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Nutritional Evaluation of Genus *Salvadora* as a Quality Livestock Feed of the Thar Desert

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Abstract: ***Western Rajasthan is the synonym of Thar Desert. It covers most part of the Indian desert. It comprises xerophytic as well as halophytic vegetation including trees, bushes and grasses. Animal husbandry is the main subsidiary activity in this desert. The fodder resources of this region are limited. The present investigation was undertaken to assess the potential nutritive value of leaves and fruits of Salvadora oleoides and S. persica in arid zone of Rajasthan, based on their chemical composition. They were analyzed for Dry Matter (DM), Crude Protein (CP), ash and mineral contents. The chemical analysis of the Salvadora species indicates that they are rich in nutrients and can be considered as a concentration ration of the livestock.***

Keywords: Nutritional evaluation, fodder tree leaves, crude protein, dry matter.

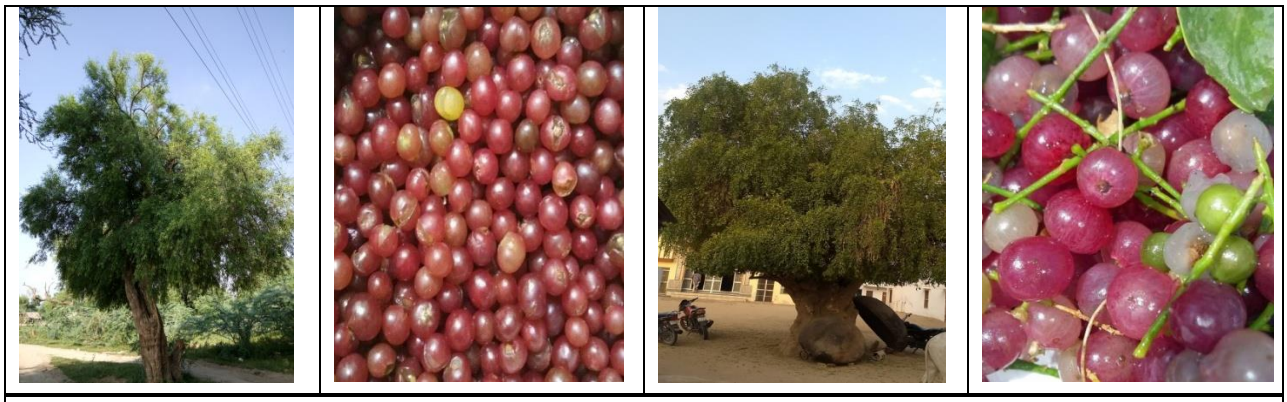
Introduction

The western Rajasthan possesses sandy warm desert known as Great Indian Thar desert. It extends into the southern portion of Haryana and Punjab and into northern part of Gujarat state. The total area of the Thar desert is about 2,00,000 km2 , spread in western part of Indian sub-continent between 24° to 28° N latitude and 68° to 71° E longitude (Arora et al.,2010). It comprises 12 districts of the Rajasthan State, viz., Barmer, Bikaner, Churu, Ganganagar, Jaisalmer, Jalore, Jhunjhunu, Jodhpur, Nagaur, Pali, Sikar and Sirohi. About 20 million persons live in the Indian desert which is about twice the population of Haryana. Besides the human population, the cattle population is quite large (23 million).

The hot arid region is characterized by scarce natural resources and an inhospitable climate. Rainfall varies from less than 100 mm to 400 mm, and is highly erratic and unpredictable. The region experiences extremes of temperature (−2 to 48°C), long day sunshine, high wind speed (35–40 km/h) and thus very high evaporation. Nearly 41–85% of ground water is saline (Bhati,1997). The region has a number of indigenous multipurpose tree species, and breeds of sheep and goat provide subsistence. The trees provide a life-line for nomadic grazers as a source of fuel, fodder, and medicine (Dhyani et al., 2009).

Animal husbandry is the main subsidiary activity in Indian desert. Trees and shrubs are important feed components of ruminant diet (Babayemi and Bamikole, 2006) and play an important role in the nutrition of livestock in areas where few or no alternatives are available (Singh and Todaria, 2012). Azim et al. (2011) has also pointed out trees and shrubs increasingly being recognized as important components of animal feeding, especially as suppliers of protein. The top fodder trees of Rajasthan are good and potential source of nutritionally and phytochemically important metabolites. Keeping in view the cattle based economy of Thar Desert and scarcity of forage in this region; the two species of *Salvadora* were selected for the present study. Leaves and fruits of *Salvadora oleoides* Decne and *Salvadora pesica* L. were analyzed for their nutritive contents.

Salvadora persica Linn. has a wider range of distribution in sandy plains, whereas, S. oleoides Decne. is commonly found growing on sandstone mostly in arid regions of Indian desert. Both the species exhibits xeromorphic characters in their general habit and vegetative parts. Leaves are dark green and thick. Both species differ in habitat, habit and morphological characters of vegetative and floral parts. There are some definite characteristic feature in the leaves, fruits and their colour, morphology of seeds and their contents in *Salvadora persica* and *Salvadora oleoides* (Plate 1 a-d).



Salvadora oleoides Decne: (a) Tree (b) Fruits *Salvadora persica* Linn.: (c) Tree (d) Fruits

Salvadora oleoides Decne is locally known as Chhota pilu, Meetha Jal, Pilu etc. This species has a great economical as well as ethno-medicinal value. Wood is used in building purposes and making of agricultural implements. Leaves of *Salvadora*

oleoides are used to relieve cough and are given to horses as purgative. Fruits are sweet and edible. The fruits of *Salvadora oleoides* are eaten locally and the pulp contains glucose, fructose, sucrose and is a good source of calcium (Duhan *et al*., 1992). Fruits are fed to cattle to increase the milk yield. Fruits are also used in the treatment of enlarged spleen, rheumatism and low fever. Seeds of *S. oleoides* are rich in non edible oil as characterized by high amount of myristic acid. Seed fat is used in the treatment of rheumatic pains (Anonymous, 1972). Purified oil is used in soap and candle making as well as in detergent industries as a substitute for coconut oil.

Salvadora persica Linn., is commonly known as miswak (tooth brush), Khara jal, Pilu etc. It is an upright evergreen small tree or shrub. Root bark contains resin , colouring matter and traces of an alkaloid called "Salvadorine", trimethylamine and ash containing a large amount of sugar, fat, coloring matter. Pieces of the roots are used as tooth brushes known as Meswak (Almas and AI-Lafi, 1995). Bark is also used as a tooth brush to strengthen the gums. It suppresses bacterial growth and the formation of plaque. The tooth stick is also said to relieve toothache and gum disease. Root bark is used to treat gonorrhoea, general body pain, back pain, spleen trouble, headaches and stomach-aches (Jindal et al., 1996). Shoots and leaves are antidotes to poison of all sorts. Leaves are fleshy and make good fodder and increase lactation in cows. Leaves are also used for treating cough and asthma, in painful piles, tumors and in scurvy. Flowers yield oil, which is stimulant and laxative and beneficial in wind, phlegm, worm, leprosy, gonorrhoea and headaches. It is applied to painful rheumatic, affections. The fruits are sweet and peppery in taste with pungent smell and eaten when ripe for medicinal purposes. Seed oil is used in rheumatic pain, diabetes, spleen and stomach disorders. Ash of the plant is used as a source of vegetables salt known as 'Kegr'. The fruits are used to increase urine flow and claimed to dissolve urinary stones.

MATERIAL AND METHODS

The leaves and fruits of *Salvadora* species were collected in the polythene bags in the month of April, May and June from the vicinity of desert. The bags were tightened immediately to have no loss of moisture. The samples were dried, powdered and then used for their nutritional. For the estimation of the chemical constituents of plants, the powdered material was subjected to chemical analysis. Moisture content, crude protein, crude fibre, ash and phosphorus content were analysed by A.O.A.C. (Association of Official Analytical Chemists, 1995) procedure. Calcium was however, estimated by and Purohit and Mathur(1970) procedure. Five samples of each plant part were taken for analysis.

Dry Matter (DM), Crude Protein (CP) and ash of the samples were determined according to AOAC (1990). The dry matter was determined by drying the samples at 80^0 C till constant weight obtained. Crude protein was estimated by micro Kjeldhal method. Oven dried sample was digested with H2SO4 in the presence of catalyst mixture containing K2SO4 and CuSO4. A known aliquate of the diluted sample was distilled in the presence of 10 ml of 2% boric acid solution and titrated against standard 0.1N H2SO4. The percentage of nitrogen was calculated for the estimation of CP. Soxhlet's apparatus was used for the estimation of fat or ether extract. For ash, sample was ignited in muffle furnace at 550° C to burn all the organic matter and leftover was weighed as ash. The conventional Weend's method was followed for the calculation of nitrogen free extract. The total carbohydrate of each dried plant part is equal to the sum of crude fibres and nitrogen free extract.

Results and Discussion

The average chemical composition of the leaves of *S. oleoides* was found to be 91.40; 14; 85; 2.25; 8.98; 42.36; 31.53; 68.46; 51.34; 8.96; 0.67 values for DM, CP, EE, CF, NFE, T. Ash, OM, TC, Ca and P respectively (Table 1).

The average percentage of chemical composition of leaves of *S. persica* was found to be 93.74 DM; 16.98 CP; 1.79 EE; 7.5 CF; 48.39 NFE; 25.28 T. Ash; 74.72 OM; 5.94 TC; 7.3 Ca and 0.63 P (Table 2). The chemical composition of leaves and fruits of *Salvadora* species did not show much variation when analyzed in different months. Leaves show higher amount of crude protein and minerals. CP was found to be higher in *S. persica* than *S. oleoides*.

Fruits of these plants are also used as a feed by livestock. They are rich in protein and carbohydrates and provide sufficient amount of nutrients.

The average percentage of chemical composition of fruits of *S. oleoides* was found to be 91.86 DM; 16.05 CP; 19.08 EE; 8.88 CF; 43.86 NFE; 12.11T. Ash; 87.88 OM; 2.74 TC; 3.40 Ca and 0.43 P (Table 3). Fruits of *S. oleoides* are rich in proteins, fat and minerals. The fruits are sweet and edible. The pulp contains glucose, fructose and sucrose, they are rich the main food in famine days. The greenish yellow seed is rich in oil (40-50 percent) which is not edible but is used for soap and candle making (Sharma and Jindal, 1983).

The average chemical composition of *S. persica* fruits on dry basis was found to be DM 91.86; CP 16.07; EE 15.13 CF 8.94; NFE 49.80;T. Ash 11.04; OM 89.95; TC 58.74; Ca 3.70 and P 0.40 (Table 4). Fruits have a strong aromatic smell and are edible. The total sugar estimates in *S. persica* was lower than the *S. oleoides*. The amount of oil content did not differ markedly. The results of the present investigation are in close agreement with the previous workers (Ganguli et al., 1964; Bhatia, 1983).

Conclusion

Nutritive contents are the basic building blocks in the synthesis of other complex substances in the cell, so that the plant as a whole or part may be efficiently utilized by livestock population.

The chemical analysis of the *Salvadora* species indicates that these are rich in nutrients and can be considered as a concentration ration of the livestock. These trees are evergreen and provide fodder for livestock even in the lean periods. These plants do not show much variation in their chemical composition in the different months of a year.

The study further suggests that some arid plants may provide feed and fodder for the livestock in this desert should be evaluated for their contents, so that the problem of shortage of feed and fodder may be reduced by providing such plant materials to the animals during famine or drought situations.

Two - three decades ago, *Salvadora oleoides* Decne was widely distributed in Punjab, Haryana and Rajasthan (Bhandari, 1978). This species is decreasing very rapidly due to over exploitation, indiscriminate collection, low rate of seed set, poor viability and inefficiency to propagate by vegetative means (Khan, 1997; Khan and Frost, 2001; Singh, 2004). Hence present investigation reveals that *Salvadora* is an important feed species under traditional livestock production systems in the arid regions. Leaves and pods are highly palatable, nutritious and eaten by camels, cattle, sheep and goats. There is

an urgent need for developing programmatic conservation strategies for *S. oleoides* and *S. persica* in the arid zone, which may lead to their effective protection.

Table 1: Nutritive value of leaves of *Salvadora oleoides*

Month	**DM**	**CP**	**EE**	**CF**	**NFE**	**T. Ash**	**OM**	**TC**	Ca	P
Apr.	91.22	16.25	2.67	8.82	40.70	31.55	68.44	49.52	8.32	0.68
May	91.00	14.32	1.89	9.11	42.62	32.06	67.94	51.73	9.23	0.65
June	92.08	14.00	2.21	9.03	43.76	31.00	69.00	52.79	9.35	0.70
Average	91.40	14.85	2.25	8.98	42.36	31.53	68.46	51.34	8.96	0.67

Abbreviation: DM=Dry Matter; CP=Crude Protein; EE= Ether Extract; CF= Crude Fibre; NFE=Nitrogen Free Extract; OM= Organic Matter; TC= Total Carbohydrate; Ca= Calcium; P=Phosphorus. Mean values expressed in percentage on dry matter basis.

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Table 2: Nutritive value of fruits of *Salvadora oleoides*

Month	**DM**	**CP**	**EE**	**CF**	**NFE**	**T. Ash**	**OM**	**TC**	Ca	P
Apr.	90.00	15.50	18.07	9.05	45.50	11.88	88.12	54.55	3.95	0.45
May	92.01	15.84	19.91	8.76	43.97	11.52	88.48	52,73	3.08	0.48
June	93.32	16.83	19.28	8.83	42.12	12.94	87.06	50.95	3.18	0.38
Average	91.74	16.05	19.08	8.88	43.86	12.11	87.88	52.74	3.40	0.43

Abbreviation: DM=Dry Matter; CP=Crude Protein; EE= Ether Extract; CF= Crude Fibre; NFE=Nitrogen Free Extract; OM= Organic Matter; TC= Total Carbohydrate; Ca= Calcium; P=Phosphorus. Mean values expressed in percentage on dry matter basis.

Table 3: Nutritive value of leaves of *Salvadora persica*

Month	**DM**	**CP**	**EE**	**CF**	**NFE**	**T. Ash**	**OM**	**TC**	Ca	P
Apr.	93.35	17.53	1.42	7.79	48.17	25,09	74.91	55.96	7.14	0.64
May	94.05	16.98	1.87	7.29	47.05	26.81	73.19	54.34	7.93	0.69
June	93.82	16.44	2.09	7.58	49.95	23.94	76.06	57.53	7.52	0.58
Average	93.74	16.98	1.79	7.55	48.39	25.28	74.72	55.94	7.53	0.63

Abbreviation: DM=Dry Matter; CP=Crude Protein; EE= Ether Extract; CF= Crude Fibre; NFE=Nitrogen Free Extract; OM= Organic Matter; TC= Total Carbohydrate; Ca= Calcium; P=Phosphorus. Mean values expressed in percentage on dry matter basis.

Table 4: Nutritive value of fruits of *Salvadora persica*

Month	**DM**	**CP**	**EE**	**CF**	**NFE**	**T. Ash**	**OM**	**TC**	Ca	P
Apr.	92.58	15.33	14.50	9.34	50.49	11.32	89.66	59.83	3.76	0.39

May	91.00	16.03	15.68	9.32	49.11	11.88	90.14	58.43	3.72	0.41
June	92.00	16.86	15.23	8.16	49.81	9.94	90.06	57.97	3.62	0.41
Average	91.86	16.78	15.13	8.94	49.80	11.04	89.95	58.74	3.70	0.40

Abbreviation: DM=Dry Matter; CP=Crude Protein; EE= Ether Extract; CF= Crude Fibre; NFE=Nitrogen Free Extract; OM= Organic Matter; TC= Total Carbohydrate; Ca= Calcium; P=Phosphorus. Mean values expressed in percentage on dry matter basis.

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