

INFLUENCE OF PLOUGHING ON NATURAL VEGETATION IN THE NORTHWESTERN COAST OF EGYPT

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ABSTRACT

This study focuses on the effect of ploughing on vegetation composition, plant density, coverage and frequency percentage and foliage productivity, during the growing seasons (spring and autumn) of 2005 and 2006 in Umm El-Rakham area, 40 km West of Marsa Matruh city at the North West Coast region of Egypt. Fifty plant species belonging to twenty two families were recorded. Higher averages of plant density, coverage and frequency percentage and foliage productivity were recorded for most perennial and annual species in the unploughed sites, compared to the ploughed ones. Among perennial species, the highest figure of importance value (IVs) was contributed by *Thymelaea hirsute*, *Halocylon salicornicum*, and *Lycium shawii*. While, *Anacyclus monanthos*, *Hordeum marinum*, and *Plantago notata*, had the highest IVs among annual species. Such previous species showed high adaptation under Umm El-Rakham habitat conditions (ploughing stress, varied percentage of CaCO₃, low salinity and pH from neutral to alkalinity).

Keywords: Importance value (IVs), Rangeland measurements, Rangeland ploughing, Umm El-Rakham habitat.

INTRODUCTION

It is quite obvious that human activities are changing the landscape through the expansion of agricultural systems, at the expense of natural habitat. In Africa, mainly in semi-arid and arid regions, overgrazing causes 49% of soil degradation, with the share other influences such as; fuel-wood harvesting, suppression of the natural fire cycle, and conversion of rangelands to croplands or human settlements WRI (1992).

The North West Coast region of Egypt is one of the arid regions which have a long history of intensive land use, mainly grazing and rainfed farming. The cause of degradation of rangeland in the North West Coast region of Egypt are mixture of environmental, socio-political and socio-economical conditions (Ayyad (1992), Heneidy and El-Darier (1995), and Heneidy and Bidak (1998)). The most important land-use in the North West Coast region of Egypt is grazing. The natural vegetation includes many annual plant species, mostly perennial herbs and a few grasses, shrubs, sub-shrubs, and a few trees. These species represent 50% of the total flora of Egypt UNESCO (2003). During the last decades, the plant life in this region was subjected to different factors such as farming activities intensified, removal of plants, overgrazing, and ploughing in different parts El-Barasi (1997). In recent years reclamation and cultivation of desert area in Egypt became a necessity. The coastal Mediterranean semi-arid stripe and the inland new valley areas are possible promising fields for such a purpose. The need for evaluating the relationship between rangelands and their

surrounding ecological factors became vital for restoring their potential productivity.

Umm El-Rakham area is situated about 40 km West of Marsa Matruh city at the Mediterranean sea coast with a depth of about 5 km south inland from the sea coast at latitudes of 31° 23' 76.4" N and longitudes of 27° 02' 35.4" E. This area was subjected to ploughed in different sites (rain-fed farming), in addition to use native plants for grazing animals (sheep, goats and camels) in the range sites of the area which un-ploughed. The ploughed sites were mainly planted with barley or wheat crop (i.e. agro-pastoral system).

The aim of this work was to study the effect of ploughing practices on vegetation structure, productivity, and other range measurements in the studied area.

MATERIALS AND METHODS

This study was conducted at Umm El-Rakham area in the North West Coast of Egypt from spring 2005 to autumn 2006 to study the effect of ploughing practices on the floristic and productivity of native plants in spring (wet season) and autumn (dry season).

The monthly variation of some climatic factors for Marsa Matruh Station is shown in Table (1). Soil samples were collected from each site (ploughing and non-ploughing) at two different depths (0-30 and 30-60 cm) from the studied area. Mechanical analyses (Table 2) were conducted using the international pipette method as described by Page (1982). Chemical determinations of the soil saturated extract (Table 3) were carried out according to Jackson (1956).

Table 1. Monthly and annual averages for climatic factors of the studied area*.

Month	2004/2005				2005/2006			
	°C Mean	WS m/s	RH %	P mm	°C Mean	WS m/s	RH %	P mm
Nov.	20.1	3.5	61	14.4	19.5	3.7	61	16.0
Dec.	15.3	2.9	63	22.1	15.4	3.8	67	21.0
Jan.	14.3	4.4	62	44.0	13.5	3.2	69	46.8
Feb.	13.7	3.6	59	12.0	14.5	3.5	63	17.4
Mar.	16.2	3.6	56	6.0	16.2	4.7	59	5.5
Apr.	17.9	4.0	59	1.0	18.8	4.8	65	0.3
May	20.7	3.4	57	0.0	20.1	3.4	68	0.4
Jun.	23.1	3.8	66	0.0	23.5	4.5	63	0.0
Jul.	25.1	3.1	71	0.0	26.6	2.8	66	0.0
Aug.	26.6	3.6	69	0.0	26.4	2.6	67	0.0
Sep.	25.9	3.7	65	0.0	24.7	2.2	65	0.0
Oct.	22.2	3.7	61	5.0	22.6	3.1	60	0.0
Annual	20.1	3.6	62.4	104.5	20.2	3.5	64.4	107.4

*RH: relative humidity (%); WS: wind speed /sec.; P: precipitation (mm); °C: air temperature.

*Source: Meteorological Authority, Cairo.

Table 2. Mechanical properties of soil in Umm El-Rakham area.

Site	Depth (cm)	Particle-size distribution of soil (%)				Texture
		Coarse sand	Fine sand	Silt	Clay	
Ploughing	0-30	57.22	25.38	11.70	5.70	Sandy loam
	30-60	54.82	28.28	11.78	5.12	Sandy loam
Non ploughing	0-30	49.23	31.10	14.29	5.38	Sandy loam
	30-60	43.55	41.65	11.72	5.08	Sandy loam

Table 3. Chemical properties of soil in Umm El-Rakham area.

Site	Depth (cm)	pH	EC mmhos cm ⁻¹	Anions meq L ⁻¹			Cations meq L ⁻¹				CaCO ₃ %
				So ₄	Cl	HCO ₃	K	Na	Mg	Ca	
Ploughing	0-30	7.85	8.29	42.25	45.00	2.75	1.57	57.03	10.51	20.92	67.60
	30-60	7.55	9.90	57.69	50.00	2.29	1.28	63.72	18.00	27.10	60.00
Non ploughing	0-30	7.89	8.34	43.53	46.10	2.47	1.57	57.43	11.00	18.11	65.61
	30-60	7.65	9.97	56.19	52.00	2.36	1.22	64.10	20.10	30.00	62.90

The following measurements were determined by using list and clipping quadrat 5x5m (25 m²) within every site and 10 randomly quadrates in each site were made. Foliage and herbage yields (Fresh and dry weight in g/m²) were estimated and other pasture measurements were done according to Mueller-Dombois and Ellenberg (1974) as follows:

- Density = (number of individuals) / (area sampled)
- Frequency = (number of sampled quadrates in which species occurs) / (total number of quadrates sampled)
- Coverage = (total of quadrat area for a species) / (total quadrat area) x 100

The importance value was determined according to Ludwig and Reynolds (1988) by calculating sum of relative density, relative frequency and relative cover for different species as follows:

- Relative density = (density for a species) / (total density for all species) x 100
- Relative frequency = (frequency for a species) / (total quadrat area) x 100
- Relative cover = (total of quadrat area for a species) / (total of quadrat area for all species) x 100
- Importance value = Relative density + Relative frequency + Relative cover

Floristic identifications were done according to Boulos (1999-2005).

The experimental design was Randomized Complete Blocks. Plant measurements were subjected to analysis by M-STAT C (Russell, 1991). Means of treatments were compared by using Least Significant Difference (LSD) at 0.05 probability.

RESULTS AND DISCUSSION

Botanical composition

Table (4) shows the floristic analysis of the recorded species in different sites of Umm EL-Rakham. Fifty plant species belonging to twenty two families were recorded in this studied area .

Table 4. Botanical composition, palatability and life duration of plant species recorded in Umm El-Rakham area during the period from spring 2005 to autumn 2006.

Family name	Scientific name	Vernacular name	Palatability	Life duration
Aizoaceae	<i>Mesembryanthemum nodiflorum</i>	Ghasool	Up	Ann.
Apiaceae	<i>Deverra tortuosa</i>	Qozzah	P	Per.
Araceae	<i>Arisarum vulgar</i>	Reinish	Up	Per.
Asphodelaceae	<i>Asphodelus aestivus</i>	Basal El onsal	Up	Per.
Asteraceae	<i>Achillea fragrantissima</i>	Beithraan	Up	Per.
	<i>Anacyclus monanthos</i>	Soret El kabsh	P	Ann.
	<i>Centaurea calcitrapa</i>	Shoak	Up	Ann.
	<i>Echinops hussoni</i>	Kharshoof	Up	Per.
	<i>Echinops spinosus</i>	Kharshoof	Up	Per.
	<i>Glebionis coronaria</i>	Oqhowaan	Up	Ann.
	<i>Onopordium alexandranium</i>	Shoak El hanash	Up	Per.
	<i>Scorzonera undulata</i>	Dabbah	P	Per.
	<i>Senecio coronopifolius</i>	Qorreis	Up	Ann.
	<i>Silybum marianum</i>	Shoak El gamal	Up	Per.
Boraginaceae	<i>Echium sericeum</i>	Saaq El hamam	P	Per.
Brassicaceae	<i>Enarthrocarpus lyratus</i>	Shiltaam	P	Ann.
	<i>Lepidium draba</i>	Lislis	P	Per.
	<i>Sisymbrium irio</i>	Saleekh	Up	Ann.
Caryophyllaceae	<i>Gymnocarpus decandrum</i>	Garad	P	Per.
	<i>Paronychia capitata</i>	Farsh El ard	Up	Per.
Chenopodiaceae	<i>Chenopodium murale</i>	Zorbeih	Up	Ann.
	<i>Haloxylon salicornicum</i>	Rimth	Up	Per.
	<i>Salsola villosa</i>	Salsola	P	Per.
	<i>Suaeda vermiculata</i>	suaeda	Up	Per.
Convolvulaceae	<i>Convolvulus arvensis</i>	Olleiq	P	Per.
Fabaceae	<i>Astragalus homosus</i>	Qorein	P	Ann.
	<i>Hippocrepis cyclocarpa</i>	Umm dawara	P	Ann.
	<i>Lotus arabicus</i>	Gatb	Up	Ann.
	<i>Melilotus elegans</i>	Nafal	P	Ann.
	<i>Trigonella maritime</i>	Helbah	P	Ann.
	<i>Vicia monantha</i>	Gharanboush	P	Ann.
	<i>Vicia sativa</i>	Gharanboush	P	Ann.
Lamiaceae	<i>Salvia aegyptiaca</i>	Zaeta	Up	Per.
	<i>Salvia lanigera</i>	Shoak	Up	Per.
Malvaceae	<i>Malva sylvestris</i>	Khobbeiza	P	Ann.
Papaveraceae	<i>Papaver hybridum</i>	Khshkhash	Up	Ann.
Peganaceae	<i>Peganum harmala</i>	Harmal	Up	Per.
Plantaginaceae	<i>Plantago notata</i>	Yanam	P	Ann.
Poaceae	<i>Aegilops kotschy</i>	Shaer El faar	P	Ann.
	<i>Bromus rubens</i>	Deil El talab	P	Ann.
	<i>Cynodon dactylon</i>	Nigeel	P	Per.
	<i>Hordeum marinum</i>	Shaeer barri	P	Ann.
	<i>Lolium temulentum</i>	Samma	P	Ann.
	<i>Lygeum spartum</i>	Halfa	P	Per.
	<i>Phalaris minor</i>	Shaer El faar	P	Ann.
Polygonaceae	<i>Polygonum equisetiforme</i>	Qordaab	P	Per.
Primulaceae	<i>Anagallis arvensis</i>	Ain El qott	Up	Ann.
Ranunculaceae	<i>Adonis dentate</i>	Naab El gamal	Up	Ann.
Solanaceae	<i>Lycium shawii</i>	Awsage	P	Per.
Thymelaeaceae	<i>Thymelaea hirsute</i>	Methanan	Up	Per.

P = Palatable; Up = Un-palatable; Ann. = Annual; Per = Perennial

There were ten species of *Asteraceae*, seven species of each *Fabaceae* and *Poaceae*, the rest families has less than five species for each. It was noticed

that a half of species was annuals and the other half was perennials. According to palatability twenty six species were palatable (52%) and the rest species were unpalatable.

The richest habitat in number of species was un-ploughing sites (31 and 43 species for spring 2005 and spring 2006, respectively), whereas, the poorest habitat in number of species was ploughing ones (21 and 23 species for spring 2005 and spring 2006, respectively) as shown in Table (A₃). This could be ascribed to ploughing effects leading to lower native plants species competition; thus in un-ploughing sites, plants are only ones that can survive.

Plant density

Results in Tables 5_a and 5_b show insignificant differences between spring 2005 and 2006, as well as, between both years. On the other hand, significant differences in plant density were shown between sites. Whereas, plant density had minimum value in ploughing sites (5.8 pls. m⁻²) as compared with non ploughing ones (12.1 pls. m⁻²).

The highest plant density was recorded in *Hordeum marinum*, *Plantago notata*, *Anacyclus monanthos*, *Glebionis coronaria* and *Aegilops kotschyi* (Table A₁). Species with high density were considered to be dominant (Maroof (1978), Abou-Deya (1984), and El-Morsy (2002)).

Table 5_a. Plant density (m²) as affected by season, site, and interaction between season and site in Umm EI-Rakham area from spring 2005 to autumn 2006.

Season	Site		Mean
	Non ploughing	Ploughing	
Spring	21.0	9.6	15.3
Autumn	3.2	2.0	2.6
Mean	12.1	5.8	---
LSD _{0.05} site = 2.5		LSD _{0.05} season X site = 3.5	LSD _{0.05} season = 2.5

Table 5_b. Plant density (m²) as affected by year, season, site and interactions in Umm EI-Rakham area from spring 2005 to autumn 2006.

Year	Season	Site		Mean	Year mean
		Non ploughing	Ploughing		
2005	Spring	20.7	9.4	15.1	9.1
	Autumn	3.7	2.4	3.1	
Mean		12.2	5.9	---	
2006	Spring	21.2	9.8	15.5	8.8
	Autumn	2.6	1.6	2.1	
Mean		11.9	5.7	---	
LSD _{0.05} year = 2.5		LSD _{0.05} year X season = 3.5			
LSD _{0.05} year X site = 3.5		LSD _{0.05} year X season X site = 4.9			

Plant cover

Tables 6_a, 6_b and A₂ show the percentage of coverage in the studied area. The interaction between site, season and year for coverage % was significant. Generally, the coverage was greater for shrubs followed by forbs then grasses. *Thymelaea hirsuta* (4.92%), *Haloxylon salicornicum* (4.01%), *Plantago notata* (3.04%), *Lycium shawii* (2.93%), and *Gymnocarpus*

decandrum (2.01%), have the highest record of coverage (Table A₂). Plant coverage in ploughing sites was lower than in non ploughing ones. This could be ascribed to effective ploughing practices leading to lower plant coverage in ploughing sites. Ploughing means that the relatively best grazing areas are stripped from their natural productive and protective vegetation and are thereby exposed to high erosion hazards Buringh (1960). Plant species showed highest cover in spring seasons (19.38%) and followed by sharp drop through the autumn dry seasons (5.39%).

Table 6a. Plant cover percentage (%) as affected by season, site, and interaction between season and site in Umm EI-Rakham area from spring 2005 to autumn 2006.

Season	Site		Mean
	Non ploughing	Ploughing	
Spring	28.55	10.21	19.38
Autumn	7.41	3.38	5.39
Mean	17.98	6.79	---
LSD _{0.05} site = 3.03 LSD _{0.05} season X site = 4.29			LSD _{0.05} season = 3.03

Table 6b. Plant cover percentage (%) as affected by year, season, site and interactions in Umm EI-Rakham area from spring 2005 to autumn 2006.

Year	Season	Site		Mean	Year mean
		Non ploughing	Ploughing		
2005	Spring	27.55	11.45	19.50	12.68
	Autumn	7.39	4.31	5.85	
Mean		17.44	7.88	---	
2006	Spring	29.55	8.96	19.25	12.10
	Autumn	7.42	2.45	4.94	
Mean		18.49	5.71	---	
LSD _{0.05} year = 3.03			LSD _{0.05} year X season = 4.29		
LSD _{0.05} year X site = 4.29			LSD _{0.05} year X season X site = 6.06		

Plant frequency

Tables 7_a, 7_b and A₃ show frequency averages (%). The highest frequencies of species were attained in spring 2005 for non-ploughed sites, while the lowest values were recorded in autumn 2006 for ploughed ones. It is obvious that the frequency averages were remarkably higher for un-ploughed sites compared to the ploughed ones. Higher averages of importance values (IVs) and absolute frequencies were recorded for most perennial and annual species in the un-ploughed stripes compared to the ploughed ones Hammouda *et. al.* (2003).

Table 7a. Plant frequency (%) as affected by season, site, and interaction between season and site in Umm EI-Rakham area from spring 2005 to autumn 2006.

Season	Site		Mean
	Non ploughing	Ploughing	
Spring	21.5	12.8	17.2
Autumn	16.5	10.6	13.6
Mean	19.0	11.7	---

Table 7_b. Plant frequency (%) as affected by year, season, site and interactions in Umm El-Rakham area from spring 2005 to autumn 2006.

Year	Season	Site		Mean	Year mean
		Non ploughing	Ploughing		
2005	Spring	23.2	13.3	18.3	16.6
	Autumn	18.6	11.1	14.9	
Mean		20.9	12.2	---	
2006	Spring	19.8	12.2	16.0	14.1
	Autumn	14.4	10.0	12.2	
Mean		17.1	11.1	---	

Forage yield (Foliage and herbage)

Tables 8_a, 8_b, 9_a and 9_b show fresh and dry forage yields (g m⁻²) of native plants in Umm El-Rakham area from spring 2005 to autumn 2006 seasons. Fresh forage yield, as well as, dry forage yield significantly increased in plants grown in spring seasons and decreased in autumn of both years, this reduction may be due to the lack of precipitation and absence of winter annuals. On the other hand, significant differences were detected among the two sites of the area (ploughing and non ploughing) in spring and autumn (dry season). Ploughing sites were the lowest production, that might be due to the harmful ploughing effect on natural plants, leading to lower weight of such plants. Intensive and improper human activities are the most important causes of grassland degradation, the main human activities are cultivation and grazing, productivity of pasture reduces from 3000-4500 kg/ha to 1500-1875 kg/ha after degradation in this pasture Zuozhong and Xiangzhen (1999).

Table 8_a. Fresh foliage yield (g m⁻²) as affected by season, site, and interaction between season and site in Umm El-Rakham area from spring 2005 to autumn 2006.

Season	Site		Mean	
	Non ploughing	Ploughing		
Spring	245.6	93.2	169.4	
Autumn	79.5	34.1	56.8	
Mean	162.6	63.7	---	
LSD _{0.05} site = 28.8		LSD _{0.05} season X site = 40.8		LSD _{0.05} season = 8.8

Table 8_b. Fresh foliage yield (g m⁻²) as affected by year, season, site and interactions in Umm El-Rakham area from spring 2005 to autumn 2006.

Year	Season	Site		Mean	Year mean
		Non ploughing	Ploughing		
2005	Spring	238.6	114.6	176.6	117.7
	Autumn	73.9	43.4	58.7	
Mean		156.3	79.0	---	
2006	Spring	252.6	71.9	162.2	108.6
	Autumn	85.1	24.7	54.9	
Mean		168.9	48.3	---	
LSD _{0.05} year = 28.8		LSD _{0.05} year X season = 40.8			
LSD _{0.05} year X site = 40.8		LSD _{0.05} year X season X site = 57.7			

Table 9a. Dry foliage yield (g m⁻²) as affected by season, site, and interaction between season and site in Umm El-Rakham area from spring 2005 to autumn 2006.

Season	Site		Mean
	Non ploughing	Ploughing	
Spring	106.0	36.4	71.2
Autumn	39.5	16.2	27.9
Mean	72.8	26.3	---
LSD _{0.05} site =14.5		LSD _{0.05} season X site = 20.5	LSD _{0.05} season =14.5

Table 9b. Dry foliage yield (g m⁻²) as affected by year, season, site and interactions in Umm El-Rakham area from spring 2005 to autumn 2006.

Year	Season	Site		Mean	Year mean
		Non ploughing	Ploughing		
2005	Spring	108.7	46.8	77.8	53.6
	Autumn	36.9	21.9	29.4	
Mean		72.8	34.4	---	
2006	Spring	103.4	26.0	64.7	45.5
	Autumn	42.1	10.5	26.3	
Mean		72.8	18.3	---	
LSD _{0.05} year =14.5		LSD _{0.05} year X season = 20.5			
LSD _{0.05} year X site = 20.5		LSD _{0.05} year X season X site = 29.0			

No significant differences in yield were observed between both years. Slight decrease in forage yield was shown in the second year compared with the first one. Significant interaction was found among sites and seasons, years and seasons, years and sites, and years, sites and seasons during the studied years. Species in ploughing site in autumn 2006 had the lowest yield. *Thymelaea hirsuta*, *Lycium shawii*, *Halocxylon salicornicum*, *Gymnocarpus decandrum*, and *Plantago notataplants* showed highest production in both years as shown in Tables (A₄ and A₅).

Importance values (IVs)

Importance value is the efficiency method to make comparisons between species by studying the relative density, relative coverage and relative frequency for each species. Importance value provides information could help in determining which species from which habitat type is the most adaptive and tolerant one to environment stresses.

Results in Table (10) show the importance value of plant species in different sites under study. Among perennial species, the highest figure of importance value was contributed by *Thymelaea hirsute*, *Halocxylon salicornicum*, and *Lycium shawii*. While, *Anacyclus monanthos*, *Hordeum marinum*, and *Plantago notata*, had the highest IVs among annual species. Such previous species showed high adaptation under Umm El-Rakham habitat conditions (ploughing stress, varied percentage of CaCO₃, low salinity and pH from neutral to alkalinity). This result was true in all seasons with various magnitudes. In this respect, Mashaly (2002) defined four edaphic factors that affect the characteristics of species, i.e.; soil texture, moisture availability, CaCO₃ and soil fertility.

Table 10. Importance value (IVs) of plant species as affected by year, site and season in Umm El-Rakham area during spring 2005 to autumn 2006.

Scientific name	2005				2006			
	Non-ploughing Sites		Ploughing Sites		Non-ploughing Sites		Ploughing Sites	
	Spr.	Aut.	Spr.	Aut.	Spr.	Aut.	Spr.	Aut.
<i>Mesem. nodiflorum</i>	---	---	---	---	3.24	---	---	---
<i>Deverra tortuosa</i>	8.04	23.48	---	---	6.70	17.54	---	---
<i>Arisarum vulgare</i>	---	---	---	---	4.52	---	---	---
<i>Asphodelus aestivus</i>	12.31	15.14	---	---	21.17	21.52	---	---
<i>Achillea fragrantissima</i>	4.87	---	---	---	4.78	---	---	---
<i>Anacyclus monanthos</i>	21.56	---	---	---	14.05	---	18.80	---
<i>Centaurea calcitrapa</i>	---	---	8.33	---	2.76	---	---	---
<i>Echinops hussoni</i>	3.69	---	---	---	4.22	13.02	---	---
<i>Echinops spinosus</i>	3.41	---	7.43	---	2.49	---	8.72	26.45
<i>Glebionis coronaria</i>	15.83	---	---	---	11.53	---	18.29	---
<i>Onopor. alexandranium</i>	3.81	---	---	---	4.48	---	6.27	---
<i>Scorzonera undulata</i>	2.87	---	---	---	3.10	---	---	---
<i>Senecio coronopifolius</i>	---	---	9.62	---	---	---	---	---
<i>Silybum marianum</i>	---	---	12.33	26.33	2.66	---	8.50	25.23
<i>Echium sericeum</i>	4.08	---	---	---	3.27	17.27	6.73	---
<i>Enarthrocarpus lyratus</i>	3.89	---	18.23	---	4.25	---	22.46	---
<i>Lepidium draba</i>	5.34	---	17.43	---	4.11	---	10.33	---
<i>Sisymbrium irio</i>	---	---	---	---	2.59	---	---	---
<i>Gymnocarpos decandrum</i>	11.52	26.25	---	---	11.61	26.36	---	---
<i>Paronychia capitata</i>	---	---	---	---	2.32	---	---	---
<i>Chenopodium murale</i>	---	---	4.81	---	2.29	---	6.86	---
<i>Haloxylon salicornicum</i>	23.91	86.98	22.00	---	20.69	63.01	20.90	43.32
<i>Salsola villosa</i>	6.19	20.49	10.88	32.25	---	---	9.85	24.01
<i>Suaeda vermiculata</i>	---	---	11.14	29.52	2.76	---	9.96	24.01
<i>Convolvulus arvensis</i>	2.86	---	16.91	32.07	2.53	---	11.32	31.48
<i>Astragalus homosus</i>	---	---	---	---	1.82	---	---	---
<i>Hippocrepis cyclocarpa</i>	---	---	---	---	1.82	---	---	---
<i>Lotus arabicus</i>	---	---	---	---	3.64	---	---	---
<i>Mellilotus elegans</i>	6.51	---	---	---	---	---	---	---
<i>Trigonella maritima</i>	---	---	---	---	2.90	---	---	---
<i>Vicia monantha</i>	3.48	---	7.36	---	---	---	---	---
<i>Vicia sativa</i>	3.48	---	---	---	4.00	---	---	---
<i>Salvia aegyptiaca</i>	---	---	---	---	1.82	---	6.06	---
<i>Salvia lanigera</i>	2.75	---	---	---	---	---	---	---
<i>Malva sylvestris</i>	---	---	8.42	---	1.99	---	13.92	---
<i>Papaver hybridum</i>	2.34	---	---	---	1.99	---	---	---
<i>Peganum harmala</i>	8.52	---	---	---	7.35	20.23	---	---
<i>Plantago notata</i>	30.11	---	---	---	27.90	---	27.81	---
<i>Aegilops kotschy</i>	11.29	---	---	---	7.88	---	---	---
<i>Bromus rubens</i>	5.51	---	---	---	5.66	---	---	---
<i>Cynodon dactylon</i>	---	---	15.99	35.72	4.59	---	15.07	36.91
<i>Hordeum marinum</i>	26.50	---	18.44	---	21.30	---	20.89	---
<i>Lolium temulentum</i>	---	---	34.10	---	4.31	---	11.00	---
<i>Lygeum spartum</i>	8.30	---	11.40	37.03	5.13	---	8.40	21.96
<i>Phalaris minor</i>	6.63	---	---	---	---	---	---	---
<i>Polygon. equisetiforme</i>	---	---	8.49	17.59	3.27	---	6.73	25.77
<i>Anagallis arvensis</i>	3.60	---	---	---	---	---	---	---
<i>Adonis dentata</i>	---	---	14.85	---	7.48	---	11.91	---
<i>Lycium shawii</i>	14.38	36.77	18.79	48.27	16.69	51.15	---	---
<i>Thymelaea hirsuta</i>	32.41	90.89	23.05	41.20	26.36	69.90	19.23	40.87
Total	300	300	300	300	300	300	300	300

Spr. = spring; Aut. = Autumn

APPENDIX

Table A1. Plant density (m²) of plant species as affected by year, site and season in Umm El-Rakham area during spring 2005 to autumn 2006.

Scientific name	2005				2006			
	Non-ploughing Sites		Ploughing Sites		Non-ploughing Sites		Ploughing Sites	
	Spr.	Aut.	Spr.	Aut.	Spr.	Aut.	Spr.	Aut.
<i>Mesem. nodiflorum</i>	---	---	---	---	0.2	---	---	---
<i>Deverra tortuosa</i>	0.6	0.5	---	---	0.2	0.2	---	---
<i>Anisarum vulgare</i>	---	---	---	---	0.5	---	---	---
<i>Asphodelus aestivus</i>	0.8	0.2	---	---	1.7	0.3	---	---
<i>Achillea fragrantissima</i>	0.1	---	---	---	0.2	---	---	---
<i>Anacyclus monanthos</i>	2.5	---	---	---	1.8	---	1.0	---
<i>Centaurea calcitrapa</i>	---	---	0.3	---	0.1	---	---	---
<i>Echinops hussoni</i>	0.1	---	---	---	0.3	0.1	---	---
<i>Echinops spinosus</i>	0.2	---	0.1	---	0.1	---	0.1	0.1
<i>Glebionis coronaria</i>	1.7	---	---	---	1.0	---	0.6	---
<i>Onopor. alexandranium</i>	0.2	---	---	---	0.2	---	0.1	---
<i>Scorzonera undulata</i>	0.3	---	---	---	0.4	---	---	---
<i>Senecio coronopifolius</i>	---	---	0.2	---	---	---	---	---
<i>Silybum marianum</i>	---	---	0.2	0.2	0.1	---	0.1	0.1
<i>Echium sericeum</i>	0.4	---	---	---	0.3	0.2	0.2	---
<i>Enarthrocarpus lyratus</i>	0.3	---	0.6	---	0.4	---	0.9	---
<i>Lepidium draba</i>	0.6	---	0.5	---	0.4	---	0.4	---
<i>Sisymbrium irio</i>	---	---	---	---	0.2	---	---	---
<i>Gymnocarpus decandrum</i>	0.3	0.4	---	---	0.3	0.3	---	---
<i>Paronychia capitata</i>	---	---	---	---	0.1	---	---	---
<i>Chenopodium murale</i>	---	---	0.1	---	0.2	---	0.3	---
<i>Haloxylon salicornicum</i>	0.5	1.0	0.2	---	0.5	0.5	0.2	0.2
<i>Salsola villosa</i>	0.3	0.3	0.4	0.4	---	---	0.2	0.1
<i>Suaeda vermiculata</i>	---	---	0.4	0.3	0.1	---	0.2	0.1
<i>Convolvulus arvensis</i>	0.2	---	0.5	0.3	0.2	---	0.3	0.2
<i>Astragalus homosus</i>	---	---	---	---	0.1	---	---	---
<i>Hippocrepis cyclocarpa</i>	---	---	---	---	0.1	---	---	---
<i>Lotus arabicus</i>	---	---	---	---	0.4	---	---	---
<i>Melilotus elegans</i>	0.6	---	---	---	---	---	---	---
<i>Trigonella maritima</i>	---	---	---	---	0.3	---	---	---
<i>Vicia monantha</i>	0.1	---	0.2	---	---	---	---	---
<i>Vicia sativa</i>	0.1	---	---	---	0.3	---	---	---
<i>Salvia aegyptiaca</i>	---	---	---	---	0.1	---	0.2	---
<i>Salvia lanigera</i>	0.2	---	---	---	---	---	---	---
<i>Malva sylvestris</i>	---	---	0.3	---	0.1	---	0.5	---
<i>Papaver hybridum</i>	0.1	---	---	---	0.1	---	---	---
<i>Peganum harmala</i>	0.3	---	---	---	0.3	0.2	---	---
<i>Plantago notata</i>	2.8	---	---	---	3.0	---	1.5	---
<i>Aegilops kotschy</i>	1.0	---	---	---	0.5	---	---	---
<i>Bromus rubens</i>	0.4	---	---	---	0.5	---	---	---
<i>Cynodon dactylon</i>	---	---	0.7	0.4	0.4	---	0.7	0.3
<i>Hordeum marinum</i>	3.6	---	0.8	---	2.8	---	0.8	---
<i>Lolium temulentum</i>	---	---	2.1	---	0.5	---	0.4	---
<i>Lygeum spartum</i>	0.4	---	0.4	0.2	0.3	---	0.2	0.1
<i>Phalaris minor</i>	0.5	---	---	---	---	---	---	---
<i>Polygon. equisetiforme</i>	---	---	0.2	0.1	0.3	---	0.2	0.2
<i>Anagallis arvensis</i>	0.3	---	---	---	---	---	---	---
<i>Adonis dentata</i>	---	---	0.7	---	0.8	---	0.5	---
<i>Lycium shawii</i>	0.2	0.2	0.3	0.3	0.3	0.3	---	---
<i>Thymelaea hirsuta</i>	1.0	1.0	0.2	0.1	0.5	0.5	0.2	0.2
Total	20.7	3.7	9.4	2.4	21.2	2.6	9.8	1.6

Spr. = spring; Aut. = Autumn

Table A₂. Coverage percentage (%) of plant species as affected by year, site and season in Umm El-Rakham area during spring 2005 to autumn 2006.

Scientific name	2005				2006			
	Non-ploughing Sites		Ploughing Sites		Non-ploughing Sites		Ploughing Sites	
	Spr.	Aut.	Spr.	Aut.	Spr.	Aut.	Spr.	Aut.
<i>Mesem. nodiflorum</i>	---	---	---	---	0.33	---	---	---
<i>Deverra tortuosa</i>	0.27	0.14	---	---	0.31	0.16	---	---
<i>Arisarum vulgare</i>	---	---	---	---	0.29	---	---	---
<i>Asphodelus aestivus</i>	1.18	0.14	---	---	1.80	0.17	---	---
<i>Achillea fragrantissima</i>	0.06	---	---	---	0.09	---	---	---
<i>Anacyclus monanthos</i>	0.70	---	---	---	0.60	---	0.45	---
<i>Centaurea calcitrapa</i>	---	---	0.18	---	0.33	---	---	---
<i>Echinops hussoni</i>	0.50	---	---	---	0.48	0.11	---	---
<i>Echinops spinosus</i>	0.29	---	0.32	---	0.25	---	0.37	0.25
<i>Glebionis coronaria</i>	0.95	---	---	---	0.97	---	0.45	---
<i>Onop. alexandranium</i>	0.40	---	---	---	0.35	---	0.15	---
<i>Scorzonera undulata</i>	0.01	---	---	---	0.01	---	---	---
<i>Senecio coronopifolius</i>	---	---	0.45	---	---	---	---	---
<i>Silybum marianum</i>	---	---	0.76	0.33	0.30	---	0.35	0.22
<i>Echium sericeum</i>	0.21	---	---	---	0.20	0.14	0.10	---
<i>Enarthrocarpus lyratus</i>	0.29	---	0.54	---	0.35	---	0.55	---
<i>Lepidium draba</i>	0.29	---	0.57	---	0.31	---	0.24	---
<i>Sisymbrium irio</i>	---	---	---	---	0.14	---	---	---
<i>Gymnocarpus decandrum</i>	2.01	0.55	---	---	1.97	0.53	---	---
<i>Paronychia capitata</i>	---	---	---	---	0.20	---	---	---
<i>Chenopodium murale</i>	---	---	0.02	---	0.05	---	0.02	---
<i>Haloxylon salicornicum</i>	4.01	2.67	1.46	---	3.68	2.11	1.05	0.51
<i>Salsola villosa</i>	0.54	0.33	0.35	0.21	---	---	0.38	0.19
<i>Suaeda vermiculata</i>	---	---	0.38	0.28	0.33	---	0.39	0.19
<i>Convolvulus arvensis</i>	0.14	---	0.51	0.39	0.12	---	0.42	0.22
<i>Astragalus homosus</i>	---	---	---	---	0.05	---	---	---
<i>Hippocrepis cyclocarpa</i>	---	---	---	---	0.05	---	---	---
<i>Lotus arabicus</i>	---	---	---	---	0.17	---	---	---
<i>Mellilotus elegans</i>	0.23	---	---	---	---	---	---	---
<i>Trigonella maritima</i>	---	---	---	---	0.09	---	---	---
<i>Vicia monantha</i>	0.06	---	0.19	---	---	---	---	---
<i>Vicia sativa</i>	0.06	---	---	---	0.07	---	---	---
<i>Salvia aegyptiaca</i>	---	---	---	---	0.05	---	0.04	---
<i>Salvia lanigera</i>	0.11	---	---	---	---	---	---	---
<i>Malva sylvestris</i>	---	---	0.19	---	0.10	---	0.47	---
<i>Papaver hybridum</i>	0.13	---	---	---	0.10	---	---	---
<i>Peganum harmala</i>	0.80	---	---	---	0.71	0.36	---	---
<i>Plantago notata</i>	3.04	---	---	---	3.02	---	0.80	---
<i>Aegilops kotschy</i>	0.25	---	---	---	0.24	---	---	---
<i>Bromus rubens</i>	0.22	---	---	---	0.28	---	---	---
<i>Cynodon dactylon</i>	---	---	0.57	0.36	0.45	---	0.39	0.20
<i>Hordeum marinum</i>	0.98	---	0.32	---	1.00	---	0.50	---
<i>Lolium temulentum</i>	---	---	0.53	---	0.23	---	0.30	---
<i>Lygeum spartum</i>	0.99	---	0.41	0.36	0.75	---	0.25	0.14
<i>Phalaris minor</i>	0.78	---	---	---	---	---	---	---
<i>Polygon. equisetiforme</i>	---	---	0.32	0.14	0.20	---	0.10	0.08
<i>Anagallis arvensis</i>	0.21	---	---	---	---	---	---	---
<i>Adonis dentata</i>	---	---	0.44	---	0.40	---	0.29	---
<i>Lycium shawii</i>	2.93	1.17	1.38	1.09	3.47	1.80	---	---
<i>Thymelaea hirsuta</i>	4.92	2.39	1.58	1.16	4.66	2.05	0.90	0.45
Total	27.55	7.39	11.45	4.31	29.55	7.42	8.96	2.45

Spr. = spring; Aut. = Autumn

Table A₃. Plant frequency of plant species (%) as affected by year, site and season in Umm El-Rakham area during spring 2005 to autumn 2006.

Scientific name	2005				2006			
	Non-ploughing Sites		Ploughing Sites		Non-ploughing Sites		Ploughing Sites	
	Spr.	Aut.	Spr.	Aut.	Spr.	Aut.	Spr.	Aut.
<i>Mesem. nodiflorum</i>	---	---	---	---	10	---	---	---
<i>Deverra tortuosa</i>	30	10	---	---	40	10	---	---
<i>Arisarum vulgar</i>	---	---	---	---	10	---	---	---
<i>Asphodelus aestivus</i>	30	10	---	---	60	10	---	---
<i>Achillea fragrantissima</i>	30	---	---	---	30	---	---	---
<i>Anacyclus monanthos</i>	50	---	---	---	30	---	10	---
<i>Centaurea calcitrapa</i>	---	---	10	---	10	---	---	---
<i>Echinops hussoni</i>	10	---	---	---	10	10	---	---
<i>Echinops spinosus</i>	10	---	10	---	10	---	10	10
<i>Glebionis coronaria</i>	30	---	---	---	30	---	20	---
<i>Onopor. alexandranium</i>	10	---	---	---	20	---	10	---
<i>Scorzoneria undulata</i>	10	---	---	---	10	---	---	---
<i>Senecio coronopifolius</i>	---	---	10	---	---	---	---	---
<i>Silybum marianum</i>	---	---	10	10	10	---	10	10
<i>Echium sericeum</i>	10	---	---	---	10	10	10	---
<i>Enarthrocarpus lyratus</i>	10	---	20	---	10	---	20	---
<i>Lepidium draba</i>	10	---	20	---	10	---	10	---
<i>Sisymbrium irio</i>	---	---	---	---	10	---	---	---
<i>Gymnocarpus decandrum</i>	20	10	---	---	30	10	---	---
<i>Paronychia capitata</i>	---	---	---	---	10	---	---	---
<i>Chenopodium murale</i>	---	---	10	---	10	---	10	---
<i>Haloxylon salicornicum</i>	50	30	20	---	50	20	20	10
<i>Salsola villosa</i>	20	10	10	10	---	---	10	10
<i>Suaeda vermiculata</i>	---	---	10	10	10	---	10	10
<i>Convolvulus arvensis</i>	10	---	20	10	10	---	10	10
<i>Astragalus homosus</i>	---	---	---	---	10	---	---	---
<i>Hippocrepis cyclocarpa</i>	---	---	---	---	10	---	---	---
<i>Lotus arabicus</i>	---	---	---	---	10	---	---	---
<i>Melilotus elegans</i>	20	---	---	---	---	---	---	---
<i>Trigonella maritima</i>	---	---	---	---	10	---	---	---
<i>Vicia monantha</i>	20	---	10	---	---	---	---	---
<i>Vicia sativa</i>	20	---	---	---	20	---	---	---
<i>Salvia aegyptiaca</i>	---	---	---	---	10	---	10	---
<i>Salvia lanigera</i>	10	---	---	---	---	---	---	---
<i>Malva sylvestris</i>	---	---	10	---	10	---	10	---
<i>Papaver hybridum</i>	10	---	---	---	10	---	---	---
<i>Peganum harmala</i>	30	---	---	---	30	10	---	---
<i>Plantago notata</i>	40	---	---	---	30	---	10	---
<i>Aegilops kotschy</i>	40	---	---	---	40	---	---	---
<i>Bromus rubens</i>	20	---	---	---	20	---	---	---
<i>Cynodon dactylon</i>	---	---	10	10	10	---	10	10
<i>Hordeum marinum</i>	40	---	20	---	40	---	20	---
<i>Lolium temulentum</i>	---	---	20	---	10	---	10	---
<i>Lygeum spartum</i>	20	---	10	20	10	---	10	10
<i>Phalaris minor</i>	10	---	---	---	---	---	---	---
<i>Polygon. equisetiforme</i>	---	---	10	10	10	---	10	10
<i>Anagallis arvensis</i>	10	---	---	---	---	---	---	---
<i>Adonis dentata</i>	---	---	10	---	20	---	10	---
<i>Lycium shawii</i>	20	20	10	10	30	20	---	---
<i>Thymelaea hirsuta</i>	70	40	20	10	70	30	20	10
Average	23.2	18.6	13.3	11.1	19.8	14.4	12.2	10.0
Species total	31	7	21	9	43	9	23	10

Spr. = spring; Aut. = Autumn

Table A4. Fresh forage yield (g m²) of plant species as affected by year, site and season in Umm El-Rakham area during spring 2005 to autumn 2006.

Scientific name	2005				2006			
	Non-ploughing Sites		Ploughing Sites		Non-ploughing Sites		Ploughing Sites	
	Spr.	Aut.	Spr.	Aut.	Spr.	Aut.	Spr.	Aut.
<i>Mesem. nodiflorum</i>	---	---	---	---	2.9	---	---	---
<i>Deverra tortuosa</i>	2.3	1.5	---	---	2.4	1.9	---	---
<i>Arisarum vulgare</i>	---	---	---	---	2.2	---	---	---
<i>Asphodelus aestivus</i>	11.9	1.4	---	---	14.8	2.2	---	---
<i>Achillea fragrantissima</i>	0.4	---	---	---	0.9	---	---	---
<i>Anacyclus monanthos</i>	5.8	---	---	---	4.8	---	3.5	---
<i>Centaurea calcitrapa</i>	---	---	1.8	---	2.8	---	---	---
<i>Echinops hussoni</i>	4.2	---	---	---	3.8	1.4	---	---
<i>Echinops spinosus</i>	4.2	---	2.8	---	2.1	---	2.4	2.2
<i>Glebionis coronaria</i>	7.6	---	---	---	7.8	---	3.8	---
<i>Onop. alexandranium</i>	3.3	---	---	---	3.8	---	1.4	---
<i>Scorzonera undulata</i>	0.05	---	---	---	0.05	---	---	---
<i>Senecio coronopifolius</i>	---	---	3.7	---	---	---	---	---
<i>Silybum marianum</i>	---	---	6.3	3.2	2.6	---	2.3	1.6
<i>Echium sericeum</i>	1.6	---	---	---	1.6	1.0	1.0	---
<i>Enarthrocarpus lyratus</i>	4.3	---	4.4	---	3.2	---	4.0	---
<i>Lepidium draba</i>	2.3	---	4.6	---	2.4	---	2.4	---
<i>Sisymbrium irio</i>	---	---	---	---	1.3	---	---	---
<i>Gymnocarpus decandrum</i>	18.1	6.2	---	---	19.4	8.1	---	---
<i>Paronychia capitata</i>	---	---	---	---	1.6	---	---	---
<i>Chenopodium murale</i>	---	---	0.2	---	0.6	---	0.4	---
<i>Haloxylon salicornicum</i>	31.1	26.6	12.7	---	34.4	26.0	8.6	5.2
<i>Salsola villosa</i>	5.7	3.2	3.3	2.0	---	---	2.8	1.8
<i>Suaeda vermiculata</i>	---	---	4.0	2.9	2.7	---	2.7	1.8
<i>Convolvulus arvensis</i>	1.2	---	3.9	2.0	0.8	---	3.4	2.4
<i>Astragalus homosus</i>	---	---	---	---	0.3	---	---	---
<i>Hippocrepis cyclocarpa</i>	---	---	---	---	0.3	---	---	---
<i>Lotus arabicus</i>	---	---	---	---	1.1	---	---	---
<i>Mellilotus elegans</i>	1.8	---	---	---	---	---	---	---
<i>Trigonella maritima</i>	---	---	---	---	0.6	---	---	---
<i>Vicia monantha</i>	0.6	---	1.7	---	---	---	---	---
<i>Vicia sativa</i>	0.6	---	---	---	0.6	---	---	---
<i>Salvia aegyptiaca</i>	---	---	---	---	0.5	---	0.4	---
<i>Salvia lanigera</i>	1.2	---	---	---	---	---	---	---
<i>Malva sylvestris</i>	---	---	1.6	---	0.7	---	3.2	---
<i>Papaver hybridum</i>	1.4	---	---	---	0.7	---	---	---
<i>Peganum harmala</i>	9.4	---	---	---	8.4	4.6	---	---
<i>Plantago notata</i>	13.6	---	---	---	13.3	---	6.0	---
<i>Aegilops kotschyi</i>	2.0	---	---	---	2.0	---	---	---
<i>Bromus rubens</i>	2.0	---	---	---	2.0	---	---	---
<i>Cynodon dactylon</i>	---	---	4.6	1.6	2.1	---	3.0	1.8
<i>Hordeum marinum</i>	8.9	---	3.7	---	7.8	---	3.9	---
<i>Lolium temulentum</i>	---	---	8.7	---	1.8	---	2.4	---
<i>Lygeum spartum</i>	8.9	---	4.0	3.1	6.7	---	2.5	1.8
<i>Phalaris minor</i>	7.0	---	---	---	---	---	---	---
<i>Polygon. equisetiforme</i>	---	---	3.1	1.4	1.4	---	1.0	0.7
<i>Anagallis arvensis</i>	1.8	---	---	---	---	---	---	---
<i>Adonis dentata</i>	---	---	4.1	---	4.4	---	2.6	---
<i>Lycium shawii</i>	32.1	13.8	21.8	16.1	31.4	21.4	---	---
<i>Thymelaea hirsuta</i>	43.4	21.1	13.4	11.1	47.7	18.4	8.2	5.5
Total	238.6	73.9	114.6	43.4	252.6	85.1	71.9	24.7

Spr. = spring; Aut. = Autumn

Table A₅. Dry forage yield (g m⁻²) of plant species as affected by year, site and season in Umm El-Rakham area during spring 2005 to autumn 2006.

Scientific name	2005				2006			
	Non-ploughing Sites		Ploughing Sites		Non-ploughing Sites		Ploughing Sites	
	Spr.	Aut.	Spr.	Aut.	Spr.	Aut.	Spr.	Aut.
<i>Mesem. nodiflorum</i>	---	---	---	---	0.5	---	---	---
<i>Deverra tortuosa</i>	1.0	0.8	---	---	1.0	0.8	---	---
<i>Arisarum vulgare</i>	---	---	---	---	0.6	---	---	---
<i>Asphodelus aestivus</i>	3.9	0.6	---	---	4.9	0.7	---	---
<i>Achillea fragrantissima</i>	0.2	---	---	---	0.4	---	---	---
<i>Anacyclus monanthos</i>	1.8	---	---	---	1.3	---	1.1	---
<i>Centaurea calcitrapa</i>	---	---	0.8	---	1.1	---	---	---
<i>Echinops hussoni</i>	2.1	---	---	---	1.4	0.6	---	---
<i>Echinops spinosus</i>	2.3	---	2.0	---	1.1	---	1.4	1.2
<i>Glebionis coronaria</i>	2.4	---	---	---	2.2	---	1.2	---
<i>Onop. alexandranium</i>	1.9	---	---	---	2.0	---	0.8	---
<i>Scorzonera undulata</i>	0.02	---	---	---	0.02	---	---	---
<i>Senecio coronopifolius</i>	---	---	1.3	---	---	---	---	---
<i>Silybum marianum</i>	---	---	3.4	2.5	1.5	---	1.4	0.7
<i>Echium sericeum</i>	0.4	---	---	---	0.4	0.2	0.3	---
<i>Enarthrocarpus lyratus</i>	1.4	---	1.8	---	1.0	---	1.4	---
<i>Lepidium draba</i>	0.9	---	1.5	---	0.9	---	0.8	---
<i>Sisymbrium irio</i>	---	---	---	---	0.4	---	---	---
<i>Gymnocarpus decandrum</i>	11.0	4.7	---	---	10.6	4.7	---	---
<i>Paronychia capitata</i>	---	---	---	---	0.6	---	---	---
<i>Chenopodium murale</i>	---	---	0.1	---	0.2	---	0.1	---
<i>Haloxylon salicornicum</i>	18.0	13.4	7.2	---	17.7	13.5	4.4	2.8
<i>Salsola villosa</i>	2.6	1.8	1.4	1.2	---	---	0.8	0.6
<i>Suaeda vermiculata</i>	---	---	1.7	1.5	0.8	---	0.8	0.6
<i>Convolvulus arvensis</i>	0.3	---	1.3	0.6	0.2	---	0.9	0.7
<i>Astragalus homosus</i>	---	---	---	---	0.1	---	---	---
<i>Hippocrepis cyclocarpa</i>	---	---	---	---	0.1	---	---	---
<i>Lotus arabicus</i>	---	---	---	---	0.2	---	---	---
<i>Melilotus elegans</i>	0.6	---	---	---	---	---	---	---
<i>Trigonella maritima</i>	---	---	---	---	0.2	---	---	---
<i>Vicia monantha</i>	0.2	---	0.5	---	---	---	---	---
<i>Vicia sativa</i>	0.2	---	---	---	0.2	---	---	---
<i>Salvia aegyptiaca</i>	---	---	---	---	0.2	---	0.2	---
<i>Salvia lanigera</i>	0.5	---	---	---	---	---	---	---
<i>Malva sylvestris</i>	---	---	0.3	---	0.2	---	0.6	---
<i>Papaver hybridum</i>	0.5	---	---	---	0.2	---	---	---
<i>Peganum harmala</i>	3.1	---	---	---	2.9	1.8	---	---
<i>Plantago notata</i>	4.6	---	---	---	4.4	---	2.1	---
<i>Aegilops kotschy</i>	0.3	---	---	---	0.5	---	---	---
<i>Bromus rubens</i>	0.6	---	---	---	0.6	---	---	---
<i>Cynodon dactylon</i>	---	---	1.4	0.5	0.6	---	0.8	0.6
<i>Hordeum marinum</i>	2.6	---	1.4	---	1.9	---	1.0	---
<i>Lolium temulentum</i>	---	---	2.2	---	0.5	---	0.6	---
<i>Lygeum spartum</i>	3.9	---	1.8	1.6	2.8	---	1.0	0.8
<i>Phalaris minor</i>	2.5	---	---	---	---	---	---	---
<i>Polygon. equisetiforme</i>	---	---	1.0	0.7	0.4	---	0.3	0.2
<i>Anagallis arvensis</i>	0.4	---	---	---	---	---	---	---
<i>Adonis dentata</i>	---	---	0.8	---	0.9	---	0.6	---
<i>Lycium shawii</i>	19.2	6.6	9.2	7.4	15.4	12.2	---	---
<i>Thymelaea hirsuta</i>	19.5	9.0	6.0	5.8	21.0	7.4	3.8	2.5
Total	108.7	36.9	46.8	21.9	103.4	42.1	26.0	10.5

Spr. = spring; Aut. = Autumn

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**تأثير عمليات الحرث علي الغطاء النباتي في إقليم الساحل الشمالي الغربي لمصر
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سلطت هذه الدراسة الضوء علي تأثير عمليات الحرث علي تركيب الغطاء النباتي، الكثافة النباتية، النسبة المئوية للتغطية والتكرار، الإنتاجية العلفية للمرعي والأنواع النباتية خلال مواسم النمو (الربيع والخريف) لعامي ٢٠٠٥ و ٢٠٠٦ في منطقة أم الرخم والتي تبعد مسافة ٤٠ كم غرب مدينة مرسى مطروح في إقليم الساحل الشمالي الغربي لمصر. سجلت عمليات مسح الغطاء النباتي وجود ٥٠ نوع نباتي تتدرج تحت ٢٢ فصيلة نباتية. اعلي معدلات الكثافة والتغطية النباتية والتكرار والإنتاجية العلفية لمعظم الأنواع النباتية المعمرة والحوالية تم رصدها في المواقع غير المحروثة مقارنةً بالمواقع المحروثة. المثان والرمث العوسج احتلت المراتب الأولى بين المعمرات من حيث الأهمية النسبية ويقابلها في ذلك من الحوليات سررة الكبش والشعير البري والينم. الأنواع النباتية سابقة الذكر متأقلمة بشكل كبير مع الظروف البيئية لمنطقة أم الرخم (عمليات حرث، تفاوت واسع في نسبة CaCo₃، ملوحة منخفضة، pH متعادل الي قلوي).