

Chapter 6.

Range Livestock Production

Livestock play an important role in the economy of Pakistan. The livestock industry contributes about 9 percent to the Gross National Product. The total livestock population has doubled during the past two decades and now totals 93.5 million head (Table 29).

Livestock provide high quality food, such as meat, milk, eggs, and raw products for industries, such as wool, skins, hides, etc. They also provide energy for various agricultural operations and manure to maintain soil fertility. Various livestock products are given in Table 30.

GRAZING PATTERNS AND PRACTICES

Livestock grazing is quite common throughout Pakistan. In irrigated areas, milking buffaloes and cows are stall fed with fodder crops and feed concentrates but dry and draught animals graze aftermath. Over a long period several traditional livestock grazing patterns have evolved as a result of biophysical, environmental, economic conditions and social customs of pastoral communities in different parts of the country.

Grazing Systems in the Northern Mountains: In the northern mountains of Pakistan, three major traditional systems of livestock grazing are practised that are not consistent with the modern scientific concept of use i.e. according to the potential of range. Nomadic grazing of livestock is dictated by seasonal climatic conditions and seasonal forage availability. Migration of livestock occurs between alpine pastures and the Pothwar Plateau, in the foothills of the Himalayas. Herds of sheep and goats start ascending

Table 29. Livestock population in Pakistan

Year	Buffaloes	Cattle	Goats	Sheep	Camels	Donkeys	Horses	Mules	Total
1971-72	9.8	14.6	15.5	13.7	0.7	1.9	0.3	0.05	56.55
1972-73	10.0	14.7	16.9	14.8	0.7	1.9	0.3	0.05	59.35
1973-74	10.2	14.7	18.4	16.1	0.7	2.0	0.3	0.05	62.45
1974-75	10.4	14.8	20.0	17.4	0.8	0.2	0.4	0.06	64.06
1975-76	11.6	14.9	21.7	18.9	0.8	2.1	0.4	0.06	70.46
1976-77	10.9	15.0	22.4	19.5	0.8	2.2	0.4	0.06	71.26
1977-78	11.1	15.2	23.2	20.1	0.8	2.2	0.4	0.06	73.06
1978-79	11.3	15.4	24.0	20.7	0.8	2.3	0.4	0.06	74.96
1979-80	11.6	15.6	24.9	21.4	0.8	2.4	0.4	0.06	77.16
1980-81	11.9	15.8	25.8	22.1	0.9	2.4	0.4	0.06	79.06
1981-82	12.1	15.9	26.7	22.8	0.9	2.5	0.4	0.06	81.36
1982-83	12.4	16.1	27.7	23.5	0.9	2.6	0.4	0.06	83.66
1983-84	12.7	16.3	28.7	24.2	0.9	2.7	0.4	0.06	85.96
1984-85	13.1	16.5	29.7	25.0	0.9	2.8	0.5	0.06	88.56
1985-86	13.4	16.7	30.8	25.8	0.9	2.9	0.5	0.07	91.07

Source: Ministry of Food and Agriculture, Livestock Division, (1988).

Table 30. Livestock products in Pakistan

Year	Milk	Beef	Mutton	Poultry Meat	Eggs (million Nos.)	Hides (million Nos.)	Skins (million Nos.)	Wool	Hair	Bones	Fat	Blood
1971-72	7800	346	208	14	583	4.3	16.4	22.1	2.9	152	45.8	14.2
1972-73	7899	349	224	19	695	4.3	17.5	24.3	3.1	157	47.2	15.0
1973-74	8044	354	245	24	811	4.4	19.4	26.1	3.4	161	49.9	16.0
1974-75	8193	357	265	27	907	4.5	21.0	28.3	3.7	166	52.2	16.0
1975-76	8348	362	288	34	1159	4.5	22.8	30.7	4.1	173	54.7	17.1
1976-77	8524	375	303	37	1443	4.6	23.6	32.2	4.3	177	57.2	17.9
1977-78	8704	389	319	41	1557	4.7	24.4	33.7	4.5	181	59.8	18.8
1978-79	8888	404	335	44	1805	4.8	25.2	35.4	4.8	185	62.5	19.6
1979-80	9075	418	352	49	2094	4.9	26.1	37.1	5.0	189	65.3	20.5
1980-81	9267	434	370	52	2319	4.9	26.9	38.9	5.3	194	68.3	21.5
1981-82	9462	448	389	57	2664	5.0	27.9	40.7	5.5	199	71.4	22.5
1982-83	9662	464	408	75	3200	5.2	28.8	42.7	5.8	203	74.7	23.9
1983-84	10242	488	436	86	3619	5.3	29.8	45.1	6.2	208	79.3	25.5
1984-85	10856	513	467	99	4093	5.4	30.8	47.7	6.6	213	84.1	27.2
1985-86	11500	539	500	114	4630	5.5	31.8	50.3	7.0	218	89.0	29.0
1986-87	12198	567	534	122	4954	5.5	32.9	53.2	7.4	223	94.7	31.0
1987-88	12900	595	570	134	4140	5.7	34.02	55.0	7.8	229	101.0	33.0

Source: Livestock Division (1988)

during March along metalled roads in the Kaghan, Indus Kohistan and Neelum valleys. Livestock spend April in sub-tropical and temperate forest grazing areas, below 2000 m. Regrowth in alpine pastures occurs in May, immediately after the snowmelt. The livestock herders move up in the alpine scrub forests where sufficient browse from shrubs is available. The alpine vegetation growth in June can support livestock. Livestock remain in the alpine areas until early October when low temperatures retard plant growth. By this time, most of the forage has been consumed by livestock and herders descend towards plains or low valleys. October and part of November is spent in the forest areas between 2000 and 3000 m. During winter, livestock remain in Pothwar scrub ranges, on 'shamlats', abandoned cultivated lands or in the valleys along water channels, roads and grazing grounds between agricultural fields.

Gujars, Dogars, Kohistani and Gilgiti tribes are herders. They pay a nominal grazing fee to the Syed families of Kaghan or the Khans of Indus Kohistan who control the use of alpine pastures. The Provincial Forest Departments also require a minimum fee for livestock grazing in the forest areas. However, overstocking has seriously reduced grazing capacity.

Semi-nomadic grazing: This involves the movement of livestock from settlements within the conifer forests to the alpine pastures. For example, livestock from the Gujal Villages in upper Hunza migrate to the Khunjerab alpine pasture. This type of grazing is common in the Northern Areas and in Chitral alpine pastures. Women look after the herds and spend the summer in the alpine areas. Men maintain food supplies by travelling back and forth. Winter season is spent around permanent settlements.

Local grazing: In this case, livestock graze between cultivated lands or in adjoining forests throughout the year. 'Shamlats' or communal ownership areas are heavily over-grazed.

Grazing Patterns in the Desert Ranges: Livestock grazing practices in Thal, Cholistan, Kohistan and Tharparkar desert areas are quite similar. Private livestock is allowed to graze state-owned rangelands after paying nominal grazing fees. Grazing permits for different categories of livestock are issued at the following rates:

Camel	Rs. 2.0 per head per annum
Cattle	Rs. 5
Sheep	Rs. 1
Goat	Rs. 5
Buffaloes	Rs. 10

Obviously, such grazing fees encourage overgrazing resulting in the deterioration of the range. A lack of adequate stock water means, livestock concentrate around rainfed water ponds and further discourages uniform utilization of ranges. There is no alternate source of feed for livestock. During the winter or droughts, the livestock move to irrigated areas but

these areas also lack adequate feed. Most of the camel population stays in the desert and obtain water by feeding on succulent salty shrubs. Greater Cholistan has better grazing grounds but a lack of watering points and inadequate communication, results in improper utilization.



Plate 22. Sheep grazing patterns in the Thal Desert.

The Tharparkar and Kohistan ranges are grazed by cattle, sheep, goats and camels. Most of the population is migratory. In the early winter, people leave their villages in search of better grazing and migrate into irrigated areas. In the early monsoon season when forage is abundant, they return to their villages and leave their animals to graze during July - November.

Grazing Systems in Baluchistan and Sulaiman Mountain Ranges: Livestock grazing patterns in Baluchistan have been studied by Baig (1977) and FAO (1983). The south western desert ranges are grazed by local livestock and livestock move within the valleys. Due to low productivity of the area, Afghan 'pawindas' do not go there. The central and northern parts of Baluchistan have a centuries-old system of nomadic grazing and the following three patterns:

- Spring summer nomadic transhumance,
- Winter nomadic transhumance and
- Year-round sedentary nomadic grazing.

A brief description of each system, studied by Baig (1977), is given

below:

Spring-summer nomadic transhumance: In this pattern, 56 percent of the sheep, 63 percent of the goat, 70 percent of the total camel population, a few cattle and 70 percent of total households migrate between the highlands and the lowlands (Sibi and Kacchi plains - the winter grazing ground). In winter, the livestock moves to the irrigated Sibi and Kacchi plains where they stay for about 4-6 months, depending upon the rainfall in the highland region, which governs their return. Sorghum is the main crop grown in the Sibi and Kacchi plains.

Most of the grain, the stem and stubble are used to feed the migrant livestock. The stock owners rent land under this crop.

With the beginning of the spring (in March), the livestock return to the highland areas where they move about for 6-8 months (March- October) on rangelands. Livestock are moved by trucks or on hoof through Bolan Pass.

Winter nomadic transhumance: In this pattern, 20 percent of the sheep, 10 percent of the goats and a few camels of the 'pawindas' come in the area from Afghanistan during the start of winter in October. The number of animals, however, fluctuates every year, depending on the rainfall. In good years, they bring more animals and the number is considerably reduced during drought. Scarcity of forage during winter coupled with extremely low temperatures force them to leave their country in search of forage. They stay in the area for about 4 months and return to the area on the onset of spring in March. During their stay in the area, they mainly depend on tree leaves, stubbles, roughages from fruits and vegetables, and partly on the forage from the ranges.

The 'pawindas' enter the area through different routes and return generally by the same route. They stop only where there is a spring or water. Men, women and children walk along the routes, while the livestock are separately driven by shepherds.

Sedentary nomadic: In this pattern, 24 percent of the sheep and 27 percent of the goats remain all year in the area. They depend either on forage from the ranges or from the cropland. In winter, they receive silage made from wheat, barley, lucerne and *Alhagi camelorum*.

With the Russian invasion of Afghanistan, the Afghan 'pawindas' do not go back to Afghanistan, thus increasing the grazing pressure on summer highland ranges and causing rangeland to deteriorate. Several protected forests in Baluchistan have disappeared due to the illegal cutting of trees and shrubs and grazing by Afghan refugees and 'pawindas'. The grazing patterns in Sulaiman mountains are similar to those in Baluchistan ranges.

RANGE ANIMALS

Sheep (Ovine Sp.): *General features:* Most of the sheep breeds have traces of mediterranean as well as Asian wild sheep. The Pakistani breeds most probably descended from urial (*Ovis vignei*), the wild sheep of

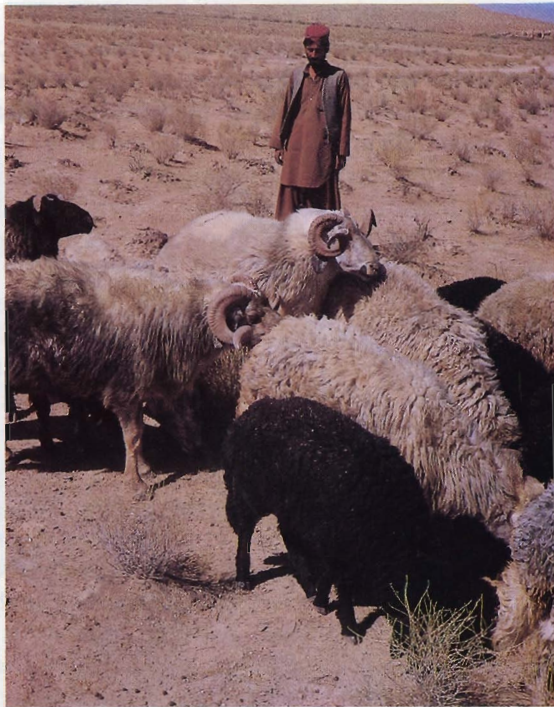


Plate 23. Sheep grazing in Baluchistan.

Baluchistan, Afghanistan, a Soviet Central Republics and from Argali (*Ovis ammon*), the morcopolo sheep of China (Husnain, 1985).

Sheep is the most important range animal. It is kept for wool, mutton and milk, although skins, guts, blood and droppings are also useful products. Pakistani wool, which is primarily a coarse type, is an ideal carpet wool. The estimated wool production during 1984- 85 was about 47,000 t. Sheep produced 42 percent of the mutton and 20 percent of the total meat production in 1984-85. (Government of Pakistan, 1986).

Different breeds of sheep are scattered all over the country in small flocks in irrigated and non-irrigated areas, but are largely maintained under transhumant system in arid and semi-arid grazing lands of the country.

Breeds and breeding: There are 28 defined breeds of sheep. Almost half of them are thin-tailed and half are fat-tailed (Naqvi, 1986). A few exotic breeds like Karakul', Hissardale' and Rambouillet' have also been introduced in Pakistan and are being crossbred with local breeds. Distribution, live weight and breed characteristics of some of the breeds are described in Table 31.

Sheep are usually shorn twice a year; February to April and in October to November. The exceptions are Quetta Region in Baluchistan and some mountainous regions in the north where they are shorn once a year. Pakistani wool is generally classed as carpet wool, and its suitability for this purpose is well-recognised at home and abroad. The wool characteristics

Table 31. General characteristics of sheep breeds of Pakistan

Breed	Distribution	Av. Birth wt. (kg)		Av. Adult wt. (kg)	
		Male	Female	Male	Female
Cholistani	Cholistan	3.5	3.0	38	30
Damani	D.I. Khan	3.0	2.8	33	26
Kachhi	Tharparkar	3.2	2.8	42	32
Kajli	Irrigated Plains	4.0	3.5	68	50
Kooka	Tharparkar	2.7	2.3	39	30
Lohi	Tharparkar	4.0	3.8	65	45
Thalli	Thal	2.5	2.3	34	27
Balkhi	NWFP Tribal	3.5	3.0	70	50
	Sulaiman Ranges				
Bibrik	Loralai and Sibi	2.8	2.4	38	30
Harnai	Loralai, Quetta and Sibi	3.0	2.8	39	31
Hasht nagri	Peshawar	3.0	2.8	40	32
Salt Range	Salt Range, Pothwar	3.0	2.7	42	32
Waziri	Sulaiman Mountain	3.0	2.8	45	30
Hissardale	Sahiwal	—	—	60	50
(Cross between Merino and Bikaneri)					
Baghdale (Three way cross between Damani, Hissardale and Rambouillet)	Mianwali	—	—	63	55

Source: Khan et al. (1982).

of various sheep breeds of Pakistan are given in Table 32

Sheep are seasonal breeders and the breeding season varies from one area to another. By and large, there are two distinct peaks of breeding activities; September - October, and in spring, March - April. However, most of the animals breed in autumn. Sheep have a more defined breeding season than goats. Once a year lambing system is common in our rural areas, but twice a year lambing has also been successful. Twice a year lambing can produce 12.7 kg more live weight and additional income of Rs. 104 per year per ewe in Lohi sheep (Salim and Shah, 1983).

The gestation period in sheep ranges from 140 to 159 days, with an average of 148 days. Oestrous cycle varies from 14 to 19 days, with an average of 16 days.

Grazing habits: Sheep are rarely stall fed. They subsist on extensive grazing in rangelands. In irrigated areas, they are fed crop residues and by-products. The desert rangelands of Thal, Cholistan, D.G. Khan, Thar-

Table 32. Wool characteristics of sheep breeds in Pakistan

Name of breed	Fleece weight (kg/yr)	Fibre dia (micron)	Spinning counts	Staple length (cm)	Clean wool content (%)	Vegetable matter (%)	Colour of wool (%)
Balkhi	1.28	45.1	36	8.3	78	2.5	Black 100
Baluchi	2.25	37.0	50	7.3	50	1.7	White yellow
Bibrik	1.55	43.5	36	5.2	63	1.4	White 100
Harnai	1.37	31.3	50	7.0	67	1.1	White 94
Hashtnagri	1.43	35.0	44	6.4	75	1.4	White 87
Afridi	1.29	34.5	44	6.1	60	1.8	Grey 99
Salt Range	1.90	35.3	44	8.4	91	1.4	White 99
Michni	1.27	30.7	50	5.4	70	2.7	White 97
Waziri	1.38	35.0	44	6.5	64	1.6	White 91
Dumbi	1.38	38.5	40	6.0	70	1.3	White 99
Rakhshani	0.93	31.0	50	4.8	75	0.9	White 97
Lohi	1.86	40.2	36	5.2	59	0.7	White 98
Thalli	1.45	37.7	40	5.3	64	1.6	White 90
Buchi	3.12	36.3	44	5.9	—	1.8	White 99
Kajli	2.50	37.1	40	5.2	51	1.2	White 100
Kooka	2.13	44.1	36	5.0	47	1.2	White 94
Damani	1.15	43.3	36	5.0	70	0.9	White 97
Kaghani	1.24	32.5	50	4.2	—	0.9	White 96
Kail	2.00	33.7	46	5.0	90	1.6	White 88
Cholistani	3.20	46.6	36	7.0	47	1.0	White 95

Source: PARC (1982).



Plate 24. A traditional way of sheep sheering in Baluchistan.

parkar and arid mountainous ranges of Baluchistan are main areas for sheep production.

A sheep has a cleft in her upper lip which, though not used in prehension, permits very close grazing. The lips, lower incisor teeth, and the dental pad are the principal prehensile structures; the tongue does not protrude during grazing as in cattle. Since there are no upper incisors, leaves and stems have to be pressed by the lower incisors against the dental pad as the animal jerks its head slightly forward and upward. In sheep, the jaws work very close to the ground and provide an opening of some 3 cm in diameter. For mechanical reasons, easily torn grasses are selected more often. The time spent on grazing and the amount eaten are summarized in Table 33.

Large flocks do not graze together but split into sub-groups, which occupy separate areas. It is not known whether the sub-groups are based on families in the flock. Different breeds vary in their tendency to move and flock together. Some breeds tend to stay within a part of the available grazing areas; others split into small groups, occupying the area around a patch of good grazing. Gregarious breeds are not adapted to pastures in which patches of herbage are widely scattered; these breeds may be well suited to uniform and abundant pastures (Hunter, 1960).

The location of grazing may vary according to the forage available. The other factors that affect grazing may be climate, nutritional requirement and presence of lambs. Sheep not receiving any supplementary feed spent more time grazing than those that were supplemented (Tribe, 1950).

Table 33. Daily ingestive and eliminative behaviour in sheep

	Pattern	Average values per day
Grazing and Feeding	Number of grazing period	4-7
	Total grazing time (hrs)	9-11
	Consumption of fresh herbage (Lambs)	1,700-1,900
	On permanent pasture (g) (Adults)	1,300-5,000
	Dry matter consumption on (Lambs)	480-830
	Permanent pasture (g) (Adults)	530-1,300
Rumination	No. rumination periods	15
	Total rumination time (hrs)	9-10
	No. of chews/rumination	39,000
	Rate of chews/min	91
	Duration of a rumination period (min)	1-20
	No. of boli regurgitated	500
	No. of chews/bolus	78
Drinking Water (lb)	On range or dry pasture	5-13
	On hay and concentrates	3.0-6.0
Ranging	Distance travelled (miles)	3-8
Elimination	No. of urinations	9-13
	No. of defaecations	6-8

Source: Hafez and Scott (1962)

Sheep prefer certain species of herbage, stages of growth in a given species, and specific parts of individual plants. Several psychological, physiological and mechanical factors are potentially involved in selective grazing. This type of grazing was studied by comparing the chemical composition of forage samples (Wier and Torrel, 1959). The sheep consistently selected forage higher in protein and lower in crude fibre. In general, selectivity is directly proportional to the amount of herbage available; thus the less feed is available, the less sheep discriminate among plants. Sheep ordinarily reject plant, contaminated with the odour of sheep urine and faeces. However, in a pasture widely contaminated with excreta, they adapt to the odour of faeces and may eat the contaminated herbage (Tribe, 1949, 1955). This behaviour contributes to overgrazing.

Sheep graze on young and tender grasses. When grasses are not available sheep browse on bushes and shrubs. Sheep graze relatively few flora (Anon, 1970). Wahid (1984) found that sheep in Thal preferred grasses,

e.g., *Cynodon dactylon*, *Aristida plumosa*, and grazed browse only, when young and succulent grasses were not available. The species thus browsed were *Salvadora oleoides* (green and dry leaves) and *Calligonum polygonoides*.

Areas for future research: Breeding for improved mutton and milk production.

- Digestive efficiency of sheep.
- Grazing behaviour of sheep, alone versus mixed grazing with goat cattle, etc.
- Grazing systems for better production in rangelands.
- Reproductive performance (fertility, multiple births, age at first lambing, lambing interval, lambing twice a year, etc.).
- Housing and management for economical production.
- Ecto-parasites and diseases.
- Role of sheep in the livestock farming system in Pakistan.

Goat (*Capra* Sp): *General features:* The goat is an important range animal. It is believed to have descended from two living races of wild goats namely, the Bazoar or Pasang (*Capra hircus aegagrus*) breed of the high mountains of Asia Minor and the wild goats of Sind (*Capra hircus blythi*). The latter is replaced by Markhor (*Capra falconieri*) in Baluchistan and Afghanistan and Caucasian Tur (*Capra caucasica*) in the Soviet Central Republics. Toys from Harappa and seals from Moenjodaro show that goats greatly resemble the ancestral wild goats (Husnain, 1985).

The goat is known as the poor man's cow. It provides meat, mohair, skins, blood, etc. Small ruminants have a high potential as a source of meat in Pakistan. Goat meat is preferred and is priced much higher than beef. During 1984-85, goat meat was 28 percent of total meat production and 58 percent of total mutton production; they produced 0.2 million tons of meat and 57 percent of the skins (17.62 million). They also provided about 4 percent of the total milk production in the country. (Government of Pakistan, 1986).

In Pakistan, goats are distributed in tropical sub-tropical, arid and semi-arid rangelands, extending from coastal region to sub-mountain areas in the north. The uncultivated area and goat population has a positive correlation. The highest percentage of goats is in the Hyderabad Division (20 percent) followed by Multan (12 percent), Quetta (11 percent) and Sargodha (10 percent).

Breeds and breeding: Twenty-five breeds of goats have been recognized in Pakistan; they can be categorised as hairy or smooth coated. They can also be classified as dairy or meat types (Husnain, 1985). 'Beetal' and 'Dira Din Panah' are milk breeds, whereas 'Barbari', 'Chappar' and 'Teddy' are reared for meat production. 'Bekanari', Kaghani 'Kharasani' and 'Angora' are well known for mohairs and Nachi, Beetal and 'Dira Din Panah' are known for their skin (Ishaque, 1987). In India the 'Jamnapari' and 'Dera', which closely resemble the, Nubian, is known for its milk production

(Ishaque, 1984). Live weights of Pakistan breeds are given in Table 34.

Breeding season under wild conditions is in autumn and/or spring when grazing is good and the flocks gain weight. The breeding season is also adjusted so enough of mother's milk is available, followed by good grazing. Domestication and regular availability of feed has altered the breeding behaviour of some species.

Table 34. Average birth weight, weight at six months and adult weight of different breeds of goats in Pakistan

Breed	(kg)					
	Birth Weight		Six month weight		Adult weight	
	M	F	M	F	M	F
Barbari	2.05	1.82	10.45	10.00	21.36	20.00
Beetal	2.50	2.27	15.91	13.64	36.36	29.55
Beiari (Camber)	1.80	1.50	13.00	10.00	25.00	20.00
Buchi	2.00	1.08	14.00	11.00	30.00	22.00
Chapper	2.27	2.05	13.64	11.36	26.36	22.73
Damani	2.27	2.05	12.27	10.00	22.73	20.45
Dera Din Panah	2.73	2.50	25.00	21.82	45.45	40.91
Desi (Jattal)	1.05	1.02	12.00	9.05	23.00	19.00
Gaddi	2.82	2.59	23.64	21.36	50.00	46.91
Kaghani	2.05	2.02	20.04	17.20	36.03	31.08
Kajli	2.45	2.32	15.91	13.64	29.55	25.00
Kamori	2.70	2.50	29.50	25.00	59.00	50.00
Kharasani	2.27	1.82	12.05	10.23	29.55	25.00
Kooti	1.02	1.00	10.00	8.00	20.00	15.00
Lehri	2.73	2.50	15.45	13.64	32.95	30.68
Nachi	2.00	1.08	14.00	11.00	28.00	22.00
Pothowari	2.00	1.08	12.70	10.00	25.00	20.04
Shurri	2.03	2.01	18.00	14.00	38.00	30.00
Sind Desi	2.73	2.50	29.55	25.00	59.09	50.00
Teddy	1.60	1.40	16.00	13.60	33.90	23.20

Source: Naqvi (1986)

In goat, heat lasts from 1 to 2 days at 21-day intervals. According to MacKenzie (1980), the gestation period ranges from 143 to 157 days with an average of 150 days. The average of gestation period in tropics is 146 days which ranges from 145 to 148 days (Ishaque, 1984). In 'Teddy' goats, the average kidding interval is 205 days and that service period (how soon a doe conceives after kidding) is 61 days (Ishaque, 1983). Breeding behaviour and mutton production potential of different Pakistani goat breeds are given in Table 35 (Naqvi, 1986).

Grazing habits: Goats have special feeding habits. They always prefer

Table 35. Breeding behaviour and mutton production of different goat breeds

Traits	Teddy	Beetal	Nachi	Dera Din Panah
Average weaning age (days)	120	90	90	90
Average weaning weight in males (kg)	11.6	9.7	14.3	11.5
Average weaning weight in females (kg)	11.4	9.6	11.3	11.4
Average service period (days)	60	202	146	162
Average kidding interval (days)	206	352	296	312
Average gestation period (days)	146	150	150	150
Average twinning rate (%)	56.4	26.5	27.5	22.5

Source: Naqvi (1986).

to browse. They would, however, graze if there is little or no browse available. The feed includes herbs, forbs, shrubs, tree leaves, twigs, bark, clothes and even papers (Wahid, 1975). Goats' diet consists more than 50 percent browse during all seasons of the year. Forbs constitute less than 15 percent of the total diet. Grasses are utilized only in spring when they are young and succulent (McMahan, 1964).

Hanjra (1984), studied the grazing behaviour of 'Teddy' goats and sheep and observed that most of the prevalent species of grasses, shrubs and trees such as *Cenchrus ciliaris*, *Lasiurus indicus*, *Pennisetum dichotomum*, *Cymbopogon jwarancusa*, *Aristida adscenciosis*, *Eleusine flagellifera*, *Cynodon dactylon*, *Calligonum polygonoides* *Zizyphus nummularia*, *Z. mauritiana*, *Salvadora oleoides*, *Calotropis procera*, *Prosopis cineraria* etc., were grazed and browsed by goats in the Thal range area. Goats travelled more than sheep in search of feed, and unlike sheep did not show any noticeable loss in body weight when fodder was scarce. The female goats matured at 180 days and kidded at 330 days. The ewes matured at 365 days and lambed at 515 days. The goats were more fertile, had better carcasses and produced more meat.

Grazing capacity of the goat varies from 25 to 40 percent normally and can be as high as 50 or 55 percent of body weight (Ishaque, 1984). In temperate pastures, goats use 15 percent more of the available varieties of plants.

Goats eat many varieties of roughages with low nutritional value. They eat leaves, small branches, weeds, herbs, grasses, hays, silage, roots and concentrate feeds. High intakes of grasses are normal in paddocks but while browsing, over 80 percent of their feed consists of leaves and young shoots of shrubs and bushes while browsing.

Feeding habits of goats vary. Consumption of grass varies from 75 to 85 percent daily to practically nil in arid areas. Season and ecological factors affect these variations. Goats are selective when feed is abundant but



Plate 25. Beetal goat — an important milch and mutton breed of the Punjab.

less so when it is deficient. The senses of touch, smell and taste are constantly used while grazing or browsing. One sense important in determining the preference to one plant specie may be of little value in deciding the acceptability of another plant. Goats can distinguish between bitter, salt, sweet and sour, which enables them to choose from a wider range plant species than cattle and sheep. This is why they can survive in areas where cattle and sheep cannot. Goats also eat certain plants at a definite stage of maturity and not at any or all stages of growth.

Goats do not graze uniformly. They normally pick more palatable grasses and leave a feeding site long before all the available feed is consumed. The time spent on grazing depends on the quality and quantity of forages

and the nutrients, consumed from concentrated feeds. Normally, 8 hours of grazing a day during spring and monsoon, when plenty of forage is available, are sufficient; grazing may be extended to 13 hours during the dry season. Usually goats are put in the pens by evening but when allowed to graze during the evening about 20 percent of the total daily intake was consumed during the night (French, 1970). Kurrar and Midgal (1978) suggested that browsing goats need considerably higher intake than penned goats.

Areas for future research: Breeding goats for better meat, milk and hair production.

- Digestive efficiency of goats for various forages.
- The nutritional requirements for maintenance and production (meat and milk).
- Stocking capacity of various grazing areas.
- Sole grazing of goats vs mixed herds, and grazing systems in various rangelands.
- Mortality due to various diseases and other causes at different ages and in different seasons.
- Feeding habits and grazing behaviour under climatic stress and thermo regulation.
- Water conservation mechanisms.

Camel (*Camelus Dromedarius*): *General features:* There are only two living species of camel, the dromedary (one-humped, or Arabian (*Camelus dromedarius*)) and the bactrian (two-humped of the Asia C. *bactrianus*). The first is not wild, but the second species is found wild in the Gobi Desert (Burton, 1972). The bactrian camel has long, dark hair, shorter legs and a more massive body, which are features useful in adaptation to the cold. The dromedary is slightly larger than the bactrian camel. Its coat is also woolly but shorter than that of the bactrian and its coat colour is usually fawn. In general, bacterian camels are found in mountainous rocky regions while dromedaries are restricted to dry, arid climates and on flat terrian. Bactrian camels are not found in Pakistan. The Arabian or single-humped animal is the only camel found in Pakistan in the arid, and semi-arid areas of Thal, Thar, Cholistan and arid mountainous areas of NWFP and Baluchistan. The estimated population in Pakistan is 0.9 million head. In addition to the production of meat, milk, bones, fibre, and hides, it is used as a draught animal for agriculture and to pull carts. It is the cheapest means of transport in desert and is a beast of burden. It is popularly known as the ship of the desert.

Breeds and breeding: Fifteen breeds have been differentiated in Pakistan which may be classified into two general types; the riding camel and the loading camel. (Ansari and Shah, 1983). The distribution and breed characteristics of some of the camel breeds are given in Table 36.

The breeding season lasts from February to April in the mountains and from November to January in the plains. Oestrus duration is 3-4 days

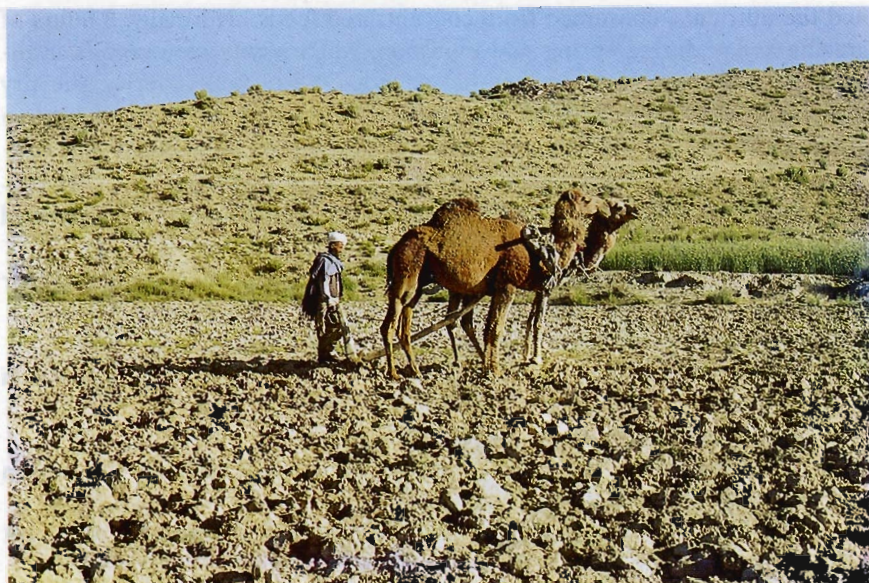


Plate 26. Camels used for draught power in Baluchistan

Table 36. Characteristics of camel in Pakistan

Breed	Distribution	Characteristics
Marecha/Mahra or Bekanari	Cholistan in Pakistan and Rajputana in India	The most excellent riding and racing animal small size head, pointed muzzle, slim body long legs.
Bagri or Booja	Cholistan and Thal	Excelling riding and racing animal, small head, blunt muzzle.
Brela	Reverian tract of Punjab and Sind	Milch type, yields 10-14 litres per day. Lactation 9-18 months, beast of burdon, and can carry upto 1000 kg of load.
Sindi	Sind Province	Heavy size animals used for loading.
Mountaineous breeds such as Kachhi, Mokrani, Brohi, Pashin.	Arid areas of NWFP and Baluchistan	Short statured animal with compact body, used for loading.

Source: Qureshi (1986).

and the oestrus cycle is 23 days (Qureshi, 1986). Gestation is 12 to 13 months, and lactation lasts 1 to 2 years. The mares foal every second year. The foal can run after 2-3 hours (Burton, 1972).

Grazing habits: The camels only browse on local vegetation, and rarely receive any supplementary feed. However, in drought and when working extra barley, oats, date stones or maize is sometimes fed. Unlike slow moving cattle and intensively grazing goats, camels are economical feeders that never overgraze. They keep on moving while feeding. On a good pasture, for example, they may cover 5 kilometers in 2.5 hours while grazing. No matter how rich or how poor the vegetation, the camels take only a few bites from any one plant before moving to another (Pilters and Dagg, 1981). Despite low food intake compared with body weight (300-500 kilograms) desert camels can tolerate hard work and a shortage of food and water than the camels that graze on richer pastures in less arid regions. Indeed, low food intake may increase tolerance to heat (Schmidt-Nielsen, 1964).

Camels thrive on hard dry thorny plants. They have often been observed browsing on spiny plants and ignore leaves that appear to be more palatable. (Pilters and Dagg, 1981).

Camels usually take a variety of food that presumably provides optimal nutrition. The plants commonly utilized by camels belong to genera *Acacia*, *Salsola*, *Suaeda*, *Calligonum*, *Atriplex*, *Zizyphus*, *Tamarix*, *Aristida*, *Helianthimum*, *Capparis*, *Gymnocarpos*, *Albizia*, *Parkinsonia*, *Prosopis*, *Haloxylon*, *Salvadora* and *Tecoma*.

Camels consume 10 - 20 kg of green feed each day, depending on the plants available, which corresponds to 5 to 10 kg of dry matter. Unlike sheep, which graze for longer periods when vegetation is poor or when the water/dry matter ratio is so high that they must eat a large quantity of food to get enough nutritious material (Arnold 1964), camels graze 8 - 12 hours a day, irrespective of the quality of ranges.

The flexible long neck and legs enable them to browse on tall trees and shrubs. The upper lip is cut in the middle and the flaps of the upper lip not only help catch twigs but also enable the nostrils to close during dust storm to keep sand and dust away. They can smell the water from a long distance.

In conclusion, the camel is the most economical and efficient animal in the arid and semi-arid rangelands of tropical and sub-tropical areas of Pakistan.

Yak (*Bos Grunniens*): General features: The Yak is an important animal of alpine pastures and the Trans-Himalayan grazinglands. It is unsurpassed among the bovines for its capacity to survive under these harsh environments. Perhaps no mammal can thrive at the altitudes of the Himalayas as well as the yak.

Domesticated yaks are about the size of ordinary cattle and rarely exceed 1.3 m at the shoulder. Their live weight is generally between 250 to 550 kg for the male and 180 to 350 kg for the female. The wild yak bull is

twice large as a domesticated bull. The wild yak is one of the largest members of the ox family. Bulls can be more than 2 m high at the withers.

In the Himalayas, the domestic yaks are found almost above an elevation of 2000 m. Most are found in the mountains and plateaus of Tibet and western China. However, they occur from north Afghanistan, the Northern Areas of Pakistan, Nepal, India, Bhutan to Mongolia and the Soviet Union (Annon, (1983).

Domestic yaks are pack animals and are especially useful for riding. They can carry up to 150 kg and at an altitude up to 6000 m. They may carry a pack or persons at a steady pace for day and still remain in good condition. They are also used for ploughing and threshing grain. In some regions, they are the only feasible pack animals. Yak's milk is golden coloured, aromatic and much richer than cow's milk. Milk production varies according to management and nutrition and averages 600 to 1000 kg per lactation period. Yak's hair is used to make ropes, saddles and blankets. Because they are often found above the timber line, their dung is an important fuel at very high altitudes.

Grazing habits: Yaks eat grasses and herbs and also browse, nibbling the leaves of small shrubs. (Annon, 1981). Often, they graze just below the snowline, but use their hooves to uncover patches of grass. They can eat snow when water is scarce. While grazing, they remain widely spaced up to 20 to 50 m apart, and gather for wallowing at mid-day. They eat all types of grasses and small shrubs and may eat encrusted earth to supplement their mineral requirements (Shrestha, 1981). In early summer, yaks graze on lush green grass but subsist on dry, coarse mountain grasses, shrub twigs and leaves during much of the year.

Areas for future research:

- Identification of different yak breeds.
- The genetic potential of the yak for meat, milk and crossing with various cattle breeds adapted to high altitudes.
- Breeding strategies, and herd management systems for domestic yaks.
- Feeding behaviour and nutritional requirement for better production.
- Herd hygiene and diseases.

Buffalo (*Bos Bubalis*) *General features:* The buffaloes are normally stall fed but dry animals usually graze. Buffaloes were first domesticated in Mesopotamia about 2500 B.C, but the homeland of water buffalo (milk buffalo) is reportedly the Pakistan - India sub-continent. Discovery of seals with drawing of buffalo bulls from Moenjodaro revealed that buffaloes were also reared in this area (Cockrill, 1974). Pakistan's Nili-Rivi is the finest milk breed in the world (Saleem, 1986). Besides several dairy products, it also provides meat, manure and draught power. About 75 percent of the milk supply comes from buffaloes. The average milk yield of Nili-Ravi, is 1800 litres in 305 days; of 5733 litres in 305 days has also been observed.

Ahmed (1983), compared the performance of Nili-Ravi buffaloes and Sahiwal cows; better buffalo calves and heifers gained more weight and utilized nutrients more efficiently than cow calves and heifers. Lactating buffaloes were also superior to cows with respect to the digestibility of various nutrients and in milk production. The dressing percentage of calves varies from 42 to 49 percent and the carcass quality of calves is generally good and meat is consumed in rural as well as in urban areas.

Pakistan has 9.8 percent of the buffaloes of the world which produce about 23 percent (6.525 million t) of the world's buffalo milk (Chaudhry, 1987).

On the basis of the "buffalo human ratio," Pakistan ranks number one in the world (1:7). It also has about 13.6 million head of the best milk breeds (Nili-Ravi and Kundi). Nili-Ravi is found mainly on banks and areas between the Ravi and Sutlej rivers. Though it is concentrated in the central and southern areas of Punjab, it can be seen also in other areas. Kundi is found in Nawabshah, Hyderabad, Larkana and the Mirpur districts of Sind province. The buffalo population in Pakistan by province is 79.19 percent in Punjab, 15.20 percent in Sind. 0.21 percent in Baluchistan and 0.04 percent in the Northern Areas. Buffaloes are mainly concentrated in the province of Punjab, where a large number of animals are reared in and around the cities for milk production.

Breeds and breeding: The buffaloes are divided into 19 distinct breeds (Saleem, 1986) but the major breeds in Pakistan are Nili-Ravi and Kundi, which are described below:

NILI-RAVI: The skin and hair are usually black but brown skin is not uncommon 10 - 15 percent, forehead, face, muzzle, legs, and tail swirl

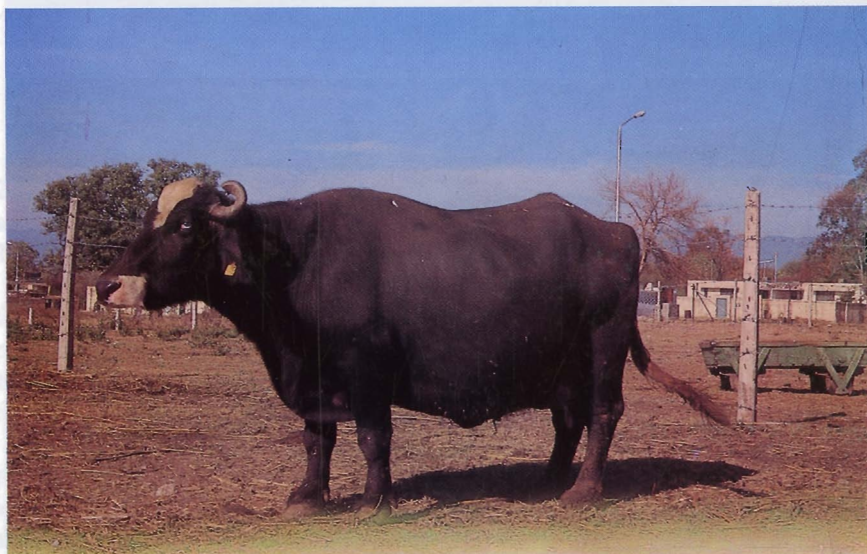


Plate 27. Nili-Ravi buffalo known for high milk yield.

desired, pink markings on the udder are also occasionally present. Horns are short, broad at the base and closely curled back behind the base, teats are long and uniformly placed.

KUNDI: The name 'Kundi' reflects the shape of horns (Kundi means fish-hook); the horns are small and spirally twisted, The skin is jet black but may be light brown. It has a small head and forehead, the tail is thin and flexible. Teats are smaller than Nili-Ravis. Average annual milk yield is 320-450 kg.

Females mature in 959 days, which could be reduced to 585 days if fed a balanced ration. Average age at first calving is 1222 days. Average calving interval is 512 days. Lactation lasts 300 to 326 days and the dry period varies from 65 to 145 days (Saleem, 1986). Gestation period averages 317 days.

Feeding habits: Buffaloes are normally stall-fed. The dry animals are allowed to graze in the areas where cereals have been harvested. Fodder crops such as oats, lucerne, sorghum, maize and cowpeas are the main source of feed. Wheat straw in combination with grains is also liberally given to lactating animals. Buffaloes are often allowed to graze along the river and canal banks. Wallowing in rivers and cannals is also a common feature.

Dry animals are usually fed wheat and paddy straw when fodder is not available. Treating paddy and wheat straw with alkali compound markedly improved the palatability and digestibility of these major roughages. Alkali treated straws had a satisfactory mineral balance (Fahimuddin, 1975).



Plate 28. A herd of Nili-Ravi buffaloes in NARC pasture.

Mudgal (1966) found that buffalo can utilize protein, ether extract, crude fiber, calcium and phosphorus.

Areas for future research:

Future research should address nutrient digestion, rumen microbiology and digestive efficiency, etc.

- Female reproductive problems and artificial insemination.
- Fattening of male calves for beef production by economical balanced rations.
- Production traits, especially to reduce the age at maturity, age at first calving, calving interval, service period, etc., to increase production per animal.

Cattle (*Bos Indicus*) General features: Cattle are very important range animals. In addition to providing milk, meat, hides, and manure, they are also the source of motive power for various agricultural operations such as ploughing, threshing, working wells and mills. They also pull carts in towns and villages and are used as pack animals in some places. Zebu cattle of Pakistan and India are famous for their heat and drought tolerance and are crossbred with Western breeds to upgrade their tolerance for heat.

The cattle provide 23 percent of the total meat and 48 percent of the beef. They provide 2.5 million t of milk annually, 24 percent of total milk production.

The estimated population of cattle during 1987 was 16.9 million head. The percentage of total cattle population in the provinces is as follows:

Punjab	55 %
Sind	19 %
NWFP	20 %
Baluchistan	6 %

Breeds and breeding: According to Joshi and Phillip (1953), there are 28 breeds and types of Zebu cattle in Pakistan and India. The distribution, average weight and milk yield of some of the Pakistani breeds are given in Table 37.

In general, there is no specific breeding season. The cows breed throughout the year; their fertility is higher than buffaloes; the gestation period is 270-299 days, with an average of 280 days (Husnain and Shah, 1985). The age at maturity, age at first calving, calving interval, and lactation period of some of cattle breeds are given in Table 38.

Feeding habits: Feeding pattern varies tremendously according to the purpose, breed and the zone. The milk breeds are usually stall-fed and allowed to graze wherever possible. The river banks provide some pasture after the monsoon in Punjab and Sind. The cattle breeds of Thar, Cholistan and Baluchistan, however, subsist on grazing in extensive and depleted desert rangelands and are rarely stall-fed. In marginal lands, however, bajri

Table 37. Characteristics of cattle breeds of Pakistan

Breed	Distribution	Average weight (kg)		At maturity		Average milk yield (305 days)
		At birth	Female	Male	Female	
Red Sindhi	North and north western part of Karachi and Hyderabad popularly known as "Kohistan area" in Sind Province and Lasbela district in Baluchistan Province.	26	24	410	320	2050 litres with 4.2% butter fat
Sahiwal	District Sahiwal and parts of districts Multan and Faisalabad in Punjab Province.	28	26	430	350	3000 litres with 4.5% butter fat
Bhagnari	Bhag territory in north of district Jacobabad in Baluchistan Province.	33	32	600	480	900 litres
Dajal	Dajal area in district Dera Ghazi Khan in Punjab Province	32	30	500	390	900 litres
Dhanni	Attock, Rawalpindi and Jhelum districts in Punjab Province	24	22	400	300	800 litres
Lohani	Loralai district in Baluchistan Province and Dera Ismail Khan in NWFP Province	22	20	300	235	Very low

(continued)

Table 37 continued

Rojhan	Sulaiman Range of Mountains in Southern part of D.G. Khan district (Rojhan, Kachagaddi, Umarkot and Somemiani Villages) in Punjab Province and parts of Dera Ismail Khan, Kohat and Bannu districts in NWFP Province.	23	21	350	250	Very low
Tharparkar Thari	Tharparkar District and Surrounding areas in Sind Province	30	28	480	380	1900 litres

Source: Khan et al., (1982).

Table 38. Production traits of cattle breeds of Pakistan

Breed	Age at maturity (days)	Age at first calving (days)	Calving interval (days)	Lactation period (days)	Dry period (days)
Sahiwal	808	1149	412	269	143
Bhagnari	830	1263	545	312	223
Lohani	912	1275	390	192	198
Thari	916	1336	571	353	218
Dhanni	869	1210	459	224	235

Source: Lala and Saleem (1984), Wahid (1975).



Plate 29. Cross breeding of Sahiwal and Australian cattle for high milk yielding hybrid.

(*Pennisetum typhoides*) and guar (*Cymopsis psoraloides*) are grown, if monsoon rainfall is adequate. Famine in the desert areas usually occurs every third or fourth year. The intensity is inversely proportional to the amount of rainfall received during monsoon. Cattle normally graze on grasses and legumes, but can also browse various fodder trees and shrubs when forage

is scarce. When little or no grazing land is available, the cattle are fed wheat straw, dry stalks of jowar, bajri and rice paddy. The milk cows often receive concentrates. The by-products of farm crops and industry including, oil cakes, crushed grains and pulses, pulse husks, wheat bran and rice polishings are fed as concentrates to milking animals. In irrigated areas, the maize, sorghum, cowpeas, oats, brassica, lucerne and barseem are grown for fodder and fed either as green fodder or as hay.

Cattle have no upper incisors and, therefore, use their highly mobile tongue as prehensile organs. The tongue encircles a small stand of grass, and is drawn into the mouth. The structure of the lower jaw makes it impossible for cattle to graze closer than 1 cm from the soil while sheep can graze at soil level (Hafez and Scott, 1962).

Cattle cover about 4 km per day during grazing. It increases in warm, wet, windy weather and when forage is scarce. Cattle prefer to consume herbage just under the muzzles. Intake of fresh herbage is about one-tenth of body weight. Time of grazing varies from 4 to 9 hours a day.

Areas for future research:

- Beef breeds of cattle suited for extensive/semi-extensive farming system in various ecological zones.
- Efficiency of feed utilization, for beef production, milk production, etc.
- Economical and available rations to fatten beef calves.
- Reproduction performance, e.g., reduction of calving interval and age at first calving, fertility.
- Crossing with exotic breeds for beef and milk production.
- Grazing behaviour and grazing systems suited to various ecological zones.

RANGE ANIMAL FEEDS AND NUTRITION

Livestock are fed on different sources of feed from season to season as well as from one ecological zone to the other. At present, about 2.71 m ha are devoted to fodder crops, which produce about 17.44 million t of dry fodder.

Cereal crop residues are fed to animals in combination with concentrates. About 35.8 million t of crop residues are produced from wheat, rice, barley, oats, maize, sorghum, millet and rice hulls; production is 21.7, 8.7, 0.4, 1.3, 1.5, 0.5, 0.5 and 1.2 million t, respectively (Ali, 1986). Production of oilseed cakes/meals from cotton seed, brassica seed and other oilseed is about 1.8 million t. Rangelands provide about 15.30 million t forage. It is estimated that shamlats, belas and irrigated plantations provide about 2 million t of dry forage. Total forage yield and TDN and DP yield are given in Table 39.

To feed 93.5 million livestock, about 43.8 million.t of TDN and 4.8 million.t of DP are required. The TDN shortage is about 21 percent and the DP shortage is about 35 percent. Due to heavy competition with grain

Table 39. Livestock feed resources in Pakistan

Feedstuff	DM (m.t)	TDN (%)	DP (%)	TDN (million tons)	DP
Fodder crops	17.50	60	10.0	10.57	1.75
Cereal crop residues, straw, etc	35.85	30	2.0	10.76	0.70
Crop by-products, etc	3.00	30	2.0	0.90	0.06
Rangelands at 60% utilization of available forage	15.30	50	4.5	7.65	0.69
Oilseed cakes and other protein concentrates	1.80	70	18.0	1.26	0.31
Cereals, legume seeds and their by-products	4.60	70	7.0	3.22	0.31
Total:	78.05	—	—	34.36	3.82

Source: Mohammad (1987)

crops, there is a limited ability to expand the production of fodder crops on cultivated areas. However, rangelands, which constitute over 60 percent area of Pakistan, have the potential to feed the increasing livestock population. The current annual forage production from rangelands is about 25 million t of dry matter which could be increased three times.

Very limited research has been concerned with the digestibility of grasses, legumes and fodder trees and shrubs. Even the nutritional values of most of the range forages are not known. Estimated analysis of a few promising grasses was obtained from University of Agriculture, Faisalabad, (Table 40). Gohl (1981) reviewed the nutritional contents of tropical feeds. Sheikh (1966) reported the nutritional composition of a few plants of desert lands. Pathak and Jakhmola (1984) provided the estimated composition of common forages, many of which are found in Pakistan. Research concerning forage quality, particularly of fodder trees and shrubs, must be emphasized.

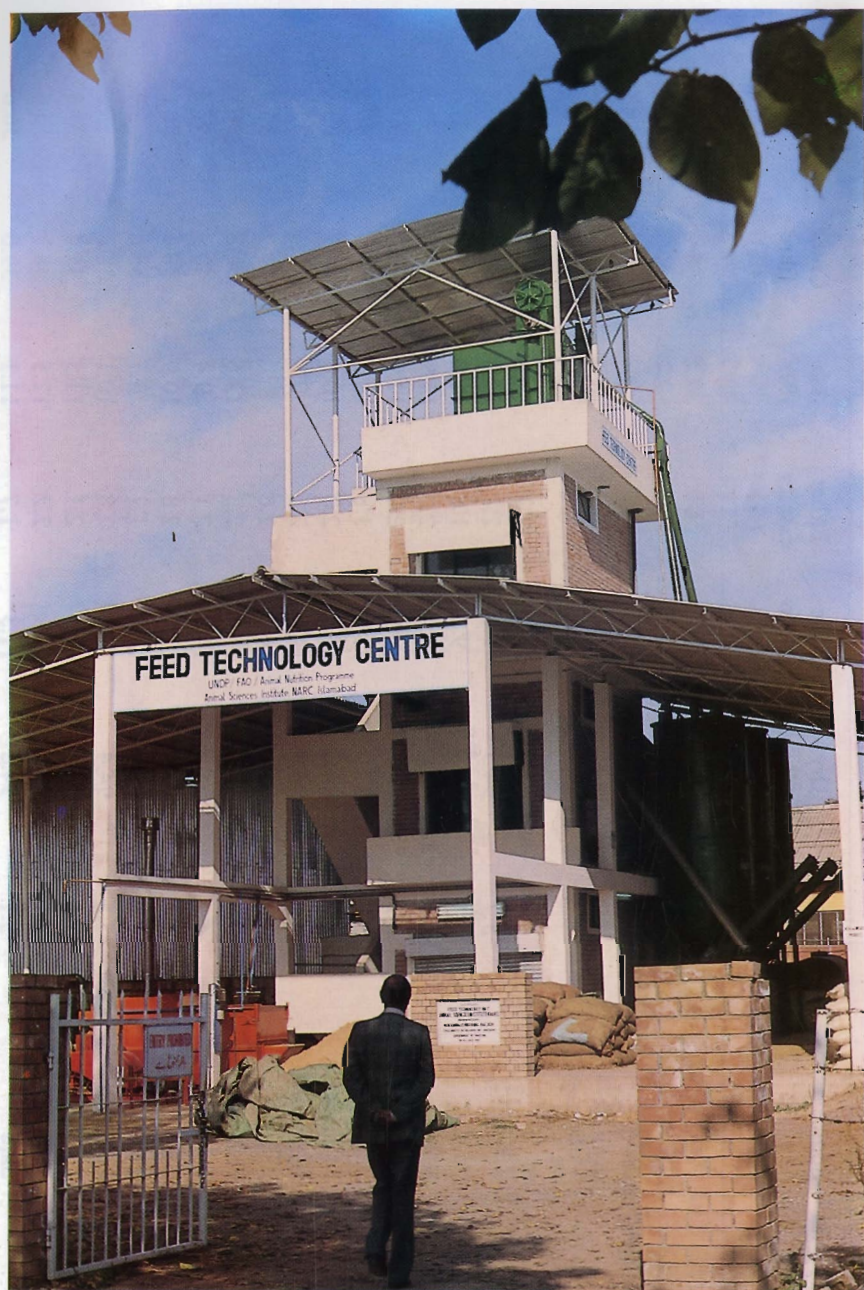


Plate 30. Feed Technology Unit at National Agricultural Research Centre, Islamabad.

Table 40. Proximate analysis of range plants in Pakistan

Forage Species	Source	Moisture (%)	Dry matter (%)	Crude protein (%)	Either extract (%)	Ash (%)	Crude fibre (%)	NFE (%)
1	2	3	4	5	6	7	8	9
A. Forage Grasses								
<i>Cenchrus ciliaris</i>	PFI	5.4	94.5	10.7	1.8	10.0	37.6	39.7
"	"	5.2	94.7	11.8	2.3	11.6	38.2	35.8
"	"	5.7	94.3	9.6	2.1	14.0	36.7	37.5
"	"	5.1	94.8	9.8	1.8	11.2	36.3	40.6
"	Islamabad	5.1	94.8	10.0	2.0	11.9	37.8	38.2
"	"	3.2	96.7	9.6	2.0	12.9	36.2	39.1
"	Sind	5.9	94.0	11.8	1.8	12.2	37.6	36.5
"	Peshawar	5.9	94.0	13.1	2.0	10.8	40.1	33.8
"	Islamabad	4.9	95.8	14.0	2.2	9.3	41.4	32.9
"	Australia	4.7	95.2	14.0	2.6	8.3	41.2	33.7
"	Peshawar	3.9	95.0	11.8	2.3	12.6	36.8	36.4
"	"	4.7	95.2	14.2	2.1	9.4	40.9	33.2
"	USA (Texas)	5.1	94.8	11.9	2.8	10.9	38.3	36.8
"	Thal	4.9	95.0	12.1	1.7	9.7	38.6	37.7
"	Peshawar	5.5	94.4	13.1	2.8	10.1	38.3	35.5
"	"	5.5	94.4	11.3	2.1	11.5	37.4	37.5
"	"	5.7	94.2	10.9	2.2	12.5	38.1	36.0
"	Sind	5.1	94.8	11.3	1.7	11.1	39.0	36.6

(continued)

Table 40 continued

"	Tunis	5.2	94.7	12.5	2.1	10.9	39.4	34.9
"	"	4.0	95.9	10.3	2.5	9.9	37.3	39.8
"	Peshawar	6.0	93.9	9.6	2.0	13.4	36.6	38.2
"	Australia	5.8	94.1	14.4	2.8	9.7	40.1	32.9
"	"	7.0	92.9	14.5	1.8	9.2	40.1	34.2
"	Peshawar	5.4	94.5	11.8	1.7	10.4	37.5	39.4
"	India	6.0	93.9	12.6	2.1	10.8	35.2	39.1
"	"	6.9	93.1	12.2	2.7	11.1	35.1	38.8
"	USA	6.1	93.8	14.4	2.3	8.7	39.7	34.7
"	Peshawar	7.3	92.6	13.3	2.6	9.1	39.8	34.9
"	"	7.3	92.6	13.3	2.6	9.1	39.8	34.9
"	"	5.9	94.0	11.3	2.1	11.8	37.5	37.6
"	"	6.2	93.7	13.1	2.0	10.3	36.2	38.2
"	USA	6.1	93.8	11.8	2.1	12.3	38.4	35.3
"	"	6.0	93.9	12.6	2.1	10.9	30.7	35.5
"	Cholistan	6.3	93.6	11.8	2.4	10.1	39.1	36.4
"	Peshawar	6.2	93.7	10.0	1.9	11.5	39.5	36.9
"	Local	4.0	95.3	13.2	2.2	9.6	40.1	34.6
"	USA	6.2	93.7	13.1	2.3	9.5	40.2	34.7
"	Karachi	5.3	94.6	9.7	2.0	12.8	36.5	38.7
"	Thal	5.3	94.6	12.6	2.8	10.1	38.2	36.8
"	Peshawar	6.2	93.7	12.2	2.2	10.4	38.4	36.5
"	"	5.6	94.3	9.2	1.4	10.5	26.3	52.2

Chrysopogon

(continued)

Table 40 continued

<i>montanus</i>									
<i>Chrysopogon</i>	"	6.1	93.8	9.6	1.5	9.6	28.5	50.6	
<i>aucherii</i>									
<i>Cymbopogon</i>	"	4.8	95.1	8.7	4.2	11.1	26.7	49.0	
<i>javanarancusa</i>									
<i>Eragrostis</i>	USA	4.7	95.3	10.5	1.1	12.1	33.5	42.4	
<i>superba</i>									
<i>Lasiurus</i>	Sind	4.4	95.6	8.9	1.5	8.1	40.3	40.9	
<i>sindicus</i>									
<i>Panicum</i>	"	6.1	93.8	16.1	3.2	13.1	29.3	38.1	
<i>Panicum</i>									
<i>antidotale</i>	Peshawar	6.3	93.6	16.4	3.2	9.7	28.1	42.3	
"	"	4.8	95.1	15.3	2.8	10.6	29.7	41.6	
"	Islamabad	5.3	94.6	15.3	3.4	10.2	29.3	41.6	
"	Peshawar	5.1	94.8	16.7	2.7	10.3	28.6	41.5	
"	Sind	4.9	95.0	14.8	3.2	8.7	30.1	42.9	
"	"	6.1	93.8	14.4	3.4	8.8	29.6	43.6	
"	Peshawar	5.3	94.6	16.6	3.0	10.2	29.5	40.5	
"	"	5.7	94.2	17.5	3.4	10.3	28.9	39.7	
"	Sind	5.5	94.4	15.7	3.6	9.3	29.6	40.6	
"	"	6.5	93.4	15.3	3.5	9.4	30.5	41.1	
"	USA	5.9	94.0	15.7	3.8	10.1	30.0	40.7	
"	Sind	6.7	93.2	14.1	3.1	9.6	30.1	42.5	
"	"	6.1	93.8	16.6	3.4	9.4	29.2	41.3	
"	"	7.1	92.8	16.4	3.5	9.5	29.2	41.1	

(continued)

Table 40 continued

B. Fodder crops:

Berseem (*Trifolium alexandrinum*)

F.S.D. Late	83.1	16.9	16.7	2.1	12.9	18.6	49.3
Khundrani	83.0	16.9	19.3	2.1	13.5	17.7	47.3
I-64 + 13	83.7	16.3	17.5	2.1	13.6	18.2	54.4
Murtiflate	84.6	15.3	19.1	2.2	14.2	17.7	86.5
Muscavi	85.6	14.3	19.4	2.2	13.8	17.3	47.4
P-31	83.6	16.3	17.4	2.2	13.0	18.3	48.9
P-37	85.2	14.7	17.4	2.3	12.1	16.2	52.0
P-57	82.6	14.7	17.4	2.2	13.6	18.4	50.5
P-157	82.6	17.5	18.5	2.1	13.2	18.2	47.6
Sadi	85.5	14.4	18.3	1.9	13.6	18.6	48.2
Synthetic 1/79	83.4	16.5	17.8	2.1	14.3	17.7	47.9
3/73	82.7	17.2	16.9	2.2	13.9	18.1	48.3
4/11	84.5	14.5	17.9	1.9	14.4	17.9	48.5
P-139	83.6	16.3	17.4	1.9	13.4	17.8	49.5
P-143	83.6	16.3	16.5	2.2	12.9	17.7	50.4
P-155	83.6	16.3	16.6	2.0	12.9	16.5	51.9
Synthetic II	84.0	15.9	16.8	2.1	12.4	18.2	50.2
Synthetic III	83.0	17.1	17.3	2.1	12.5	17.2	50.7
B-18	83.1	16.8	19.6	2.1	14.3	17.2	46.5
B-32	83.4	16.5	17.1	1.9	12.3	17.7	50.5

(continued)

Table 40 continued

L-67	83.4	16.5	16.5	2.4	13.8	18.3	48.9
L-94	82.9	17.0	17.1	2.2	13.5	18.4	48.9
L-117	83.1	16.8	19.1	2.2	12.5	17.5	48.5
P-22	83.9	16.0	18.3	2.1	13.4	17.8	47.9
P-178	85.4	14.4	17.7	2.1	13.7	18.4	47.1
P-185	83.5	16.6	17.3	2.1	12.8	17.7	49.9
Sadabahar (<i>Sorghum sudanensis</i>)							
J-S 263	75.0	24.9	6.4	1.5	8.3	32.7	50.8
RLA x SG 523	77.1	22.8	5.8	1.5	8.5	32.2	51.9
RLA x SG 555	76.8	23.1	6.2	1.3	9.3	32.0	50.9
RLA x SG 556	77.7	22.2	7.0	1.7	9.2	32.2	49.6
RLA x SG 565	77.1	22.8	6.6	1.8	8.4	32.4	50.4
RLA x SG 605	74.0	25.9	7.2	1.6	10.1	32.1	48.8
RLA x SG 1252	77.5	22.3	6.2	1.5	8.2	32.1	51.3
RLA x SG 1253	76.0	23.9	7.2	1.7	8.7	32.8	49.2
RLA x SG 4158	76.5	23.4	7.0	1.5	8.4	32.0	50.8
RLA x SG 8823	78.5	21.4	6.3	1.7	9.5	32.6	49.7
RLA x SG Piper	77.2	22.7	6.3	1.7	9.8	32.5	49.5
RLA x SG Sweet I	76.4	23.5	5.9	1.8	9.8	32.4	49.8
RLA x SG Sweet II	77.1	22.8	6.4	1.5	9.3	32.4	50.1
RLA x SG Sweet III	76.9	22.9	6.7	1.5	9.8	32.0	48.7

(continued)

Table 40 continued

Sorghum	65.8	34.6	4.9	0.8	6.7	30.8	56.6
Oats (<i>Avena sativa</i>)							
Avon	67.1	32.3	5.8	2.0	10.5	26.9	54.4
Kent	70.8	29.1	6.3	2.1	10.5	26.9	53.9
No. 11	70.2	30.0	5.7	2.2	10.5	27.1	54.2
Pd2 Lv65	72.3	27.6	6.4	2.1	10.5	25.6	54.9
Swan	69.3	30.6	5.4	2.1	10.8	26.9	54.6
Sargodha 81	70.0	28.9	6.2	2.1	10.8	26.6	54.1
Algerian	70.2	29.4	6.6	2.1	10.7	26.8	53.6
Cowpeas (<i>Vigna sinensis</i>)							
Australian	82.1	17.8	14.6	2.7	13.4	24.0	45.1
Mississippi	82.4	17.5	14.7	2.6	12.7	24.3	45.3
No. 1	81.5	18.4	14.0	2.8	11.7	24.7	46.9
P-76	81.8	18.1	14.1	2.4	13.6	24.8	44.8
P-251	82.3	17.6	14.2	2.6	13.3	23.8	46.3
P-259	83.0	17.0	13.8	2.6	11.3	24.2	47.8
P-518	82.6	17.3	13.8	2.6	13.5	24.5	45.3
411	81.5	18.4	13.4	2.8	13.2	24.8	45.6

Source: Forage and Fodder Research Unit, University of Agriculture, Faisalabad, 1987.