



## Effects of growth stages on forage quality indices in Arak saline rangelands

Seyed Mehdi Adnani<sup>1</sup>, Mohammad Reza Tatian<sup>2\*</sup>, Reza Tamartash<sup>3</sup>, Ehsan Zandi Esfahan<sup>4</sup>

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### Extended Abstract

**Introduction:** Halophytes are plants that can grow in saline habitats and tolerate salinity through various ecophysiological mechanisms. Halophytes, compared to palatable and class I species, have less palatability; however, they have unique features, including that these plants are able to grow in conditions where both water and soil are saline. In other words, because of high resistance to salinity, halophytes can complete their growth stages under conditions that other plants cannot withstand. On the other hand, these plants, in the autumn and winter, when most rangeland plants have disappeared, is an important food source for livestock grazing in fall and winter. Knowledge of forage quality of halophytes in saline lands and at each phenological stage is important in determining grazing capacity and grazing season as well as introducing superior species with a higher nutritional value to the beneficiaries in order to be used in haloculture programs. In the present study, the forage quality of three halophytes, growing in saline rangelands of Arak Meighan Desert, was compared at different phenological stages in order to identify the superior species to be used by the beneficiaries in the haloculture programs.

**Materials and methods:** Sampling were performed inside the key areas of vegetation types. For each species, three replicates and in each replicate 10 individuals were randomly selected. Shoot sampling was performed the areas where grazed by livestock. After transferring the samples to the laboratory of Qom Agricultural Research Center, they were first air dried and then dried in an oven at 70 ° C for 48 hours. Finally, each species was powdered by a mill and passed through a 1-mm sieve to do the forage quality experiments. The measurement of forage quality parameters was performed based on AOAC method in the laboratory of the Research Institute of Forests and Rangelands (RIFR) using NIR (Near Infrared Spectroscopy-INFRAMATIC8620), calibrated for halophytes. Forage quality parameters included crude protein (CP), crude

1. Ph.D. Student of Rangeland Sciences, Faculty of Natural Resources, Sari Agricultural Sciences and Natural Resources University  
 2. Assistant Professor, Faculty of Natural Resources, Sari Agricultural Sciences and Natural Resources University; Corresponding author; m.tatian@sanru.ac.ir  
 3. Assistant Professor, Faculty of Natural Resources, Sari Agricultural Sciences and Natural Resources University  
 4. Assistant Professor, Rangeland Research Division, Research Institute of Forests and Rangelands, Agricultural Research Education and Extension Organization (AREEO), Tehran  
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fiber (CF), dry matter digestibility (DMD), acidic detergent fiber (ADF), neutral detergent fiber (NDF), water soluble carbohydrates (WSC), ash (Ash) and metabolizable energy (ME). The study was arranged in a factorial experiment based on completely randomized design with three replications to study the simple effects and the interaction effects between species and phenological stage. SAS and MSTATC software were used for statistical analysis and mean comparisons were performed by Duncan's Multiple Range Test.

**Results:** According to the results of analysis of variance, the effects of species and phenological growth stage on all forage quality indices were significant at 1% level, except for WSC. This difference was significant for WSC at 5% level. The interaction of species \* phenological growth stage was significant only for the CF at 1% level and it was not significant for other indices. according to the results of mean comparisons, the highest content of CP, DMD, WSC, and ME (18.58, 42.5, 10.15, and 5.22, respectively) and the lowest content of ADF, CF, NDF, and ash (45.23, 29.63, 56.04, 1.83, respectively) were recorded for *Ha. strobilaceum*. The highest ADF (65.64), NDF (77.30), CF (56.08), and ash (7.13) content were recorded for *Ni. schoberi*. With the advancement of phenological stages, the content of CP, DMD, WSC, and ME were reduced, contrary to ADF, CF, NDF and ash. The CP content at vegetative growth, flowering and seeding stages was recorded to be 21.35, 15.74, and 13.30%. The DMD content during three phenological stages was recorded to be 43.12, 37.76, and 34.4%, respectively. The ADF content was recorded to be 53.1%, 57.26%, and 62.01% in vegetative growth, flowering and seeding stages, respectively. The highest and lowest CP content were recorded for *Ha. strobilaceum* at vegetative growth stage (25.24%) and *Ni. schoberi* at seeding stage (11.08%), respectively.

**Discussion:** The obtained results of the present study showed that the parameters effective on forage quality in the three species studied (*Ha. strobilaceum*, *Ni. schoberi* and *Su. aegyptiaca*) and in three phenological stages (vegetative growth, flowering and seeding) were significantly different. The highest and lowest crude protein content, dry matter digestibility, water-soluble carbohydrates, and metabolizable energy were observed in vegetative and seeding stages, respectively. However, the highest and lowest crude fiber, ADF, NDF, and ash were recorded in seeding and vegetative growth stages, respectively. In general, if the presence of plant species with crude protein less than 7% is high, livestock will face protein deficiency, reducing its yield and economic life in the rangeland. On the other hand, the amount of metabolizable energy to meet the maintenance requirements of a 45-kg ewe is reported to be 9.2-10.5 MJ. It is seen that the amount of crude protein in the three species studied and at all phenological stages was more than livestock maintenance requirements (CP>7%); however, metabolizable energy in all three species and at three phenological stages was less than the critical level to meet livestock maintenance requirements (ME<2/9). Halophytes were the main components of saline rangelands, containing high levels of crude protein and low levels of metabolizable energy; however, in order to be considered as an adequate diet, mixed supplement is also required. In this research, the values of desirable forage quality indices (parameters) including CP, DMD, WSC, and ME in *Ha. strobilaceum* was more than those of other two species, indicating the superiority of this species. In the same vein, *Ni. schoberi* and *Su. aegyptiaca* ranked second and third respectively. However, *Ha. strobilaceum* can be considered as a superior forage species in saline habitats to be used in haloculture programs.

**Keywords:** Nutritional value, Phenological stage, *Halocnemum strobilaceum*, *Nitraria schoberi*, *Suaeda aegyptiaca*.