk, meat and hair	Muzaffargarh, Leiah and Multan	55	50	1.3-2.2	1.2
Teddy	Meat	Gujrat, Jhelum, Sargodha and Rawalpindi	34	23		
Kaghani	Hair and meat	Kaghan Valley (Abbotabad, Mansehra, Kohistan and Swat)	37	32	0.4-0.7	1.0
Khurassani	Milk and meat	Quetta, Loralai, Zhob, Chagi in Balochistan	30	25	0.9-1.3	
Damani	Milk, meat and hair	Dera Ismail Khan and Peshawar	35	30	1.1-1.4	0.7
Gaddi	Milk, Meat and Hair	Kaghan Valley	50	41	0.4-0.7	1.4
Lehri	Hair and Meat	Lehri Town in Kachi area of Sibi	33	30	-	1.8
Kajli (Pahari)	Meat, Hair and Milk	Loralai in Balochistan and D.G. Khan in Punjab	30	25	0.9-1.3	0.8 to 1.0
Baltistani	Milk and Meat	Baltistan in Northern Areas	28.8	25.6	1.1	
Bari	Meat	Hyderabad, Dadu, Larkana, Khairpur, Naw abshah and Jacobabad	29	24	0.8-1	
Beiari	Meat	Kotli and Mirpur	25	20	0.9	
Buchi	Meat and Hair	Neelum Valley and Muzaffarabad	30	22	0.6	
Bugi Toori	Meat and Hair	Eastern part of Hyderabad and Tando Allah Yar Taluka	33	25	0.5-0.75	
Bujri	Milk meat and hair	Badin and Thatta	45	35.5	1-1.25	
Jarakheil	Milk and Meat	Chilas in Diamir district	51.5	42	1.39	
Jattal	Milk, Meat and Hair	Kotli and Mirpur	23	19	0.53	
Jattan	Milk and Meat	Mirpurkhas	78	50	1.5-3	
Kacchan	Milk and Meat	Hyderabad and Parts of Badin	68	45	2-3	
Kail	Meat and Hair	Azad Kashmir	28.12	23.58	0.62	
Koh-I-Ghizer	Meat	Strip along Kohi-Ghizer from Gilgit to Yasin, Gupis and Imit	41	35.6	0.97	
Kooti	Milk and Meat	Neelum Valley	20	15	0.71	
Kurri	Milk and Meat	Kandhkot, Jacobabad, Sukkur, Naw abshah & Kashmir	50	35	1	
Labri	Milk and Meat	Muzaffarabad & Poonch	45	35	1.12	

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Kooti	Milk and Meat	Neelam Valley	20	15	0.71	
Kurri	Milk and Meat	Kandhkot, Jacobabad, Sukhur, Naw abshah & Kashmore	50	35	1	
Labri	Milk and Meat	Muzaffarabad & Poonch	45	35	1.12	
Lohri	Meat	Kacha area of river Indus, Dadu, Larkana, Khairpur, Sakkur	58	45	0.75	
Lehri	Meat and Hair	Lehri Town of Karachi, Sibi and surroundings	32.8	30.5	0.9	1.8
Pamiri	Meat	Hunza near Khunjrab and adjoining Pamir region.	40.5	36	0.8	
Pateri	Milk and Meat	Sanghar, Tando Adam and Shahadpur	70	45	1.0-2.0	
Potohari	Meat	Potohar area in Punjab and Poonch	28	22	0.73	
Shurri	Meat and Hair	Muzafarabad and poonch	38	30	0.9	
Tapri or Lappi	Milk and Meat	Hyderabad, Mirpurkhas to Khipro and Khairpur districts of Sindh	33	25	0.5-1.0	
Tharki or Tharri	Meat	Semi arid and arid parts of Thar	32	24	0.5-0.75	
Milk type	=	Milk >1 lit/day				
Hair type	=	Hair production >0.7 kg/year				

and 7 Semen-Production Units in the country. Semen of buffaloes (both Nili-Ravia and Kundi) and cattle (Sahiwal and Red Sindhi) is produced locally at four Semen-Production Centres. In addition to these, semen from Holstein-Friesian and Jersey cattle is produced locally, as well as imported from other countries.

Bull-selection for A.I. (Artificial Insemination) has been a major problem. Bulls were initially purchased from farmers having better producing animals or from government livestock-farms. However, in 1980 a progeny-testing programme was launched for Nili-Ravi buffaloes, which was later expanded to include Sahiwal cattle. With occasional break, this programme is still continued and now candidate bulls for these two breeds (Nili-Ravi buffaloes and Sahiwal cattle) are picked from 10-15% topmost elite females, being maintained at government farms or with registered farmers. There is, however, a limited number of these bulls and the rest are still selected on available limited pedigree record.

- V. **Progeny-Testing Programme:** A progeny-testing programme for Nili-Ravi buffalo-bulls was started in 1978. The work was, later on, expanded to include Sahiwal cattle also. Three buffalo-

populations i.e. government farms, private buffalo farms and selected village buffalo-population, at 27 sub-centres in three districts of Okara, Faisalabad and Sahiwal, were included in this progeny-testing programme. However, progeny-testing programme of Sahiwal cattle has only been limited to public-sector farms and surrounding villages. So far, 13 batches having 276 bulls of Nili-Ravi buffalo have been included in the programme. Similarly, 12 batches having 94 bulls of Sahiwal cattle have been handled. Fifty-one buffalo and 21 Sahiwal bulls with positive predictive values have been identified through this programme. Semen of these bulls is available in A.I. network, as well as stored in the semen bank.

- VI. **Import of Exotic Germplasm:** Like many other countries, Pakistan has also imported exotic cattle in an effort to establish these breeds in the local environment. Several exotic breeds of cattle, notably Holstein-Friesian, Jersey, Red Dane and Australian Illawara shorthorn have been imported with different objectives such as establishment of nucleus herds, use in crossbreeding programmes or as demonstration and commercial units of modern dairy-farming. These importations have been done in both public and private sector. In addition to poor adaptability, these animals under

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Table - 6: Main Characteristics of Camel-Breeds of Pakistan

Camel Breed	Type	Areas of Concentration	Adult Weight		Age at Maturity (year)	Milk Yield (lit/lact)	Lactation Length (days)
			Male	Female			
Brahvi *	Ploughing and Baggage	Chagai, Qubo Saeed Khan, Shahdad Kot, Garhi Khairo, Larkana and Jacobabad	705	690	3.94	1619.82	587.14
Kachhi *	Riding and Baggage	Kachhi in Balochistan, Jacobabad, Shikarpur and Sukkur	680.5	660	4.45	2017.73	515.91
Kharani *	Ploughing and transportation and lifting water from wells	Kharan, Jhalawan and Kalat	640.75	622.5	4.14	1928.52	522.11
Lassi *	Riding and Baggage	Lasbella district and adjoining areas in Sindh and Balochistan	570	550	3.7	1305	300
Makrani *	Baggage, transportation & milk	Makran, Kharan, Lasbella, Thalwan, Karachi and Dadu	659	675	3.82	1928.53	518.01
Pishin *	Baggager	Quetta, Pishin and surroundings	715	700	4.09	1720.44	353.68
Rodbari *	Transportation and lifting of water from underground	Gwadar, Pasni, Turbat, Daska, Kappar, Punigur and Khuzdar	720.5	705.5	2.96	1692.98	466.53
Gaddi @	Used for transportation	Lucky Murwat, Waziristan Agency and D.I. Khan	600.75	588.5	3.02	1310	315
Ghulmani @	Transportation and riding	D.I.Khan, Bhittari, Marwat, Dera Ghazi Khan, Muzaffar Garh, Multan and Zhobe	745	735	4.04	2040.69	538.3
Khader @	Transportation	D.G. Khan range lands	685	670	3.6	1656.45	450
Maya @	Draught type also used for riding	North Western hilly areas of NWFP, Waziristan	730.75	720.5	2.96	1518.9	480.9
Bagri #	Riding and racing	Cholistan and Thal area of Mianwali to Multan and Dera Ghazi Khan	670 kg	650 kg	4.25	2056.3	564.78
Brela or Thalocha #	Transportation/ good fighting camel	Sargodha, Mianwali, Gujranwala, Multan, Muzaffargarh & Faisalabad	700.5	689.59	2.9	2840.83	478.25
Cambelpuri #	Draught, riding	The area of distribution lies between Indus and Jehlum rivers.	750.5	740.3	3.04	1659.61	552.78
Kala Chitta #	Draught and riding	Lohi Bher, Pabbi, Kala Chitta, Margalla Hills, Sohawa and Salt Range	702.75	690	3.33	1495.6	310
Morecha #	Riding, loading and milk	Bahawalpur, Rahimyar Khan, Bahawalnagar and adjoining areas.	655	635	3.7	4179.51	479.29
Dhatti + (Mehari)	Riding and racing	Tharparkar, Khairpur and Badin	578.5	569	3.19	2844.66	529.59
Kharai +	Riding, loading and milk	Mirpur Sakro to Sujawal district of Thatta, Badin and Karachi	620	600	3.54	1833.53	320
Larri + (Sindhi)	Riding and loading	Badin, Hyderabad, Dadu, Nawabshah, Khairpur, Sanghar and Mirpur Khas	770.5	765.5	4.5	1817.67	511.95
Sakrai +	Riding and loading	Thatta	585.75	570	3.45	1480.1	312
Bactrin	Draught and pack	Koh-e-Gizar (20 specimens)	800	785	4	1150.1	250

Note: * denotes Balochistan, @ NWFP, # Punjab and + Sindh.

Table - 7: Distribution of Livestock by Herd-Size in Pakistan (Livestock Census 1996)

Large Ruminants			Small Ruminants		
Herd Size	Percent share in population		Herd Size	Percent share in population	
	Buffalo	Cattle		Sheep	Goat
1-2	18.1	16.3	1-5	6.5	21.4
3-4	24.5 (42.6)	22.0 (38.3)	6-15	13.2 (19.7)	28.5 (49.9)
5-6	17.4 (60.0)	17.2 (55.5)	16-30	15.7 (35.5)	16.3 (66.2)
7-10	19.6 (79.6)	20.0 (75.5)	31-50	12.8 (48.2)	9.9 (76.1)
11-15	10.2 (89.8)	9.9 (85.4)	51-75	8.5 (56.7)	5.7 (81.8)
16-20	4.2 (94.0)	4.8 (90.2)	76-100	6.8 (63.5)	4.2 (86.0)
21-30	2.9 (96.9)	4.3 (94.5)	101-150	9.1 (72.6)	4.9 (90.9)
31-50	1.6 (98.5)	2.9 (97.4)	151-200	7.5 (80.1)	3.1 (94.0)
> 50	1.5 (100.0)	2.5 (99.9)	201-350	12.2 (92.3)	4.3 (98.3)
			> 350	7.9 (100.2)	1.5 (99.8)

Values in parentheses indicate cumulative value indicating %age of total animals up to that herd size.

local environmental and management conditions, usually lost their high production. A limited number of small Friesian and Jersey cattle-herds are still being maintained by the public sector. Males are usually sold to interested farmers for crossbreeding of local non-descript cattle.

Awassi and Rambouillet sheep and Angora goats have also been imported in the country. Angora goat have been raised as pure-bred animals for mohair production. Both Awassi and Rambouillet sheep have been used in crossbreeding to increase mutton and wool production of local sheep.

VII. **Crossbreeding:** Crossbreeding in Pakistan has been carried out in cattle and to a limited extent in sheep. Among the ten breeds of cattle, only two (Sahiwal and Red Sindhi) can be classified as dairy breeds; all others are low milk-producers. Furthermore, pure-bred cattle in Pakistan only comprise 25-30% of the population and the rest are non-descript low producers. Cattle crossbreeding was started in Pakistan in 1970. Experiments at public-sector farms clearly showed that crossbred animals were better (50 to 150%) producers. Thus, crossbreeding has been carried out through government A.I. network, as well as provision of male exotic animals to the interested farmers. Exotic semen used in crossbreeding included Holstein Friesian, Jersey, Australian Illawara shorthorn, Black Welch, Chinese Black

and White and Swedish Red and White, etc. Initially, crossbreeding experiments were carried out using Sahiwal and Cholistani cattle. However, later a national breeding-policy was formulated, which encourages selective breeding in Sahiwal and Red Sindhi cattle and crossbreeding was limited to only non-descript cattle. Currently, there are about 2 million crossbred cattle in Pakistan.

Crossbreeding in sheep has focussed on Rambouillet x Kaghani for improved wool and mutton production, and on Awassi x Lohi and other breeds for improved mutton production. Rambouillet x Kaghani crosses have better wool-yield and live-weight and the quality of wool is also significantly improved. These crossbreds are now a common sight in Swat, the home tract of Kaghani.

CHANGING PATTERN OF MILK AND MEAT PRODUCTION

Traditionally, large ruminants (buffaloes and cattle) have been raised in Pakistan for milk and draught, and small ruminants (sheep and goats) for meat production. There is now a changing pattern of milk-production from subsistence to commercial production. Market-access for milk-sale and increasing demand of the milk are the main factors pushing this change. Market-oriented rural milk-production and peri-urban dairying are becoming more important for supply of milk to the urban centers. Peri-urban dairying is particularly a high input-

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high-output system and is fast turning into a commercial activity, rather than farming in the traditional sense. Cap on the price of livestock products, particularly milk and meat works, as disincentive for the promotion of livestock in the country.

Beef production has typically been a by-product of dairy and draught power in Pakistan. Price of meat (beef and mutton) has been controlled by the government and has been artificially kept at lower level, to favour the city consumers. Contrary to international trend, beef is the cheapest meat in the country. Thus, fattening of animals (which is an important requirement for meat development) has never got hold in our farming system. Fattening of animals for sale at 'Eid -ul Azha' is the only exception, where fattening pays off and this practice is gaining momentum in recent years. Research and development studies, carried out at different institutions of the country, clearly indicate potential of beef-production in local cattle and buffalo-breeds. Many studies have reported a weight-gain of more than one kg per day in local cattle and buffalo and 175 to 250 grams per day in sheep and goats, over a fattening period of 90 to 120 days. Although some of the weight-gain could be attributed to compensatory growth, the studies clearly demonstrate the potential of local breeds for meat-production [Muller, 1986, Alvi, 1991]. However, economically, fattening of animals was not feasible until recently. Meat prices in major cities have risen to a level where fattening seems to be now feasible and is expected to gain momentum. Furthermore, export of meat to Gulf countries has also given an incentive for the fattening enterprises.

There are some additional constraints to meat-production in the country. Fattening operations require a continuous source of supply of feeder-animals. In the absence of large livestock farms, purchase of feeder-animals has to be from the livestock-markets where basic infrastructure of weighing of animals is not present. Furthermore, animals coming from different sources, when reared together, require special management skills.

Introduction of beef breeds has been debated in Pakistan since long. Non-availability of good-quality range has worked as disincentive for this introduction. Efforts to develop a beef-breed have been carried out at Beef Development Centre, Sibi (Balochistan), where Australian Draught Master was used to cross with

Baghnari cattle in order to develop a local beef breed. On-farm results have shown improvement in weight-gain, as well as other productive and reproductive parameters of the newly developed breed i.e. NariMaster but these animals have never been evaluated under farmers' fields. There is need to first evaluate local cattle, like Sahiwal, Dhanni, Baghnari, Thari and Lohani cattle and Nili-Ravi and Kundi buffaloes for their beef-potential under optimum feeding and management conditions. Research and development work, however, should continue to improve local breeds through selection and crossbreeding for their beef-potential.

THREATS TO LIVESTOCK BREEDS

Human preferences and environmental pressures may result in erosion of livestock diversity. For livestock, it is usually changing farming or production systems, economy of the area and relevance of a specific breed in the changed economic and farming system that determine the survivability of the breed. Peri-urban dairying is growing and subsistence farming is fading in Pakistan. Consumers prefer buffalo milk to cow milk and goat meat to sheep meat. Furthermore, human population-pressure is resulting in decrease in rangelands and other grazing areas and crop-production patterns are changing. These factors will result in preferences for breeds that are more productive and suitable in the changing farming systems. Buffaloes occupy a central position in milk production in Pakistan and, since both buffalo breeds are reasonably good milk producers, this animal will continue to flourish. Traditionally, cattle have been used as a draught power for agriculture in Pakistan. With the introduction of machinery, their utility for draught power is being challenged. In fact, demographic changes are already being seen in cattle population. The two milch breeds i.e. Sahiwal and Red Sindhi, are medium producers and inferior to crossbred animals in milk-production, thus their survival will be threatened if no selective-breeding programmes for the improvement of these breeds are carried out.

Rojhan, Lohani, Dajjal and Kankrej cattle-breeds will probably face a real threat for their survival in the next two decades. These breeds are low milk-producers and have less potential of being developed as beef-breeds also. Furthermore, areas of concentration of these breeds are being developed for crop-production,

irrigation-facilities are being developed, and grazing areas are shrinking. These conditions will favour buffalo and crossbred animals.

Sheep and goat breeds are at higher risk of losing their identity, due to indiscriminate breeding and lack of any breeding-policy or directive from the government. In fact government has never seriously undertaken any significant development-project or programme for improvement or selective breeding of local breeds. Sheep breeds will be more vulnerable as, in many areas, sheep-raising is being replaced by goat husbandry. Furthermore, grazing-places and rangelands are decreasing, thus reducing nutrient availability to these animals. Since phenotypic and genetic characterization of the sheep-breeds have not been carried out, the value of each breed is judged only from their mutton-potential, thus breeds with lower adult weight will be more liable to disappear. Government-sponsored project of crossbreeding Rambouillet with local Kaghani sheep has clearly shown this trend. In fact in Swat, the home tract of Kaghani, every 3rd or 4th sheep is a crossbred now, within a short span of 10 years, the popularity being due to higher weight-gain and better-quality wool.

Camel breeds face the real threat. Although 21 breeds of camel have been described in one study, these may not describe the real situation. Many of these may not be true breeds and require phenotypic and genetic characterization studies. Furthermore, the habitat of camels is changing fast. Road-infrastructure is resulting in greater vehicle-transport in these areas and irrigation facilities are resulting in crop husbandry and keeping buffaloes and, cattle. Camel population is also decreasing and, without any significant market for camel milk and meat, many breeds may not be able to survive.

RESEARCH AND DEVELOPMENT NEEDS

Improvement of livestock-productivity per unit animal remains the primary concern of research and development efforts. Only those breeds of livestock will survive that will be useful in the changing farming-systems scenario. Thus, there is a real danger that many of the breeds may not survive and some conservation programme has to be put in place. Furthermore, genetic-improvement programmes have to be put in place for the promising breeds. Due to small herd-sizes and a large number of farmers involved in livestock activities, many of them part-time, it is

generally felt that livestock genetic-improvement programmes developed in western countries cannot be applied to the local farming system. Furthermore, there is practically no identification and production-recording system in vogue in the country; thus the genetic improvement programmes become an uphill task. These concerns have been expressed in many seminars and workshops on the subject. Major research and development needs in the area of genetic improvement of livestock are listed below:

1. Introduction of a uniform performance-recording system is a basic requirement of any genetic improvement programme. A low-cost self-sustaining model for performance-recording needs to be developed and implemented in different socio-economic and geographical locations of the country. Will there be one model for dairy animals, meat animals and small ruminants or separate recording-systems have to be evolved for different situations? The performance-records then can be used for genetic improvement of animals. Alternately, development of molecular markers for selection of animals for economic traits, at an early age, can provide an easy tool for genetic improvement. It is known that most of the production-traits are controlled by more than one gene. However, research on genes associated with milk-production and growth-rate needs to be studied, to develop molecular marker assisted selection in large and small ruminants.
2. There is need for evaluation and strengthening of progeny-testing programme of Nili-Ravi buffalo and Sahiwal cattle. Cost:benefit ratio needs to be calculated and how the sustainability of the programme can be ensured? There is need to start breed-improvement programmes for Kundi buffaloes and Red Sindhi cattle in Sindh province. This programme will have to focus on involving farmers, organizing them into organization(s) that can take over this programme in the long run.
3. Development of breed-associations is another area for R&D in Pakistan. The interested farmers needs to be organized. Once established, how will these associations be self-sustaining without government support? Initially there is need to start with breed associations of Nili-Ravi and Kundi buffaloes and Sahiwal and Red Sindhi cattle, which can be expanded to include other breeds later on.
4. Undefined off-shoots of buffalo breeds (Azakheli, white Nili-Ravi and Bhuri Kundi buffaloes) need to be studied for their production-potential and genetic relationship with main buffalo-breeds.

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5. There is need to genetically characterize all breeds of cattle. Some of these cattle-breeds may not be economical in the changing farming-system. Thus there is need to determine genetic relationship among different breeds. Furthermore, there is need to determine specific phenotypic characteristics of each cattle-breed e.g. disease-resistance, tick-resistance, etc., and then conservation-policy needs to be developed.
6. Model selective breeding-programmes for main sheep breeds i.e. Lohi, Kajli, Thalli and Sipli in Punjab; Bibrik, Baluchi and Rakhshani in Balochistan; Waziri, Hashtnagri and Damani in NWFP; Kacchi, Kooka and Dumbi in Sindh and Kail in Azad Jammu and Kashmir, needs to be started. These programmes should in the long run be self-sustaining.
7. Goat breeds of Beetal, Kamori and Dera Din Panah should be developed as dairy-cum-meat breeds, through sustainable selective breeding-programmes.
8. There are a large number of sheep and goat breeds in Pakistan. Although general production-traits of these breeds are known, peculiar genetic and phenotypic characteristics need to be studied. Are all these really breeds? Many of these breeds may be off-shoots of other breeds. Molecular genetic studies need to be carried out, to answer this question. Results of these studies will define the breeds to be conserved.
9. Local breeds of cattle should be evaluated for their beef-potential under optimum nutritional and management conditions. Those showing potential for beef-production, may be selected for growth-rate and other beef parameters. Development of synthetic beef breed, using exotic blood may also be a topic of future research and development. Similarly, efforts may also be made to identify buffalo-strains with high potential for beef.

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