Feed and Fodder

There are two main, distinct types of livestock production systems in Afghanistan; sedentary, mixed farming and nomadic, transhumant pastoralism such as the Kuchis and the Karakul Sheep Production Systems. In mixed farming, livestock keepers rely to some extent on the common grazing lands that normally surround the village, whereas transhumant herders practise vertical, sesonal migration between the dry plains and the mountain summer pastures. Grazing lands and pastures form thus a crucial resource for livestock feeding in Afghanistan, as the country is mostly comprised of **extensive grazing land**: desert, semi-desert and high mountains. The availabilty of adequate biomass all year around is limited, especially in winter as only about 40% of the land is suitable for winter grazing. The productivity of pastures in Afghanistan vary greatly between areas and from year to year. As per Thieme et al. 2006, average dry matter productivity of pastures of 700 kg/ha per year and 50% utilisation puts the total estimated amount of available dry matter at 20 million tonnes. In addition, 3.5 million tonnes of roughage from agriculture by-products, mainly cereal straw, can be utilised for livestock feeding in Afghanistan.

Fodder resources

Pastures in Afghanistan are often so-called **natural pastures**, as opposed to improved or sown pastures as these are of less relevance here. ***Artemisia steppe*** is the most predominant grasland type because of the low precipitation in winter. Moreover, there are also high-quality pastures in the high mountain regions, albeit only for a very short season. In the eastern monsoon regions, where there is adequate rainfall, the grasses *Cymbopogon, Chrysopogon, Heteropogon* and *Aristida* form the main grasslands, often in association with *Acacia modesta* and *Olea cuspidata*. In the northern plains, the leguminous sub-shrub *Alhagi* provides useful browsing for small stock and camels. *Alhagi* is, for instance, also made into hay in Balkh Province (Thieme et al. 2006).

In mixed farming systems, **crop residues**, cultivated **fodder**, **(palatable) weed** species and **fodder trees** play an important role alongside grazing, and are usually grown or collected near the homestead. Straw from wheat and to a lesser extent from barley are the main roughages for winter feeding in Afghanistan. The haulms of pulses including grams, lentils, peas and groundnuts are other crop residues used to feed livestock. Lucerne is the most widely sown fodder, even though it requires irrigation. Shaftal, vetch, grass pea and clover are other plants cultivated for fodder in Afghanistan. Weeds around the homestead are also suitable for feeding stock, and farmers cut or uproot them to feed their livestock. Common trees for the cultivation of fodder include mulberry (*Morus serrata and M. alba*), willow (*Salix spp.*), poplar (*Populus spp.*) and Russian olive (*Elaeagnus spp.*). On the hillsides, where soil moisture levels are better, oaks (*Quercus spp*.) and olive trees (*Olea cuspidata*) are grown and browsed by stock (Thieme et al. 2006).

However, adequate animal quality feed and fodder is a major challenge in Afghanistan, and it is difficult to meet livestock's energy and protein requirements all year round. Winter feeding is one of the greatest challenges for ruminants in the country.

Feed requirement

Ruminants' feed requirements vary according to their bodyweight, production stage and also the functions they perform. The maintenance ration is the nutrient level a ruminant needs based on bodyweight and type. Additional rations are required during different stages of production: gestation (early and late pregnancy), lactation, breeding, animal traction or during increased performance such as drought. The ration also varies with regard to the development stage, and the requirement is higher in the first years of life. **Poultry** rations are classified separately for chicks, growers, layers and broilers, or for chicks, pullets and adult birds in case of backyard poultry.

Nutrient limitations

The limiting factors in the feeding strategy are energy and protein. Low **energy** affects performance more than any other nutritional deficiency, and its requirements depend on the stage of production. For **ruminants** adequate amounts of energy are extremely important during late gestation and early lactation. Moreover,

energy shortages are often complicated by protein or mineral deficiencies. Energy needs can generally be met by feeding good-quality pasture, tree leaves, hay or silage. Additional energy is generally needed immediately before and after calving/kidding/lambing. When supplementation is necessary, cereal by-products such as barley, corn, wheat bran, oats and molasses are used to boost energy levels. For **poultry,** layers require high energy feed to maintain egg production. The diagram provided in Figure 1 presented below shows the key aspects of a feeding strategy.

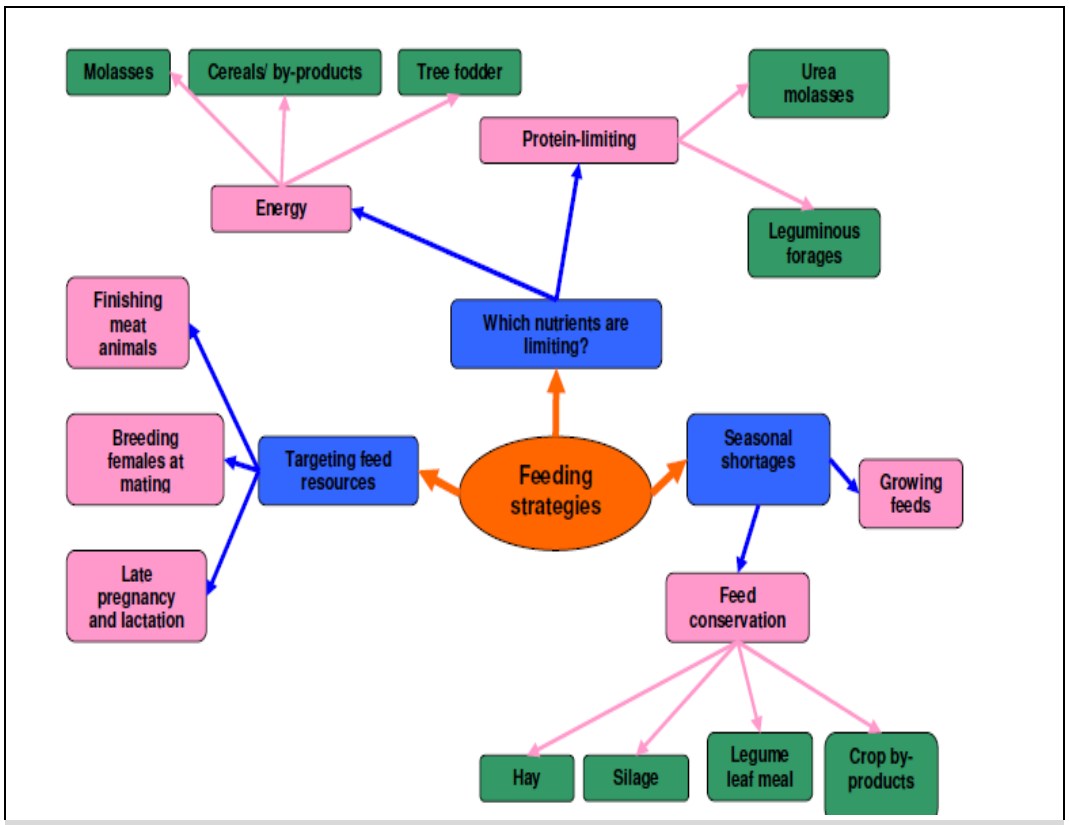

Figure 1: Feeding strategies consider the stages of production, the limiting nutrient and seasonal shortages (Yami et al. 2008).

In most situations, the amount of **protein** supplied in the diet is more critical than protein quality. **Ruminants** have the ability to convert low quality protein sources into high quality proteins through bacterial action. Microbial protein synthesis is sufficient to supply the ruminant protein needs, provided that adequate precursors are available, except during lactation in high milk-producing ewes and in very young lambs, when rumen activity is limited. When they make up the entire diet, green pastures will provide adequate protein for most types of ruminant. During the dry period, when green fodder is not available, and when grass hay or high grain rations are fed, additional protein may have to be provided by feeding urea molasses and high-quality leguminous forages. Particularly in the case of **poultry**, chicks and growers need high-protein feed. Growing maggots on animal waste is an excellent small-scale source of protein, for example maggot-growing as animal feed (see: http://jresearchbiology.com/documents/RA0374.pdf).

Feed shortages

Seasonal variations in feed resources is a common phenomenon across Afghanistan. Some common techniques for addressing seasonal shortages are preserving surplus feed in the flush season for use during times of scarcity so as to ensure year-around feed availability. **Hay and silage making** are two practices that preserve surplus fodder for use during the deficit period. Lucerne is very often grown as a cover crop in orchards or vineyards in Kandahar, for example. Lucerne is both fed fresh and conserved as hay to supplement crop residues in winter. There is also a practice of using **standing hay** (leaving part of the range as a reserve for barren periods; these dried up grasses are then called ‘standing hay’).

Sustainable feeding strategies

Agroforestry with tree legumes

One sustainable feeding strategy is to develop agroforestry systems with leguminous fodder trees or dual-purpose trees. Leguminous trees fix nitrogen and improve soil fertility. Agroforestry also has many other benefits for farming systems. There are different ways to introduce and promote tree legumes in a farming system, such as alley farming, hedgerows, a fence line around the homestead or along the borders of a cultivated field or as a fodder bank. Both, black locust (*Robinia pseudoacacia*) and Russian olive (*Elaeagnus latifolia*) are promising fodder trees for all the regions of Afghanistan, as well as having the ability to fix nitrogen. (USDA&UC Davis

2013). One can search the Agroforestre Database of the World Agroforestry Centre (http://www.worldagroforestry.org/resources/databases/agroforestree) for trees in Afghanistan - for instance trees to improve soil fertility, trees as a source of fodder, etc. As it covers Afghanistan, one can read that there are for instance ten native fodder tree species, namely *Calotropis procera*, *Dalbergia sissoo*, *Hardwickia binata*, *Mallotus philippensis*, *Prosopis cineraria*, *Punica granatum*, *Quercus floribunda, Quercus semecarpifolia*, *Ziziphus mauritiana* and *Zizyphus nummularia*.

Box 1: Integrating forage legumes into a farming system

Crop mixtures/crop rotation: All kinds of intercropping, e.g. undersowing a cereal with a compatible legume. This practice has the advantage of increasing the nutritive value and the overall yield (grain, crop residue and legume) while also enriching the soil.

Orchards: Orchard intercropping with fodder crops is common practice in Afghanistan in newly established orchards. As a perennial, lucerne is the favoured fodder rather than clover. The beneficial effects of a fodder intercrop include: protection of the soil and weed control during the early years when the trees are small; soil enrichment as a consequence of nitrogen fixation; and biological pest control (lucerne is an alternative host to some predators of orchard pests).

Source: Thieme et al. 2006

Sowing forage legumes

The introduction of fodder legumes into the farming system is not only a sustainable but also a traditional strategy in Afghanistan. Fodder legumes can be fed fresh or made into hay to support winter feeding. Lucerne (*Medicago sativa*) is the most widespread fodder, but it needs substantial irrigation and has a reputation as an inefficient crop in terms of water use (*crop per drop of water*). Persian clover (*Trifolium resupinatum*) is grown in winter and gives two hay cuts in spring. Vetch (*Vicia spp.*) and grass pea (*Lathyrus sativus*) are cultivated in high-altitude areas under rainfed conditions. Egyptian clover (*T. alexandrinum*) is cultivated in the Eastern Regions, but it cannot be made into hay (Thieme et al. 2006). Moreover, crop residues from legumes cultivated for human consumption - beans, chickpeas, field peas, lentils, mung beans, etc. - can also be used to feed livestock as fresh leaves, hay or straw. (USDA&UC Davis 2013)

Agro-industrial by-products

The waste from processing pulses, cereals, oil seeds, cotton seeds, citrus, etc. are categorised as agro-industrial by-products. These agro-industrial by-products, which are rich in digestible nutrients, are good animal feeds. For example, cotton seed cake is excellent feed for sheep to address protein deficiencies in winter.

Thinning and leaf stripping

Thinning and leaf stripping from cereals such as maize and sorghum is widely practised in eastern Ethiopia to increase fodder resources. Maize crops are sown very densely and later thinned and used for feeding livestock. This practice is also widespread in the Himalayas and Hindu Kush region, which encompasses parts of Pakistan, India and Nepal (Thieme et al. 2006).

Dual-purpose crops

Dual-purpose crops are crops which are grazed in an early stage of development with minimal effects on the later grain yield. Wheat and barley are both dual-purpose crops. However, dual-purpose cropping is risky in dry regions with poor water retention and water shortages towards the end of crop development (GRDC, 2009).

Mulberry-fruit-based feed blocks

Mulberry-fruit-based feed blocks are a feed supplement for livestock in mountainous regions. A feed block contains fresh mulberry, urea, lime powder minerals, salt and wheat barn. These feed-blocks are an ecofriendly technology and can be developed as a micro-business, especially in areas containing large numbers of mulberry trees (Habib, 2004). This actually provides business opportunities for women, as it can be prepared at household level.

Fodder banks

Fodder banks address the problem of feed scarcity in winter. Fodder banks are in principle based on plantings of high-quality fodder species which meet the forage needs in the dry seasons. In Bamyan MAIL established a fodder bank to support winter feeding. The fodder bank is organised as a cooperative and purchases animal feed in summer when prices of feed are low and stores the feed for the winter months. Fodder banks increase the availability of animal feed during winter at affortable prices, and also offer new business ideas in the field of animal feeding (see: http://asia.ifad.org/web/afghanistan).

Hay storage

Haymaking is the cutting of green forage, which is then dried and stored to feed animals in fodder-deficit times. By contrast, straw is matured and dried in the field before harvest. In Afghanistan, hay is crucial to supplement winter feeding, and is often from irrigated forage legumes such as lucerne and shaftal. In the north of Afghanistan hay is usally made from *Alhagi spp.* The biggest problem is leaf loss through shattering. The crop is mown and left to wilt, but is removed from the field and dried elsewhere, either in swaths or in trusses. Moreover, drying has to be done properly by exposing the cut forage to the sun on the ground and by turning it over regularly to aerate it. It usually requires two to three days in the sun to dry. When storing hay it is important to keep it dry, thus in areas with rain/snowfall hay should be covered (see: http://teca.fao.org/read/3579).

Figure 2: Farmer in Bamyan in front of his stored hay for the winter

Silage-making

Silage is fermented fodder which is stored with a high moisture content. This ensures that losses of dry matter and nutritional value are kept to a minimum. Silage is perfect for feeding animals during fodder-deficit seasons. Silage production involves a fermenation process in airtight conditions, which can be achieved by storing it in silos or pits in the ground (see: http://teca.fao.org/read/3579). In Bhutan, willow silage is increasinlgy used as winter fodder. Willow twigs and leaves are evently laid in a pit lined with polythene sheeting before being covered to protect it from the sun and the rain. After one month it is ready to use as an alternative winter fodder (see: http://sapplpp.org/files-repository/goodpractices/BHGP13-PotentialGPNote.pdf).

In both cases, the stage at which the grass is cut (ideally, just before full flowering) determines the quality of the end product, hay and/or silage.

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