International Journal of Advanced Research in Arts, Science, Engineering & Management (IJARASEM)

| ISSN: 2395-7852 | www.ijarasem.com | Bimonthly, Peer Reviewed & Referred Journal |

| Volume 4, Issue 5, September 2017 |

Estimation of Fodder Value of Halophytic Plant Species of Sariska Region Through Nutrient Analysis

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ABSTRACT: It is the chemical composition of the halophyte forages and the digestion process of these forages that matter. As the science gets more advanced and the information about these two points becomes clearer, the view of this information might modify our understanding to these processes. Then, some topics might be dropped, and others might be raised or become more obvious. However, the feeding of halophyte forages as per se has several drawbacks and therefore, they have to be fed in mixed rations, fortifying these rations with energy supplements.

KEYWORDS: halophytes, Sariska, Rajasthan, taxonomic, plants, feeding, fodder, supplements

I.INTRODUCTION

Fodder Halophytes in Sariska, Rajasthan, are not a distinct taxonomic group. Halophytes are several species of trees, shrubs, forbs and grasses. They fall into various taxonomic groups, and their life form spectrum exhibits a wide range of variation. When salt tolerant plants are included, the number of halophytes increases significantly. It was estimated [1] that the flowering plants are about to be 350 families of which one-third is halophyte forages. It was found [2] that 50% of the genera belong to 20 of these families. It is concluded, then, that the halophyte forages do not constitute a family per se but they are widely distributed within different families of flowering plants. The fact that the limited number of halophytic species is spread among so many different families indicates that halophytism, even though a trait controlled by several genes, is not such a complex characteristic that only arose once during evolution. The word halophyte, then, does not imply any reference to being a particular taxon or any specific geographic or physiogeographic area [3].Nature and ecology of halophytes are very complex [4]. They do not necessarily need salinity to grow. Halophytes survive salt concentrations around 200 mM NaCl or more in order to reproduce in environments where they constitute about 1% of the world's flora [5].It is estimated that 7–10% of the world land area is salt affected [6]. Salt-affected soils happen to occur in all over the world and almost under all climatic conditions. Their distribution, however, is relatively more extensive in the arid and semi-arid regions compared to the humid regions.The natural resources in Rajasthan have been diminishing because of increased demands. The increased population and the decline of the arable lands make it inevitable to utilize marginal and long-neglected natural resources and re-assess them in preparation for utilization. Halophyte plants are widely distributed throughout several regions of Mangroves of Rajasthan due to the presence of numerous saline areas along the Mediterranean Sea and Red Sea shores and inlands (littoral salt marshes and inland salt marshes). The less and unpalatable plant species represent approximately 70% of the total coverage. FAO [7] has estimated that salt-affected soil area mangrove Rajasthan is about 7360 (ha). The arid climate is characterized by high evaporation rates (1500–2400 mm/year), and a little rainfall (5–200 mm/year), which may add up to the existing salt affected soils.Main causes of salinity development are irrigation with saline water; disturbance of the water balance between rainfall, on the one hand, and streamflow, groundwater level, and evapotranspiration, on the other; overgrazing, and cutting bushes; water percolation through saline materials; and intrusion of seawater [8].

Halophytes can grow naturally or be planted. The biomass production and quality of the natural vegetation of halophytes in such areas vary considerably from season to season and from area to area depending on several factors, mainly environmental ones. In almost any forage populations, of a given species of a browse, there are various degrees of palatability from one plant to the other.Suppressed growth[9,10] of field crops is a direct result of the presence of salt in soils and the irrigation with saline waters. Therefore, the yield of these mangrove crops is affected dramatically where the expected yield relates to the plant species and salt concentrations either in soil or irrigation water. The studies to estimate the yield potential of halophyte forages were carried out on a laboratory scale. Very few studies were performed in the field. It was found that some halophyte fodder like some species of Atriplex (e.g., A. nummularia, A. griffithii and A. hortensis) could tolerate high concentration of salt. It was found [9] that optimal growth of such species would be at 5–10 g/l^{-1} NaCl. The estimated yield value of A. leucoclada in the high salinity experimental site was 3735 kg fresh weight and 2058 kg of dry weight [10]. Some species of Atriplex yielded 1.26–2.09 kg/m2 dry matter, 15.5–39.5% crude fiber and 10.2–19.5% crude protein [11,12].Kochia indica was found [12] to produce fresh biomass of 8.5 kg per bush from March through August in India. Table 1 represents some information gathered [13] concerning the yield of some halophytic forages grown under high salt effects. However, the estimated yield of halophytic forages reaches about 4–5 billion tons [14] resulting from 450 million hectares in the world according to FAO.[13]

Plant species	**Salt concentration (mM)**	**Yield (kg m^{-2} year $^{-1}$)**
Aster tripolium	40	14.0 (fresh weight basis)
Atriplex lentiformis	500	1.8 (dry weight basis)
Atriplex triangularis	150	21.3 (fresh weight basis)
Batis maritima	500	1.7 (dry weight basis)
Salicornia europaea	500	1.5 (dry weight basis)
Salicornia persica	100	15.0 (fresh weight basis)
Sarcocornia fruticosa	100	28.0 (fresh weight basis)

II.RESULTS & DISCUSSION

The quality might be the extent to which a halophytic or salt tolerant plant, as forage, has the potentiality to reach the required animal response. The quality of fodder halophytes as forage varies greatly among and within each crop. In order to determine fodder quality, different issues have to be taken into consideration.[14,15]The factors that affect forage quality include palatability, nutrient contents (chemical compositions), plant secondary metabolites [15], feeding value (voluntary animal intake, nutrient digestibility), and eventually animal performance. Analyzing fodder for nutrient content (chemical compositions) can be used to determine the quality of forage if it is adequate to meet the animal requirements and to be used for proper ration supplementation. Limitations of halophytic fodder as feeds for animals (i.e., accounting for non-protein nitrogen and non-nutritional components) could represent a problem in formulating rations. He also referred to the palatability issues of the halophytic fodder as important factors in determining the acceptability of these fodder by animals and to which extent they might be consumed. The other factors that assess the quality of these fodder (like an assessment of feeding and nutritional values) might be looked upon after the issues of palatability are addressed.[16,17]

The definition of palatability has been an argument. Regardless of the scientific controversy over this issue, the most agreed upon is that palatability of a feed is the ration between the consumed and offered amounts of feed by any class of herbivores animals on a given time [17, 18]. The palatability and feeding values of individual halophytes or any other types of rangelands vary widely from virtually zero to very high. In almost any forage populations, of a given species of a browse, there are various degrees of palatability from one plant to the other. Palatability depends (among other factors) on the relative abundance of the species on the rangeland. Considering all other conditions being equal, the palatability of a given plant is inversely related to its profusion on the range.[18,19]

Animal species	**Plant species**
Sheep, goats	*Alhagi maurorum*
Camels	*Arhthrocenemon glaucum*
All species	*Atriplex halimus*
Sheep, goats	*Atriplex leucoclada*
All species	*Atriplex nummularia*
Camels	*Halocnemom strobilaceum*
Nil	*Haloxylon salicornicum*
All species	*Juncus acutus*
All species	*Nitraria retusa*
Camels	*Salicornia fruticosa*
All species	*Salsola tetrandra*
All species	*Suaeda fruticosa*
All species	*Limoniastrum monopetalum*

Animal species	Plant species
Goats, camels	*Tamarix aphylla*
All species	*Tamarix mannifera*
Nil	*Zygophyllum album*
Camels	*Zygophyllum simplex*
Camels, goats	*Zygophyllum decumbens*

III.CONCLUSIONS

Natural resources have been diminishing because of increased human pressure. This pressure results from the ever-increasing population of the world. Inevitably, under current and predicted future conditions marginal resources and long-neglected natural resources such as halophytic plants have to be re-assessed[20,21] in preparation for future utilization. Shortage of animal fodder is one of the main constraints of indigenous animal production on salt affected soils of arid and semi-arid regions and limits its expansion. Animal husbandry, as the main income resource for nomads, is based mostly on the natural vegetation for feeding sheep, goats and other herbivores.

The way in which halophytes are used depends very much on the nature of the community that dominates their ecosystem. Evaluation of the possible contribution of halophytes to the economic well-being of the local nomadic communities depends on the understanding of the economy, agrobiology, and ecology of the forage plants and the knowledge of the carrying capacity of the grazing animals. Halophytic plants have long been ignored and viewed as marginal resources.[22,23]

The use of halophytes for animal feed has several constraints that must be dealt with, on a rational exploratory and experimental basis. The high content of mineral ash, the presence of plant secondary metabolites and the low nitrogen content are examples of the constraints that face animal nutritionists. Little was done in the exploration of the richness of various halophytic species for the purpose of selection of halophytes of high quality for grazing.

Most of the halophytes contain secondary metabolites (tannins, glucosides, flavonoids, alkaloids, terpenoids, cyanides, coumarin, nitrate, oxalate and organic acids). There are many plants capable of producing toxic metabolites including palatable plants . For example, Nitraria retusa one of the most palatable grazed halophytic shrub in Egypt contained different proportions of crude alkaloids, saponins in addition to tannins and sterols .

Harmful effects of plant secondary metabolites cause great economic losses to livestock producers. However, ruminants are more tolerant to poisonous plants than non-ruminants. Even among ruminants, there are striking differences in tolerance of plant toxicants. In ruminants, tolerance of poisonous plants may be modified by microbial fermentation of ingesta in the reticulorumen, which can diminish toxicity of some plants compounds and increase the toxicity of other. Some plant compounds may be biotransformed within tissues of the host ruminant yielding products that are more toxic or less toxic than the plant compound ingested [24] Ruminants may convert a toxic substance to another toxic one (cyanide to thiocyanate, which is goitrogenic) [23,24] They also may detoxify some substances with a concurrent loss of some nutrients . Methods of overcoming these constraints may include cooking, germination. The effectiveness of these methods differs from one another. On the other hand, some methods (like steam treatment) may improve the nutritive values of halophytes by increasing the accessibility of nutrients. Steam can break down plant secondary metabolites to some extent and may make fat more available.

Plant secondary metabolites in fodder	Impact on animal	Methods to relief
Phenolic compounds	Affect rumen fermentation	PEG Physical treatment Silage
Glycosides: 1. Saponins	Bloat inhibit microbial fermentation Formation of calcium salt	Repeated washing with water Ensiling or wilting in the field

Plant secondary metabolites in fodder	Impact on animal	Methods to relief
	Decrease growth rate	
2. Cyanogens	Animal death due to its harmful on hemoglobin	Add methionine to animal diet (sulfur combines with cyanide to form thiocyanate (non-toxic) Sun drying
3. Goitergens	Enlargement of thyroid gland Rapid decline in serum thyroxine, Decreased intake Prolonged feeding has produced hair loss, excessive salivation and esophageal lesions	Broken down in the rumen by rumen bacteria
Alkaloids	Ataxia Diarrhea Decrease animal performance	Air drying Ensiling
Nitrates	inhibition of cellulose digestion Combines with hemoglobin, thus reducing the oxygen High nitrates cause abortion in livestock	Add grains and vitamin A to the diet Mechanical treatment Add more soluble CHO to increase microbial nitrogen requirements
Oxalate	Excess oxalate may result in fatal intoxication with hypocalcaemia, metabolic disturbances and kidney failure May result in fatal intoxication with hypocalcaemia, metabolic disturbances and kidney failure Kidney failure due to the accumulation of oxalate crystals	Animal adaptation because rumen bacteria can degrade it
Phytates	Hypomagnesima (low WBC) Milk fever (decreased Ca & P)	Mineral balance Vitamin D injection
Tannins	Reduced voluntary feed intake Reduced digestibility of protein and carbohydrate through the inhibition of digestive enzymes May reduce bacterial enzymes Tannins/protein complex that survives in the ruminal environmental may not be digested in the lower tract	Add PEG

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