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PRODUCTIVITY AND NUTRITIVE VALUE OF NATURAL VEGETATION AT WADI-WATEER REGION IN SINAI

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ABSTRACT

The present study was carried out in 2004/ 2005 – 2005/2006 seasons to make survey of plant vegetation at Wadi Wateer (East southern of Sinai) (a bout 100 km length) at 9 successive sites. The study was carried through two years (two wet and dry seasons) to evaluate the vegetation structure throughout 20 chart quadrates (2 m x 2 m) at each site. The results showed that most of the pasture measurements such as plant density (plants / 4 m^2), coverage %, frequency %, abundance % and fresh, and dry yields (ton/fad.) reached its maximum values during the wet seasons. Sites 5, 6, 7, 8 and 9 were more suitable for growth of the plant associations than other sites under studies. Many plant species such as *Astragalus spinsous, Medicago laciniata, Artemisia Judica, Artemisia monosperma, Legum spartum, Haloxylon salicornicum, Calotropis procera, Lycium shawii and Paronychia sinaica* were capable to grow under the aridity conditions at Wadi Wateer area.

INTRODUCTION

Natural vegetation are mainly dependent on the prevailing environmental conditions in the desert, such conditions play a great role in controlling the seasonal aspects of the floral vegetation.

East southern of Sinai, Egypt is considered the minimum district in its annual winter rainfall, were the average 16.17 mm at Nowibaa and 17.6 mm at Nikhil with uneven distribution, low and medium relative humidity through 5 months, were various plant communities can be grow during such limited rainy seasons. Natural vegetation in most countries of the world consider as main resource for supporting the wild and domestic animals with its basic forage requirements. The productivity and quality in relation to prevailing environmental conditions need to be assessed and clarified in order to get more Justification for the optimum and adequate use for better range management.

Ayyad and Ghabbour (1977) revealed that the existing environmental conditions have an important role in range flourishing productivity and nutritive value.

Moreover, moisture availability for vigorous growth of native plants is limited, under arid land condition, however profit feasible biomass production is associated with adequate precipitation **Abou Dyea and Salem (1990 a) and Habbs *et al* (1984).**

Abou Dyea and Salem (1990 b) in El-Negila area they found that the genera of legumes and grasses had the greatest number of species. Density (plant/ m^2), coverage %, abundance % and frequency % varied widely from one season to another, where different vegetation characters attained its maximum in spring and winter seasons. **Reiad *et al* (1996b)** studied the effect of locations and environmental conditions in Sidi- Barrani and El- Negila area on vegetative characters. They reported that the vegetative measurements varied according to the studied locations and growing seasons and the highest averages values were recorded at Sidi- Barrani due to its favorable environmental conditions. **Hendawy (2002)** studied the effect of eight different sites at Gabal El- Maghara region in middle Sinai on the natural vegetation. He found that the highest values of the most parameters were recorded during the spring seasons. This is could be due to the increase in available relative humidity which result in more growth activity. **El-Toukhy *et al* (2002)** studied the productivity of some associations and seasonal locations as well as climatic factors on growth parameters at wadi El- Natron , Al- Alameen road in the North Western Coast (NWC) of Egypt under 5 different sites condition. The results showed that sites 5 and

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1 produced higher yields during winter seasons, where these sites more correlated by the availabity of rains as well as the other favourable climatic factors.

Ahmed and Nassar (1999) studied the chemical composition of 108 samples of various range plants belonging to 19 families from different sties along the NWC of Egypt. The results indicated that the chemical composition of the concerned range plants varied within the different species under different habitat conditions.

MATERIALS AND METHODS

Natural range vegetation depends mainly on the amount of rainfall which widely varies in quantity and frequency from year to year. Moreover, various types of range plants are closely associated with the edaphic and prevailing climatic conditions of the studied areas. This investigation was conducted to asses the productivity and the nutritive values for the present range plants in Wadi Wateer area in east south Sinai. This study was conducted in two seasons of nine successive sites during the two years (from autumn 2004 up to spring 2006).

Nine sites were determined inside Wadi Wateer beginning from the 260 km at the international road at middle Sinai to Nowibaa city, each site was determined after each consecutive 10 km distance in the direction of Nowibaa. The different sites are located at 8, 19, 27, 36, 48, 55, 66, 78, 95 km from the beginning of the wadi, respectively.

Means of some meterological data of Nowibaa and Nikhl city during the period extended from autumn 2004 up to spring 2006 are presented in **Table (2).**

Twenty chart quadrates of 2 m x 2m tool were used to determine the plant density (plants/ 4 m^2), coverage %, frequency %, abundance % of the natural vegetation. Number of individual species and the area occupied by them were determined from twenty stand sampling over the nine sties during both wet (spring) and dry (autumn) seasons.

Hanson and Churchill (1965) equations were used to calculate the previous measurements as the following

$$\text{Density (plant/m}^2\text{)} = \frac{\text{Number of the individual species}}{\text{Total area (in units)}}$$

$$\text{Coverage \%} = \frac{\text{The area occupied by the species}}{\text{The whole investigated area (in units)}} \times 100$$

$$\text{Frequency \%} = \frac{\text{Number of occurrence of the individual species}}{\text{Number of occurrence of the whole species}} \times 100$$

$$\text{Abundance \%} = \frac{\text{Number of the individual species}}{\text{Total number of the whole species}} \times 100$$

Fresh and dry production

Fresh production was determined by weighting each species in a square meter and for whole plant species in unit area, then calculated in (ton/fad).

Dry production

Samples were randomly taken from the fresh matter of each species and then dried in an air forced drying oven at 70ºC for a constant weight (dry weight) during the two seasons.

Plant identification

Plant identification was done according to **Täckholm (1974) and Boulos (2005).** The list of the collected plants included family name, scientific name, palatability and life duration **Aslan, (1959).**

Chemical composition

Chemical composition of dry matter of each of the palatable plant species were determined as follows

Crude protein (CP) was estimated by using modified micro kjeldahl method as described by **Peach and Tracey (1956)** to determine total nitrogen and then multiplied by 6.25.

Crude fiber (CF) and total ash were determined according to **A.O.A.C. (1970).**

Ether Extract (EE) was extracted by Hexane in soxhelt according to **A.O.A.C (1970).**

Sodium and potassium contents of plant samples were estimated using flame- photometer in an acid digestion solution according to **A.O.A.C. (1980).**

Total digestible nutrient (TDN) was determined according to **Khafagi (1977**).

Soil physical and chemical properties

Soil samples were taken from the different sites from two depths (0- 20) and (20-40) ; physical analysis was conducted by using the international pipette method described by **Piper** (**1950)**. Chemical determinations were carried out according to **Jackson (1958)** as presented in **Table (1).**

Table 1. Soil physical and chemical properties of nine studied sties in Wadi Wateer during the period extended from autumn 2004 up to spring 2006

Site	Depth (cm)	pH	E.C m.mhos /cm	Cations (me/L)				Anions (me/L)				$CaCO^3$ %	Texture
				Ca^{++}	Mg^{++}	Na^{+}	K^{+}	Cl-	So_4^{-}	HCO_3^{-}	CO_3		
1	0-20	7.80	1.15	2.45	6.14	2.81	1.13	8.40	0.71	2.08	-	27.81	sandy
	20-40	7.74	1.19	2.56	6.18	1.19	1.82	8.34	0.88	2.81	-	21.46	sandy
2	0-20	7.70	1.20	2.63	7.00	1.30	1.91	9.14	0.91	1.89	-	31.40	Loamy sandy
	20-40	7.65	1.13	2.34	6.99	1.45	1.95	9.80	0.89	2.00	-	22.14	Loamy sandy
3	0-20	7.62	1.40	2.14	7.18	1.22	1.53	8.20	0.75	2.03	-	27.33	Loamy sandy
	20-40	7.79	1.55	3.33	7.81	2.40	2.67	10.95	0.66	2.91	-	30.01	Loamy sandy
4	0-20	7.56	1.30	2.18	6.94	3.5	1.13	10.88	0.95	2.13	-	30.41	Loamy sandy
	20-40	7.61	1.42	3.88	6.14	3.01	1.01	10.77	0.69	2.18	-	24.50	Loamy sandy
5	0-20	7.80	1.81	4.00	7.19	4.22	2.18	14.21	0.95	3.20	-	26.18	Loamy sandy
	20-40	7.55	1.94	4.81	6.90	5.21	2.11	14.99	0.78	4.03	-	28.29	Loamy sandy
6	0-20	7.40	1.90	4.85	7.34	4.88	2.10	13.80	0.88	4.80	-	33.15	Loamy sandy
	20-40	7.88	1.93	4.70	6.93	5.00	2.81	12.30	0.99	5.00	-	35.19	Loamy sandy
7	0-20	7.69	1.40	2.88	5.70	2.71	2.73	8.85	0.69	3.00	-	31.45	Loamy sandy
	20-40	7.67	1.48	2.74	5.37	3.13	2.18	7.40	0.94	5.71	-	30.80	Loamy sandy
8	0-20	7.43	2.90	10.19	8.14	6.55	4.30	20.94	0.83	6.84	-	30.18	Loamy sandy
	20-40	7.52	2.40	8.80	6.92	5.17	2.22	20.33	0.76	2.45	-	31.44	Loamy sandy
9	0-20	7.49	2.30	9.71	6.87	5.18	2.19	19.82	0.63	2.84	-	35.15	Loamy sandy
	20-40	7.50	2.17	8.81	6.00	5.14	2.01	2.01	0.74	3.07	-	35.13	Loamy sandy

Table 2. Means of some meteorological data of Nowibaa and Nikhl city during the period extended from autumn 2004 up to spring 2006

month / climatic factors	Jan.	Feb.	Mar.	Apirl	May.	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	Nowibaa											
Temperature (◦C)												
Maximum	21.0	21.8	24.5	28.3	32.5	35.7	37.5	37.0	34.4	30.5	26.2	22.6
Minimum	13.6	14.0	16.3	19.2	22.7	24.8	26.8	27.3	25.6	23.1	19.2	15.5
Relative humidity % (R.H.)	49	47	49	50	49	48	50	52	55	55	51	50
Rainfall (mm)	5.8	1.4	0.7	1.2	1.03	0	0.04	0	0	2.7	2.9	0.4
Wind speed (km/h)	15.7	15.3	15.5	14.8	13.5	13.8	10.9	11.1	13.1	11.2	13.1	14.8
	Nikhl											
Temperature (◦C)												
Maximum	18.0	19.5	23.0	28.2	32.4	34.2	37.0	35.8	32.8	28.9	24.3	19.4
Minimum	1.4	2.4	5.1	8.7	12.0	14.4	16.9	17.5	15.1	12.8	7.2	2.4
Relative humidity % (R.H.)	63	58	55	48	45	50	49	55	59	64	62	63
Rainfall (mm)	3.7	2.4	0.4	0.2	1.1	0	0	0	0	5.9	0.3	3.6
Wind speed (km/h)	10.5	11.4	12.0	11.6	10.5	8.8	7.4	9.62	9.2	7.9	7.4	8.5

Source: Meteorological authority, Cairo.

RESULTS AND DISCUSSION

Vegetative growth traits

Botanical composition

Data presented in **Table (3)** showed that the natural vegetation components of Wadi Wateer consisted of 33 plant species belonged to 15 families. Most of the existing plant species in this area 27 species were perennials. Whereas, the annuals species were 6 plants species, nineteen species were palatable and the other 14 were unpalatable. The highest number of the following plant species i.g., *Artemisia Judica, Artemisia monosperma, Peganum harmala, Zygophyllum album, Haloxylon salicornicum, Zilla spinosa* and *Calotropis procera* were noticed in both wet and dry seasons at most sites. The dominant of these plant species compared with other plant species plant could be due to its wide adaptability and capability to grow under the prevailing.

Density (Plant / 4 m^2)

Data in **Table (4)** indicated that the density of the native plant species were greatly higher in wet season compared with that of dry season. The total density of the nine investigated sites amounted 35.6 (plant / 4m^2) in wet season compared with 17.65 (plant/ 4m^2) in dry season. The density of wet season were recorded with sites, 9, 4, 7 and 5 and with sites 9 and 8 in dry season. The density of these sites were 10.95, 6.15, 5.50, 3.20 (plant / 4 m^2) in wet season and in dry season 6.10, 5.25 (plant / 4 m^2), respectively. The above results proved plant density at that Wadi Wateer in wet season at sites 4, 6, 7, 9 showed that superiority over of sites 1, 2, 3, 5, 8. This finding means that the vegetative growth activities are more dependable on the suitability and convenience of the prevailing environmental conditions, since it grow well under the adequacy of the available water, moderate temp. and dew…. etc. as presented in **Table (2)**, this could be attributed mainly to many edaphic factors as soil texture, water holding capacity, organic matter, salt content **Table (1).**

Similar results were previously obtained by **Ibrahim (1995) and Reiad *et al* (1996 a)** in North Western Coast of Egypt. They found that Sidi – Barrani associations had the highest plant density over all seasons than El-Negila area. The plant density was the highest value during the winter period (wet season) at Sidi – Barrani and El- Negila than dry season. **El-Toukhy *et al* (2002)** in Al-Alameen road (NWC), **El-Morsy (2002)** in NWC of Egypt and **Ibrahim *et al* (2006)** in North Eastern Coast of Egypt.

Coverage %

Data in **Table (5)** showed that the highest plant coverage percentages in Wadi Wateer were recorded at sites 4, 5, 6, 7, 8, 9 which were (11.88, 11.37, 12.65, 11.48, 12.75 and 14.27%) in wet season and sites (4, 5, 6, 7, 8,9) which were (9.74, 7.91, 12.54, 10.04, 9.25, 9.94) in dry season. The superiorty of coverage % in wet season than that of dry season may be attributed to the precipitation and environmental effects and the relatively appropriate soil **(Tables 1, 2).** Similar results were reported by **Ibrahim (1995)** in NWC of Egypt ; **Reiad *et al* (1996 a & b)** in NWC of Egypt; **Hendawy (2002)** in Gabal El Maghara region, Middle Sinai, **El- Morsy (2002)** in Wadi Magid and Wadi Mehgun at NWC of Egypt and **Ibrahim *et al* (2006)** In North Eastern Coast of Egypt. Plant species of the highest coverage percentage at Wadi Wateer were *Artemisia Judica, Artemisia manosperma, Haloxylon salicornicum, Zilla spinosa, Calotropis procera and lyceum shawii*.

Frequency %

Results in **Table (6)** represent the effect of sites and growing seasons on the frequency of the naturally growing plant species. It is obviously clear that the site 6 in wet seasons was of the highest frequency compered with other sites in wet and dry seasons. The highest frequencies of plant species were for *Artemisia Judica, Artemisia monosperma and Haloxylon salicornicum* in dry and wet seasons. This finding revealed that these plant species are dominant in this area and this could be due to the effect of edaphic factors which act as promoter for the richest and most adaptive to the dominant environment conditions. **Abd-Alla (1999)** in North Western Coast of Egypt; **Hendawy (2002)** in Gabal El Maghara region, Middle Sinai and **Ibrahim *et al* (2006)** In North Eastern Coast of Egypt had similar results.

Abundance %

Data in **Table (7)** showed the effect of sites and growing seasons on the abundance of the naturally grown plant species. The highest abundance % of natural plant species were noticed in sites 5, 6, 7, 8, 9 in both dry and wet seasons. This may be due

Table 4. Plant density (plant /4m^2) of plant species in Wadi Wateer as affected by sites and seasons during the period extended from autumn 2004 up to spring 2006

No.	Dry seasons										Wet seasons									
	1	2	3	4	5	6	7	8	9	Total	1	2	3	4	5	6	7	8	9	Total
1								0.05		0.05										
2								0.05	0.05	0.10				0.05					0.05	0.10
3			0.10					0.05		0.15						0.05		0.05		0.10
4			0.05	0.1		0.05	0.05	0.05		0.30			0.05	0.05	0.05				0.05	0.20
5						0.05		0.05		0.10						0.05		0.05		0.10
6								2.50	5.00	7.50					0.50	1.00	2.50	2.00	1.50	7.50
7									0.25	0.25										
8																			1.50	1.50
9																			2.50	2.50
10							0.05	0.05		0.10					0.05			0.05		0.10
11		0.05			0.15		0.05			0.25		0.15		0.20		0.05	0.05	0.15	0.20	0.80
12		0.05		0.05				0.05	0.05	0.20		0.05	0.10	0.10	0.05	0.05	0.10	0.15	0.05	0.65
13								0.70		0.70					0.50	100	1.00	1.50	4.50	8.50
14				0.05		0.05		0.05		0.15						0.05	0.05	0.05	0.05	0.20
15													0.05		0.10					0.15
16						0.05				0.05								0.05		0.05
17	0.2	0.05	0.20	0.25	0.30			0.05	0.05	1.10		0.10	0.25	0.25	0.15	0.05		0.05	0.05	0.90
18		0.30	0.15	0.15	0.15	0.20	0.15		0.15	1.25		0.15		0.05	0.05	0.05	0.20	0.05	0.10	0.65
19							0.10			0.10							0.05			0.05
20															0.05		0.05			0.10
21			0.05			0.05		0.05		0.15			0.15	2.50	0.25	0.20				3.10
22	0.8	0.4	0.40	0.25	0.40	0.35	0.35	0.45	0.30	3.7	1.00	0.40	0.3	0.20	0.15	0.30	0.10	0.15	0.15	2.75
23						0.05		0.05		0.10										
24				0.05	0.05					0.10				0.05	0.05				0.05	0.15
25						0.05	0.05			0.10				0.05			0.05		0.05	0.15
26		0.15		0.05		0.05		0.05	0.05	0.35		0.15	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.50
27			0.10	0.05	0.05	0.05			0.05	0.30		0.05	0.15	0.05	0.05	0.05	0.05		0.05	0.45
28							0.05			0.05						0.10	0.05			0.15
29					0.05				0.05	0.10				0.05	0.05	0.10	0.05		0.05	0.30
30							0.20		0.05	0.25							0.10	0.05		0.15
31													0.1			0.05	0.05			0.2
32														2.50			1.00			3.50
33							0.05		0.05	0.10					0.05					0.05
T	1.00	1.00	1.05	1.00	1.15	1.00	1.10	4.25	6.10	17.65	1.00	1.05	1.20	6.15	2.15	3.20	5.50	4.40	10.95	35.6

T. Total

Table 5. Coverage percentage of plant species in Wadi Wateer as affected by sites and seasons during the period extended from autumn 2004 up to spring 2006

No.	Dry seasons										Wet seasons									
	1	2	3	4	5	6	7	8	9	M.	1	2	3	4	5	6	7	8	9	M.
1								+												
2								1.25	1.10	0.26				1.25					1.20	0.27
3			0.35					0.25		0.06						0.70		0.20		0.10
4			0.43	0.26		1.12	0.43	0.25		0.27			0.30	0.40	0.25				0.70	0.18
5						2.00		1.25		0.36						2.10		1.20		0.37
6								0.25	0.56	0.09					0.10	0.25	0.25	0.45	0.25	0.14
7									0.10	0.01										
8																			0.70	0.08
9																			0.90	0.10
10							0.15	0.07		0.02					0.43			0.20		0.07
11		0.43			0.48		0.25			0.13		0.87		0.90		0.18	0.40	2.20	0.65	0.58
12		0.15		0.80				0.18	1.25	0.26		0.18	0.50	0.50	0.26	0.40	0.70	2.30	0.45	0.59
13								0.07		0.01					0.25	1.10	0.25	1.10	1.00	0.41
14				1.25		0.15		0.90		0.25						0.30	0.60	1.00	0.80	0.30
15													0.25		0.80					0.12
16						0.80				0.08								0.15		0.02
17	0.29	0.18	0.97	1.10	1.40			0.52	0.40	0.54		0.06	0.80	0.90	1.50	0.37		0.50	0.56	0.59
18		1.33	0.88	0.48	0.53	0.70	0.23		0.48	0.51		1.41		1.00	0.37	0.56	0.50	0.05	1.10	0.55
19							0.15			0.02							0.30			0.03
20															0.18		0.25			0.05
21			0.35			0.18		0.15		0.07			0.25	0.70	0.40	0.15				0.17
22	2.92	1.80	1.61	3.17	2.25	3.02	3.02	2.06	3.70	2.61	7.35	5.35	2.80	1.70	2.21	3.90	1.05	1.50	2.40	3.14
23						1.80		1.87		0.40										
24				1.25	1.25					0.27				1.25	1.25				1.20	0.41
25						1.25	1.25			0.27				0.43			1.12		1.20	0.31
26		0.51		0.18		0.40		0.18	0.25	0.16		1.10	1.45	0.90	0.87	0.18	0.60	0.70	0.26	0.67
27			0.40	1.25	0.80	1.12			0.30	0.43		0.70	1.15	0.50	1.00	0.70	0.43		0.45	0.55
28							0.43			0.04						0.40	0.60			0.11
29					1.20				0.37	0.17				1.10	1.10	1.10	1.20		0.45	0.55
30							4.06		1.25	0.59							2.30	1.20		0.39
31													0.56			0.26	0.50			0.15
32														0.35			0.43			0.09
33							0.07		0.18	0.02					0.40					0.04
T	3.21	4.40	4.99	9.74	7.91	12.54	10.04	9.25	9.94	8.00	7.35	9.67	8.06	11.88	11.37	12.65	11.48	12.75	14.27	11.05

T. Total

Table 6. Frequency percentage of plant species in Wadi Wateer as affected by sites and seasons during the period extended from autumn 2004 up to spring 2006

No.	Dry seasons										Wet seasons									
	1	2	3	4	5	6	7	8	9	M.	1	2	3	4	5	6	7	8	9	M.
1								5		0.56										
2								5	5	1.11				5					5	1.11
3								5		1.11						5		5		1.11
4			5	5		5	5	5		2.78			5	5	5				5	2.22
5						5		5		1.11						5		5		1.11
6								5	5	1.11					5	5	5	5	5	2.78
7									5	0.56										
8																			5	0.56
9																			5	0.56
10							5	5		1.11					5			5		1.11
11		5			15		5			2.78		15		5		5	5	15	10	6.11
12		5		5				5	5	2.22		5	5	5	5	5	5	15	5	5.56
13								5		0.56					5	5	5	5	5	2.78
14				5		5		5		1.67						5	5	5	5	2.22
15													5		5					1.11
16						5				0.56								5		0.56
17	20	5	20	25	20			5	5	11.11		5	25	20	15	5		5	5	8.89
18		30	15	15	15	20	15		15	13.89		15		5	5	10	10	5	5	6.11
19							5			0.56							5			0.56
20															5		5			1.11
21			5			5		5		1.67			5	5	5	5				2.22
22	80	40	40	25	35	35	30	30	30	38.33	100	40	30	20	15	30	10	15	15	30.56
23						5		5		1.11										
24				5	5					1.11				5	5				5	1.67
25						5	5			1.11				5			5		5	1.67
26		15		5		5		5	5	3.89		15	5	5	5	5	5	5	5	5.56
27			10	5	5	5			5	3.33		5	15	5	5	5	5		5	5.00
28							5			0.56						5	5			1.11
29					5				5	1.11				5	5	10	5		5	3.33
30							20		5	2.78							10	5		1.67
31													5			5	5			1.67
32														5			5			1.11
33							5		5	1.11					5					0.56
T	100	100	100	95	100	100	100	100	95	98.91	100	100	100	100	100	115	100	100	100	101.67

T. Total

Table 7. Abundance percentage of plant species in Wadi Wateer as affected by sites and seasons during the period extended from autumn 2004 up to spring 2006

No.	Dry seasons										Wet seasons									
	1	2	3	4	5	6	7	8	9	M.	1	2	3	4	5	6	7	8	9	M.
1								1.2		0.1										
2								1.8	0.8	2.9				1.3					0.5	0.2
3			9.5					1.2		1.2						1.5		1.1		0.3
4			4.8	5.0		5.0	4.8	1.2		2.3			4.2	1.3	2.3				0.5	0.9
5						5.0		1.2		0.7						1.5		1.1		0.3
6								58.8	81.3	15.6					23.3	30.8	45.5	44.4	13.6	17.5
7									4.6	0.5										
8																			13.6	1.5
9																			22.9	2.5
10							4.8	1.2		0.7					2.3			1.1		0.4
11		4.8			13.0		4.8			2.5		14.3		5.1		1.5	0.9	3.3	0.5	2.8
12		4.8		5.0				1.2	0.8	1.3		4.8	8.3	2.6	2.3	1.5	1.8	5.6	0.5	3.0
13								16.5		1.8					23.4	30.8	18.2	33.3	41.0	16.3
14				5.0		5.0		1.2		1.2						1.5	0.9	1.1	0.5	0.4
15													4.2		4.7					1.0
16						5.0				0.6								1.1		0.1
17	20.0	4.8	19.0	25.0	26.1			1.2	0.8	10.8		9.5	20.8	6.4	7.0	1.5		1.1	0.5	5.2
18		28.6	14.3	15.0	13.0	2.0	14.3		3.34	12.1		14.3		1.3	2.3	3.5	3.6	1.1	0.9	3.0
19							9.5			1.1							0.9			0.1
20															2.3		1.9			0.5
21			4.8			5.0		1.2		1.2			12.5	6.4	11.6	6.2				4.1
22	80.0	42.7	38.1	30.0	34.8	35.0	28.6	9.7	4.9	33.8	100.0	38.1	25.0	5.1	7.0	9.2	0.9	3.3	1.4	21.0
23						5.0		1.2		0.7										
24				5.0	4.3					1.0				1.3	2.3				1.6	0.6
25						5.0	4.8			1.1				1.3			0.9		0.5	0.3
26		14.3		5.0		5.0		1.2	0.8	2.9		14.3	4.2	1.3	2.3	1.5	0.9	1.3	0.5	2.9
27			9.5	5.0	4.3	5.0			0.8	2.7		4.7	12.5	1.3	2.3	1.5	0.9		0.5	2.6
28							4.6			0.5						3.00	0.9			0.4
29					4.5				0.8	0.6				1.3	2.3	3.0	0.9		0.5	0.9
30							19.0		0.8	2.2							1.8	1.1		0.3
31													8.3			1.5	0.9			1.2
32														64.0			18.2			9.1
33							4.8		0.8	0.6					2.3					0.3
T	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

T. Total

Table 8. Fresh and dry foliage yields (ton/fad) of plant species in Wadi Wateer as affected by sites and seasons during the period extended from autumn 2004 up to spring 2006

Seasons productivity	Dry seasons								
	1	2	3	4	5	6	7	8	9
Fresh yield (ton/fed)	0.161	0.300	0.402	0.548	0.532	0.604	0.604	0.571	0.619
Dry yield (ton/fed)	0.068	0.134	0.188	0.270	0.250	0.270	0.263	0.251	0.311
Seasons productivity	**Wet seasons**								
	1	2	3	4	5	6	7	8	9
Fresh yield (ton/fed)	0.180	0.380	0.377	0.668	0.681	0.846	0.797	0.770	0.795
Dry yield (ton/fed)	0.101	0.201	0.192	0.297	0.285	0.391	0.403	0.332	0.396

to both edaphic and climatic factors particularly precipitation and wind stress effect. These results confirmed what obtained by **Reiad *et al* (1996 a); Hendawy (2002) and Ibrahim *et al* (2006).** In general, the greatest abundance of grown plant species were, *Medicago laciniata* in both wet and dry season, *Glebionis coronaria* wet season, *Haloxylon salicornicum* dry and wet seasons, *Paronychia sinaica* wet season.

Fresh and dry productivity

Fresh and dry yields of native plants are presented in **Table (8).** Results showed that sites 6, 7 and 9 produced the highest fresh yields 0.846, 0.797, 0.795 (ton/fad) respectively, during wet season. This indicated that the yields of this three sites was correlated much by availability of soil moisture as well as climatic and edaphic factors which considered as suitable for most plant species in this area.

In respect of the dry foliage yield results in **Table (8)** showed that the highest dry yields (0.403 and 0.396 ton/fad) were obtained in sites 7, 9 respectively, in wet season and in site 9 in dry season (0.311 ton/fad).

Moreover, the following plant species, i.e., *Artemisia Judica, Artemisia monosperma* and *Haloxylon salicornicum* plants produced the highest fresh and dry weights. The obtain results are in agreement with those of **Ibrahim (1995) and Reiad *et al* (1996 b & c)** in North Western Coast of Egypt; **Hendawy (2002)** in Gabal El Maghara region Middle Sinai **El-Morsy (2002)** in NWC of Egypt and **Ibrahim *et al* (2006)** in North Eastern Coast of Egypt.

Chemical composition

Data of chemical composition of some native plant species are presented in **Table (9).** The results revealed that the all chemical composition traits, i.e., CP, CF, Ash, EE, TDN, Na and K were higher in wet season than that in dry season. The highest chemical composition content of plants in wet seasons compared with that in dry season indicated that chemical composition content of plants were much positively correlated with the available moisture in the soil as well as the surrounding favourable atmosphere for mineral absorption and accumulation in the grown plant species. These results are in harmany with what was reported earlier by **Ibrahim (1995) and Reiad *et al* (1996 b & c)** noticed that the superiority of surpassed native plants with respect to the chemical composion (CP, CF, EE and total carbohydrates) in Sidi-Barrani in compare with El- Negila site these results were truth in autumn season only in Sidi-Barrani and El- Negila . **Ahmed and Nassar (1999)** studied the chemical composition of 108 samples from different sites along the North Western Coast of Egypt. They found that the highest average of CP was concerned to *Fabaceae* compared to *Poaceae* and *Chenopodiaceae* in the North Western Coast of Egypt. Average of ash and mineral composition reached to us maximum in *Chenopodiaceae*. **El-Toukhy *et al* (2002)** studied effect of the variations in climatic on growth parameters of most of the grown plants species during survey of the plant vegetation at Wadi El-Natron - El-Alameen road at five sites. They noticed no clear trend for the chemical constituents for the different studied sites except for Sodium which was higher in some plants for some of the studied sites. Fiber content was higher in *Zilla spinoza, Artemisia inculata, Pituranthos tortuosus, Carduncellus eriocephalus* and *Lycium eurpeum*. and

Table 9. Mean values of chemical content of different plant species at different sites in Wadi Wateer in wet and dry seasons

Site	No.	Dry season							Wet season						
		CP	CF	Ash	Fat	TDN	Na	K	CP	CF	Ash	Fat	TDN	Na	K
2	11	5.21	20.10	6.81	3.40	25.18	0.13	0.20	6.81	20.13	7.12	5.30	30.14	0.73	0.27
	12	6.14	21.80	5.14	2.20	28.30	0.91	0.74	6.13	22.18	8.13	5.20	31.20	0.15	0.34
3	3	12.70	23.11	5.40	6.80	18.19	0.12	0.10	-	-	-	-	-	-	-
	4	13.40	25.18	6.20	5.04	33.14	0.15	0.73	13.18	26.10	5.02	6.71	32.0	0.17	0.56
	12	-	-	-	-	-	-	-	8.14	30.18	2.18	4.10	30.11	0.33	0.34
	31	-	-	-	-	-	-	-	4.05	30.80	3.17	4.05	14.18	0.20	0.43
4	2	-	-	-	-	-	-	-	18.14	29.19	8.19	3.02	27.11	0.81	0.93
	4	12.41	28.02	2.15	3.30	20.99	0.10	0.25	14.13	22.18	3.14	4.35	21.13	0.19	0.33
	11	-	-	-	-	-	-	-	5.80	23.19	6.22	6.01	28.29	0.30	0.32
	12	4.13	30.18	4.19	3.20	23.12	0.31	0.82	6.13	29.90	5.00	5.14	29.00	0.21	0.34
	14	4.15	28.31	6.90	2.80	30.19	0.75	0.84	-	-	-	-	-	-	-
	24	6.18	30.19	5.33	4.31	18.19	0.14	0.39	7.00	29.40	6.20	5.14	28.00	0.33	0.57
	25	-	-	-	-	-	-	-	6.19	25.18	8.9	4.15	20.18	0.74	0.98
	29	-	-	-	-	-	-	-	4.80	29.90	7.14	3.19	28.29	0.21	0.17
	32	-	-	-	-	-	-	-	6.80	19.8	4.14	2.33	29.17	0.33	0.35
5	4	-	-	-	-	-	-	-	9.38	25.80	6.08	6.14	33.70	0.12	0.31
	6	-	-	-	-	-	-	-	10.10	20.91	5.50	5.37	29.10	0.37	0.55
	11	6.01	22.18	5.80	2.14	30.31	0.19	0.40	-	-	-	-	-	-	-
	12	-	-	-	-	-	-	-	7.80	30.14	6.71	3.19	37.0	0.17	0.80
	24	5.44	31.14	3.81	3.11	22.07	0.25	0.45	8.19	30.80	5.19	4.90	22.0	0.47	0.79
	29	5.05	28.19	7.55	3.51	29.11	0.74	0.71	6.18	30.19	6.02	5.80	30.30	0.15	0.93
6	3	-	-	-	-	-	-	-	11.71	25.18	8.14	3.33	30.70	0.18	0.80
	4	10.30	26.10	7.14	3.90	29.80	0.25	0.22	-	-	-	-	-	-	-
	5	8.80	26.81	6.60	4.19	22.14	0.28	0.19	9.11	30.74	7.15	5.37	20.00	0.70	0.33
	6	-	-	-	-	-	-	-	14.4	23.1	5.3	5.7	25.19	0.30	0.35
	11	-	-	-	-	-	-	-	5.3	31.6	7.0	3.1	19.6	0.86	0.23
	12	-	-	-	-	-	-	-	6.9	33.8	8.4	2.9	31.14	0.90	0.59
	14	5.21	28.0	8.9	3.3	25.5	0.74	0.82	6.6	35.4	8.3	3.7	30.4	0.66	0.71
	23	6.6	29.1	7.4	2.2	23.4	0.70	0.11	-	-	-	-	-	-	-
	25	6.5	30.7	6.8	5.4	28.8	0.54	0.64	-	-	-	-	-	-	-
	29	-	-	-	-	-	-	-	6.2	29.1	5.5	2.4	21.7	0.17	0.91
	31	-	-	-	-	-	-	-	8.4	23.4	3.2	3.7	18.8	0.27	0.61
7	4	11.8	20.7	8.4	3.9	22.14	0.11	0.74	-	-	-	-	-	-	-
	6	-	-	-	-	-	-	-	10.5	24.10	7.7	4.5	35.9	0.81	0.52
	11	6.8	29.90	7.7	2.3	26.4	0.71	0.64	6.53	30.20	7.8	4.3	30.18	0.89	0.71
	12	-	-	-	-	-	-	-	8.9	31.1	8.0	4.7	30.7	0.68	0.50
	14	-	-	-	-	-	-	-	7.7	25.9	5.1	2.8	28.8	0.19	0.37
	25	7.4	29.13	5.0	6.6	22.17	0.33	0.78	8.9	30.14	7.9	6.8	30.81	0.84	0.91
	29	-	-	-	-	-	-	-	6.3	29.9	6.8	3.9	22.9	0.54	0.69
	30	8.01	30.13	6.7	3.9	25.9	0.76	0.27	8.4	31.10	6.8	4.00	26.3	0.68	0.81
	31	-	-	-	-	-	-	-	7.4	25.8	5.10	2.2	21.7	0.21	0.37
	32	-	-	-	-	-	-	-	5.9	21.7	3.0	3.05	19.7	0.20	0.81
8	1	16.8	27.20	8.9	5.7	22.9	0.71	0.77	-	-	-	-	-	-	-
	2	15.1	30.7	7.8	5.9	23.1	0.65	0.89	-	-	-	-	-	-	-
	3	12.3	29.1	5.2	3.4	21.9	0.54	0.73	12.1	30.2	6.1	2.9	23.8	0.51	0.11
	5	10.3	26.4	6.7	2.1	24	0.71	0.65	9.14	35.1	5.9	4.10	29.9	0.84	0.97
	6	13.7	28.1	9.7	5.2	35.7	0.19	0.81	14.0	29.8	7.20	6.0	34.7	0.71	0.52
	11	-	-	-	-	-	-	-	7.7	31.7	5.7	4.8	20.3	0.81	0.21
	12	8.2	31.3	7.8	3.3	25.0	0.91	0.72	8.3	30.9	6.00	4.5	26.7	0.57	0.55
	14	5.5	29.1	6.6	2.9	20.4	0.71	0.52	5.4	27.1	5.7	5.3	23.5	0.81	0.25
	23	9.3	30.8	8.7	5.1	29.1	0.29	0.54	-	-	-	-	-	-	-
	30	-	-	-	-	-	-	-	7.7	35.8	8.3	5.5	23.3	0.87	0.74

Table 9. Cont.

Site	No.	Dry season							Wet season						
		CP	CF	Ash	Fat	TDN	Na	K	CP	CF	Ash	Fat	TDN	Na	K
9	2	15.35	29.7	9.1	6.4	29.2	0.91	0.11	18.0	37.8	9.8	7.0	24.8	0.84	0.88
	4	-	-	-	-	-	-	-	9.8	29.9	5.4	4.8	29.5	0.94	0.44
	6	10.5	29.7	6.6	5.4	29.5	0.65	0.51	11.0	28.8	7.8	6.2	30.7	0.71	0.72
	7	9.9	24.0	4.8	2.51	25.4	0.21	0.35	-	-	-	-	-	-	-
	8	-	-	-	-	-	-	-	9.8	22.4	6.8	5.1	33.8	0.81	0.77
	9	-	-	-	-	-	-	-	13.4	20.9	7.8	6.2	38.9	0.74	0.58
	11	-	-	-	-	-	-	-	8.5	31.0	8.0	3.2	20.7	0.85	0.52
	12	7.3	29.9	5.20	4.1	19.4	0.22	0.29	8.0	33.4	6.7	4.0	18.5	0.84	0.41
	14	-	-	-	-	-	-	-	6.7	30.8	5.9	2.1	25.4	0.71	0.88
	24	-	-	-	-	-	-	-	9.9	31.9	7.8	5.8	22.8	0.71	0.94
	29	6.3	30.4	6.1	3.2	22.9	0.68	0.85	8.5	33.8	7.0	4.1	20.7	0.51	0.34
	30	10.4	28.8	9.4	6.2	24.8	0.53	0.81	-	-	-	-	-	-	-

ash content was higher for *Anabasis articulata* followed *Arthocnemon glaucum* and *Carduncllus eriocophalus*. However, they reported no clear trend for the rest of chemical contents in wet and dry seasons.

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