Rangeland management and animal production sustainability under arid and semi arid conditions: Egypt overview

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Rangeland management and animal production sustainability under arid and semi arid conditions: Egypt overview

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Abstract. Livestock fodder needs in nearly all developing countries now exceed the sustainable yield of rangelands and other forage resources. In Africa, overgrazing has reduced range productivity virtually everywhere. It is important to provide animals with adequate nutrition to ensure the high productive and reproductive performance. Meanwhile, it is necessary to avoid the deterioration of the pastureland from the grazing pressure; some procedures should be carried out to ensure the integration and balancing of the bio-system elements such as determining the suitable carrying capacity and stocking rate of the rangeland, use of suitable grazing system, multi species grazing, optimizing pasture utilization and supplemental feeding.

Keywords. Rangeland management – Carrying capacity – Multi-species grazing – Alternative feeds – Supplemental feeding.

Gestion des parcours et durabilité de la production animale dans des conditions arides et semi-arides: Aperçu d'ensemble pour l'Égypte

Résumé. *Les besoins en fourrage pour l'élevage dépassent maintenant dans presque tous les pays en développement le rendement durable des parcours et des autres ressources fourragères. En Afrique, le surpâturage a réduit la productivité pratiquement partout. Il est important de fournir aux animaux les éléments nutritionnels appropriés pour assurer des performances productives et reproductives élevées. Pour éviter la détérioration des pâturages en raison de la pression de pâturage, d'autres procédures doivent être menées pour assurer l'intégration et l'équilibre des éléments du bio-système, comme la détermination de la capacité d'accueil adéquate et du taux de charge des pâturages, l'utilisation de systèmes de pâturage appropriés et du pâturage multi-espèces, l'optimisation de l'utilisation des pâturages et l'alimentation complémentaire.*

Mots-clés. *Gestion des parcours – Capacité de charge – Pâturage multi-espèces – Aliments alternatifs – Alimentation supplémentaire.*

I – Introduction

Rangelands, consisting almost entirely of land that is too dry or too steeply sloping to support crop production, account for one fifth of the earth's land surface, more than double the area that is cropped. Tapping the productivity of this vast area depends on ruminant animals due to their ability on converting roughage to meat, milk, leather and wool. Grazing in semi-arid regions is characterized by strong feedback mechanisms between economic and ecological factors (Beukes *et al.*, 2002). Economic yield is directly linked to livestock number and hence to pasture condition while ecological resources are easily damaged by inappropriate use.

The contraction of rangeland areas, increased populations of pastoralists, the improved veterinary services, watering mismanagement and the lack of viable marketing systems, helped the rapid growth of animal numbers around the world (Widstrand, 1975) that led to increased overgrazing and accelerated desertification.

The successful livestock breeding operation depends mainly on the proper use of pasture. Producers must be familiar with the amount of dry matter forage the pasture can produce and

the amount of forage required over the grazing season by each animal and the herd as a whole. To sustain the long-term productivity of a pasture, the proper combination of land, time and number of animals should be chosen. The optimum number of animals on the pasture makes efficient use of the forage without waste, but still leaves enough forage to allow quick and complete recovery. Thus, the first step in determining how many animals can be supported on an available land area is to assess the pasture productivity and how much forage an animal needs.

II – Carrying capacity and stocking rate of a pasture

The successful livestock breeding operation depends mainly on the proper use of pasture. Producer must be familiar with the amount of dry matter forage the pasture can produce and the amount of forage required over the grazing season by each animal and the herd as a whole. To sustain the long-term productivity of a pasture, the proper combination of land, time and number of animals should be chosen. The optimum number of animals on the pasture makes efficient use of the forage without waste, but still leaves enough forage to allow quick and complete recovery.

III – Use of suitable grazing system

A grazing system is a planned effort by rangeland managers to leave some grazing areas unused for at least part of the year. It is a powerful tool that can help rangeland and livestock managers to achieve management objectives related to range-land and livestock production (e.g., forage production, average daily gain), as well as those related to ecosystem structure (e.g., wildlife habitat) and function (e.g., erosion control, water quantity and quality). Selection of the proper grazing system depends on the uniformity of the circumstances in which it is applied (e.g., topography, soils, vegetation types, climate, etc.).

IV – Multi-species grazing

Grazing cattle, sheep, and goats together on a diverse pasture should result in all types of plants being eaten, thus controlling weeds and brush, while yielding more pounds of gain per acre compared to single-species grazing (Taylor, 1985). The addition of goats to cattle pastures has been shown to benefit the cattle by reducing browse plants and broad-leaved weeds. This permits more grass growth and controls many harmful plants. Adding one goat per cow to a pasture would not cause any reduction in cattle performance, and would control the weedy species and improve the carrying capacity of the pasture. Although sheep are less likely to clean up woody plants, they are effective at controlling other weeds, with proper stocking pressure.

Multi-species grazing may also avail pastures that are less diverse by encouraging more even grazing. Cattle will tend to graze taller grasses that sheep may reject. It has been shown that sheep graze near cattle manure deposits, which cattle avoid (Forbes and Hodgson, 1985); this results in more use of the pasture. Carrying capacity and pasture utilization are improved, and animal gains are also increased (Meyer and Harvey, 1985; Esmail, 1991). Multi-species grazing can improve pasture and animal production through the consumption of poisonous plants by a species that is not harmed by the toxins. (Taylor and Ralphs, 1992). Another profit of multi-species grazing is controlling parasites, which are a major concern with sheep and goats, under any system. Worm eggs are deposited on the pasture in the manure; the eggs hatch and larvae are consumed by grazing animals. If left untreated, concentrations of parasites will increase with time as this cycle is repeated. Higher concentrations of animals on a pasture may tend to magnify the infestation. Commercial livestock ranchers in the arid regions could increase livestock production without reducing numbers of cattle, sheep, or goats if camels were added

to their herds, because camels do not compete with other livestock species for forage. Camels possess a height advantage over other livestock where they can browse at 3.5 m above the ground (Morton, 1980); thus, they compete only with the giraffe for browse. This characteristic makes them excellent for multi-species herds composed of low browsing goats and grazing sheep and cattle. Evans and Powys (1979) reported that camels actually improved the rangeland through better brush control not obtainable with goats and cattle alone (Morton, 1980).

Opposite to camels, cattle, sheep, and goats do not have high ability to compensate the water lost in dehydration capability for rapid and complete dehydration and they are restricted, therefore, to graze closer to water. This situation leads to overgrazing, desertification, and high livestock mortality when numbers of these ruminants exceeds the carrying capacity of the surrounding rangeland (Giles, 1982). Camels are disease-tolerant, drought-tolerant, easily domesticated, and efficient converters of feed and water to meat, milk and hair. Therefore, the use of the dromedary camel as a source of revenue should permit the pastoralist and rancher to reduce their total dependence on higher risk livestock enterprises. All these reasons put camels in the spotlight when planning to rangelands managing strategies in the hot arid regions.

V – Optimizing the pasture utilization

The optimum usage of pasture may be achieved by several ways such as overcoming the presence of some antinutritional factors in forage plants and increasing its palatability. One of the major problems in the economic balance of the livestock breeders is feeding costs. In most of the arid and semi-arid regions, animal feed production is difficult and farmers purchase expensive concentrates. In these regions, browse species play a major role in providing feed for ruminants especially during the dry season when poor quality roughage prevail (Ben Salem *et al.*, 1996 and Priolo *et al.*, 1998). In many cases a problem in utilization of these alternative feeds is the presence of antinutritional factors such as condensed tannins (CT) and phenolic compounds found in many forage plants (Krebs *et al.*, 2003). Feeding on forage plants containing CT was reported to cause negative effects in animals (Priolo *et al.*, 2000) including reduced absorption of minerals (Waghorn *et al.*, 1994), rumen protein utilisation (Barry and Duncan, 1984), voluntary intake (Reed, 1995), microbial activity in the rumen (Nuñez-Hernandez *et al*., 1991) and damage of kidney and liver (Kumar and Singh, 1984). In rumen, CT bind with plant proteins, reducing their availability for rumen microflora and the host animal resulting in reduction of the rate and extent of fiber digestibility, voluntary intake, metabolic energy and amino acid (AA) absorption. Barry (1985) reported that at higher concentration of CT, wool production was depressed. Decandia *et al*. (2000) reported a decrease in milk yield and milk urea but not in milk fat and protein percentage in goats browsing on shrubs contain relatively high levels of CT. Terrill *et al*. (1992) found a reduction in carcass fat content in lambs grazing on pasture plants with high content of CT.

A number of methods of detannification have been investigated but widespread application of some of these methods has often been hindered by practical limitations or economic viability (Miller *et al*., 1997). Incorporation with Polyethylene glycol (PEG) has been widely used in the studies of tannin-rich forages. PEG has been applied by spraying onto tannin-rich browse, infusion into the rumen and by oral drenches (Ben Salem *et al*., 1999). Positive responses to supplementation with PEG, including increased dry matter intake, digestibility, wool growth and live weight gain have been shown in numerous studies involved tannin-rich species (Degen *et al*., 1998). Pre-treatment with chemicals such as urea (Bhakt *et al*., 1993); Ferric chloride (FeCl) (Hagerman and Butler, 1989); Ferric sulfate ($FeSO_4$) and many organic solvent (Makkar and Singh, 1992) decreased significantly tannins levels in treated feedstuffs. However, cost and labour requirements make their use impractical or uneconomic. Field drying (Terrill *et al*., 1989) or oven drying (Ahn *et al*.,1989) were found to decrease CT concentration in forage plants. The initial moisture levels in the leaves and the different chemical nature of tannins play an

important role in the success of this technique (Makkar and Singh, 1991). Field drying of *Acacia saligna*, compared with fresh foliage, increased the DMI of *Acacia saligna* by sheep. However, it did not significantly affect digestibility or ruminal fermentation (Ben Salem *et al*., 1999). Terrill *et al*. (1989) observed that field drying of high-tannin Lespedeza cuneata decreased its assayable tannin concentration, resulting in improved intake and increased N and fiber digestibility. A series of studies were conducted at the Desert Research Center (Ministry of Agriculture, Egypt) on increasing the utilization and consumption (palatability) of halophytic plants as sheep fodder (El Shaer and Ismail, 2002 and Abd El-Rahman, 2003). The results of these studies indicated a significant effect of ensiling process on lowering the level of CT in *Acacia saligna* and *Atriplex nummularia*.

VI – Supplemental feeding

The intensification of ruminant production systems demands the introduction of high-producing breeds and a better quality of feeds (Teferedegne, 2000). Lack of adequate nutrition all year round is one of the major causes of the low productivity of ruminants in Sub-Saharan Africa (Osuji *et al*., 1995). These information indicate the need of profiting from untraditional feed stuffs (crop residuals and by products) and to conserve forage as supplemental feed in the critical periods of range resting or drought. Supplemental feeding can have the next most important impact on animal production after grazing management. It could provide a good chance to the complete restoration for enough rest periods for rangelands, thereby helping to prevent overgrazing and subsequent degradation. The balance between nitrogen and carbohydrates should be concerned when supplemented feed offers to grazing animals (Gerrish and Morrow, 1998). The residuals of cultivated crops and by products could be used to sustain animals during the rangelands rest periods either by direct grazing or after being harvested and stored in hay or silage forms. Improving harvesting and storage of crop residues is required to increase its usage efficiency in managed feeding programs. Furthermore, developing some treatments of crop residuals is needed to improve its quality and intake. Ensilage of different crops, mixed crops, natural pastures and by-products may enhance the opportunities of sustaining the domesticated livestock in the arid and semi arid areas (Taha *et al*., 2009).

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