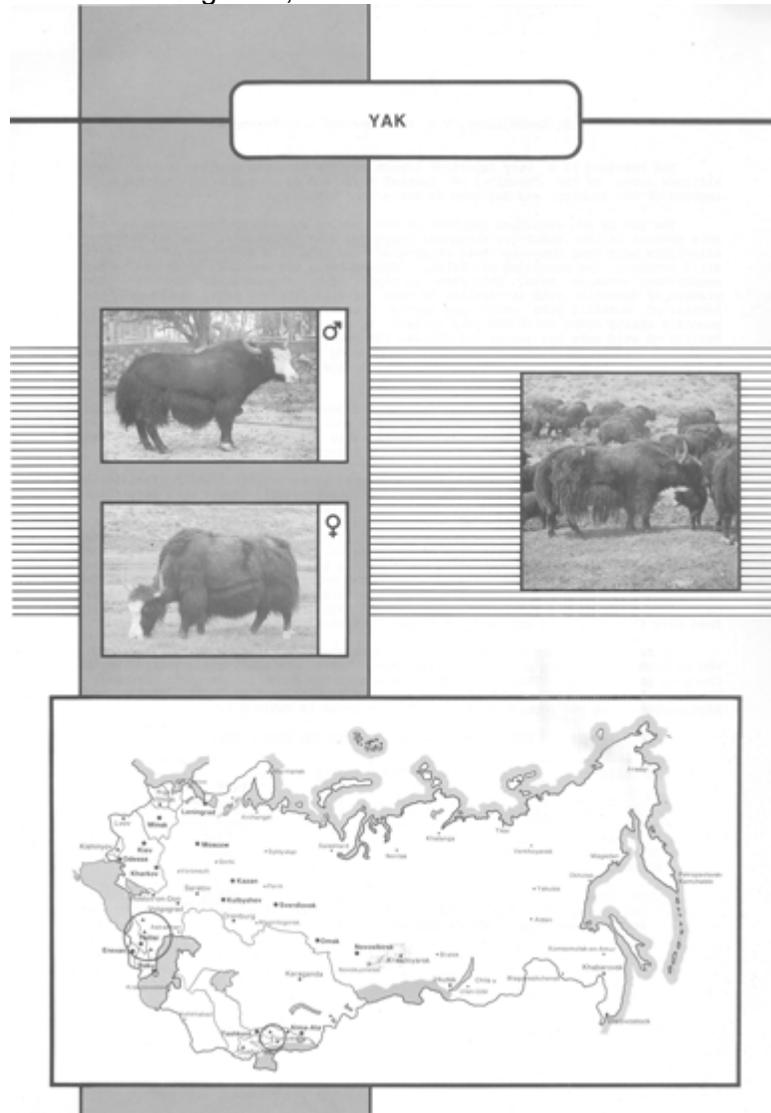

9. YAKS

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Yak breeding is a very important branch of the national economy in the high-altitude areas of the republics of Central Asia and in a number of northwestern regions of the country, and has been so for a long time. The yak is an even-toed ungulate of the bovine sub-family Bovinae and is the sole species of the genus (or subgenus) *Poephagus* - *P. grunniens*. The majority of scientists hold that domestic yaks originated from the wild *Poephagus mutus*, which still inhabits the mountains of Tibet. Subsequently the species spread to other mountainous areas in Asia. This view is supported by craniological studies - the cranium of domestic yaks is similar to that of wild Tibetan yaks. Moreover, the habitat of domestic yaks which are remote from Tibet, are connected with it by mountain chains along which the yaks spread. It can be assumed that in the past the habitat of wild yaks was larger and covered the mountains of Kun Lun and the northern

slopes of the Himalayas. Gradually with the coming of people to new lands the yaks had to escape high in the mountains and thus became restricted to severe mountain habitats in Tibet.

It is not known for sure when yaks were domesticated. Some scientists hold that they were domesticated in prehistoric times while others believe it happened in the historic period. The latter is more probable and would explain why yaks can thrive under extreme conditions and without any interference from man.

Yaks have a number of biologically valuable characteristics which facilitate their keeping and breeding. They are highly resistant to cold thanks to a very thick hide and subcutaneous fat, and dense hair. These impede heat exchange and thus contribute to the preservation of energy. Yaks are exceptionally resistant to hypoxia and tolerate well the low oxygen content in the air of high mountains. They have a narrow muzzle and mobile lips which make it possible for them to graze the more nourishing low-growing vegetation which cattle and other domestic animals cannot graze. Thus they are biologically adapted to the scarce and low-growing vegetation of the high-altitude deserts and steppe and the steep rocky slopes which form their natural habitat. In winter yaks feed on dry and half-dry plants. They can get their feed only if the snow is soft and not deeper than 10-12 cm.

At present yaks are bred in Kirgizia, Tajikistan, Buryatia, in Altai territory, and in high-altitude regions of the Tyan Shan. There are small herds in the North Caucasus and Yakutia. There are large numbers in the Mongolian People's Republic, Tibet, northwest China, and Nepal and smaller populations in India, Bhutan and Afghanistan. The yak population in the USSR is shown in Table 9.1.

Table 9.1 CHANGES IN THE YAK STOCK IN THE USSR ('000)

Republic	At the beginning of the year			
	1970	1975	1980	1984
	Total	Total	Total	Total
Kirgizia	41.2	68.8	67.5	59.4
Tajikistan	17.4	16.7	17.5	16.8
RSFSR	17.4	45.2	45.6	59.1 ^u
USSR Total	88.9	130.7	130.6	136.0

^uThis total includes 32 400 in Tuva, 16 300 in Altai, 6700 in Buryatia and 3700 in North Caucasus.

Between 1970 and 1984 the total yak population increased by 52.6%. The population of yaks in Kirgizia increased 1.44 times during this period while in Tajikistan it decreased slightly. In 1984 about one-third were breeding females.

Buryatia and the Altai mountains have long been the habitat of yaks. From these regions yaks were taken to Yakutia in 1971, 1973 and 1974. Yaks from Kirgizia were brought to the North Caucasus in 1972-73.

In Kirgizia and Tajikistan there are vast mountain and high altitude pastures situated at 2500-3500 m or more above sea level. These pastures are exceptionally good for yak breeding. The geobotanical survey by the Kirgiz Design Institute for Land Management showed that the total land area in Kirgizia situated at more than 4000 m above sea level amounts to 1 200

000 ha. On average, these pastures produce 400 kg of dry feed per hectare.

The herbage on these pastures consists of mixed stands of: Festuca sulcata/Artemisia or forbs, Cobresia/Carex, Bromopsis/Artemisia, Carex/Festuca pratensis, Stipa/Festuca sulcata, Poa/other grasses, Festuca sulcata/Cobresia, Poa/forbs. In summer 100 kg of absolutely dry matter of fescue with Artemisia, and Cobresia with sedge fodder contain 77.2-93.3 fodder units and 3.03-7.67% of digestible protein; in winter these figures are 32.8-34.9 and 1.80-2.24 respectively. Therefore winter pastures are very poor in digestible protein, particularly if the herbage is predominantly grasses with a small amount of Artemisia. The average content of digestible protein in dry grass is 1.76% with a range from 1.38 to 2.21%. Yaks thrive in severe weather and climatic conditions -they reproduce normally and use the vegetation of alpine and subalpine pastures to the maximum.

Despite their relationship and general similarity to cattle, yaks differ considerably from them in conformation. They have a characteristic hump formed by elongated spinous processes of the thoracic vertebrae. The average height of the hump in females is 4 cm while in males it is somewhat higher. Quite often the back is sway. The hump intensifies this deflection. The height at the rump is somewhat greater than or equal to the height at withers, which testifies to well-developed hindlegs. This is a result of the adaptation to grazing on steep slopes. The animals have a large chest depth.

Table 9.2 BODY MEASUREMENTS OF ADULT YAKS (CM)

Measurement	Males	Females
Height at withers	122.77+0.88	109.21+0.36
Height at rump	120.39+0.93	109.00+0.36
Chest width	36.70+0.90	35.58+0.37
Chest depth	68.85+1.11	66.21+0.30
Heart girth	177.85+2.16	164.93+0.68
Oblique body length	137.13+1.59	124.52+0.46
Shank girth	19.30+0.30	16.10+0.09

The forelegs are short but as thick and strong as the hindlegs. The neck is short. The udder is not large, has short teats (2.5-4 cm) and is covered with thick fine hair. The fore udder is less developed - the udder index is only 36.2%. The hide is thick and has a dense hair coat. The sweat glands are less developed and the subcutaneous fat is more developed than in related animals. These traits characteristic of yaks allow them to preserve energy, to adapt well to the severe conditions of their habitat and to reproduce at low temperatures. Yaks do not require any particular care and can be kept in the open all the year round.

The colour of their coat is usually black. Among 258 test animals there were 211 (81.8%) with pure black or white-spotted black coats, 22 (8.5%) with greyish brown or pale yellow coats and 9.7% of other colours.

In the best yak breeding farms of Kirgizia the live weight of yak cows is 285-330 kg and that of bulls 400-550 kg. The live weight of 3-4 year-old bulls bred for meat under satisfactory conditions of maintenance and feeding is

320-350 kg. At slaughter the meat and internal fat amount to more than 52%.

Newborn yaks are smaller than cattle calves both absolutely and relatively. In different breeds of cattle the weight of newborn calves varies from 6.5 to 8% of the live weight of adults while for newborn yaks the figure is 5.9%. The average live weight of yaks at birth is 9-16 kg, at the age of 1 month 21-22, 3 months 33-35, 6 months 57-60, 9 months 140-145, 12 months 150-160 and 16 months 175-180 kg. Yaks bred in Kirgizia are considerably larger than those of Tajikistan. This is because in Kirgizia yaks are not milked as they are bred exclusively for meat.

Yaks produce meat, milk and wool. The authors recorded their fattening and meat characteristics in the state farms Alai and Son-Kul in Osh and Naryn regions in 1983. The animals selected for fattening grazed on natural pastures situated at 3500-5000 m above sea level. The herbage on the pasture was predominantly *Festuca* and *Artemisia*.

The average yield of the herbage was 310 kg dry matter per ha. In addition the animals were given 60-80 g of fodder salt per animal per day. Over the grazing period all the animals had a good daily weight gain and at the age of 3.5 years they had a high live weight and were in good condition for slaughter. Castrated yaks at the age of 3-4 years had the heaviest carcasses. Besides meat, the yaks produced hides to be used as raw material by the leather industry.

Table 9.3 CHANGES IN THE LIVE WEIGHT OF YAKS DURING THE FATTENING PERIOD

Number of animals	Age in months:		Average live weight:		Average weight Total (kg)
	Beginning of fattening	End of fattening	Beginning of fattening	End of fattening	
248	18	30	169.2	275.7	106.5
87	42	54	253.7	380.1	126.4
11	66	78	391.8	483.6	91.8

Table 9.4 SLAUGHTER CHARACTERISTICS OF CASTRATED YAKS

Number of animals	Age in years	Live weight prior to slaughter	Carcass weight		Hide weight	
			kg	%	kg	%
5	2	226.0	130.2	57.0	17.4	7.7
5	3	298.6	170.3	57.0	22.1	7.4
5	4	326.0	185.0	56.8	21.8	6.7
2	5	338.0	197.9	58.6	22.1	6.6

In the carcasses of 3-year-old yaks the bone content was 15.7-18.6% while that of the muscular tissue was 70.6-75.4%. Chemical analysis showed that the highest protein and fat content is found in the meat of yaks over 3 years of age and its calorific value is also higher. It is expedient to slaughter the animals at this age provided their live weight is not less than 300 kg.

The milk production of yak cows is not high - the average milk yield varies from 858 to 1066 kg a year. This figure depends very much on availability of feed, age, season of calving and other factors.

Table 9.5 CHEMICAL COMPOSITION AND CALORIFIC VALUE OF YAK MEAT

Age in years	Content in the meat (%)					Calorific value of 1 kg (Kcal)
	dry matter	water	protein	fat	ash	
2	38.53	61.47	21.7	16.75	0.08	2447.5
3	44.54	55.48	23.6	20.84	0.08	2656.3
5	40.10	58.82	22.54	18.55	0.09	2906.5

The milk yield of first-calf heifers is 54% of that of adult cows; it slowly increases till the animals are 9 years old after which it begins to diminish. The average lactation period is approximately 256 days with variations from 82 to 388 days. The fat content (5.3-8.6%) and the protein content (5.1-5.3%) are among the highest figures characterizing different breeds of cattle. Butter made from yak milk stores well and has a pleasant flavour. A characteristic of yaks is their thick hair cover which is different on different parts of the body. It is shortest on the neck and sides and consists predominantly of soft fine hair through which coarse guard hairs project. The underside is covered with long coarse hairs which form a fringe; the outer sides of the legs are covered with the same type of hair. The backbone on the neck and spine as well as the occipital and frontal parts of the head are also covered with coarse hair which however is much shorter. The tail of yaks has no switch like that of cattle and is similar to the horse's tail. Long hair grows along the tail and often reaches the ground; therefore the yak's tail is much thicker than that of horses. The hair clip of male yaks aged 3 years or older varies from 0.3 to 0.9 kg; at 2 years it is 0.4-0.5 kg and under 1 year 0.5-1.3 kg. For female yaks 3 or more years old and 2 years old the figures are 0.2-0.6 and 0.3-0.5 kg respectively. The hair of yaks is used in the felt industry and that of yak calves in the textile industry for the manufacture of high-quality thick cloth.

The hide of animals slaughtered for meat is a valuable raw material for the tanning industry and meets the standards for cattle hides.

The demand for beautiful bijouterie, hand-made articles and souvenirs made of natural materials obtained from yaks has become greater of late both in this country and abroad. Their wool, hair and bones are widely used by the community service centres of Kirgizia to make wigs, chignons and different articles of wool and horn. Yaks have not lost their importance as pack animals since they can easily traverse passes in the mountains of Kirgizia and Tajikistan where other animals cannot tolerate the low oxygen levels.

Scientists of the Kirgiz Animal Breeding and Veterinary Research Institute developed for the first time in 1972 evaluation specifications for yak breeding. These specifications reflect the main principles underlying the breeding of pedigree stock, indices of productivity, conformation and constitution which allow the evaluation of animals by a set of characteristics and specify the minimal live weight. The specifications contain standard constitution indices for yak cows bred in different zones.

At first calving the live weight of yak cows should be not less than 255 kg, at the second and subsequent calvings 295 kg. Bulls at the age of 1.5-3 years

should have a live weight of 340-420 kg, at the age of 4-5 years 480 kg or more.

To create highly productive lines and a gene pool of yaks a number of pedigree stock-breeding farms were set up in the areas with large yak stocks - in the Kalinin collective farm of the At-Bashi region, in the state farm Alai of the Alai region and elsewhere. The stocks at these farms are formed from well-developed animals.

Yak heifers reach puberty at different ages - from 16 to 40 months.

According to the data of Denisov (1958) the age depends on whether their mothers were also being milked while suckling. If the young got little milk because their mothers were milked they developed worse and reached puberty at a later age - 71.9% at the age of 24-30 months and 12.4% at 36-40 months. When the cows are not milked and their young get all the milk, they reach puberty earlier, mostly at the age of 16-18 months. According to the data of Ivanova (1951) and Aksenova (1947), in Altai and Buryatia yak heifers reach puberty at the age of 18-24 months. The heifers usually calve for the first time at the age of three years.

Yaks acclimatized in Yakutia often become pregnant at the age of 18 months, which is at least a year earlier than in the areas where they were originally bred. Yaks in Mongolia reach puberty at the age of 27-30 months, when their live weight is 190-200 kg, i.e. 73.5% of the average live weight of adult yak cows. Most yak heifers in China reach puberty at the age of 18-24 months. In rare cases heifers may come in heat at the age of 8-10 months but no fertilization has been observed at this age.

Yaks are seasonally polyoestrous. The beginning of the breeding season of Kirgiz yaks depends on the natural and climatic conditions as well as on the altitude. In the Tyan Shan at altitudes of 2400-2500 m mating begins in late June. Sometimes it begins in early June. Mating continues till late October, in rare cases till December or January. In the Alai valley of Kirgizia at the altitude of 3000-4000 m where the natural conditions are more severe mating begins in mid-July and ends in early October.

The physiological condition of the animals determines to a great extent the manifestation of heat during the breeding season. Barren cows come into heat in June-July while calved cows are in heat from July till September, depending on the time of calving. Thus if a cow calved in March it comes again into heat in 131 days, in April in 124 days, in May in 89.6 days and in June in 75.3 days.

Oestrus in yak cows lasts for 2-4 days with an overall range of 10 to 118 hours; in some cases it may last for 5-7 or 8-9 days. Prolonged non-ovulatory heat is frequently observed in yak cows which graze on southern mountain slopes.

Manifestations of heat in yak cows are similar to those in domestic cattle. On coming in heat the cows get excited, stop grazing, begin to sniff other animals and try to jump them. In mid-oestrus they search for males and mate. Their physiological condition is characterized by an increase in body temperature of 0.5-1.2 C, and a higher pulse and respiration rate. The neck of the uterus is opened and it discharges transparent fluid mucus which later becomes more viscous. In young animals heat is shorter and less strongly expressed than in adults. Yak cows ovulate 3-6 hours after heat is over. Unfertilized cows come into heat again after various periods - 7.6% in 3-5 days, 50.7% in 6-20 days and 41.7% in 21-40 days.

On high-altitude summer pastures the mating of yaks is more successful on cooler days. The conception rate in yak cows kept on high-altitude pastures in Mongolia is 75.8% while in those kept at lower altitudes it is 66.7%. Keeping yaks on summer pastures in the Tyan Shan at 2600-3400 m increased the conception rate to 82.9% and in the Pamirs at 3900-4200 m the conception rate was 97.8%. The author notes that one of the most effective ways of decreasing the number of barren cows is to drive the yak herds to high-altitude summer pastures at the earliest possible time. The nervous system in yaks is highly reactive. They easily get excited and quickly react to changes in the environment. The sexual activity of yak cows is suppressed by heat, lower altitudes (or a higher oxygen content in the ambient air), low-growing grasses in the pasture and other unfavourable factors. Even the presence of a herdsman in the vicinity of the animals interferes not only with the reflexes of the animals but also with their grazing. Yaks try to keep out of sight of man; their sexual reflexes are suppressed in man's presence. Therefore prolonged driving of the animals and other factors which may bother them should be avoided during the breeding season.

The average gestation period is 257 days with a range from 224 to 284, which is 30 days less than in domestic cattle. The shorter gestation period and lower weight of newborn calves are a result of the adaptation of yaks to their habitat. Calving takes place mainly in spring (from March to May) at pasture without any intervention by man. Cows which calve after August usually remain barren which is a result of the autumn conditions - air temperature drops sharply, oestrogen content in the feed diminishes and spermatogenesis in male yaks is reduced after the high sexual activity during the breeding season.

The age of puberty in male yaks depends on the conditions during rearing. If their mothers were milked when they were suckling they mostly reach puberty at the age of 2 years and if their mothers got better feed in the suckling period, at the age of 15-18 months. At the age of 12-13 months spermatids are found in the seminal ducts of the testis while at 14-16 months an increasing number of spermatozoa are observed. Under the conditions of free mating and year-round keeping on pasture the sexual activity of male yaks depends on their age and sexual load. They are most active at the age of 1.5-4 years. At 6 years yak bulls become less mobile and sexually active than cattle bulls. As the mating period is short and bulls have to serve many cows, only 2-4-year-old bulls should be used for mating. The number of cows served by one bull should not exceed 10-12.

On the basis of the pedigree and breeding value a group of dams is selected for every yak sire. Each of these dam groups with a sire attached should be given an isolated pasture to prevent mingling of the groups. Stand-by bulls are kept separately from dam herds and groups to be serviced. After mating, dams are gathered into herds with 130-150 animals in each. Herds of different quality are kept on different pastures.

The experience of the best yak breeders over many years shows that timely mating, the use of young bulls with a limited number of mates (10-12), the keeping of the animals during the mating period on pastures with good herbage and situated at not less than 3000 m above sea level as well as proper management of calving ensure a higher weaner output per hundred cows.

The work at the Kirgiz Animal Breeding and Veterinary Research Institute on the adaptation of young yak males to a lowland environment (the elimination of wild state reflexes) has shown for the first time that it is possible to obtain intact semen from yaks, to store it deep frozen by the methods developed for cattle and to use it for artificial insemination. The first batches of frozen yak semen were sent in 1983-84 from Kirgizia to Dagestan and Yakutia where yaks had been brought for acclimatization. The organization of the semen pool is a necessary condition for the introduction of artificial insemination into yak breeding. Another problem is to develop a method of oestrus synchronization in female yaks and thus enable artificial insemination to be carried out over a short period of time on special grounds directly on mountain pastures. Laboratory and field tests have shown that the sexual system of female yaks is very sensitive to the administration of sex hormones and biologically active substances (prostaglandins) which synchronize sexual reflexes. The introduction of artificial insemination in yak breeding will allow the fuller use of economically valuable characteristics of yaks in their hybridization with cattle.

Yaks are susceptible to the same diseases as cattle - brucellosis, tuberculosis, foot-and-mouth disease, anthrax, blackquarter and some other contagious and parasitic diseases. Foot-and-mouth disease in yaks is much less morbid than in cattle. Individual cases of necrobacillosis have been recorded in yak calves and adults. Generally yaks are not subject to pyroplasmosis when high in the mountains. When driven down in the warm season, they become susceptible to haematozoal diseases. This is also true of the subcutaneous gadfly strike. The larvae of gadflies are found less frequently under the hide of yaks than of cattle kept together with yaks. The yaks are susceptible to many helminths. The examination of the viscera of animals slaughtered at meat-packing plants showed that some animals had fascioliasis and lung and liver echinococcosis. In practical yak breeding cases are registered of monieziosis, telasiosis and brain coenurosis. The diagnosis, prevention and treatment of the above diseases in yaks is similar to those in cattle.

BIBLIOGRAPHY

(In Russian)

- Denisov V.F. Domestic yaks and their hybrids. Selkhozgiz, Moscow. 1958.
 Sarbagishev B. and Chertkiev Sh. Ways of increasing the productivity of yaks. Frunze. 1983.
 Solomonov N.G., Kiselev Yu.A. and Sleptsov M.K. Acclimatization of yaks in Yakutia. Nauka, Novosibirsk. 1980.