Animal Production from Rangelands in Yemen

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Yemen is situated between latitude 12° and 18° north and longitude 42° and 46° east in the southwest corner of the Arabian peninsula (Fig. 1). The country covers an area of 20 million hectares and has 11 million inhabitants. Eight million hectares fall under the broad definition of rangeland, with an additional 2 million hectares being under cultivation (Abdulmalek et al. 1984).

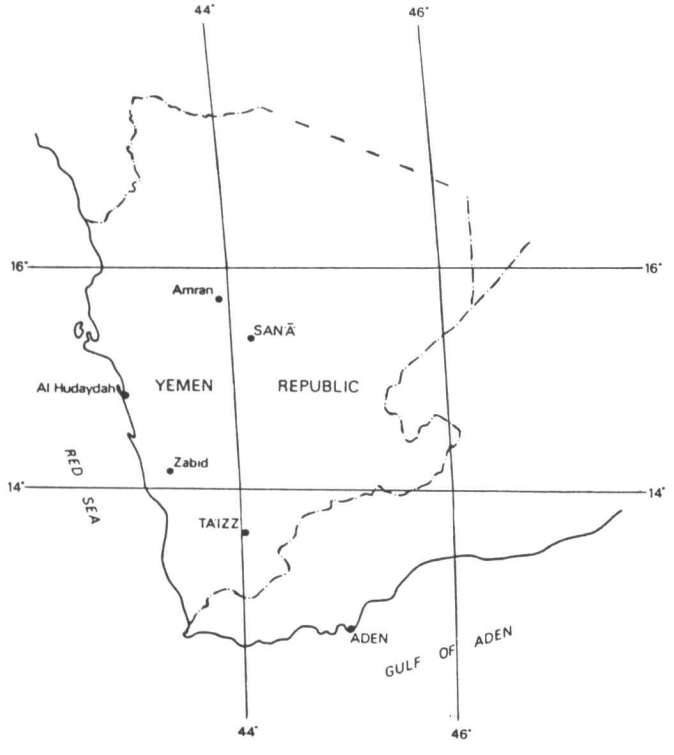

Fig. 1. *Geographic location of Yemen.*

Rangelands provide the basic feed resources for sheep and goats, which are the most important grazing livestock in Yemen. An average farmer owns mixed flocks of 10–150 sheep and goats, which are generally permitted on all rangelands despite the fact that most land is privately owned. By contrast, the farmer will have only 1–3 cattle, which are rarely allowed to graze. Croplands and arable fields are the only areas with restricted grazing. Even on some of these areas the grazing rights are sold.

Natural vegetation of much of the rangelands is in a degraded condition with regards to the floral composition, vegetation structure, and productivity. This is caused by the expanding human and animal populations increasing the use of rangelands. Other factors such as plant toxicity and mineral deficiency also decreased the value of rangelands as feed sources for grazing livestock. It is becoming increasingly necessary to restore rangelands and control the grazing of animals.

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Range Ecology and Management

Rangelands in Yemen may be classified broadly into three major geographic areas. The first is the central highlands at 1500–3700 meters above sea level, with an average rainfall of 600 mm. The rainfall increases slightly towards the west, whereas in the eastern part there is less reliable rainfall. The second is the coastal plains of Tihama in the west, with a strict tropical climate and an average rainfall of 200 mm. The third is the East desert with an average rainfall of less than 100 mm. This part of the country is considered the least important in terms of range and livestock production. The amounts of rainfall at different times of the year for each of the three rangeland areas are given in Figure 2.

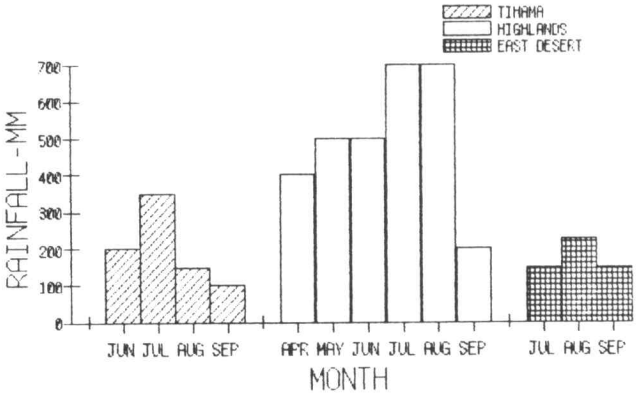

Fig. 2. *Amounts of rainfall (mm) at different times of the year for the main rangeland areas of Yemen (average of 5 years taken from 1985–1989).*

In the highlands, the mountain plains are considered the best for grazing. Here the vegetation consists mainly of grasses with relatively long periods of vegetation growth. The specific vegetation type varies with the amount of rainfall. In the western part of the central plains with relatively high rainfall, perennial grasses such as *Themeda triandra, Heteropogon contortus, Andropogon greenwayl, Eleusine floccifolia,* and *Elonurus muticus* are the most common species. Towards the east, where there is less rainfall, perennial grasses such as *Chrysopogon plumulosus, Aristida adscensionis, Enneapogon schimperianus,* and *Tetrapogon villosum* are commonly grown. In the high rainfall central-west areas the available standing biomass in rangelands is around 500 kg/ha. In the lower rainfall central-east areas the amount may decrease

to 400 kg/ha.

The mountain ranges are less favorable to grazing. Vegetation consists largely of unplatable shrubs and succulents. Species of perennial grasses such as *Microchloa indica* and *Pennisetum setaceum* may also be found. Mountain grazing is also tiring and risky for sheep because of the steep slopes and roughness of the terrain (Fig. 3). These ranges may only be used following a heavy rain when the flat plateaus are muddy, or early in the morning when grasses in the mountains are drier than those in flat areas which are covered with a heavy dew. Also, in cold or windy weather herders may go to the lee sides in the mountain for protection against adverse climatic conditions.

Fig. 3 *Mountain range in Yemen.*

In the coastal part of the country (Tihama), sparse species of drought-resistant perennial grasses such as *Hyparrhenia hirta, Chrysopogon plumulosus,* and *Tetrapogon villosum* occur to some extent. The vegetation cover also consists of annual grasses such as *Cynodon dactylon.* In addition, some dwarf shrub vegetation may occur. The available standing biomass in this area is around 100 kg/ha or less most of the year.

In the mountain plains the average digestiblity value of grazed rangelands is around 60%, and protein value ranges from 6% to 16% (Kessler 1987a). These values are considered high compared to areas with more tropical climates, such as the Tihama plains, where the average digestibility may drop to 30–40% and the protein content to 2%. The relatively high nutritive value of mountain plain vegetation is believed to be a result of low humidity and low temperature, which reduce the leaching of nutrients and lignification of plant materials (Chrowder and Cheda 1982).

Grazing animal obtain around 20–40% of their total feed requirements from rangelands where they follow an open range free-choice system. Feed requirements not provided by rangelands are obtained from other sources such as croplands and alfalfa fields. Croplands provide feed from crop failure, crop residues, and grasses grown in the borders of the croplands. Alfalfa fields are limited in number and are always visited as last grazing areas on a day to reduce the chances of bloat. Additional supplements consist of stover, alfalfa, and some agricultural by-products.

Factors Affecting Animal Production from Rangelands

1. Change of vegetation structure:

In many of the rangeland areas in Yemen, Kessler (1987b) estimated that the average sheep and goat density is over 14 per hectare. This value approaches the most densely stocked countries of the world. With this high stocking rate, the cover of perennial grasses decreases from overgrazing to be replaced by shrubs. In some locations in the mountain plains, overgrazing has led to significant spot grazing. Animals tend to graze the growth of previously grazed plants rather than the more mature vegetation, resulting in poor distribution of range forages. The collection of plants for medical purposes and for making hay and brooms have affected certain plant species, particularly in the more accessible ranges. Further, the increased construction of roads and tracks between villages has reduced the total range area available for grazing. Animals often exhibit low performance on rangelands because of low forage production.

2. Plant toxicity:

Shrubs are major sources of toxicity particularly in overgrazed areas where certain species are better adapted than the grasses to the environmental conditions in their areas. Weeds are also major sources of toxicity. Some species grow throughout the country, such as *Tribulus terrestris.* This contains steroides, which cause photosensitivity as a result of an accumulation of certain pigments under the skin. Other species, such as *Solanum nigrum* may be found in cropland areas. This weed contains solanine, which causes diarrhoea, gastric disturbance, and paralysis.

In the Tihama, drought may predispose animals to toxic plants by decreasing supplies of alternative feeds. An animal's susceptibility to toxins often occurs when animals are forced to eat rubbish as a feed alternative (Finch 1985).

3. Aphosphorosis:

Phosphorus deficiency is a common problem in grazing animals in Yemen. The continuous ingestion of forages that are phosphorus deficient inevitably leads to impaired health, fertility, growth, and milk production, Aphosphorosis is more prevalent in areas with high rainfall, where forage production is relatively high. By contrast, in areas with low rainfall phosphorus deficiency is unlikely to occur. Hunter and Heath (1982) reported that in parts of the central highlands with an average rainfall of

600 mm and total range forage production of 500 kg/ha, the phosphorus-deficient animals represent 35% of the total sample population. In the Tihama, however, where the average animal rainfall is around 200 mm and the total range forage production is less than 100 kg/ha, no animals were found to be phosphorus-deficient.

Range and Livestock Improvement Strategies

It has already been stated that most rangelands in Yemen are in a degraded condition and low in productivity. As a result, animal performance is low and they are prone to serious disease problems which restrict their production potential. The selection of appropriate grazing systems would be one step towards an improvement. This would improve the vegetation composition and give a more uniform distribution of range forages. Goodwen (1980) suggested the use of deferred grazing for this purpose.

Improvement of range vegetation may also be achieved by introducing new plant species which are productive, nutritious, and adaptable to the local environment. This should compensate for the limited number and the low nutritive value of local species, particularly in the coastal part of the country. Mufareh and Briede (1985) tested the production potential of imported various species of grasses and legumes over a 6-year period, including *Agropyron cristatum, Agropyron elongatum, Lolium multiflorum, Panicum coloratum, Panicum maximum, Trifolium elexandrium, Trifolium subterranium,* and *Medicago Lettoralis.* Results have been promising, but further work is needed to expand such trials all over the country. Efforts are also needed to identify, test, improve, and expand distribution of indigenous plant species adapted to the local environment.

The improvement of range forage production should alleviate the effects of heavy stocking rates. Toxicity problems could be alleviated with increased availability of grasses and legumes and less utilization of toxic shrubs or weeds. Even when ingesting toxic plants, animals would be better resistant to toxins when the supply of other other forages is abundant. Phosphorus deficiency may be corrected by proper supplementation. Increased use of cereal grains high in phosphorus and low in calcium content would balance the low phosphorus-high calcium feeds provided from rangelands.

Farmers may not always be aware of the scientific basis of nutrition, range management, or animal husbandry practices. Herein lies the importance of agricultural extension programs which help farmers to scientifically manage their animals and range resources. Although many extension centers have been established for this purpose in various parts of the country, the activities of these centers have not proved satsifactory. The lack of training provided to the extension agents and the shortage of materials and means of transporation have all restricted proper communication with farmers. With intensive extension programs involving widespread media such as radio and TV, it may be possible to efficiently transmit the extension messages and cover larger areas with problems of interest.

Summary and Conclusion

Both yield and quality of range vegetation vary from one part of Yemen to another depending on ecological factors. Generally, most rangelands are in a degraded condition because they are heavily overgrazed and intensively used by the human population. With such deterioration, animals perform less well and are prone to serious disease problems. Therefore, it is becoming necessary to restore rangelands and control grazing of animals. The selection of appropriate grazing systems, introduction of new plant species, and proper supplementation of range livestock are all needed to improve range conditions and maximize animal production from rangelands. Effective extension programs should also be conducted to help solve common problems of grzing livestock in Yemen.

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