J. King Saud Univ., Vol. 7, *Agric. Sci.* (2), pp. 259-270, Riyadh (A.H. 1415/1995).

Nutritive Value Parameters of Seven *Atriplex* spp. Around the Year

S.S. Tag El Din and A.A. Al Sheikh
Center for Desert Studies, Faculty of Agriculture, King Saud University, Riyadh, Saudi Arabia

(Received 27/7/1414; accepted for publication 18/1/1415)

Abstract. *Atriplex* species could be utilized for range improvement in arid, semiarid and saline lands. These could be browsed nearly the year around. This study was aimed at evaluating the nutritive-value parameters of seven *Atriplex* species around the year in the field conditions.

The species studied were *Atriplex halimus, A. nummularia, A. undulata, A. canescens, A. lentiforms, A. polycarpa* and *A. leucoclada*. Samples were defoliated every two months through two years. Nutritive-value parameters estimated were the percentages of dry matter, carbohydrate, protein and fiber.

Results showed that highest percentages were for dry matter in October, carbohydrate in August, protein in April and fiber in December. The lowest percentages were in December for dry matter, carbohydrae and protein, and in June for fiber.

A. halimus had the highest dry matter and fiber, *A. nummularia* had the highest carbohydrate, while, *A. polycarpa* had the highest protein.

Introduction

Shrub species are major components of arid and semiarid rangelands through out the world and are important sources of forage (browse) for domestic and wild herbivores [1]. In most Arab countries, research is being directed towards both native and introduced species that have evolved and adapted to the harsh semiarid and arid environments [2], where inadequate water supplies limit agricultural development. On these dry sites, introduced species could be established without affecting current food and fiber production [3]. Browse, however, is considered important in low rainfall areas as a reserve feed in times of drought [4]. The traditional land management scheme

could be improved by maintaining or increasing dry season forage production, controlling re-growth of undesirable species, and maintaining or enhancing environmental stability [5].

Forage production varies within and among species, with age of the plant, season of the year, among years, and with site [6]. It was suggested that managers should consider grazing Lehman love grass in late spring and summer because live biomass, crude protein, phosphorus, and organic matter digestibility peak in those seasons [7-9].

The chemical composition and harvestable yields of plant materials are strongly associated with the phenological stages of the plants. Kelsey *et al.*, [3] broke down the yearly cycle of sagebrush into four periods, the primary growth of spring, secondary grwoth and differentiation in the summer, reproduction in the fall and a winter quiescence. The monthly timing of these stages may vary depending on species and sub-species, environmental, and climatic conditions [10-12].

Hickman [13] and Kelsey [3] found that crude protein and total non-structural carbohydrates in the sagebrush foliage were high in the June samples, decreased during the summer and rose again in December as the plants entered their winter dormancy.

The objective of the present study was to determine the nutritive quality of seven species of *Atriplex* around the year in the central region of Saudi Arabia.

Materials and Methods

This study was carried out in El Muzahimya Research Station of the Centre for Desert Studies, King Saud University, 50 km. west of Riyadh. The climate is subtropical hyper-arid type. Annual precipitation average totals about 100 mm. The soil was defined as a Torripsamment soil with a deep profile and a sandy loam texture, calcareous; very low in organic matter content, alkaline in reaction with electrical conductivity ranging from 0.8 to 3.8 m. mohs, and a gypsum content ranging from 2.6 to 3.5% [2].

The species evaluated in this study were *Atriplex halimus* L., *A. nummularia* Lindley, *A. canescens* James, *A. undulata* Dieter., *A. lentiformis* (Torr.) S. Wats, *A. polycarpa* S. Wats, and *A. leucoclada* Boiss. A. halimus and A. leucoclada are local endangered shrubs, while the other five species are exotic.

Six month old seedlings of different species were transplanted in the last week of March 1989. Plants were spaced 2 m apart and were irrigated with artesian water (salinity about 5000 ppm) monthly in summer and every two months in winter. After the

establishment of plants, three shrubs from each species were randomly selected for sampling. Foliage samples were defoliated bi-monthly from February 1991 till December 1992. The experimental design was split plot design with three replicates for each year. The species were assigned to the main plots, whereas the time of defoliation was assigned to the sub plots.

Samples were washed with distilled water, air dried at 65°C, ground in a Wiley mill through a 1 mm. mesh screen, and stored in sealed jars for analyses. Plant samples were analyzed to determine the percentage of dry matter (DM), total carbohydrate, crude protein (CP), and acid detergent fiber. DM% was calculated from fresh sub-samples of approximately 100 gr dried at 65°C, and weighed. Total carbohydrate was determined by the iodometric method of shaffer and Hartmann modified by Noakell and El Gawadi [14]. Crude protein (N × 6.25) was determined by the AOAC method [15]. Fiber % was determined according to the procedure described by Van Soest *et al.*, [16].

Analyses of variance were performed using the SAS statistical package [17, pp. 119-138] and means were compared with Duncan's multiple range test at 1 % level [18, pp. 377-400], for each year and the two years average.

Results and Discussion

The influence of *Atriplex* species and defoliation date on nutritive value parameters for both years and their averages are concluded in Table 1. All sources of variance for all nutritive parameters, either in the first or the second year, were highly significant, except the interaction between species and date of defoliation in the first year, which was significant only at the 5% level. For the two years' averages, there was highly significant variance between the first and the second year in DM % and fiber %, while the differences were not significant for carbohydrate % and protein %. It can be noticed that any interaction with years was not significant for all nutritive parameters, while the other interactions were highly significant.

Percent dry matter (DM)

The effect of date of defoliation on DM for seven *Atriplex* species in each year and the two years average are presented in Table 2. DM % of the second year (39.6) was significantly higher than that for the first year (38.4). There were significant differences between species for both years and the two years average. For the two years average, *A. halimus* had the highest DM % (46.4) followed by *A. leucoclada* (40), *A. nummularia* and *A. undulata* (39.2), *A. polycarpa* (38.2), *A. canescens* (36.1) and *A. lentiformis* (34). The same trend was obtained for both years. It was noticed that the local species, *A. halimus* and *A. leucoclada,* had higher DM % than the exotic species.

Table 1. Nutritive value parameters as influenced by *Atriplex* spp. and date of defoliation.

Source	D.f.	D.M.%	Carbohy.	Protein	Fibers
First year					
Species	6	**	**	**	**
Date	5	**	**	**	**
Spp. X date	11	**	**	**	*
Second year					
Species	6	**	**	**	**
Date	5	**	**	**	**
Spp. X date	11	**	**	**	**
Two years average					
Species	6	**	**	**	**
Date	5	**	**	**	**
Spp. X date	30	**	**	**	**
Year	1	**	N.S.	N.S.	**
Spp. X year	6	N.S.	N.S.	N.S.	N.S.
Date X year	5	N.S.	N.S.	N.S.	N.S.
Spp. X date X year	30	N.S.	N.S.	N.S.	N.S.

D.F. = Degree of freedom D.M.% = Dry matter percentage
Carboh % = Total carbohydrate percentage
N.S. = not significant.
* = Significant at 0.05 level.
** = Significant at 0.01 level.

There were highly significant differences for DM % between dates of defoliation. It increased gradually from February till October then dropped in December. For the two years' average, the highest DM % was found in October (46.9) and the lowest value in December (31.4). This drop may be due to the low DM % in the small new leaves after the first rainfall. The harvestable yields of plant materials are strongly associated with the phenological stages of the plants [3].

The interaction between species and defoliation dates was highly significant. The highest DM % for all studied species were in October, While the lowest in

Table 2. Dry mater % as affected by *Atriplex* spp. and date of defoliation.

First year

Spp. Month	*A. halimus*	*A. numm.*	*A. undulata*	*A. casnc.*	*A. lentifor.*	*A. polyca.*	*A. leococ.*	Mean*
February	42.7 c	34.0 cd	39.3 bc	35.0 b	28.0 c	36.3 c	30.2 d	35.1 d
April	44.0 c	38.7 bc	36.0 c	36.7 ab	30.3 c	34.0 c	31.3 d	35.9 d
June	47.3 bc	39.4 bc	37.7 c	35.7 b	35.0 b	36.7 bc	41.3 c	39.0 c
August	52.3 ab	44.0 ab	41.7 b	41.0 a	38.3 ab	40.7 b	48.3 b	43.8 b
October	55.0 a	46.3 a	47.0 a	35.7 b	42.0 a	46.7 a	53.7 a	46.6 a
December	31.0 d	29.0 d	30.4 d	28.7 c	36.7 c	34.0 c	32.3 d	30.3 e
Mean**	45.4 A	38.6 B	38.7 B	35.5 C	33.4 D	38.1 B	39.5 B	38.4 B

Second year

February	43.8 c	35.4 d	38.9 c	36.1 b	29.3 cd	36.6 c	31.3 e	35.9 d
April	44.6 bc	39.6 c	37.6 c	38.1 ab	31.5 c	35.3 c	33.1 de	37.1 d
June	48.6 b	42.4 bc	38.4 c	36.6 b	36.9 b	37.5 bc	41.7 c	40.3 c
August	53.3 a	44.5 ab	42.6 b	41.2 a	39.5 ab	41.6 b	49.2 b	44.6 b
October	55.9 a	46.5 a	48.1 a	37.1 b	43.1 a	46.4 a	52.9 a	47.1 a
December	38.3 d	30.6 e	32.7 d	30.9 c	27.7 d	32.9 c	34.9 d	32.6 e
Mean**	47.4 A	39.8 BC	39.7 BC	36.7 D	34.7 A	38.4 C	40.5 B	39.6 A

Two years average

February	43.3 c	34.7 c	39.1 c	35.6 b	28.6 de	36.5 c	30.8 e	35.5 d
April	44.3 c	39.2 b	36.8 d	37.4 b	30.9 d	34.7 cd	32.2 de	36.5 d
June	48.0 b	40.9 b	38.1 cd	36.2 b	36.0 c	37.1 c	41.5 c	39.7 c
August	52.8 a	44.3 a	42.2 b	41.1 a	38.9 b	41.2 b	48.8 b	44.2 b
October	55.5 a	46.4 a	47.6 a	36.4 b	42.6 a	46.5 a	53.3 a	46.9 a
December	34.6 d	29.8 d	31.6 e	29.8 c	27.2 e	33.4 d	33.6 d	31.4 e
Mean**	46.4 A	39.2 BC	39.2 BC	36.1 D	34.0 E	38.2 C	40.0 B	39.0

* Means in e ach column with the same small leter are not significantly different at 0.01 level.
** Means in each row with the same capital leter are not significantly different at 0.01 level.

December, except for *A. canescens* which had the highest DM % in August (41.4).

Total carbohydrate content

Total carbohydrate % of different *Atriplex* species and the effect of defoliation date in two years and the two years average are presented in Table 3. Carbohydrate

% for the two years' average reached 25.8%, and there was no significant difference between the two years' means.

Table 3. Total carbohydrate % as affected by *Atriplex* spp. and date of defoliation.

First year

Spp. Month	*A. halimus*	*A. numm.*	*A. undulata*	*A. casnc.*	*A. lentifor.*	*A. polyca.*	*A. leococ.*	Mean*
February	33.1 a	29.6 ab	28.3 a	24.1 bc	28.2 abc	23.1 c	24.0 abc	27.2 b
April	26.5 b	28.2 b	22.3 bc	23.3 bc	25.9 bc	24.2 c	24.9 ab	25.0 c
June	25.6 b	30.3 ab	27.1 ab	24.6 b	26.1 abc	23.5 c	20.3 c	25.4 c
August	26.7 b	32.6 a	26.8 abc	28.6 a	29.8 ab	31.2 a	27.0 a	29.0 a
October	26.9 b	32.8 a	22.7 abc	23.8 bc	32.1 a	28.3 b	23.4 abc	27.1 b
December	17.2 c	22.7 c	21.0 c	20.9 c	22.5 c	23.4 c	22.7 bc	21.5 d
Mean**	26.0 BC	29.4 A	24.7 CDE	24.2 DE	27.4 B	25.6 CD	23.7 E	25.9

Second year

February	32.3 a	29.4 ab	28.4 a	24.3 bc	28.4 ab	23.7 c	24.8 ab	27.3 b
April	25.3 b	26.7 b	22.8 bc	24.1 bc	25.3 bc	23.5 c	24.7 ab	24.6 c
June	24.5 b	30.0 ab	27.4 ab	25.1 b	25.3 bc	23.6 c	21.0 b	25.3 c
August	26.1 b	32.3 a	26.7 abc	30.0 a	30.0 ab	31.6 a	27.9 a	29.2 a
October	25.6 b	32.6 a	21.9 cd	24.5 bc	31.2 a	28.4 b	23.2 b	26.8 b
December	18.5 c	22.1 c	20.8 d	20.3 c	23.4 c	23.5 c	22.8 b	21.6 d
Mean**	25.4 CD	28.8 A	24.7 CD	24.7 CD	27.3 B	25.7 C	24.1 D	25.8

Two years average

February	32.7 a	29.5 bc	28.3 a	24.2 b	28.3 ab	23.4 c	24.4 b	27.3 b
April	25.9 b	27.5 c	22.6 b	23.7 b	25.6 bc	23.9 c	24.8 ab	24.8 c
June	25.1 b	30.1 b	27.3 a	24.8 b	25.7 bc	23.5 c	20.6 c	25.3 c
August	26.4 b	32.5 a	26.7 a	29.3 a	29.9 a	31.4 a	27.5 a	29.1 a
October	26.3 b	32.7 a	22.3 b	24.2 b	31.7 a	28.4 b	23.3 bc	27.0 b
December	17.9 c	22.4 d	20.9 b	20.6 c	23.0 c	23.5 c	22.8 bc	21.6 d
Mean**	25.7 C	29.1 A	24.7 CD	24.5 D	27.3 B	25.7 C	23.9 D	25.8

* Means in each column with the same small leter are not significantly different at 0.01 level.

** Means in each row with the same capital leter are not significantly different at 0.01 level.

There were highly significant differences for carbohydrate content between different species. With respect to the two years' average, *A. nummularia* (29.1) had the highest carbohydrate % followed by *A. lentiformis* (27.3), *A. halimus* and *A. polycarpa* (25.7), *A. undulata* (24.7), *A. canescens* (24.5) and *A. leucoclada* (23.9), respectively. Nearly the same trend was obtained for each year.

Dates of defoliation affect carbohydrate % significantly for all species in each year and the two years' average. For the two years average, defoliated samples in August had the highest carbohydrate while in December had the lowest percentage. The same trend was observed for each year. Carbohydrate % was low in December when the new branches and leaves began to grow after the beginning of rainfall season; then it increased gradually till August. After August, the carbohydrate % decreased gradually: this might be due to the translocation from terminal leaves and branches to other parts, before the shrubs start shedding their leaves.

The interaction between species and defoliation date was highly significant. Most of the species had the highest carbohydrate % in August, and the lowest in December, except the two local species (*A. halimus* and *A. leucoclada*). *A. halimus* had the highest carbohydrate in Feb. (32.7) and *A. leucoclada* had the lowest carbohydrate % in June (20.6). For different species, the defoliation date trend is nearly the same in each year and the two years' average.

Crude protein content

The effect of *Atriplex* species and defoliation date on crude protein % of the current year growth for two years and their average are concluded in Table 4. The two years' average of protein % was 14.7 %. There were no significant differences between the two years means.

There were highly significant differences between different *Atriplex* species in their protein %. For the two years' average, *A. polycarpa* had the highet protein % (18.1), followed by *A. nummularia* (18), *A. lentiformis* (17.4), *A. canescens* (16.1), *A. leucoclada* (11.8), *A. halimus* (11.5) and *A. undulata* (10.4), respectively. The same trend can be nearly noticed for each year.

Defoliation dates influenced significantly the crude protein % in each year and the two years' average. In the two years average, protein % of current year growth defoliated in April (17.1) was the highest, followed by June (15.9), February (14.9), August (14.7), October (13.6) and December (12.2), respectively. Nearly, the same trend was found in each year.

The interaction between *Atriplex* species and defoliation date was highly significant. For the two years' average, all the species had the highest crude protein % in April, except *A. nummularia* (Feb. 20.2) and *A. lentiformis* (Feb. 20.6). For the last

Table 4. Crude Protein % as affected by *Atriplex* spp. and date of defoliation.

First years

Spp. Month	*A. halimus*	*A. numm.*	*A. undulata*	*A. casnc.*	*A. lentifor.*	*A. polyca.*	*A. leococ.*	Mean*
February	7.5 c	20.0 a	10.4 ab	15.3	21.1 a	17.6 b	12.4 bc	14.9 bc
April	14.5 a	19.5 ab	12.5 a	17.5	19.8 a	21.6 a	14.7 a	17.2 a
June	13.4 a	17.9 abc	11.3 ab	16.4	17.1 b	20.4 a	13.2 ab	15.7 b
August	12.9 a	16.9 bc	10.7 ab	15.6	16.9 b	17.7 b	11.8 bc	14.7 c
October	10.8 b	16.3 c	9.8 b	15.1	15.6 bc	16.2 bc	10.4 c	13.5 d
December	8.0 c	16.7 c	7.2 c	14.7	14.1 c	15.0 c	8.2 d	12.0 e
Mean**	11.2 DC	17.9 A	10.3 D	15.8 B	17.4 A	18.1 A	11.8 C	14.6

Second year

February	8.6 d	20.3 a	10.8 ab	15.8	20.1 a	17.8 b	11.6 bc	15.0 b
April	15.0 a	19.3 ab	11.4 ab	17.7	19.9 a	21.4 a	14.4 a	17.0 a
June	14.3 ab	18.7 abc	12.3 a	17.0	17.5 b	20.3 a	13.6 ab	16.2 a
August	13.0 bc	16.7 c	11.0 ab	16.9	16.7 b	17.5 b	11.6 bc	14.8 b
October	11.6 c	16.3 c	9.5 bc	15.6	16.0 bc	16.4 bc	10.9 c	13.8 c
December	8.5 d	17.5 bc	8.1 c	15.4	13.7 c	15.1 c	8.2 d	12.4 d
Mean**	11.8 C	18.1 A	10.5 D	16.4 B	17.3 A	18.1 A	11.7 c	14.9

Two years average

February	8.0 d	20.2 a	10.6 ab	15.6 ab	20.6 a	17.7 b	12.0 b	14.9 c
April	14.8 a	19.4 ab	11.9 a	17.6 a	19.9 a	21.5 a	14.6 a	17.1 a
June	13.9 ab	18.3 bc	11.8 a	16.7 ab	17.3 b	20.3 a	13.4 a	15.9 b
August	12.9 b	16.8 cd	10.9 ab	16.2 ab	16.8 b	17.6 b	11.7 b	14.7 c
October	11.2 c	16.3 d	9.7 b	15.4 b	15.8 b	16.3 bc	10.7 b	13.6 d
December	8.3 d	17.1 cd	7.7 c	15.1 b	13.9 c	15.1 c	8.2 c	12.2 e
Mean**	11.5 D	18.0 AB	10.4 E	16.1 C	17.4 B	18.1 A	11.8 D	14.7

* Means in each column with the same small leter are not significantly different at 0.01 level.

** Means in each row with the same capital leter are not significantly different at 0.01 level.

two species, there were no significant differences between the protein % in Feb. and April. The lowest protein content for all species was in December, except that for *A. halimus* (Feb. 8) and *A. nummularia* (Oct. 16.3).

Within different species, there were highly significant differences between the protein content of samples defoliated in different dates, except *A. canescens.*

Fiber content

Fiber % of seven *Atriplex* species as affected by defoliation date treatments in two years and their average are presented in Table 5. Fiber % of the two years average reached 17.6. The mean of the second year (18.4) was significantly higher than that of the first (16.9).

Table 5. Fiber content as affected by *Atriplex* spp. and date of defoliation.

Spp. Month	*A. halimus*	*A. numm.*	*A. undulata*	*A. casnc.*	*A. lentifor.*	*A. polyca.*	*A. leococ.*	Mean*
First years								
February	28.2 b	12.3 b	8.1 c	9.0 c	11.8 d	5.6 c	16.0 e	13.0 e
April	29.0 b	13.5 ab	9.0 bc	9.3 c	12.5 cd	6.2 c	19.6 de	14.2 e
June	34.0 a	13.8 ab	10.2 b	10.6 c	14.3 bc	12.7 b	20.0 cd	16.5 d
August	34.2 a	14.6 ab	11.8 ab	10.7 bc	15.5 ab	15.1 a	23.6 bc	17.9 c
October	34.6 a	15.5 ab	12.5 ab	13.6 ab	16.5 ab	15.6 a	25.9 ab	19.2 b
December	36.6 a	16.7 a	14.7 a	15.0 a	17.5 a	16.4 a	28.6 a	20.8 a
Mean**	32.8 A	14.4 C	11.1 D	11.4 D	14.7 C	11.9 D	22.3 B	16.9 B
Second year								
February	30.2 b	14.0 b	10.0 b	10.1 d	13.7 d	7.8 c	17.6 d	14.6 d
April	30.1 b	14.9 ab	11.7 b	10.0 d	13.3 d	8.2 c	19.7 cd	15.4 d
June	34.9 a	15.9 ab	11.4 b	11.8 cd	15.7 c	14.3 b	21.5 c	17.9 c
August	35.7 a	16.3 ab	13.3 ab	12.9 bc	16.7 bc	16.8 a	24.98 b	19.5 b
October	35.5 a	17.5 ab	13.4 ab	14.8 ab	17.8 ab	16.8 a	28.0 a	20.5 b
December	38.1 a	18.4 a	15.5 a	16.6 a	18.7 a	17.9 a	30.2 a	22.2 a
Mean**	34.1 A	16.2 C	12.5 D	12.7 D	15.8 C	13.6 D	23.7 B	18.4 A
Two years average								
February	29.2 c	13.2 c	9.1 d	9.6 c	12.3 d	6.7 c	16.8 e	13.8 f
April	29.6 c	14.2 bc	10.4 cd	9.7 c	12.9 d	7.2 c	19.7 d	14.8 e
June	34.4 b	14.9 bc	10.8 bcd	11.2 bc	15.0 c	13.5 b	20.8 d	17.2 d
August	35.0 ab	15.5 abc	12.5 bc	11.8 b	16.1 bc	16.0 a	24.3 c	18.7 c
October	35.0 ab	16.5 ab	13.0 ab	14.2 a	17.1 ab	16.2 a	27.0 b	19.9 b
December	37.4 a	17.6 a	15.1 a	15.8 a	18.1 a	17.2 a	29.4 a	21.5 a
Mean**	33.4 A	15.3 C	11.8 E	12.0 DE	15.3 C	12.8 D	22.8 B	17.6

* Means in each column with the same small leter are not significantly different at 0.01 level.
** Means in each row with the same capital leter are not significantly different at 0.01 level.

The local species (*A. halimus* and *A. leucoclada*) had higher fiber content than the exotic species. In the two years' average, the highest fiber % was found in *A. halimus* (33.4) followed by *A. leucoclada* (22.8), *A. nummularia* and *A. lentiformis* (15.3), *A. polycarpa* (12.8), *A. canescens* (12) and *A. undulata* (11.8), respectively. For each year the trend was nearly the same as that of the two years' average.

Defoliation date treatments affected fiber % significantly in each year and the two years average. Fiber % increased gradually from February (13.8) till December (27.5), for tghe two years' average. The same trend was found for each year. The interactions between *Atriplex* species and defoliation date treatments on fiber % were highly significant in the second year and the two years' average, while it was significant only at the 0.05% level in the first year.

From Tables 2-5, it could be concluded that, the local species (*A. halimus* and *A. leucoclada*) had the highest DM% and fiber %, but low in carbohydrate and crude protein. *A. nummularia* which gave nearly the highest fresh yield [2], had also the highest carbohydrate % and high crude protein content. These characters in addition to its high adaptation to most of Arab countries give it a high periority for range improvement and soil conservation.

A. polycarpa which had the highest crude protein % had also high percentage of DM, carbohydrate and was low in fibers, but it gave relatively low yield. For grazing, it is preferable to establish different species, taking the nutritive contents and the period of grazing in consideration.

The suitability of the dates of defoliation or browsing depends on many factors especially the range condition [2]. From the results of this study, most of these species could be grazed from April to October as the highest DM was in October, the highest carbohydrate content was in August; protein content was high in June, while fibers could be considered low all over this period. In December the plants showed the lowest percentage of dry matter, protein and carbohydrate and the highest percentage of fiber all of which limit the defoliation at that time.

References

[1] Ruyle, G.B.; Bowns, J.E., and Schlundt, A.F. "Estimating Snowberry [*Symphoricarpus orephilus*] Utilization by Sheep from Twig Diameter-Weight Relations." *J. Range Manage,* 36, (1983), 472-474.

[2] Tag El Din, S.S. "Effect of Grazing Season on the Productivity parameters of Five Range Shrubs." *Arab Gulf J. Soc. Res.*, 11, (1993), 209-219.

[3] Kelsey, R.C.; Stephens, J.R., and Shafizadeh, F. "The Chemical Constituants of Sagebrush Foliage and Their Isolation." *J. Range Manage.*, 35, (1982), 617-622.

[4] Wilson, A.D. "A Review of Browse in the Nutrition of Grazing Animals." *J. Range Manage.*, 22, (1969): 23-28.

[5] Hardestyt, L.H. and Box, T.W. "Defoliation Impacts on Coppicing Browse Species in North-east Brazil." *J. Range Manage.*, 41, (1988), 66-70.

[6] Bartolome, J.W. and Kosco, B.H. "Estimating Browse Production by Deerbrush [*Ceanothus integerrimus*]." *J. Range Manage.*, 35, (1982), 671-672.

[7] Cox, J.R. "Lehmann Lovegrass Live Component Biomass and Chemical Composition." *J. Range Manage.*, 45, (1992): 523-527.

[8] Fourie, J.H. and Roberts, B.R. "Seasonal Dry Matter Production and Digestibility of *Themeda triandra* and *Eragrostis lehmanniana*." *Agro-Planta.*, 9, (1977), 124-133.

[9] Obo, P.G. "Effects of Prescribed Burning on the Nutritive Quality of Lehmann Lovegrass (*Eragrostis lehmanniana*)." *M.S. Thesis, Univ. Arizona*, Tucson. (1986).

[10] Wright, H.A. "Response of Big Sagebrush and Three-tip Sagebrush to Season of Clipping." *J. Range Manage.*, 23, (1970), 20-22.

[11] De Puit, E.J. and M.M. Coldwell, "Seasonal Pattern of Net Phytosynthesis of *Artemisia tridentata*." *Amer. J. Bot.*, 60, (1973), 426-435.

[12] Daubenmire, R. "Ecology of *Artemisia tridentata* in the State of Washington." *Northwest Sci.*, 49, (1975), 24-45.

[13] Hickman, O.E. "Seasonal Trends in the Nutritive Content of Important Range Forage Species Near Silver Lake, Oregon." *U.S. Dep. Agr. Forest Serv. Res. Pap.* PNW-187, (1975), 32p.

[14] Shaffer, P.A. and Hartmann, A.F. "The Iodometric Determination of Cupper and Its Use in Sugar Analyses." Modefied by Noakell E.J. and El Gawadi, A.P., *New Phytol.*, 35, (1921), 229-266, *J. Biol. Chem.*, 45: 365.

[15] AOAC. *Official Methods of Analysis*. 13 th (ed.) Washington, D.C.: Association of Official Analytical Chemists, 1980.

[16] Van Soest, P.J. and Wine, R.H. "Use of Detergents in the Analysis of Fibrous Feeds. 4. Methods for Determination of Plant Cell Walls." *J. Ass. Offie. Anal. Chem.*, 50, (1976), 50-55.

[17] SAS. SAS User's Guide Statistics. North Carolina, Cary: SAS., 1985.

[18] Steel, R.G.D. and J.H. Torrie. *Principles and Procedures of Statistics*. New York: Mc Graw-Hill Book Co. 1980.

القيمة الغذائية لسبعة أنواع من القطف على مدار السنة

صلاح سعد تاج الدين و عبدالملك آل الشيخ
مركز دراسات الصحراء وكلية الزراعة، جامعة الملك سعود، الرياض، المملكة العربية السعودية
(قدم للنشر في ١٤١٤/٧/٢٧هـ؛ وقُبل للنشر في ١٤١٥/١/١٨هـ)

ملخص البحث. تعد شجيرات القطف من الشجيرات التي تتحمل الجفاف والملوحة وتستخدم أساسًا في تحسين المراعي الطبيعية أو للتكامل مع المرعى الطبيعي ويمكن رعي معظمها على مدار العام. ويهدف هذا البحث إلى تقدير القيمة الغذائية لسبعة أنواع من القطف على مدار السنة.

شجيرات القطف تحت الدراسة هي القطف الملحي والقطف الأسترالي والقطف الأمريكي وقطف إنديولاتا وقطف لنتيفورمس وقطف البولي كاربا والرغل. حيث قطفت عينات من الجزء المأكول كل شهرين على مدى سنتين وتم تقدير محددات القيمة الغذائية وهي كل من نسبة المادة الجافة والكربوهيدرات والبروتين والألياف. وتبين من النتائج أن:

١ ـ نسبة المادة الجافة تزداد حتى شهر أكتوبر ثم تنخفض بحدة لتصل إلى أقل نسبة في شهر ديسمبر نتيجة لبداية النموات الجديدة بعد بداية الأمطار.

٢ ـ أن أعلى نسبة كربوهيدرات في شهر أغسطس وأقلها في شهر ديسمبر.

٣ ـ أعلى نسبة بروتين في شهر إبريل وأقلها أيضًا في شهر ديسمبر.

٤ ـ أعلى نسبة ألياف في شهر ديسمبر وأقلها في فبراير.

من جهة أخرى أظهرت النتائج أن القطف الملحي يحتوي على أعلى نسبة مادة جافة وألياف في حين أن القطف الأسترالي يحتوي على أعلى نسبة كربوهيدرات وقطف البولي كاربا على أعلى نسبة بروتين في حين يحتوي قطف اللنتيفورمس على أقل نسبة جافة والرغل على أقل كربوهيدرات وقطف الانديولاتا على أقل نسبة بروتين وألياف.