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COVER: Tick-infested cow. Photos: Courtesy P.B. Capstick, The Wellcome Foundation Ltd, Beckenham, UK.

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AWASSI SHEEP

• H. Epstein

The FAO/UNEP Consultation on Animal Genetic Resources Conservation and Management, held in 1980, recommended high priority being given to indigenous breeds and, in particular, named the N'Dama, Sahiwal and Boron breeds of cattle, Shami goats and Awassi sheep. This article describes the Awassi, an outstanding breed of fat-tailed sheep found in many countries of the Near East.

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Awassi ram



Awassi ewe and lamb

Origin of Awassi sheep.

The Awassi is the most numerous and widespread breed of sheep in south-west Asia. It is the dominant type in Iraq, the most important sheep in the Syrian Arab Republic and the only indigenous breed of sheep in Lebanon, Jordan and Israel. In the north of the Kingdom of Saudi Arabia, it is bred under desert conditions. In Turkey, the Awassi makes up one percent of the ovine population; its breeding area is situated in southern Anatolia in a border strip along the main range habitat of the breed in the Syrian Arab Republic. The name of the Awassi is attributed to the El Awas tribe between the Tigris and Euphrates rivers. In literary Arabic, *awas* is the term for the red-and-white camel garb or for a white sheep (Hirsch, 1933). The name of the breed is also sometimes spelled Awasi, Aouasse, El Awas, Oussi, Ussy or Iwessi; in Turkey it is called Ivesi or Arab and in some parts of the Syrian Arab Republic, Nu'amieh or Shami, the latter being the Arabic name for Damascus.

Fat-tailed sheep have been bred in the breeding area of the Awassi for at least 5 000 years. In physical and functional properties, the Awassi seems to be very close to the prototype from which the fat-tailed sheep of Asia, Africa and Europe are derived. Many of these still show a close likeness to the Awassi. This holds true not only of the sheep of Cyprus and North Africa and several Turkish and Iranian breeds but animals similar to the Awassi are also encountered among the Ronderib Afrikander sheep of South Africa and the Mongolian sheep of eastern Asia. Fat-tailed breeds deviating from the Awassi in some physical or functional properties may owe their characteristics either to evolution in a different environment, specialized breeding aims or to cross-breeding.



Awassi sheep following their shepherd on the Syrian steppe

Physical characteristics.

The unimproved Awassi is a robust and vigorous, medium-sized sheep of milk and mutton type. The improved dairy type is larger and more refined than the ordinary Awassi. The bodily proportions are affected by the size and weight of the fat tail, which produces the impression of a lack of balance between fore- and hindquarters. In ewes this impression is enhanced by the large udder. The height at withers recorded in Awassi sheep ' of Iraq, Palestine and the Syrian Arab Republic ranges from 68 to 80 cm in adult rams and from 65 to 70 cm in ewes, and the length of body from 62 to 72 cm in rams and from 58 to 67 cm in ewes. The weight of unimproved adult Awassi rams throughout the range of the breed varies between 60 and 90 kg, and of ewes between 30 and 50 kg (Mason, 1967). In several thousand Awassi ewes purchased for slaughter in Transjordan, the Syrian Arab Republic and Iraq during the Second World War, the author established an average weight of 42 kg. In improved Awassi, weights of dairy ewes range from 60 to 70 kg while that of rams may exceed 100 kg.

The head of the Awassi is long and narrow, with a convex profile. In adult, strongly horned rams, the convex line of the profile may be broken by a slight indentation between the forehead and the markedly curved nasal part of the head. The ears are pendulous, about 15 cm long and 9 cm broad. Occasionally the auricula is rudimentary or entirely absent. Rams are nearly always horned. The horns, which are 40-60 cm long and strongly wrinkled, curve backward and downward with the tips directed outward. In the Syrian Arab Republic and Iraq, Awassi rams with up to six horns are occasionally encountered in Bedouin flocks; such horns show a high degree of variability and lack symmetry in shape and direction. Ewes are commonly polled; in Turkey about 10 percent have poorly developed rudimentary horns, while in other countries the number of such ewes may go up to 25 percent. In Awassi dairy flocks in Israel, about 80 percent of the ewes have thin, weak and shapeless scurs, about 3-8 cm long which are partly covered by curls of hair. Fully developed, 10- to 15-cm-long horns are rare in Awassi ewes. The neck is fairly long, lappets being frequent. The chest is also long but of only moderate depth and width,

with a small, thin dewlap and prominent brisket. In unimproved flocks, narrowness at heart is a common weakness. The back is long and straight, the anterior part of the rump relatively broad and nearly on a level with the back, but the rump is short with a slope to the fat tail. The barrel is deep and wide. The legs are of medium length and thickness; not as short and sturdy as those of the early maturing mutton breeds of the United Kingdom nor as long and thin as the legs of the thin-tailed sheep of the savanna region of West Africa. They are usually well placed, with strong pasterns and durable hoofs.



Bedouin flock of Awassi sheep and desert goats

The fat tail is broad and relatively short, usually ending above the hocks, more rarely extending below them. Long fat tails present an obstacle in the process of milking. In adult Iraqi Awassi rams, the average length of the fat tail is close to 30 cm and its width 25 cm; in ewes, the length averages 18 cm and the width 15-16 cm. In rams, the fat tail may weigh as much as 12 kg and in ewes up to 6 kg; in heavy male lambs it may reach 8 kg. Without the fat cushions, the tail weighs about 70 g. The main portion of the tail emerges from the lower part of the rump with the same width as the thurls and hangs down in two lobes which are separated by the caudal skeleton and are bare of hair or wool on the under-surface. In the middle of the lower portion, the lobes are not connected but are separated by a deep notch which gives the underside of the tail a heart-shaped appearance. Slightly above the notch, the tail skeleton turns upward to emerge from the fat moieties, producing a hairy tassel of variable length which hangs down from the upturned tail skeleton.

In unimproved Awassi ewes, the udder and teats are of variable shape with numerous faults. In some animals, the udder is pendulous, occasionally extending down as low as the heels or it may have the shape of two bottles or sausages with a deep indentation between the two halves. Frequently the teats are very small, with either a downward, lateral or upward direction, or they may project, not from the bottom of the udder but from the outer sides, rendering milking difficult. In ewes of improved dairy type, the udder is generally well attached, of moderate depth, not pendulous but of globular shape, wide between the legs, elongated anteriorly and extending well to the rear. The teats are of fair length and thickness, with a downward direction.

The skin of the Awassi is moderately thin and elastic, unpigmented and very sensitive. In aged animals, it loses its fineness and becomes thicker and coarser. There are no folds on the neck or body but a thin dewlap extends from the throat down to the brisket.

The head and ears of the adult Awassi are covered with short, stiff hair, and the back, sides of the body and posterior part of the fat tail with wool. Up to the age of 12-15 months, Awassi sheep have the entire neck, including the throat, also covered with wool. In the large majority, the wool later disappears on the throat, and in many animals the neck also becomes short-haired, except for its top ridge. In the ram, a fringe of longer and coarser wool extends from the throat along the dewlap to the lower part of the brisket. In young lambs, wool grows on the belly; as the animal grows older, this is replaced by fairly long, coarse hair. The forelegs are usually short-haired, while the hind-legs may also be woolless or, more rarely, be thinly covered with short wool down to the hocks, sometimes as far down as the fetlocks.

Generally, Awassi sheep have a light fleece owing to the low density of wool follicles and the limited surface area covered with wool fibres (Shara-feldin, 1965). For rams, Mason (1967) gives an average annual fleece weight of 2.0-2.5 kg and for ewes 1.75 kg. In improved Awassi ewes, the fleece weighs 2.6-3.0 kg and in rams 4.35 kg on average. In a flock selected for heavier fleeces, a ram had a fleece weight of 6.8 kg and a ewe 6.5 kg. In the Syrian Arab Republic, a ram of an improved Awassi flock produced 9.96 kg of wool in a year (Gadzhiev, 1968). Dry females grow heavier fleeces than lactating ewes, and two shearings per year increase the total annual wool yield as compared with one shearing (Al-Aubaidi *et al.*, 1968). Typically, the wool of the Awassi is white with a yellowish hue. The head, ears and anterior part of the neck are brown, while the legs may be wholly or partly brown. Some animals have a white blaze on the head. Lambs born with a light-brown whole-coloured or spotted coat frequently grow white fleeces after first shearing. The hoofs of the Awassi are dark brown.

Physiological characteristics.

In the course of several thousand years, the Awassi has become fully adapted to the sub-tropical environment of its extensive breeding area in the semi-arid or arid regions of southwest Asia. The flocks of the Bedouin and of the majority of fellahin (peasant agriculturists) are kept in the open, day and night, throughout the year and depend entirely on the natural grasslands. Their natural protection against the strong solar radiation during the hot months of the year is their fleeces and their habit of keeping their heads in the shade below the bellies of their flock mates. Owing to the pigmentation of the head, diseases due to photosensitivity of the exposed mucous membrane of the mouth, nostrils, ears and eyelids do not occur in Awassi sheep. However, the hardiness of the Awassi may break down during a succession of rainy days during the cold season when they remain without feed and have used up the fat reserves accumulated in their tails and bodies in the previous spring and early summer, and have become completely emaciated. At such times the death rate from exposure and starvation may be extremely high.



Badawy shepherd with full paraphernalia

The adaptation of the Awassi sheep to their sub-tropical environment is to a considerable degree due to their physiological ability to regulate the heat balance of their bodies at different seasons of the year under different diurnal temperatures and humidity conditions and in the shade or under direct solar radiation. Epstein and Herz (1964) reported that the average body temperature of Awassi sheep in Israel was 0.9°C lower than that of imported UK mutton sheep kept in the same place and under the same conditions. The fleece provides shade for the skin of the Awassi and encloses a layer of still air which forms a *thermal* barrier between the epidermis and the environment. Eyal (1963) has estimated that the Awassi sheep traps approximately 80 l of air in its 8-cm-long winter fleece and 50 l in the 5-cm-deep summer fleece. This layer of air has a microclimate of temperature and humidity that is governed by the physiological activity of the skin and by changes in the ambient macroclimate. The changes occurring in the microclimate always lag behind environmental changes. During the summer, the pulse rate of the Awassi is lower than during the winter, namely 60-100 as against 90-130 per minute. A rise in ambient temperature during the summer is accompanied by a lower pulse rate, with the lowest of 42 per minute on hot dry days in the desert.

Although respiration rate cannot be used as the sole criterion in estimating heat resistance in sheep, a breed with a lower respiration rate is generally better adapted to a hot climate than sheep prone to panting, for panting on hot days suggests an insufficiency of other cooling mechanisms. Epstein and Herz (1964) noted that, on hot summer days, the average number of breaths per minute was 64 in Awassi sheep as against 170 in Romney Marsh, 150 in Dorset Horn and 128 in Suffolk sheep kept in the same place and under the same conditions. Degen (1977) found that Awassi lambs exposed to summer heat without shade increased their mean panting rate from the coolest (16°C) to the hottest part of the day (45°C) from 35 to 135 per minute. German mutton Merino lambs kept under identical conditions increased their panting rate from 41 to 199 over the same hours, while their breaths were shallower than those of the Awassi lambs.

Shepherding of Bedouin and fellahin flocks.

In large parts of the subtropical, semi-arid Awassi breeding area, the sheep depend for their sustenance throughout the year solely on natural grassland growth. In the winter and spring, they enjoy the new *grazing that sprouts* up after the rains. When the winter rains have been plentiful, the Bedouin do not water their flocks as these obtain sufficient moisture from the young juicy plants. In summer, the sheep live on weeds and the stubble, gleanings and fallen grains on the harvested fields of the fellahin. In autumn and early winter, they have to content themselves with the meagre herbage they may find on hillsides or in valleys. This is the time of scarcity of nourishment when the Awassi sheep use up the fat stored in their tails during the months of plenty. In the season of scanty grazing or during violent rain storms, fellahin flocks may be given some tibben, that is, straw crushed by primitive threshing methods. In some parts of the breeding area, the Awassi flocks are not stationary but travel with their nomad owners over long distances in search of grazing. Stationary Awassi flocks owned by fellahin are commonly grazed in the neighbourhood of the villages. When the ewes are in milk, they are taken to the tents of the Bedouin or the villages of the fellahin in the evening to be milked, and rest in the vicinity during the night. During the season when the ewes are dry, they remain in the field during the night together with the shepherds and their dogs.



Awassi flock bred for milk

In the Syrian Arab Republic, flocks belonging to fellahin are usually taken by shepherds to mountain pastures in the spring. They return to the villages for the winter when temperatures at high altitudes are very low and the mountains are covered with snow. In the plains there is ample grazing during the rainy winter season. The Awassi sheep of the Bedouin of the Syrian Arab Republic are entirely migratory. In winter, numerous flocks move deep into the Syrian desert, often as far as the Euphrates, where pasture growth is fairly satisfactory during this time of the year. As soon as the steppe and desert flora dry up early in the summer, they return to the western parts of the country where the winter rains are more copious and the grazing provides feed until well into the dry season. On their migrations from west to east and east to west, they cover hundreds of kilometres (Hirsch, 1932). Other Bedouin flocks are taken in winter to grazing lands in the southern

parts of the Syrian Arab Republic, where the vegetation begins to grow in October and November. Later, the flocks return to the north, their movements closely following rainfall distribution. With the advent of the summer heat, the vegetation fades. During droughts, the lack of fodder causes serious loss of weight in the sheep of the Bedouin and great numbers of them perish (Gadzhiev, 1968).

In Iraq, the difference in the grazing between fellahin and Bedouin flocks is similar to that practised in the Syrian Arab Republic. The fellahin flocks subsist for more than six months of the year on the rich grazing of the winter wheat, the summer stubble and weeds of the arable land, and fortuitous grazing on communal ground or the nearby desert. For the rest of the year, the flocks are sent under the care of shepherds into the desert for spring and early summer grazing. The distance traversed by the fellahin flocks in search of grazing depends on the year's rainfall, but in general is relatively small. The Awassi flocks of the Bedouin of Iraq are required to obtain their sustenance by foraging over vast distances. This kind of management is prevalent in all areas — in the mountains, on the plains, in the marshlands and in the forests (Kazzal, 1973). The daily distance covered in the desert is about 6-8 km when the grazing is fairly good; when migrating to more distant pastures, 16 km are considered to be a fair rate of progress but, if pressed, flocks may be driven for as much as 35 km in 24 hours (Williamson, 1949). In many parts of the breeding area of the Awassi, flocks comprise sheep as well as goats in varying ratios which depend on the climate and topographical conditions of each region. The Awassi sheep, which are rather slow of movement during the summer, are stimulated by the goats to greater activity.

Bedouin and fellahin shepherds know nothing of tent or house but live entirely in the open together with the flocks under their care. They are working 365 days a year, from 13 to 16 hours a day. Their work includes shepherding, watching at night, care of sick animals, training of bell-wethers, shearing, weaning of lambs, and tying the ewes up for milking which is usually done by the women. Commonly, Awassi flocks of the Bedouin and fellahin are accompanied by rams throughout the year. Hence, a ewe in oestrus is served several times. Ewes coming in heat very early in the season may lamb when there is still a shortage of grazing before the rains. The number of ewes for each ram varies between 25 and 35 in Bedouin flocks, and between 40 and 50 in those belonging to fellahin.

During the lambing season, lambs born in the field and still too weak to follow their dams are carried by the shepherds to the tents or villages where they remain for a few days until strong enough to join their dams at pasture. The suckling period lasts for two to three months, depending on the state of the grazing, the time of birth, and the development of the lamb. After weaning, the lambs are put into separate flocks away from the ewes and have to subsist solely on the natural grazing. Milking commences when a sufficiently large number of ewes have suckled their lambs for at least two months. During the first three or four months of the milking season, the ewes are milked twice a day and during the following month only once a day until they dry off. As the Bedouin have no enclosures for milking, the ewes have to be milked in the open. The animals are placed in two rows along a long rope to which they are tied by their heads in opposite pairs. Neither Bedouin nor fellahin castrate male lambs. Only a very few destined to become bellwethers leading the flock may be castrated, either by biting

through the spermatic cord or by tying a string tightly around the upper part of the scrotum.

In some parts of the breeding area, Awassi sheep are shorn once a year, in others twice. Shearing is usually done in a rough manner by hand shears or with simple scissors while the sheep are lying on the ground. Wounds caused by the shearers are common. A shearer may shear 20-30 animals a day. Often the wool is sold before shearing, by number and not by weight.

Reproduction.

In Awassi ram lambs in Iraq, puberty, as defined by the presence of spermatozoa in the testes and epididymides, is attained during the first half of the eighth month at a weight of 30-37 kg. In Lebanon, the onset of sexual maturity in male Awassi lambs occurs two months earlier than in Iraq, namely at 140-190 days, but at a similar body weight (29-36 kg). Barr (1969) noted that, under the conditions of Lebanon, Awassi ram lambs should be separated from the females not later than at five months of age, and could be used for service at seven months. Well-fed male Awassi lambs of the improved dairy type show first signs of sexual desire at weaning time at the age of three or four months when they weigh 40-50 kg. At five to six months, they produce normal spermatozoa, and at eight months, when they have reached a weight of 90-110 kg, they can be employed for service.

In unimproved Awassi flocks, the ewes lamb for the first time at the age of two years or more. In improved dairy flocks, female lambs born early in the season come into heat in August at the age of nine or ten months, and are served or inseminated at the first heat. Those in which natural oestrus is delayed are given hormone treatment in September or October, provided that they weigh not less than 50 kg. About 60-70 percent of the young ewes lamb as yearlings, the rest at the age of two years.

In Awassi flocks of the Bedouin and fellahin, the breeding season is to a large extent determined by the condition of the grazing. The ewes come into heat only when the spring and summer grazing has restored the weight lost during the preceding period of drought and brought them back to a fair condition. The mating season lasts approximately from June to September, so that the lambs are born when there is enough pasture for the ewes in milk and for the young lambs. Occasionally oestrus occurs earlier in the season and, since the rams are running with the ewes all the year round, lambs may be born before the grasslands provide sufficient nourishment for the ewes to have enough milk and for their lambs to develop normally. Nor is oestrus at the usual breeding time always a success, for delayed or scanty winter rains and poor growth of grass in spring may be calamitous for the whole flock, but especially for ewes in lamb or in milk, young lambs and aged animals.

In an experimental flock in Lebanon, oestrus reached its peak with regular cycles in August and September but was still maintained on a fairly high level until December; from January to April the heats markedly decreased in number, and from May to July they ceased altogether. The length of the oestrus cycle varied between 15 and 20 days, with an average of 18 days. The duration of heats ranged from 16 to 59 hours, with 29 hours on average. Nine percent of the heats were silent, as manifested by the occurrence

of multiple cycles, accompanied by the absence of mating response (Barr, 1968). The Awassi ewe displays few outward signs of oestrus. Pro-oestrus is short and rather indefinite and the onset of oestrus abrupt, while the cessation is gradual. In Iraq, the principal lambing season of Awassi ewes is in November, and in Lebanon, the Syrian Arab Republic and Israel in December-January.

The mean gestation period in an Awassi flock in Lebanon has been reported to be 149.5 days for male lambs and 148.6 days for females (Choueiri, Barr and Khalil, 1966). In another Lebanese flock, the average gestation length for single-born lambs was 151.2 days (Fox *et al.*, 1971) while, at the American University Farm in Lebanon, it was found to be 152.6 days (McLeroy and Kurdian, 1958).



Awassi sheep on the Syrian steppe

In Bedouin and fellahin Awassi flocks, not more than 5 percent of the adult ewes have twins. In Lebanon, the lambing percentage of mature Awassi breeding ewes usually averages about 60. In Syrian Awassi flocks, fertility is also low — 70-80 lambs per 100 ewes. In experimental flocks with superior feeding and maintenance, higher lambing rates (110-120) have been recorded. The twinning rate of Awassi ewes tends to increase up to the age of six years and decreases thereafter.

The sex ratio recorded in over 1 000 lambs of an Awassi flock in Lebanon was 48.3 males to 51.7 females. In a stationary flock purchased from Syrian nomads, the number of males exceeded that of females; in single lambs it was 52.4:47.6 and in twins 57.4:42.6. In a flock of Anatolian Awassi sheep, the overall sex ratio of male to female single and twin lambs was 49.3:50.7; 22.8 percent of the twin pairs were of male, 24.6 percent of female, and 52.6 percent of both sexes.

The records of barrenness show a wide range in different flocks. In a Lebanese flock in which the ewes were accompanied by rams from June to January, there were only 4 percent barren ewes. In a large flock, obtained from six different regions in Lebanon, 10 percent of the ewes which came into heat did not lamb, ranging from 2 percent to 26 percent among regional groups. In a stationary flock where the rams were kept with the

ewes throughout the year, 14 percent did not lamb during a single year. In an Awassi flock in central Anatolia, 20 percent of the ewes mated in one year and 12 percent mated in another year remained barren. In Egypt, 20 percent of a group of Awassi ewes derived from Syrian stock did not conceive. Computer records of all milk-recorded Awassi ewes in Israel during two consecutive years show an average barrenness of 40.7 percent in yearlings, 10.5 percent in two-year-olds, and 6.25 percent in adult ewes.

The mortality rate in Bedouin and fellahin Awassi flocks is 15-20 percent in normal years, and up to 50 percent in years of drought or severe winters (Hirsch, 1933). While this refers to flocks as a whole, the mortality of lambs is certainly not less than that of adult sheep. In Syrian Awassi flocks belonging to the Bedouin, the mortality of lambs shortly after birth reaches 5-10 percent in favourable years, and 30-50 percent in years with cold winters and snow-covered grasslands, when the ewes are starved. In fellahin flocks, kept in villages where the ewes lamb in protected places and are given *some straw* in addition to pasture, lamb mortality is less than in Bedouin flocks. In Iraq, famine and disease are reckoned to reduce the average lamb crop to 40-60 percent (Williamson, 1949). In an experimental Awassi flock in Iraq, where nutrition and management of the sheep are superior to those commonly found in Bedouin and fellahin flocks, single lambs showed an average mortality rate of 15.7 percent and twins 18.0 percent during a six-year period. There is a general tendency in Awassi flocks for male lambs to have a considerably higher mortality rate during the first week of life than for female lambs. In countries where the Awassi is not indigenous but has been imported in relatively small numbers, mortality of lambs during the period of acclimatization in a new microbial environment is usually high.

Numerous birth weights of lambs have been recorded in the different countries of the breeding area of the Awassi. In flocks which subsist entirely or mainly on grazing, the year and month of lambing, owing to variable conditions of climate and grassland growth, affect the birth weights of the lambs. In a flock of unimproved but well-fed Awassi sheep in Lebanon, the mean birth weight of male lambs was 4.3 kg and of female lambs 4.1 kg. In another flock originating from different regions in Lebanon, single male lambs weighed on average 4.5 kg and single female lambs 4.0 kg. In a flock of unselected Awassi sheep, collected from Syrian nomad tribes, single lambs were 21 percent heavier than twins, and male lambs 7-9 percent heavier than females at birth. At the first lambing of two-year-old ewes, birth weights were approximately 15 percent lower than at later lambings.

Similar birth weights have been reported from other countries. In Turkey, single male Awassi lambs weighed 4.5 kg and single female lambs 4.2 kg; male twins 3.7 kg and female twins 3.5 kg. In an experimental flock in Iraq, single male and female lambs averaged 4.6 and 4.3 kg respectively. At an agricultural experiment station in Iraq, male Awassi lambs exceeded females by 240 g at birth, and single lambs were 620 g heavier than twins. The weight of the dams has a marked effect on birth weights of Awassi lambs in Iraq; ewes weighing 60 kg have heavier lambs than those of either smaller or larger weight. In improved Awassi dairy flocks where the ewes are considerably larger and better fed than in most unimproved flocks, the lambs have 10-15 percent heavier birth weights. In several thousand single male and female lambs, average weights of 5.4 and 4.8 kg respectively have been recorded, and 4.4 and 3.9 kg in male and female twins.

Milk and butterfat.

Awassi sheep possess a high potential for milk production although the annual yield of ewes in unimproved flocks of Bedouin and fellahin has been estimated at only 40 kg, to which about 20 kg taken by the lamb must be added (Mason, 1967). The high potential for milk production is testified by an experimental Awassi flock in Lebanon, derived from "unknown sources", in which average yields in six consecutive lactations ranged from 197 to 231 kg, and maximum yields from 268 to 406 kg. For Syrian Awassi ewes, an average lactation yield of only 60 kg has been reported by Erokhin (1973), with 160-180 kg for high-yielding animals. In Turkey, average lactation yields of Awassi sheep vary between 100 and 185 kg; record ewes yield as much as 390 kg. In Iraq, where the Awassi is bred mainly for mutton and not for milk, lactation yields range from 90 to 130 kg.

Very high yields have been recorded in Israel where, for the last 40 or 50 years, the Awassi has been selected for milk. In many flocks, average yields of ewes exceed 400 kg; in a large stud, the lactation yield of all ewes is above 500 kg on average. Several ewes have record yields of 1 100-1 300 kg per lactation. The milk of Awassi ewes contains on average 7.5 percent fat (Mason, 1967). In Iraq, fat percentages of 5.4 and 6.9, and in Turkey percentages of 6.1 and 7.0 have been recorded in different flocks. In Palestine, the mixed morning and evening milk, tested in a central collecting station in 1942/43, contained 7.54 percent fat on average. In 1949/50 a similar test at the same station showed an average fat content of 7.25 percent, in 1950/51 6.83 percent, and in 1975/76 5.44 percent. This decrease is attributed mainly to the general use of milking machines in improved dairy flocks and the cessation of secondary hand-milking. It is also due to the large share of concentrates in the rations of dairy ewes, for in Yugoslavia, where the sheep are kept on high-quality roughage and good grazing, Awassi ewes imported from Israel or bred from imported stock tested at 6.84 percent in a socialist cooperative combine and at 7.4 percent on a peasant farm (Todorovski, Tanic and Stojanovski, 1975).

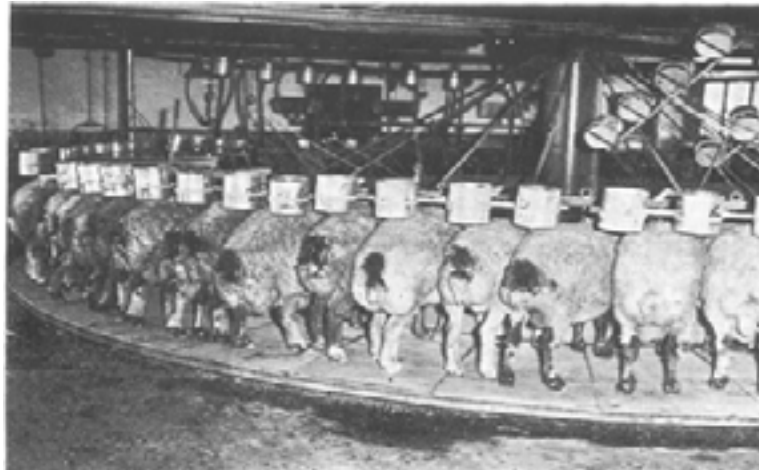
Mutton and lamb.

With its characteristic conformation and large accumulation of fat in the tail, the Awassi is far from being a mutton sheep proper. Yet, Awassi mutton and lamb form a welcome dish throughout the range of the breed, and the meat largely lacks the characteristic flavour associated with mutton in Europe.

The killing out percentage of fat, adult Awassi sheep ranges from 50 to 54 percent. Slaughter ewes from Bedouin flocks, of an average liveweight of 40 kg, may have a warm-dressed weight of less than 40 percent. Nearly 40 years ago, the author recorded a carcass yield of 38.8 percent in 20 unshorn ewes of an average liveweight of 32.75 kg. Recently a number of culled dairy ewes in good condition, weighing 70.6 kg on the farm and 68.0 kg before slaughter, killed out at 50.1 percent, of which the forequarters yielded 23.1 percent and the hindquarters with the fat tail 27.0 percent. The weight of the tail amounted to 5.3 percent of the liveweight. The carcass without head, legs and inner organs yielded 23.2 percent muscle, 13.9 percent body fat, 5.0 percent tail fat and 7.2 percent bone. An adult ram in a rather lean condition killed out at 57.3 percent, of which

muscle tissue amounted to 30.5 percent, body fat 8.3 percent, tail fat 6.2 percent and bone to 11.2 percent.

The carcass composition of Awassi lambs depends largely on the age and weight at slaughter. The majority of male lambs are slaughtered at weaning when they are two to three months old and weigh about 20-25 kg. In 90-day-old male lambs, Epstein (1961) recorded an average dressed weight of 50.4 percent, composed of 23.6 percent forequarters and 26.8 percent hindquarters including the fat tail. The weight of the wet pelt amounted to 13.7 percent of the liveweight. In Lebanon, the dressing percentage of male Awassi lambs with a liveweight of 42.8 kg is similar, namely 50.8 percent. In Iraq, 13-month-old Awassi rams of an average liveweight of 43.6 kg killed out at only 41.2 percent (Asker, El-Khalsy and Juma, 1964), while, in another test, male lambs slaughtered at about eight months of age and an average liveweight of 40.5 kg yielded 57 percent, of which the fat tail amounted to 6.7 percent (Farhan, Al-Khalisi and Hameed, 1969). Fattened Awassi lambs weighing 60-70 kg before slaughter have a carcass yield of approximately 50 percent; 45 percent of the carcass weight consists of muscle, 43 percent of fat and 11 percent of bone.



Awassi dairy ewes in rotary milking parlour

Wool.

The Awassi has long wool with an open, lofty and moderately lustrous fleece of carpet wool with distinct, wide crimps. The fleece consists of an outer coat, an undercoat and kemp. It has the principal requisites of carpet wool, namely coarseness and resilience, qualities that make carpet wool resistant to matting down and to wear under the constant scuffing of passing feet. An ideal carpet wool should have a fibre diameter of 30 μ , a fibre length of 10 cm with a 20 percent variation in length, and 4 percent by weight of kempy fibres. Awassi wool complies with these requirements as regards fibre thickness and length, but the fibre length has a greater variation and kemp contents are somewhat greater.



The fat tail of an Awassi ram

In Awassi flocks in Lebanon, the normal yield of scoured wool averages 50-60 percent. At an experimental farm, the average annual yield in two successive years was 66.3 percent (McLeroy and Kurdian, 1958). In Egypt, wool of six months' growth from Awassi ewes of Syrian origin yielded 74.6 percent clean wool. In the Kingdom of Saudi Arabia, the mean percentage yield of clean wool from Awassi ewes of Syrian origin was 77.9 and from lambs 77.5. In Anatolia, a flock of Awassi sheep kept at a research station had an average clean wool yield of 61.2 percent during two years of examination. In another study, the average yield of Turkish Awassi wool was 66.8 percent. Wool samples taken from the hip region had a clean fibre yield of 77.0 percent for rams, 71.7 percent for ewes, and 78.2 percent for yearlings. In Iraq, the mean yield of wool of 12 months' growth from ewes of different ages was 84.8 percent, the low shrinkage being attributed to the comparatively small number of sudoriferous and sebaceous glands in the wool follicle structure.

In wool from Syrian Awassi rams and ewes, the percentages of heterotype fibres were 45.2 and 41.5, of undercoat fibres 2.7 and 15.5, and of kemp 52.1 and 43.0 respectively. Turkish Awassi fleeces from rams and ewes consisted of 75.8 and 78.2 percent true wool fibres, 8.1 and 11.8 percent heterotype, 8.4 and 3.9 percent medullated fibres, and 7.7 and 6.1 percent respectively of kemp. In Egypt, the average ratios of undercoat, outer coat and kemp fibres in wool of six months' growth from Awassi ewes of Syrian origin were 69.7:24.4:5.9 by count, and 41.4:54.2:4.4 by weight.

The staple length of Awassi fleeces of 12 months' growth varies between different territories. In Israel, an average length of 13.75 cm has been recorded in ewes, in Lebanon 10.0 cm, in Turkey 16.4 cm, in an experimental flock in Turkey 15.9 cm for rams and 14.5 cm for ewes, and in Iraq 16.5 cm for ewes.

The average fibre lengths of Syrian Awassi wool of 12 months' growth are reported to be 16.4 and 13.2 cm for heterotype fibres from rams and ewes respectively, for undercoat 11.3 and 9.6 cm, and for kemp 20.6 and 15.8 cm (Erokhin, 1973). The average fibre diameter of Awassi wool of 12 months' growth is approximately 36 μ , equal to a 44's count, ranging from 32/36's to 58/60's. In fleeces of Syrian Awassi rams and ewes,

Erokhin (1973) recorded the following fibre diameters: heterotype 33.7 and 31.9 μ , undercoat 26.4 and 24.0 μ , and kemp 56.9 and 49.0 μ . In Turkey, the average fibre diameter of wool from Awassi rams has been reported to be 36.0 μ , and from ewes 35.0 μ , with distributions of fibre fineness from 10-160 μ , and 10-180 μ ; and in Egypt, the wool of six months' growth from Awassi ewes of Syrian origin measured 51.4-75.8 μ for kemp, 46.5-54.5 μ for outer coat, and 23.9-29.8 μ for undercoat.

The Awassi fleece is highly medullated. The difference in the percentage of medullated fibres between the outer and undercoats is large. The fine and moderately fine fibres are generally not medullated. The stronger fibres have either a very thin medullary canal or a discontinuous medulla, present in some sections of the fibre and absent in others. The coarse wool fibres, permanent hair and kemp have fully developed medullae from root to tip.

In wool of 12 months' growth from Awassi ewes in Iraq, the number of crimps per 2 cm averages 4.2. There is a significant positive correlation between crimps and fibre diameter. Thus in Awassi fleeces of 10 months' growth in Israel, the fine non-medullated fibres have 4-6 crimps over a length of 1 cm. In Awassi wool in Egypt, the undercoat has more crimps than the outer coat, namely 6.1 as against 2.1 per 2 cm on average.

The tensile strength of wool from Turkish Awassi rams is reported to be 19.9 g and the elasticity 32.0 percent, and from ewes 17.5 g and 31.7 percent respectively.

Unscoured Awassi fleeces have a low yolk content. In adult ewes, slight to deep canary stains are found in about 55 percent of shorn fleeces. □

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