Sudan University of Science and Technology

College of Agricultural Studies

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Soil seed bank weeds in cultivated area (shambat)

مخزون بذور الحشائش في الأراضي المزروعة(شمبات)

By:

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A thesis submitted in partial fulfillment of the requirements for the degree of B.Sc. Agric. in plant Protection

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2016

بسم الله الرحمن الرحيم

قال تعالي: (وَالْأَرْضَ مَدَدْنَاهَا وأَلْقَيْنَا فيها رَوَاسِيَ وَأَنْبَتْنَا فيها مِنْ كُلِّ شَيْءٍ مَوْزُونٍ * وَجَعَلْنَا لَكُمْ فيها مَعَايِشَ وَمَنْ لَسْتُمْ لَهُ بِرَازِقِينَ * وَإِنْ مِنْ شَيْءٍ إِلَّا عِنْدَنَا خَزَائِنُهُ وَمَا نُنَزِّلُهُ إِلَّا بِقَدَرٍ مَعْلُومٍ) .

سورة الحجر (الآيات 19 : 21)

صدق الله العظيم

DEDICATION

To my parents

To my mother and sisters

To my Dear uncle Musa Haroun Ibrahim

And all my family and friends

Thank you

With loves

ACKNOWLEDGEMENTS

I render my thanks and praise to Almighty Allah who has given me the healthy and strength to accomplish this work.

It is a pleasure to express my sincere gratitude and thanks to my supervisor **Dr. Mawahib Ahmed ElSiddig**, for his continuous help and guidance throughout the course of this research work.

Also thanks extend to my **Dear uncle Musa Haroun Ibrahim** and my **Class Mate Salih Osman** all my teachers in the department of plant protection Sudan University of Science and Technology.

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ملخص البحث

أجريت التجربة بجامعة السودان للعلوم والتكنولوجيا، كلية الدراسات الزراعية بقسم وقاية النباتات بمعمل امراض النبات، –شمبات، في الفترة (ابريل –2016م)، لمعرفة مخزون بذور الحشائش في اراضي مزروعة . تم اخذ عينات التربة من داخل مزرعة الطلاب بكلية الدراسات الزراعية جامعة السودان للعلوم والتكنولوجيا من مساحة (10×10متر) على مسافات متساوية حتى عمق (10سم) وقطر(8سم) بعدد 25عينة ووزن كل عينة (1كجم) ومن ثم مُزجت العينات مع بعضها وغُربلت بغربال (2)مش وقُسمت ل(5) أجزاء وتم استخلاص بذور الحشائش مباشرة عن طريق الغسيل بالماء في غرابيل متدرجة الأقطار (2_0.2)مش، وتم اختبار حيوية البذور عن طريق مركب كلوريد الكالسيوم وأظهرت النتائج أن أكثر أنواع الحشائش سيادة هي الربعة *Trianthema portulacastrum*(35%) تليها النجيلة(17.7%) dactylon *Cynodon* وأم فروة(17.7%) *Brachiar deflexi* تليها الحنتوت(11.8%)*Ipomoea cordofana* والضريسة(8.8%) *Tribulus terrestris* والرجلة(8.8%) *Portulaca olearaceae*.

Abstract

Experiment was conducted at the University of Sudan of Science and Technology, College of Agricultural Studies Department of Plant Protection Laboratory of Plant Pathology, -(shambat), in the period (April- 2016 m), to know the soil seed bank weed seeds of cultivated area. The samples were took from the demonstrated Farm in the College of Agricultural Studies, Sudan University for Science and Technology, The distances between samples were equal (10x10 meters) at a depth of (10 cm) and a diameter (8 cm), and the number of samples (25), and the weight of each sample, then mix the samples together and sieved in sieve (2) Mesh. The samples divided into (5) parts and the weed seeds extracted directly by washing with water in sieves graded diameters (0.2_2) mesh. The viability of the seeds was tested by compound calcium chloride. The results showed that the most common types of weeds sovereignty was *Trianthema portulacastrum*(35%), followed by *Cynodon dactylon* and *Brachiaria deflexa*(17.7%), followed by *Ipomoea Cordofana*(11.8%), *Tribulus terrestris* and *Portulaca olearaceae*(8.8%).

CHAPTER ONE

INTRODUCTION

The topic of soil seed banks is important because of the impact seed reserves in soil have on current and future vegetation (Greene, 2001).

There is an increasing demand for reliable information on seed banks, both for scientific purposes and as decisiontoolin habitat and landscape management (Hölzel, and Otte, 2004).

The vegetation of cultivated landscapes essentially reflected the current land use, in addition to the feature of the area. The seed bank is major importance as a developmental potential future vegetation types (Richard, *et al* 2009).

The assessment of weed seed banks played a vital role in control of weed communities and to develop a sound weed management strategy information on ecological and biological behavior of weed species (Zimdhal, 1995).The vegetation of cultivated landscapes essentially reflected the current land use, in addition to the feature of the area

(Galland *et al,*1999),studied weed flora and seed bank and related their number to different types of soils and cropping system. The spatial and temporal relationship between weed from in different years and weed species densities, soil factors and the seed bank (Iinglis,2000).

Soil seed bank of plant is notoriously variable across a wide range of spatial scale. Deeply buried seed probably doesn't ever germinate until brought seed bank, are strongly introduced by direction and strength of wind and water flow, the distribution of established plants and soil surface (Glass and Howell, 2000).

The weed seed bank is the reserve of viable weed seeds present on the soil surface and scattered in the soil profile. It consists of both new weed seeds recently shed and older seeds that have persisted in the soil for several years. Agricultural soils can contain thousands of weed seeds per square foot and understanding the factors impacting the dynamics of weed seedbanks can help in the development of integrated weed management (IWM) programs(Mohler, 2001).

The objective of this study was to look into the soil seed bank in cultivated area in shambat.

CHAPTER TWO

LITERATURE REVIEW

2.1 The Weeds

There are numerous definitions of a weed. Some common definitions include: a plant that is out of place and not intentionally sown, and grows where it is not wanted or welcomed, it whose virtues have not yet been discovered, and it that is competitive, persistent, pernicious, and interferes negatively with human activity No matter which definition is used, weeds are plants whose undesirable qualities outweigh their good points, at least according to humans. Human activities create weed problems since no plant is a weed in nature (Thompson *et al*., 1997).

Weeds are naturally strong competitors, and those weeds that can best compete always tend to dominate. Both humans and nature are involved in plant-breeding programs. The main difference between the two programs is that humans breed plants for yield, while nature breeds plants for survival (Anonymous, 1994).

2.2 Problem caused by weeds

Weeds are one of the major threats to the natural environment. They are destroying native habitats, threatening native plants and animals and choking our natural systems including rivers. Directly or indirectly, all the countries are affected by weeds. Weeds reduce farm and forest productivity, invade crops, smother pastures and some can harm livestock. Land and water managers incur

material and lab our costs to control weeds - these costs are passed on to the public through higher prices for produce. Weeds reduce the quantity and quality of agricultural, horticultural and forestry products, affecting both industry and consumers. Farmers are often concerned that weeds may reduce crop yields. Weeds use the same nutrients that crop plants use, often in very similar proportions. They also use resources such as water, sunshine and space that might have gone to crops. The more similar the weed and crop requirements, the more they will compete for those resources. Weeds that compete aggressively with crops reduce their yield. Weeds are most damaging to crop yields if they have some advantage over the crop. Four factors are especially important: density, timing, size and chemistry (Norris, 1999).

2.3 Characteristics of weeds

1) The weeds seed germinate early and the seedlings grow faster. They being hardy compete with the crop plants and deprive them of light, moisture and nutrients.

2) They flower earlier, run to seed in profusion and mature ahead of the crop. They are, therefore, difficult to control and it may be even impossible to eradicate some weeds completely.

3) They are un useful, unwanted and undesirable.

4) They are harmful to crops, cattle and human-beings.

5) They can survive even under adverse conditions.

6) They are prolific and have a very high reproductive capacity.

7) Viability of seeds remains intact, even if they are buried deep in the soil.

8) The seeds may have special structures like wings, spines, hooks, sticky hairs etc. on account of which they can be easily disseminated over long distance.

9) Many weeds like doab are vegatativelypropagated and spread rapidly all over the field even under adverse conditions.

Classification of Weeds may be classified on the basis of:-

1) Life cycle

2) Place of occurrence

3) Plant family

4) Dependence on the other hosts

5) Soil types

(Brainerd, *et al*., 2008).

2.4 Soil seed bank

The topic of soil seed banks is important because of the impact seed reserves in soil have on current and future vegetation (Greene, 2001).
There is an increasing demand for reliable information on seed banks, both for scientific purposes and as decisiontoolin habitat and landscape management (Hölzel, and Otte, 2004).

Several environmental variables affect arable weed populations, not so much through the soil seed bank but through the germination, establishment, and reproduction phases in the field. The correlation of the soil seed content and the density of individuals on the soil surface were highly significant. The

analysis for a single species revealed that the seed bank/field density-ratios of different taxa vary from below 10:1 up to100:1 and more. This wide range may be related to the life-forms and ecological requirements characteristic for each species (Albrecht & Forster, 1996).

2.5 Soil seed bank in agricultural area

Land preparation and crop rotation are the two primary agricultural practices that generate impacts on weed seed banks (Ball, 1992). The land preparation practices are used in order to control weeds, break soil surface hardness, and increase aeration; the seed germination is stimulated because of the seed dormancy break by light, alternated temperature, water and nitrate ions (Cavers & Benoit, 1989).

The type of land preparation influences the seed dispersion in the soil profile; themanagement at same depth, favor a uniform distribution of the seeds in the soil profile, finding lower seed populations deeper in the soil (Dessaint*et al*,. 1990).

Ball, (1992) comparing land preparation systems, disc plow versus disc harrow, observed the predominance of weed seeds closer to the surface after disc harrowing.(Clements *et al*,. 1996) studied the influence of land preparation types over the seed bank and found that more than 70% of the seeds were present in the layer of 0-5 cm in plots where no mechanical method was used, and 30% for plots mechanically managed. Some weed species may present higher intensity of emergence in the no till planting than in the conventional till. (Carmona, 1992) stated that no till and superficial tillage tend to reduce the amount of seeds at the soil surface shed by plants, since there is induction in the germination or loss of viability. The presence of seeds at the

superficial layer of the soil and frequent cultivation, are factors that reduce the seed bank rapidly. This situation can facilitate seed predation by exposure of seeds to variations in temperature and humidity, and breaking their dormancy. However, the speed of soil seed bank depletion depends on the seed production of the species. For the seeds that are buried in the soil profile, where the conditions are more uniform, the action of external factors is less intense. The maintenance of viability will depend basically on the seed characteristics (Yenish *et al*., 1992).

2.6 Methodology

Development alternative weed systems, it is necessary to have information about the seed bank biology. However, in most agroecosystems little is known about weeds. The determination of seed banks of the soils is very difficult through the techniques that have been used lately, since they demand a lot of work and sometimes destruct seed viability (Maxwell, 1993).

According to (Roberts, 1981), the best way to determine the presence and amount the seed in soil is to observe the seedlings emergence at the site. However, the most frequently used technique involves the determination of the number of seeds placing soil samples for germination in appropriate places, or using physical separation of seeds from the soil particles, based in differences in size and density. When the soil samples are collected the main problems are related to the heterogeneity present in the soil profile. If there is no previous information in relation to the seed distribution, it is recommended to take the soil samples in "W", like it is normally used for soil chemical analyses (Roberts, 1981).

The method of emergence of seedlings is simple and has the advantage of the easy identification of the species; however, it requires space in the greenhouse or growth chamber and the results can be influenced by seed dormancy (Maxwell, 1993).

The use of substances that promote the floatation is a good method for seed separation, but these substances can reduce the viability of the seeds. It is, therefore, desirable to reduce the seed exposition to the solution in order to reduce the losses in the seed viability (Maxwell, 1993).

Several chemical substances have been used for seed separation, mainly cheap salts not highly toxic to. Potassium and sodium carbonate and zinc calcium chlorine are examples. For soils with high clay content it is necessary to use a dispersant, like sodium hex metaphosphate + sodium bicarbonate (Roberts, 1981). (Maxwell, 1993) using a solution of potassium carbonate at 10,000 rpm centrifugation, recovered about 100% of the seeds of giant foxtail e Abutilon theophrasti. The germination of Chenopodium album, giant foxtail and Abutilon theophrasti was reduced by the exposition to carbonate.

CHAPTER THREE

MATERIALS AND METHODS

3.1 TheStudy area

The study reported in this research was established in April (2016), to investigate and analyzed of soil seed bank of cultivated area in shambat. This area (shambat) is located in Khartoum Bahri 5 km North of Khartoum, latitude 15° 40′ N longitude, 32° 32′ and latitude 37° 6 to 38°. The soilsamples were collected from the demonstrated Farm in the College of Agricultural Studies, Sudan University for Science and Technology.

3.2 Collection of soil samples and Steps of the test

The total numbers of soil samples were taken per soil depth (10) are 25fromt he study area in Shambat using auger **(Fig. 1)**. The samples were taken to plant pathology lab, in department plant protection, College of Agricultural Studies, Sudan University for Science and Technology.

The samples mixed thoroughly anddivided into five plastic bags, each bag containing (500 g); the viability of the seed was tested by calcium chloride compound. These-soil samples were placed in a set of sieves with pores of 0.06m and 0.03m respectively, and then were washed for 10-15min under continuous flow of water **(Fig. 2)**. The soil was washed away leaving only the seeds. The seed were transferred to a 500ml beaker and water was added, the dead seeds were observed to float **(Fig. 3)**. The water containing the floating dead seeds was immediately filtered in a Bunchner funnel. The residue (dead seeds) was air –dried. The live seeds at bottom of the beaker were extracted as

follows: A weigh of 1.5 of CaCl2was accurately weighed and dissolved in 250ml of distillated water. The solution was added to live seed in the beaker and left for 40 minutes. The live seeds were observed to float in the Cacl2 solution. These were then filtered in a Buchner funnel and the residue (live seeds) was air-dried.

3.3 Statistical analysis

The Statistical analysis was done by SPSS program for analysis of variance; and means were statistically separated using Duncan's Multiple Range Test.

Figure (1) Soil samples

Figure (2) Extracted weeds seeds directly

Figure (3) the dead seeds in the upper and live seeds in the lower cite of cylinder

CHAPTERFOUR

RESULTS AND DISCUSSION

The study reported in this research was done inplant pathology lab, department plant protection, College of Agricultural Studies, Sudan University for Science and Technology, to investigate and analyzed soil seed bank of cultivated area in demonstrated farm in shambat

4.1 Number of live and dead seeds (broad- leaf and narrow leaf)

Table 1 showed the number of live seeds (broad- leaf and narrow leaf) of cultivated area shambat.There were no significant differences in number of live seeds in grasses and broad leaf (2.6 and 4.2)respectively.

The results of average number of dead seeds (broad- leaf and narrow leaf) of cultivated area shambt are presented in (Table 2). Same results were observed to that reported in the live seeds.

The grand mean of live and dead seeds were (3.5and 1.5) respectively.That mean the number of all seeds were few .Many factors affecting in number of weed seeds in cultivated area like land preparation, this finding was agree with (Ball, (1992); Dessaint *et al*, (1990)), they reported that Land preparation and crop rotation are the two primary agricultural practices that generate impacts on weed seed banks. The land preparation practices are used in order to control weeds, break soil surface hardness, and increase aeration; the seed germination is stimulated because of the seed dormancy break by light, alternated temperature, water and nitrate ions. The type of land preparation influences the seed dispersion in the soil profile; themanagement at same depthfavors a

uniform distribution of the seeds in the soil profile, finding lower seed populations deeper in the soil.

Table (1). The number of live seeds (broad- leaf and narrow leaf) of cultivated area shambat

Narrow leave	Mean	2.6[a]
	Std. Deviation	0.9
Broad leave	Mean	4.2[a]
	Std. Deviation	1.9
Grand mean	3.4	
	Std. Deviation	1.6

Table (2). The number of dead seeds (broad- leaf and narrow leaf) of Cultivated area shambat

Narrow leave	Mean	1.4[a]
	Std. Deviation	1.1
Broad leave	Mean	1.4[a]
	Std. Deviation	1.1
Grand mean	1.4	
	Std. Deviation	1.1

4.2 Species of the weeds in the experimental site

The data pertaining to Species of weeds was presented in **(**Table 3 and Figure 4**)**, the majority of weeds were found the broad leaved (dicotyledonous), while grasses (monocotyledonous) found in very low density. The dominant weeds flora were: *Trianthema portulacastrum* (35%), *Cynodon dactylon*, *Brachiaria deflexa* (17.7%), *Ipomoea Cordofana* (11.8%), *Tribulus terrestris* And *Portulaca olearaceae* (8.8%).

Table (3) Species of weeds in cultivated area shambat

Scientific name	Weeds (%)	Classification of weed
Trianthema portulacastrum	**35%**	Broadleaved
Cynodon dactylon	**17.7 %**	Narrow leave
Brachiaria deflexa	**17.7 %**	Broadleaved
Ipomoea cordofana	**11.8 %**	Narrow leave
Tribulus terrestris	**8.8 %**	Broadleaved
Portulacas olearacease	**8.8 %**	Broadleaved

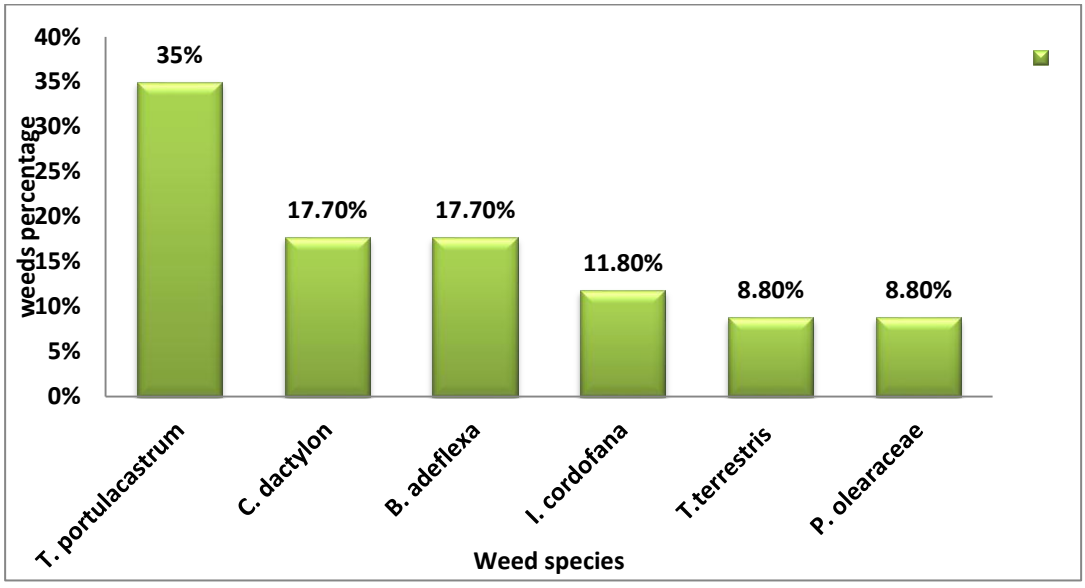

Figure (4) Weed species of cultivated area shambat

Recommendation

Study is regarded as the base for future studies to show differences in the number and density of live and dead seeds species weeds in the study area**.**

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