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GRAZING BEHAVIOR OF AWASSI SHEEP IN REFERENCE TO PLANT SURVEY IN THE SOUTHERN PART OF JORDAN

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Abstract: This study was carried out at Twana Reserve in Al-Tafilah district. About 40 hectares were selected at the reserve which is about 200 km to the south of Amman the capital. During May, 2007 grazing behavior of Awassi sheep was recorded through day light for nine days from at 8:00 am up to 18:00 sheep behavior was recorded each 6 minutes interval. Sheep were grouped into three different intensities (light (L), moderate (M) and heavy (H) grazing). Selected sites were surveyed for vegetation species. Plant list was prepared; vegetation coverage percentage, species frequency, abundance, density, relative density and shanon diver's index were calculated. Plant productivity was determined. Allowable productivity and stocking rate were calculated.

Non-significant differences were observed between the grazing behaviors of the three groups, while M group have the highest ($p<.001$) browsing, ruminating and drinking behaviors, the H group was significantly ($p<.001$) the highest in lying behavior, while the L group was observed to behave the highest ($p<.001$) in standing. Grazing and browsing behavior was significantly ($P< 0.01$) differ between the hours of observations. Morning grazing was shorter significantly ($p<.0001$) than evening grazing, the browsing behavior was observed to be highly significantly ($p<.001$) affected by parts of day light. Evening browsing behavior was longer than morning, Morning was longer ($p<.0001$) than evening in lying period while evening was longer in ruminating. Non-significant differences were observed between morning and evening drinking and standing behaviors.

The allowable productivity was 422.5 kg/ha. Stocking rate was 9.38, 18.75 and 28.13 head/ha for the light, moderate and heavy grazing, respectively. Results on plants survey showed that 76 species belongs to 19 families were identified. The best represented families were *Cruciferae* and *Compositae* they encountered the highest species number 15 and 14 species, respectively. The most dominant species were *Carex divisa*, *Sisymbrium irio L.*, *Torularia torulosa* and *Astragalus spp.* The total coverage percent was estimated by 40%. The percentage of vegetation cover use was 21%, 60% and 68% while dry matter use was 47%, 57% and 60% for low, moderate and heavy grazing, respectively.

Key wards: Awassi sheep, plant survey, grazing behavior.

Introduction:

Jordan is a country dominated by arid climate and fragile ecological system. More than 90% of the land area of Jordan is considered as rangeland (MOA, 2005). Fat-tailed Awassi sheep are the most widely distributed sheep with a population of nearly 1.97 million heads (MOA, 2005).

The majority of small ruminants in Jordan are kept in extensive (20-30%) or semi-intensive systems (45-70%), both systems being more or less transhumant, Flock size ranges from 10 to 2,500 heads (Hailat, 2005). Sheep are adapted to arid untellable lands and steep slops. The grazing habits of sheep are often maligned as the primary causes of denudation and erosion of vegetated land (Ely, 1994). The local feed resources are limited, and there is a large gap between available resources and livestock requirements, while Jordan produces less than 25% of feedstuff requirements. Indigenous resources need to be protected and developed (Abu-Zanat, 1997).

However, protecting rangelands is considered as a national task. The utilization of pastures by the grazing animals remains a complex biological process that is not well understood in Jordan.

Observing of grazing animals can provide valuable information to sheep owners regarding the quantity and quality of the available forages in the semi-arid area of Jordan. The objectives of this study were to investigate the grazing behavior of Awassi sheep raised under extensive conditions in semi-arid lands and how to protect the rangelands under different grazing intensities , and to classify plant and vegetation patterns available in the study area.

Materials and methods:

Site description and data collection:

About 40 hectares were selected at Twana reserve which is located in Tafilah district, and far about 200 km to the south of Amman. Topography of the reserve characterized by formation of mountains and hells with slope fluctuated between 5 – 10 %. The annual rainfall is 150 mm and altitude of 1220 m above sea level. The total area of the reserve is 2500 hectare, about 500 hectare were planted with fodder shrubs (mainly *Atriplex halimus*) in December, 2003. Spacing between contour ridges was 12 m while 2.5 m between shrubs. Plant density was 267 shrubs per hectare.

During spring of 2007, and before starting grazing period a plant survey was conducted, considering the following features:

Plant List: The list was prepared using line transect method (Ambshat, 1982) to determine this list. Three Transects of 50 m length were selected randomly one

inside Atriplex area while the other 2 were above and below the planted site. Each transect was divided into 5 quadrate of 10 m length and all plant kinds were recorded and counted. Vegetation coverage percentage, species frequency, abundance, density, relative density and shanon divers index were calculated following the method described by Ambshat, (1982) as following:

- **Coverage Percentage (C):** it was calculated by measuring the vegetation cover length for all plants occurrence within each quadrate (VCL) divided by the quadrate length (QL) multiplied by 100: C =VCL ÷ Q (Ambshat, 1982).

- **Species frequency (F):** it was calculated using the following equation:

F = QO /TQ Where QO is the number of quadrates of occurrence, and TQ is the total number of quadrates. (Ambshat, 1982).

- **Species abundance (A):** it was calculated using the following equation

A = Sno. ÷ QO Where (Sno.) is the total number of individuals of each species recorded at the site and (QO) is the number of quadrate of occurrence. (Ambshat, 1982).

- **Species density (D):** it was calculated as the total number of individuals of each species (Sno.) divided by the number of quadrate studied TQ:

D = Sno. ÷ TQ (Ambshat, 1982).

- **Species relative density (RD):** it was calculated as the number of individuals of a species in all quadrates (TSno.) divided by the total number of all species in all quadrates studied (All S no.) multiplied by 100: RD = TSno. ÷ All S no.

- **Proportion (P):** it was calculated as the number of individuals of a species in all quadrates (TSno.) divided by the total number of all species in all quadrates studied (All S no.):P = TSno. ÷ All S no.

- **Shannon Diversity Index H' (SDI):** it was calculated as absolute value of the natural logarithm of the proportion (LNP) multiplied by the proportion (P): SDI = LNP * P.

Plant Productivity:

***Atriplex* Productivity:** Reference Unit Method (RU) was used to estimate shrub biomass (Andrew *et al*, 1981). Considering that branch forms about 20% of shrubs size which was selected and shrub biomass was estimated in comparison to RU. Branch weighted, afterward boawsable parts was separated, weighted and dried on oven dry at 72°C for 72 hours and weighted again. Fresh, dry and edible production was calculated for shrubs in the study site and stocking rate was calculated for each grazing density per 1.6 hectare (Table 1).

Table(1): Biomass production for both *Atriplex* and native vegetation (NV) based on dry matter (DM) at Twanah Reserve during April 2007

Productivity per treatment (1.6 ha)			
Atriplex yield (kg/1.6ha)		Native Yield (kg/ha)	
Atriplex yield (g/shrub)	82	DM (g/sample)	32.4
Total Shrub no. per 1.6 ha	427	Sample (m^2)	0.79
Survival %	86%	Yield (kg/ha)	411
Net shrubs numbers	367	Treat area (ha)	1.6
Allowable Yield per Treat (60%)*	18 Kg	NV Yield (kg)	658/1.6ha
Total yield / 1.6 ha =	676 Kg DM		

* Allowable Yield per Treatment (60%) = yield (g/shrub)* Shrub no. per 1.6 ha* Survival%*60%.

Native Vegetation Productivity: it was estimated by using clipping method. Nine transect of 50 m long were selected randomly in each treatment of this experiment, each transect was contain 5 quadrates of 0.79 m^2. A total of 45 quadrates were clipped for each treatment and recorded its data. Coverage percentage was estimated visually, annual plants clipped, weighted, dried and weighted again.

Animal behavior: the experiment was conducted in the period from the 2-10. May, 2007. A fifteen, thirty and forty five non lactating Awassi ewes between 3 and 6 years old were selected randomly and distributed basically on light, moderate and heavy grazing intensity systems respectively. Average live weight of those ewes was 57 kg. Animals were numbered on both sides using normal spray paint in order to distinguish her grazing behavior.

A special sheet was made to investigate and monitor the required data on grazing, drinking, browsing, ruminating, standing, and laying periods. Observations were made at six minutes intervals (through daylight), for three treatments. Three stocking rate were selected to study the grazing management practices and Awassi sheep use.

Collected data were preliminary introduced into excel sheet to calculate the exact time required for the animal activity and during morning (am) and evening (pm) time. Thereafter; data were analyzed using PROC GLM procedure of SAS (SAS, 2004).

The following model was used to analyze the data:

$E_{ij} = \mu + t_i + e_{ij}$

Where

E_{ij} : is the observation values for the i-th treatment

μ : is the overall mean

t_i : is the effect of the treatment (light, moderate and heavy grazing intensities), morning and evening behavior

e : is the random error

Table(2): Stocking rate density calculations for 1.6 hectare.

Animal intake per day	1.5 (kg/animal)
Animal units per treatment	676 kg ÷ 1.5 = 450 sheep days
Grazing period (day)	15
Stocking rate (animal / Treat)	
Light grazing (-15)	15 head
Moderate grazing	30 head
Heavy grazing (+15)	45 head

Results and discussion:

Plant survey: A total of 19 families including 76 species were identified within the experiment site (Table 3). The most encountered families were *Cruciferae* and *Compositae*, they encountered the highest species number 15 and 14 species respectively. While the families *Boraginaceae*, *Caryophyllaceae*, *Cestaceae*, *Cyperaceae*, *Ephedraceae*, *Labiatae*, *Papaveraceae*, *Plantaginaceae*, *Tamaricaceae*, *Brassicaceae and Scrophulariaceae* encountered the lowest species number, each family was encountered one species. Also, the plant survey included the preparation of a plant list contain the family name, genus and species. The frequency, density, relative density, abundance, portion and shanon diversely index for all species encountered were calculated (Table 4). The species with the highest frequency are *Carex divisa*, *Sisymbrium irio*, *Torularia torulosa* and *Astragalus spp.* they were recorded 80, 73.3, 73.3 and 66.7 respectively. While, the species with the lowest frequency are *Adonis dentate*, *Lolium spp*, *Torularia torulosa*, *Erodium gruinum*, and *Herniaria hirsute* all of them have the same value 6.7. In previous studies (MOA, 2005), results on plants survey in the reserve showed that the most frequent species were *Poa spp*, *Iris posti*, *Anchusa italic*, *Euphorbia spp*, *Noaea mucronata* . These differences could be attributed to the differences in the environmental factors (rainfall amounts and

Table(3): Plant Families, Genus and Species for the Native Vegetation Survey at Twanah Reserve in spring 2007.

Family	Name	Family	Name
Boraginaceae	*Nonea ventricoza*	Cruciferae	*Sisymbrium runcinatum*
Caryophyllaceae	*Herniaria hirsuta*		*Torularia torulosa*
Cestaceae	*Helianthemum ledifolium*	Cyperaceae	*Carex divisa*
Chenopodiaceae	*Atriplex halimus*	Ephedraceae	*Ephedra spp.*
	Hammada eigii	Geraniaceae	*Erodium gruinum*
	Salsola jordanicola		*Erodium spp.*
	Noaea mucronata		*Geranium spp.*
	Anabasis syriaca	Gramineae	*Bromus spp*
	Noaea mucronata		*Hordeum spontaneum*
	Salsola jordanicola		*Hordeum glaucum*
	Salsola vermiculata		*Lolium spp*
Compositae	*Ifloga spicata*		*Poa sinaica*
	Aaronsohnia factorowskyi	Iridaceae	*Crocus aleppicus*
	Carduus spp.		*Iris sisyrinchium*
	Anthemis spp.		*Crocus cancellatus*
	Achillea fragrantisium	Labiatae	*Salvia spinosa*
	Centaurea iberica Trevir.	Liliaceae	*Gagea spp.*
	Scorzonera judaica Eig		*Bellevalia spp.*
	Filago desertorum Pomel		*Allium spp.*
	Artemisia herba-alba		*Colchicum tunicatum*
	Lactuca spp.		*Gagea reticulata*
	Matricaria aurea		*Tulipa spp.*
	Scorzonera judaica Eig	Papaveraceae	*Roemeria hybrida*
	Scorzonera papposa	Papilionaceae	*Astragalus spp*
	Senecio spp		*Medicago spp.*
Cruciferae	*Allysum spp.*		*Onobrychis cristan*
	Biscutella spp.		*Onobrychius capu-galli*
	Hypecoum pendulum		*Onobrychis crista-galli*
	Torularia torulosa	Plantaginaceae	*Plantago ovata*
	Matthiola spp.	Ranunculaceae	*Ceratocephala falcata*
	Sisymbrium irio L.		*Adonis aestivalis*
	Malcolmia conringioides		*Adonis dentata*
	Torularia torulosa		*Anemone spp.*
	Malcolmia aratica	Tamaricaceae	*Tamarix spp.*
	Malcolmia conringioides	Brassicaceae	*Diplotaxis erucoides*
	Matthiola aspera	Umbellefereae	*Caetosciadium spp.*
	Matthiola spp.		*Umbellicum spp.*
	Sisymbrium irio L.	*Scrophulariaceae*	*Kickxia spp.*

Table(4): Family, Scientific name, Frequency, Abundance, Density, Relative density, Proportion and Shinion Divers Index (SDI) of the experimental site at Twanah Reserve in Spring 2007.

Family	Scientific name	Frequency	Density	Relative density	Abundance	Proportion	SDI
Gramineae	*Poa sinaica*	53.3	2.1	4.05	4.0	0.04051	0.1299
Chenopodiaceae	*Anabasis syriaca*	53.3	1.6	3.04	3.0	0.03038	0.1061
Compositae	*Artemisia herba-alba*	20.0	0.4	0.76	2.0	0.00759	0.0371
Brassicaceae	*Diplotaxis erucoides*	86.7	10.5	19.87	12.1	0.19873	0.3211
Compositae	*Scorzonera judaica Eig*	40.0	0.8	1.52	2.0	0.01519	0.0636
Cestaceae	*Helianthemum ledifolium*	40.0	1.5	2.78	3.7	0.02785	0.0997
Papilionaceae	*Astragalus spp.*	66.7	4.3	8.10	6.4	0.08101	0.2036
Cruciferae	*Torularia torulosa*	73.3	4.3	8.23	5.9	0.08228	0.2055
Cruciferae	*Matthiola spp.*	20.0	0.2	0.38	1.0	0.00380	0.0212
Liliaceae	*Allium spp.*	33.3	0.7	1.39	2.2	0.01392	0.0595
Gramineae	*Hordeum glaucum*	26.7	0.4	0.76	1.5	0.00759	0.0371
Cruciferae	*Sisymbrium irio L.*	73.3	5.9	11.14	8.0	0.11139	0.2445
Papilionaceae	*Onobrychis cristan*	33.3	1.3	2.41	3.8	0.02405	0.0897
Liliaceae	*Colchicum tunicatum*	53.3	1.3	2.53	2.5	0.02532	0.0931
Liliaceae	*Gagea reticulata*	33.3	1.1	2.03	3.2	0.02025	0.0790
Cruciferae	*Malcolmia conringioides*	40.0	0.5	0.89	1.2	0.00886	0.0419
Ranunculaceae	*Adonis dentata*	6.7	0.1	0.13	1.0	0.00127	0.0084
Cyperaceae	*Carex divisa*	80.0	6.9	13.04	8.6	0.13038	0.2656
Iridaceae	*Crocus cancellatus*	13.3	0.4	0.76	3.0	0.00759	0.0371
Compositae	*Filago desertorum Pomel*	33.3	0.6	1.14	1.8	0.01139	0.0510
Umbellefereve	*Caetosciadnum spp.*	13.3	0.3	0.51	2.0	0.00506	0.0268
Gramineae	*Lolium spp.*	6.7	0.1	0.13	1.0	0.00127	0.0084
Chenopodiaceae	*Salsola jordanicola*	26.7	7.2	13.67	27.0	0.13671	0.2720
Cruciferae	*Torularia torulosa*	6.7	0.1	0.13	1.0	0.00127	0.0084
Geraniaceae	*Erodium gruinum*	6.7	0.1	0.13	1.0	0.00127	0.0084
Chenopodiaceae	*Noaea mucronata*	20.0	0.2	0.38	1.0	0.00380	0.0212
Caryophyllaceae	*Herniaria hirsuta*	6.7	0.1	0.13	1.0	0.00127	0.0084

temperature) and soil topography. Snow accumulation was happened during winter 2007 which is unusual at the study location.

The species with the highest SDI were *Salsola jordanicola Carex divisa, Sisymbrium irio L., Torularia torulosa* and *Astragalus spp.* they were recorded 0.27, 0.26, 0.2445, 0.20 and 0.20 respectively. These species are characterized by high diversity and they are considered of high economic value within the reserve area because of their palatability and it is nutritive value for sheep. Population of *Salsola vermiculata* under extinct, its highly palatable and preferable by Awassi sheep than other grazing plants. While *Noaea mucronata* and *Anabasis syriaca* are invasive plants. In Jordan, the degradation of plant cover due to overgrazing and the absence of control measures has caused a decline in more palatable subshrubs, perennial grasses and legumes such as *Salsola vermiculata, Salsola laneifolia, Stipa barbatagalus spp and Onobrychis spp,* formerly common in the Jordan steppe area. They have been replaced by less palatable plants such as *Noaea mucronata*, and *Peganum harmala* (FAO, 1994).

Productivity: Table (2) shows productivity of Atriplex shrubs and native vegetation before grazing. Results on *Atriplex halimus* yield in Al-Khanasry reserve which is located in the north of Jordan in the year 2006 estimated by 129 kg/1.6 hectare (Al-Satari et al. 2007), while in our study it was estimated by 18 kg/1.6 hectare, which is extremely lower than the productivity in Al-Khanasry reserve, this may be due to the differences in average of rainfall and humidity which were higher in the north of Jordan is much higher than in the southern part where our study was performed. Particularly speaking about *Atriplex halimus* because it has considerable forage potential in the arid and semi-arid rangelands. It has been planted in numerous zones in the country, including Twana reserve. Its well known as a tolerant plant for drought and heavy grazing (Nefzaoui, 1997).

Forage production was 676 Kg / 1.6 ha dry matter including both annuals and shrubs (*Atriplex halimas*) in the study site.

Coverage percent was calculated during the plant survey and estimated by 40% of the total area. While covering percentage in 2005 in the same reserve was 21%. This explained as the protection actions considered which allowed better plant growth and coverage. Plant density in the year 2005 was 8.53% plant/ m^2 this was the highest for *Eucarea boveana* (MOA, 2005). This result is not

in agreement with our current study, since this species is not observed in our survey. The highest plant density investigated in this study was 10.5 % plant/ m^2 for *Diplotaxis erucoides*, followed by *Salsola jordanicola* with plant density of 7.2% plant/ m^2. The large area of the reserve and variation of the topography within its area elucidate why are those differences in the dominant plant species prevalence in the reserve. Table (2) shows stocking rate density results for that are used within the animal behavior study.

Animal behavior: result on sheep grazing behavior shows that there is significant difference between the three grazing scenarios of the native vegetation use. The vegetation cover decreased significantly under the moderate and heavy grazing intensities (Table 5).

Table(5): Vegetation cover (%) and Dry Matter use after grazing.

Grazing	Vegetation Cover % use	DM% use
Low	21	47
Moderate	60	57
Heavy	68	60

This result was expected, since the high number of animals per area unit and due to the increase in dry matter intake for the moderate and heavy grazing intensities . The same result was reported by Ngugi and Conant (2003) and by Hyder et al. (1975).

Table 6 shows that grazing and browsing behavior to be highly significantly ($P< 0.01$) differ between observations hours. At 18:00 o'clock animals were observed to spend more time in grazing (35.33 minutes) and browsing (5.33 minutes) while the lowest grazing and browsing hours were observed during 11:00, 12:00 and 15:00. This could be attributed to the fact that the day temperature is lower in the evening than in the mid of the day. Additionally, pasture level and physiological stage influence grazing time (Arnold, 1981).However the sheep's major strategy for meeting their nutritional requirements is to increase total daily grazing time (Gibb and Robert 1997) this was clear in the evening grazing .Also during 1.8 hour, animals appeared the lowest lying behavior which was 0.00 minutes, compared to 30.26 and 27.91 minutes, at 11:00 and 12:00 respectively, which were the highest in lying also. When the shade is lack, animals may

Table(6): Animal behavior through day light.

Status	Hours of monitoring (hours of starting at morning)										
	8	9	10	11	12	13	14	15	16	17	18
Grazing	28.23 b	15.33c	14.61 c	6.13f	5.87 f	10.27de	13.2 dc	6.93 fe	12.13 dc	27.89 b	35.33 a
Browsing	3.14b	0.00 d	1.17 cd	1.174cd	1.70cd	2.8cb	1.67 cd	1.47cd	2.13cb	2.27cb	5.33 a
Laying	1.64 e	11.73 dc	12.26 dc	30.26 a	27.91 ab	7.733 d	14.00 c	24.67 b	15.87 c	2.93 e	0.00 e
Drinking	0.00 e	0.4 ed	1.04 cd	0.39 ed	4.83 a	2.00 cb	0.53 cd	0.13 ed	0.00 e	1.73 cd	2.53 b
Standing	21.96 ec	29.87 a	25.96 ac	19.57 ed	18.39 e	29.07 a	26.53 ab	22.67 bd	27.73 a	19.47 ed	10.40 f
Ruminating	5.05 bd	2.67 ed	4.96 bd	2.48 ed	3.13 ed	8.267 a	4.27 bd	4.27 bd	2.13 e	5.73 bc	6.4 ab

show heat stress and walk excessively to optimize evaporative cooling (ON) but this is not the case in Awassi sheep, since this breed of sheep possess a social behavior where they hide their heads under the bodies of the other surrounding sheep. At 12:00 drinking behavior was the highest (4.83 minutes). This explained as the temperature is the highest in the mid of the day and that the grazing time is the lowest during this hour. It could be noticed that the distance animals need to reach the water point and the daily temperature influence water intake. Water and forage is interrelated, forage intake is well associated with water intake (Hyder et al. 1968). However, Through 9:00, 13:00 and 16:00 hour's animals spend the highest time in standing, while ruminating was observed to be the highest in 13:00 (8.27 minutes).

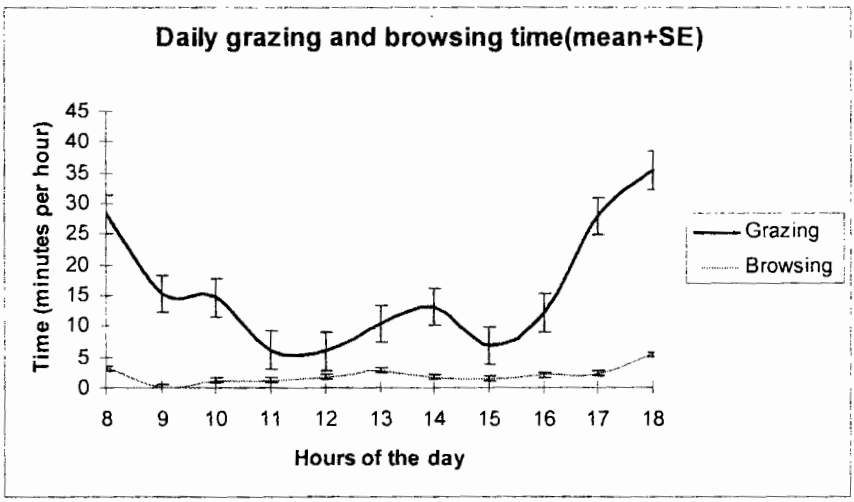

Fig.(1): Daily grazing and browsing times (minutes per hour).

The over all means of grazing, browsing, lying, drinking ,standing and ruminating behaviors during day light were 15.92 ± 0.57, 2.01 ± 0.17, 13.58 ± 0.66, 1.24 ± 0.16, 22.86 ± 0.48 and 4.47 ± 0.26 minutes/hour, respectively. Time of standing, ruminating and laying is longer than what Sharp et al (1995) has found. This could be attributed to the difference in the experiment location and environmental conditions prevailing in the semi-arid rangelands, and to the fact that Awassi sheep differ from other sheep breeds in laying and standing behavior. Ruminating

activity was the highest during the night and the lowest during the day time which could be attributed to the fact that Awassi sheep graze on different shrubs, but not on perennial ryegrasses, this implicate more time for ruminating in the laying time and in the evening. Low browsing may attributed to the high palatability of the annual plants comparing to shrubs.

Non-significant differences were observed between the grazing behavior of the three groups, while the moderate density group have the highest ($p<.001$) browsing, ruminating and drinking behaviors, the heavy density group was significantly ($p<.001$) the highest in lying behavior, while the light density group was observed to behave the highest ($p<.001$) in standing (Table 7).

Table(7): Effect of Grazing density in the animal behavior under light, moderate and heavy stocking rate.

Status	Grazing density		
	Light	Moderate	Heavy
Grazing	15.116	16.5	16.145
Browsing	1.719 b	2.928 a	1.381 b
Laying	12.0 b	12.464 b	16.291 a
Drinking	1.866 a	1.286 ab	0.581 b
Standing	25.939 a	20.929 b	21.782 b
Ruminating	3.732 b	5.928 a	3.745 b

Morning (8:00-12:00) grazing period (13.98±0.83minutes/hour) was lower significantly ($p<.0001$) than evening (12:00-18:00) grazing (17.62 ± 0.76), the browsing behavior was observed to be highly significantly ($p<.001$) affected by parts of day light, evening browsing behavior was higher (2.51 ± 0.24) than morning (1.42 ± 0.26). However, sheep has relatively small mouth and remarkably dexterous lips, they are able to graze closely to the ground and are also able to comfortably adapt to browsing (picking the leaf material from bushes or other plants), this anatomical behavior result in ability of sheep to be extremely selective about what they consume, its reported that if abundance of pasture are available, sheep will be very selective (Gill, 2004). The narrow mouth and flexible lips for sheep allow them to be

selective in their grazing by taking individual bites (Weisebrot, 2007). Morning was higher ($p<.0001$) (16.81 ± 0.95) than evening (10.86 ± 0.87) in lying period while evening was higher in ruminating, this is explained as the light determining the rumination rhythm during 24 h. In general small ruminants eat during the day and ruminate during the night (Welch and Hopper, 1988). The same result reported by (Keskin et al. 2005) Non-significant differences were observed between morning and evening drinking and standing behaviors (Table 8).

Table (8): Animal behavior during morning and evening period.

Status	Part of day	
	Morning (am)	Evening (pm)
Grazing	13.905 b	17.626 a
Browsing	1.4273 b	2.5111 a
Laying	16.811 a	10.867 b
Drinking	1.3480	1.1556
Standing	23.1278 a	33.6444 a
Ruminating	3.6476 b	5.1778 a

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السلوك الرعوي لأغنام العواسي حسب المسح للنبات الموجودة في جنوب الأردن

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تم تنفيذ هذه الدراسة في محمية التوانة خلال شهر أيار 2007 وقد سجل السلوك الرعوي لأغنام العواسي خلال النهار لمدة 9 أيام (ابتداء من 8 صباحا وحتى 6 مساء) كل 6 دقائق، تم استخدام ثلاث فئات لرعي الأغنام حسب شدة الرعي: خفيف (L)، معتدل (M)، شديد (H)، تم اعداد مسح وتصنيف لأنواع الغطاء النباتي وتحضير قائمة نباتية، وتسجيل نسبة التغطية النباتية وحساب تكرار الانواع، وتواجدها وشدتها، والكثافة النسبية لها، ومؤشر" شانون دايفر" والإنتاجية النباتية والمسموح بها للرعي للموقع والحمولة الرعوية.

لم تظهر النتائج أية اختلافات معنوية بين مجموعات الرعي الثلاث بينما كانت مجموعة (M) اعلى تغذية للشجيرات Browsing (P<.001)، الاجترار Ruminating والشرب، كانت مجموعة (H)) الأعلى بشكل واضح في سلوك الاستلقاء Laying (P<.001) ، و مجموعة (L) كانت الاعلى في الوقوف (P<.001).

أعطى سلوك رعي النباتات الطبيعة الحولية ورعي الشجيرات اختلافا معنويا (P<.01) حسب ساعات المشاهدة. بينما رعي النباتات الطبيعة الحولية في النهار كان أقل معنويا (P<.0001) منه في المساء، كان رعي الشجيرات في المساء أعلى معنويا (P<.001) منه في النهار. حيث لوحظ بأن الحيوان يتأثر بشكل واضح بضوء النهار.

اظهر سلوك الأغنام بأن فترة الاستلقاء تكون أطول في النهار (P<.0001) منها في إلليل، بينما في الليل كان أعلى من حيث الاجترار ولم يلاحظ اية اختلافات معنوية في الشرب والوقوف بين فترتي الليل والنهار.

كانت الإنتاجية المسموح بها 422.5 كغم/هكتار ، ومعدل الرعي 9.38 و 18.75 و 28.13 رأس/هكتار للمجموعات (L) (M) (H) على التوالي. أهم نتائج المسح النباتي أظهرت 76 صنف تنتمي إلى 19 عائلة نباتية وكانت العائلات الأكثر شيوعا العائلة الصليبية والمركبة التي سجلت أعلى أعداد من الأصناف 15 و 14 على التوالي.

اما الأصناف السائدة فقد كانت *Carex divisa* و *Sisymbrium irio* (حويرنة، شبسة) و *Torularia torulosa* و *Astragalus* spp. (القتاد).

كما قدرت نسبة التغطية الكلية ب 40% ونسبة الغطاء النباتي المستخدم في الرعي 21% 60,% و 68% بينما المادة الجافة المستخدمة كانت 47%و 57%و 60% في الرعي الخفيف، المعتدل والشديد على التوالي.