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Wild halophyte plants as potential fodder resource under extreme saline environment of Kachchh, Gujarat, India

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Introduction

Rann of Kachchh in North West India is a unique saline marshy desert. It is described as "a desolate area of unrelieved, sun-baked saline clay desert, shimmering with the images of a perpetual mirage"(Mountfort *et al.*, 1991) and is regarded as the largest salt desert in the world. In the Indian part it stretches in 7505.22 sq. km known as Great Rann and 4,953 sq. km known as Little Rann. The Ranns turns into marshy land by inundated water from runoff during monsoonal rainfall and water driven by forces of winds and tides from Arabian Sea making the area unapproachable especially during June to September and in reminder of months the area remain as a hyper saline desert. Even at these extreme saline conditions certain halophytic plants come up from the native seed bank/ roots once the water gets evaporated as these plants possess some mechanisms to survive salinity even higher than that of sea water (Goswami *et al.*, 2014). Some of these plants are grazed by livestock of the area. Due to uncontrolled grazing by ever increasing livestock population and increasing demand for fuel wood, in these deserts the natural diversity of these halophytes are at stake (Arndt *et al.*, 2004). Information on the diversity of halophytes in the hyper saline desert in relation to varying degree of salinization is not available. Therefore the present study was undertaken to study the distribution of halophyte grasses and non-grasses in Great Rann of Kachchh and their usefulness as fodder resource.

Materials and Methods

Field visits were carried out throughout Great Rann of Kachchh during November 2014. In total 11 sites were selected for study based on survey at 10 km interval. Standard quadrate method was used to sample and identify plants. Soil samples were collected from four different depths (0-5, 0-15, 15-30 and 30-45 cm) at each location and analysed for pH, electrical conductivity, organic carbon and soluble ions. The plant density was calculated and fodder quality was assessed by using standard methods.

Results and Discussion

Soil pH at upper 5 cm ranged from 7.73 to 9.23. Soil pH generally increased down the profile to a depth of 45 cm and highest surface pH (8.3) was noticed in site 7. The soils were low in organic carbon content (0.02 to 0.28% at top 5 cm layer). Electrical conductivity generally increased with site proceeding to India Bridge and ranged from 0.14 to 94.77 dSm^{-1}. The soluble cations followed the order Na>Ca>Mg>K. Chloride was the dominant cation followed by sulphate.

Total of 13 grass species, along with 55 non grass halophytes were identified and collected from different study sites. From site 1, total 45 species of halophytes were observed, with 24 non grasses, 2 sedges and 9 grass halophytes. Some common plants of first site were *Abutilon indicum* L., *Chloris barbata* L.and *Dichanthium annulatum* L. In case of site 2, 11 species were observed with 5 grasses, 2 non grasses. Site 2 was dominated by *Aeluropus lagopoides* L. (Trin), and *Suaeda nudiflora* (Wild.) Moq along with three species of *Cenchrus* namely *Cenchrus ciliaris* L., *Cenchrus setigerus* L. and *Cenchrus biflorus* L. At site 2, *Aeluropus lagopoides* L. (Trin) recorded density of 1.7 m^{-2}, *Cressa cretica* L. 140.4 m^{-2} and *Suaeda nudiflora* (Wild.) Moq 7.4 m^{-2}. Dominant species in site 3 and 4 were, *Aeluropus lagopoides* L. (Trin) (density of 33.7 and 33.8 m^{-2} respectively), *Cressa cretica* L. (46.8 and 52.7 m^{-2}) and *Suaeda nudiflora* (Wild.) Moq (2.5 and 3.3 m^{-2})**.** At site 5 the dominant plants were *Cressa cretica* L. (120.9 m^{-2}) and *Suaeda nudiflora* (Wild.) Moq (1.3 m^{-2}). Major halophytes noticed at site 6 m were *Cressa cretica* L. (100 m^{-2}), *Suaeda nudiflora* (Wild.) Moq (1.56 m^{-2}) and *Aeluropus lagopoides* L. (Trin) (0.22 m^{-2}). Site 7 had an EC value of 69.7 dSm^{-1}, where *Urochondra setulosa* (Trin) C.E.with a density of 5.44 plant m^{-2} was observed. The dominant species at sites 8 to 11 were *Suaeda nudiflora* (Wild.) Moq, *Aeluropus lagopoides* L. (Trin), and *Cressa cretica* L. At site 8, *Aeluropus lagopoides* L. (Trin) was dominant with highest density of 8.4 plants m^{-2} followed by *Tamarix gallica* L. with density value of 0.45 plants m^{-2}. At the same site

density of *Cressa cretica* L. and *Suaeda nudiflora* (Wild.) Moq were 0.33 and 0.12 plants m^{-2} respectively. At site 9, *Aristida* sp. showed maximum density with value of 1.83 plants m^{-2} followed by *Aeluropus lagopoides* L. (Trin) with value of 1.70 plants m^{-2} and *Suaeda nudiflora* (Wild.) Moq showed a density of 1.2 plants m^{-2}. At site 10 and 11, density of *Aeluropus lagopoides* L. (Trin) increased with values of 16.6 for site 10 and 7.7 plants m^{-2} for site 11 respectively. In general the dominant species of the study area were *Suaeda nudiflora* (Wild.) Moq.,*Aeluropus lagopoides* L. (Trin), *Cressa cretica* L., *Cyperus* sp., *Prosopis juliflora* L., *Salvadora persica* L. and *Salvadora oleoides* L.

The salinitywise distribution of halophytes indicated that Aeluropus was widely distributed whereas Sporobolus was observed upto medium salinity conditions. Non grass halophytes such as Suaeda and Cressa were widely distributed throughout Rann of Kachchh. Urochondra was observed only at areas of higher salinity.

Most of halophytic forages contained moderate amounts of crude protein (5.1 to 14.1%) which it seems fair enough to meet the nitrogen requirements of grazing animals. They also contained high levels of fibre and ash contents, which could limit intake, and digestibility of such forages. Wide variation in composition nutritional quality factors exists between sampling dates and also between sites.

Table 1: Details of sampling locations and soil properties

Site no.	Latitude (N)	Longitude (E)	pH (1:2) 0-15 cm	EC (dSm-1) 0-15 cm	OC (%) 0-15 cm
1	230 25’ 58.1’’	690 39’ 42.4’’	7.88±.04	0.15±0.02	0.19±.01
2	230 30’ 22.6’’	690 35’ 43.2’’	8.06±0.09	2.69±0.34	0.24±0.01
3	230 35’ 5.6’’	690 40’ 10.3’’	8.32±0.06	27.74±0.71	0.12±0.02
4	230 41’ 25.9’’	690 42’ 50.2’’	9.07±0.37	0.57±0.04	0.02±0.01
5	230 58’ 58.5’’	690 44’ 44.2’’	8.24±0.03	1.10±0.18	0.15±0.02
6	230 58’ 25.7’’	690 44’ 33.0’’	8.14±0.01	83.06±2.76	0.26±0.03
7	230 30’ 41.8’’	69 39’ 21.9’’	7.85±0.11	6.79±0.33	0.17±0.02
8	230 32’ 3.1’’	690 38’ 41.7’’	7.66±0.09	4.32±0.04	0.16±0.01
9	230 34’ 6.2’’	69 34’ 32.5’’	8.00±0.05	11.25±0.6	0.08±0.01
10	230 31’ 8.1’’	690 34’ 6.6’’	7.79±0.04	21.92±1.5	0.10±0.02
11	230 48’ 47.6’’	690 30’ 48.5’’	8.47±0.25	12.05±0.90	0.22±0.01

Values are mean ± standard error

Conclusion

Various halophyte grasses and non-grasses grow under extreme saline conditions of Rann of Kachchh. The major halophytes observed were *Aeluropus lagopoides, Sporobolus marginatus, Urochondra setulosa, Suaeda nudiflora, Cressa cretica,*. These halophytes vary in their distribution with respect to salinity of soil. The soil salinity varied from 0.14 to 94.77 dSm^{-1}. The analysis of fodder quality of halophyte plants showed that they contain moderate amounts of crude protein to meet the nitrogen requirement of animals. The study indicates that these halophytes could serve as potential fodder resource especially in salt laden Rann areas.

References

Arndt, S. K., C. Arampatsis, A. Foetzki, X. Li, F. Zeng and X. Zhang. 2004. Contrasting patterns of leaf solute accumulation and salt adaptation in four phreatophytic desert plants in a hyperarid desert with saline groundwater. *Journal of Arid Environments* 59, 259-270.

Goswami, D., P. Dhandhukia, P. Patel and J. N. Thakker. 2014. Screening of PGPR from saline desert of Kutch: Growth promotion in Arachis hypogea by Bacillus licheniformis A2. *Microbiological Research* 169, 66-75.

Mountfort, G. R., G. S. Cubitt, M. Marel. 1991. Ongerept India: de biologische diversiteit van India en Nepal. M & P.

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