EFFECT OF LOCATION AND GROWTH SEASON ON THE PRODUCTIVITY AND QUALITY OF SOME RANGE PLANTS IN THE NORTH WESTERN COAST OF EGYPT

By

HUDA MOHAMMED ABDEL-RAZIK ABUSAIEF

B.Sc. Agric. Sci. (Soil and Water), Fac. Agric., Omar El-Mokhtar Univ., Libya, 2002

M.Sc. Agric. Sci. (Agronomy), Fac. Agric., Omar El-Mokhtar Univ., Libya, 2006

THESIS

Submitted in Partial Fulfillment of the Requirements for the Degree of

DOCTOR OF PHILOSOPHY

In

Agricultural Sciences

(Agronomy)

Department of Agronomy
Faculty of Agriculture
Cairo University
EGYPT

2010

APPROVAL SHEET

EFFECT OF LOCATION AND GROWTH SEASON ON THE PRODUCTIVITY AND QUALITY OF SOME RANGE PLANTS IN THE NORTH WESTERN COAST OF EGYPT

Ph.D. Thesis
In
Agric. Sci. (Agronomy)

By

HUDA MOHAMMED ABDEL-RAZIK ABUSAIEF

B.Sc. Agric. Sci. (Soil and Water), Fac. Agric., Omar El-Mokhtar Univ., Libya, 2002
M.Sc. Agric. Sci. (Agronomy), Fac. Agric., Omar El-Mokhtar Univ., Libya, 2006

Approval Committee

Dr. MOHAMED THANAA HASSAN ……..……...……...
Emeritus Head Researcher of Agronomy, Field Crops Res. Inst., ARC.

Dr. MOHAMED EL-SAYED RADWAN ……..……..
Emeritus Professor of Agronomy, Fac. Agric., Cairo University.

Dr. ABDEL-HAFEZ ABDEL-RAHMAN ABDEL-HAFEZ…....
Emeritus Professor of Agronomy, Fac. Agric., Cairo University.

Dr. RAFEA IBRAHEM AHMED EL-ZANATY……...……
Professor of Agronomy, Fac. Agric., Cairo University.

Date: 1 / 4 / 2010

SUPERVISION SHEET

EFFECT OF LOCATION AND GROWTH SEASON ON THE PRODUCTIVITY AND QUALITY OF SOME RANGE PLANTS IN THE NORTH WESTERN COAST OF EGYPT

Ph.D. Thesis
In
Agric. Sci. (Agronomy)

By

HUDA MOHAMMED ABDEL-RAZIK ABUSAIEF

B.Sci. Agric. Sc. (Soil and Water), Fac. Agric., Omar El-Mokhtar Univ., Libya, 2002
M.Sci. Agric. Sc. (Agronomy), Fac. Agric., Omar El-Mokhtar Univ., Libya, 2006

SUPERVISION COMMITTEE

Dr. RAFEA IBRAHEM AHMED EL-ZANATY
Professor of Agronomy, Fac. Agric., Cairo University

Dr. ABDEL-HAFEZ ABDEL-RAHMAN ABDEL-HAFEZ
Emeritus Professor of Agronomy, Fac. Agric., Cairo University

Dr. MOHAMED HELMY EL-MORSY
Researcher of Plant Ecology and Range Management, Desert Research Center

Name of Candidate: Huda Mohammed Abdel-Razik Abusaief **Degree:**Ph.D
Title of Thesis: Effect of location and growth season on the productivity and quality of some range plants in the North Western Coast of Egypt
Supervisors: Dr. Rafea Ibrahem Ahmed El-Zanaty
Dr. Abdel-Hafez Abdel-Rahman Abdel-Hafez
Dr. Mohamed Helmy El-Morsy
Department: Agronomy **Approval:** 1 / 4 / 2010

ABSTRACT

This study was conducted during spring and autumn seasons of 2007 and 2008 in coastal sand dunes and wadi Halazien, at the North West Coast region of Matruh governorate in Egypt. The aim of this investigation was to survey and classify natural plants species and to study the effect of location and seasonal changes on range productivity and quality of pasture species.

At coastal sand dunes (El-Qasr), natural vegetation contained 26 plant species belong to 13 families. In general, *Ononis vaginalis* followed by *Ammophila arenaria* gave the highest figures of vegetation characteristics, fresh and dry foliage yields in both years. The index of diversity in spring 2008 increased than the spring 2007. *Lotus polyphyllus* and *Ononis vaginalis* gave the highest value of CP % and DCP % in spring 2008. All traits, fresh and dry yields had appositive correlation with precipitation and a negative correlation with temperature.

In wadi Halazien, 72 plant species belong to 29 families were found. *Polygonum equisetiforme* in top, *Deverra tortuosa* in ridge, *Chiliadenus candicans* in bed 1 and *Carduncellus eriocephalus* in bed 2 gave the highest abundance and plant density in spring 2007. Whereas, *Gymnocarpos decandrus* in top, *Leopoldia comosa* in ridge and *Carduncellus eriocephalus* in bed 1 and 2 gave the highest ones in spring 2008. Total abundance and plant density in bed 2 significantly surpassed other sites in both years. *Gymnocarpos decandrus* in top, *Euphorbia dendroides* in ridge, *Thymelaea hirsuta* in bed 1 and *Atriplex nummularia* in bed 2 gave the highest fresh and dry yields in spring 2007. While, *Thymelaea hirsuta* in top, *Gymnocarpos decandrus* in ridge, *Fumana thymifolia* in bed 1 and *Carduncellus eriocephalus* in bed 2 had the highest ones in spring 2008. Seasonal fresh and dry yields in bed 2 significantly exceeded other sites in both years. *Haloxylon salicornicum* in top *Euphorbia dendroides* in ridge, *Lotus polyphyllus* in bed 1 and *Peganum harmala* in bed 2 gave the highest CP % and DCP % in spring 2007, while, in spring 2008 *Erodium crassifolium* in top, *Achillea santolina* in ridge, *Lotus polyphyllus* in bed 1 and 2 gave the highest ones. Crude protein % and DCP % in spring significantly exceeded it in autumn at all sites in both years. Abundance, density, fresh and dry yields had a positive correlation with precipitation, and a negative correlation with temperature.

Key words: Costal sand dunes, Wadi Halazien, Location, Seasonal changes, Productivity, Quality, Range, Natural vegetation, Diversity.

DEDICATION

I dedicate this work to whom my heart felt thanks; to my great generous father and to my affectionate sweet mother for all the support they lovely offered and for their patience and help along the period of my postgraduate studies.

ACKNOWLEDGEMENT

First of all my deepest thanks and gratitude is for my God for his blessing to achieve this stage. I would like to thank and express my appreciation to ***Dr. Rafea Ibrahem Ahmed El-Zanaty****, Professor of Agronomy, Faculty of Agriculture, Cairo University, for her direct supervision, suggesting the problem, continued assistance and her guidance through the course of study and revision of this manuscript, inspiration that had guided me throughout the development of this work. My thanks also extended to* ***Dr. Abdel-Hafez Abdel-Rahman Abdel-Hafez*** *Professor of Agronomy, Faculty of Agriculture, Cairo University, for supervision, helpful assistance and guidance during the progress, preparing and writing of this manuscript. I am grateful to* ***Dr. Korany Ismail Abdel-Gawad****, Professor of Agronomy, Faculty of Agriculture, Cairo University, for his suggesting the probleam, continued assistance and his guidance through the course of study and revision of this manuscript, inspiration that had guided me throughout the development of this work. I am Thanks to* ***Dr. Mohamed Helmy El-Morsy****, Researcher of Plant Ecology and Range Management, Desert Research Center, for his supervision contribution in the fieldwork. Also, extended to all staff members of Agronomy Department, Faculty of Agriculture, Cairo University. Thanks are also extended to* ***Dr. Deyaa El-Kadi and Dr. Ashraf Abdel-All Abd El-Mohsen*** *for their help in data analysis.*

Lastly, I feel deeply grateful to my dear country Libya.

CONTENTS

INTRODUCTION

The Northern coast region of Egypt extends around 1000 km along the Mediterranean Sea and 30 km inland. This region is characterized with arid Mediterranean climate that has a limited rainfall. Average annual rainfall over 10 years from 1999 to 2008 was 115 mm/year of meteorological authority in Matruh. The natural range considered the basic source of animal feed in the Egyptian deserts. Due to poor management and environmental impacts, the native ranges are deteriorated are seriously depleted. Range production depends on various factors as climate, soil, vegetation structure, type and intensity of management.

The vegetation survey of an area is of great importance for any type of agricultural development plan. Plant collection and identification are the starting point for any range ecology investigation. Studies of the individual plant species include the evaluation of native range plants since species are essential for possible use in range improvement. Coastal sand dune flora has a wide range of applications in nutrition, medicine, industry and agriculture (Sridhar and Bhagya, 2007). The biodiversity of each sand dune differs from region to region in the world. The wadi is typical for agricultural use (rain-fed farming), in addition to rangeland plants for grazing animals (sheep, goats and camels) in the range sector of the wadi (agro-pastoral system) and water harvesting practices by stone dams across the stream (Gab Allah, 2006). The aim of this study was to survey, classify and study the natural vegetation in two locations during two seasons. The first

location of the study was coastal sand dunes in El-Qasr and the second one was wadi Halazien.

REVIEW OF LITERATURE

There were differences in plant species between coastal sand dunes (CSD) and other wadis.

Seasonal variations in climatic factors have a great effect on growth parameters of most plant species (El-Toukhy *et al.* 2002). The vegetation activity is dependable much on the suitability of environmental conditions, since it is grown well under the availability of water, less temp., more dew….*etc*, suitability during winter and spring season in which the resultant could be much vegetation growth during spring and followed with winter as well as autumn season, in respect (Reiad *et al.* 1996 a). Results showed dramatic changes in the vegetation accompanied by the profuse growth of ephemerals in exceptionally wet years and their disappearance in extremely dry years in wadis of South West Sinai (Girgis and Ahmed, 1985). It might be explained by appearing and flourishing the most plants in spring season, which has less amount of precipitation compared with winter that has a peak of fall and less of plant appearance in El-Nigala area (Abou-Deya and Salem, 1990).

1. Coastal sand dunes

a. Botanical composition

The coastal sand dunes belong to the most important ecosystems. Vegetation structure is associated to geomorphologic heterogeneity (Celsi and Monserrat, 2008). Sridhar and Bhagya (2007) mentioned that coastal sand dunes are important locations for a variety of flora.

Members of *Poaceae* have a major share of vegetation in temperate dunes, but *Asteraceae, Cyperaceae, Fabaceae* and *Poaceae* in tropical dunes (Sridhar and Bhagya, 2007). Celsi and Monserrat (2008) found the families *Asteraceae*, *Poaceae* and *Fabaceae* had the greates number of species. However, *Polygonaceae* and *Caryophyllaceae* are represented each by one species in CSD. Migahid *et al.* (1955) noticed that *Ammophila arenaria* on the higher unstable part of the dune but *Ononis vaginalis,* found on the round more stable base of the dune. *Ammophila arenaria* associated with *Silene succulenta, Echium sericeum, Polygonum equisetiforme* and *Lotus polyphyllus* on the dunes. However, Gab Allah (2006) found *Retama raetam, Silybum marianum* and *Reseda decursiva* in CSD in El-Qasr. Galal and Fawzy (2007) mentioned that the interdunes support 58 species representing 84.1 % of the total species of them 21 species were exclusively recorded in El burullus sand dunes.

Ammophila arenaria dominated in CSD (Migahid *et al.* 1955; Ayyad, 1973; El-Ghonemy, 1973; Ayyad and Fakhry, 1994; Galal and Fawzy, 2007 in Egypt and Til *et al.* 2004 in Netherlands). While, Gab Allah (2006) found *Lycium shawii* dominated in CSD in El-Qasr of Egypt.

The number of species per family differenced with variation appearance of species between seasons. The family *Poaceae* has highest number of species (four species) followed by *Fabaceae* and *Brassicaceae* families (three species for each) then *Asteraceae* family (two species) in spring season in CSD in El-Qasr (Gab Allah, 2006). Migahid and Ayyad (1959) mentioned that there were four types of

growth habits: ephemerals, evergreen perennials, summer deciduous perennials, and winter-deciduous perennials. Seasonal changes in the desert vegetation were due to two factors: the growth habit of plants and the seasonality of the climate. Gab Allah (2006) and Galal and Fawzy (2007) found that life duration about 83 and 39 % plant species were perennials about 17 and 61 % were annuals in CSD in El-Qasr and Kafr El-Sheikh, respectively.

b. Vegetation characteristics

In Egypt, Gab Allah (2006) in coastal sand dunes in El-Qasr found that species of *Poaceae* and *Fabaceae* families had highest value of abundance, plant density and frequency. *Ammophila arenaria*, *Euphorbia paralias* and *Ononis vaginalis* had the highest abundance (25.5, 22.5 and 22 plants, respectively). The highest plant density and frequency percentage was obtained for *Ononis vaginalis* and *Ammophila arenaria*. On the contrary, the lower value of frequency was attained by *Silene succulenta*. Also, he found the total coverage significantly increased in spring in the second year than the first one. The highest coverage percentage attained in *Ononis vaginalis* and *Lotus polyphyllos*.

In Saudi Arabia, Tag El-Din *et al.* (1994) in sand dunes, stated that relatively high content of magnesium and sodium cation could be considered as a factor inhibiting growth of vegetation cover. All vegetation types having low vegetation cover percentage had high content of magnesium cation and sodium cation that might restrict the growth of most plant species.

In Argentina, Celsi and Monserrat (2008) found that *Asteraceae*, *Poaceae*, and *Fabaceae* families had best cover percentage. However, *Caryophyllaceae* had less cover percentage at fixed/semifixed in CSD. Whereas, Gab Allah (2006) in Egypt mentioned that plant species of families *Tamaricaceae* and *Fabaceae* had the highest coverage percentage.

Galal and Fawzy (2007) in CSD of Kafr El-Sheikh, Egypt, mentioned that *Silene succulenta* (11.5 %) had the lowest coverage percentage. The dunes characterized by relatively high vegetation coverage that reached 80 % in interdunal areas.

c. Importance value

Gab Allah (2006) in El-Qasr demonstrated that plant species of *Fabaceae* and *Poaceae* had the highest importance value (IV). El-Ghonemy (1973) and Gab Allah (2006) found that the highest IV of *Ammophila arenaria* recorded in Sedi-Abdel-Rahman and El-Qasr. This highest IV may be due to the highest relative frequency and relative plant density of *Ammophila arenaria*.

d. Foliage productivity

Gab Allah (2006) in CSD found insignificant differences in fresh and dry forage yields between the two springs in both years. He stated that plants growing in sand dunes were highly adapted and had the ability to grow vertically and tolerate the exposure of their underground organs. Generally, the highest fresh and dry forage yield obtained by species of families *Tamaricaceae* and *Fabaceae*. The highest fresh and dry forage yields observed in *Ononis vaginalis*, whereas the lower ones in *Salvia lanigers*.

e. Chemical composition

Plant species belonging to *Fabaceae* family generally produce higher forage quality than other species because legumes usually have high crude protein percentage and or higher intake than others. One of the most significant benefits of growing legumes with other plant species is improvement of forage quality for grazing animals (goats, sheep and camels) in different habitats in CSD (Gab Allah, 2006).

Generally, crude protein percentage (CP %) of plant species belong to *Resedaceae* and *Fabaceae* families was higher than other families. Gab Allah, (2006) noticed the highest value of CP % obtained by *Ononis vaginalis* and *Lotus polyphyllus* was 17.83 and 15.95 % in 2006, respectively. In contrast, the lowest CP % attained from *Ammophila arenaria* and *Silene succulenta* were 7.28 and 7.66 % in 2005 and 2006, respectively in CSD in El- Qasr.

Plant species of family *Apiaceae* had the highest crude fiber percentage (CF %), whereas, *Caryophyllaceae* had the lowest value. *Ammophila arenaria* had the highest value of CF %, whereas, *Silene succulenta* had the lowest CF % in CSD in El-Qasr (Gab Allah, 2006).

Plant species of family *Caryophyllaceae* had the highest total ash percentage (TA %) whereas, *Poaceae* had the lowest value. The highest TA % figure was recorded by *Silene Succulenta*. However, the lowest TA % was attained by *Retama raetam* in CSD in El-Qasr (Gab Allah, 2006).

Plant species of families *Euphorbiaceae* and *Solanaceae* had the highest ether extract (EE %). The highest content of EE % was detected for *Euphorbia paralias*, while, the lowest EE % recorded in *Ammophila*