**Sudan University of science and Technology**

**College of Agricultural Studies**

**Department of Plant Protection**

# Effects of Pendimethalin Treatments on Weed Control and Shoot FreshWeight (g) in Faba Bean (*Vicia faba* L.)

## In Khartoum state

## تأثيرات معاملات البنديميثالين على مكافحة الحشائش والوزن الرطب للمجموع الخضري (جم) في الفول المصري بولاية الخرطوم

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**Honors in Plant Protection**

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## DEDICATION

**I present this work to:**

**My Parents**

**My Relatives**

**My Tribes**

**My Teachers**

**My Colleagues**

**To all candles that glittering to pave the way before others**

**To all those taught me letter**

**I present this humble research hoping from Allah Almighty to find acceptance and success.**

## ACKONOWLEDGEMENTS

All praise to Allah, today we fold the days tiredness and the errand summing up between the cover of this humble work.

To the utmost knowledge lighthouse, to our greatest and most honored prophet Mohamed- May peace and grace from Allah be upon him.

To the spring that never stops giving, who weaves my happiness with strings from her merciful heart …. To my mother.

To whom he strives to bless comfort and welfare and never stints what he owns to push me in the success way who taught me to promote life stairs wisely life stairs wisely and patiently …to my dearest father.

To whose love flows in my veins and my heart always remembers them…to my sisters.

To those who taught us letters of gold and words jewel of the utmost and sweetest sentences in the whole knowledge. Who reworded to us their knowledge simply and made a lighthouse guides us through the knowledge and success path to our honoured teachers and professors.

## LIST of CONTEINS



## CHAPTER ONE



## CHAPTER TWO

## LITERATURE REVIEW

## CHAPTER THREE

## MATERIALS and METHODS

## CHAPTER FOUR

## RESULTS and DISCUSION

## LIST of TABLES

## ABSTRACT

The experiment was conducted in the winter season of 2017/2018 at the farm of the College of Agricultural Studies –Shambat- Sudan University of Science and Technology- Bahri Locality- Khartoum State, located between latitudes 15 and 40 degrees North and longitudes 32 and 23 degrees East to evaluate the effects of the Pendimethalin herbicide treatments used as pre-emergence at 1.0, 1.5, 2.0 and 3.0 l/f on weed control and shoot fresh weight/plant of faba bean in endeavour to determine the most suitable weed control treatment, which secure high shoot fresh weight.

All herbicide treatments except (Pendimethalin at low rate) and the hand weeding control treatment significantly increased shoot fresh weight (g) / plant. Pendimethalin at 2.0 and 3.0 l/f treatments gave shoot fresh weight (g) / plant comparable to that obtained by the hand weeding control treatment.

In the experimental site broad-leaved weeds were predominant. Pendimethalin at 1.0, 1.5 and 2.0 l/f gave moderate percentage graminae weed control while Pendimethalin at 3.0 l/f gave goodpercentage graminae weed control. The hand weeding control gave excellent gramine weed control. Among the herbicide treatments the best graminae weed control was achieved by St Pendimethalin at 1.0 l/f gave moderate percentage broad-leaved weed control, Pendimethalin at 1.5 l/f gave good percentage broad-leaved weed control while Pendimethalin at 2.0 and 3.0 l/f gave excellent percentage broad-leaved weed control. The hand weeding control gave excellent broad-leaved weed control. Pendimethalin at 2.0 and 3.0 l/f gave excellent percentage broad-leaved weed control which was comparable to that found by the hand weeding control treatment.

Pendimethalin at 1.0 and 1.5 l/f gave moderate percentage weed control, Pendimethalin at 2.0 I/f gave good percentage weed control while Pendimethalin 3.0 l/f and the hand weeding control gave excellent percentage weed control. Pendimethalin at 3.0 l/f gave excellent percentage weed control which was comparable to that obtained by the hand weeding control treatment

All herbicide treatments except pendimethalin at low rate and the hand weeding control treatments resulted in a significant decrease in weed biomass ($g/m^2$). Among herbicide treatments Pendimethalin at 2.0 and 3.0 l/f were the best treatments which gave comparable to that obtained by the hand weeding control.

**المستخلص**

اجريت التجربة في فصل الشتاء للعام 2018/2017 في مزرعة كلية الدرسات الزراعية –شمبات- جامعة السودان للعلوم والتكنولوجيا. محلية بحري – ولايه الخرطوم الواقعة بين خطي عرض 15 و40 درجه شمالا وخطي طول 32 و23 درجه شرقا، لتقيم تاثير معاملات مبيد الاستومب المستخدم قبل الانبثاق بمعدل 1،1.0. ، 2.0 و3.0 علي مكافحة الحشائش والوزن الرطب للمجموع الخضري للنبات الفول المصري، في محاوله لتحديد انسب معاملة لمكافحة الحشائش والتي تعطي اعلي وزن رطب للمجموع الخضري. كل معاملات مبيد الحشائش ما عدا (الجرعه المنخفضة) و الازلة اليدوية المستمرة ادت الي زيادة معنوية للوزن الرطب للمجموع الخضري للنبات بالجرام. معاملان الاستومب 2.0 و 3.0 لتر للفدان اعطت وزن رطب للمجموع الخضري للنبات بالجرام مساوي للزالة اليدوية المستمرة الحشائش عريضة الاوراق كانت سائدة في موقع التجربه. استومب بمعدل 1.0 ، 1.5 و 2.0 لتر للفدان اعطت نسبة مئوية متوسطة للمكافحة الحشائش النجلية بينما استومب بمعدل 3.0 لتر للفدان اعطت نسبة مئوية جيدة للمكافحة الحشائش النجلية. الازالة اليدوية المستمرة اعطت نسبة مئوية ممتازة للمكافحة الحشائش النجلية. من بين معاملات مبيد الحشائش الجرعه العالية للستومب (3.0 لتر للفدان) كانت احسن معاملة حققت مكافخة للحشائش النجلية. استومب بمعدل 1.0 لتر للفدان اعطت نسبة مئوية متوسطة لمكافحة الحشائش العريضة بينما استومب بمعدل 2.0 ،3.0 لتر للفدان اعطت نسبة مئوية ممتازة لمكافحة الحشائش العريضة والتي كانت مساوية لازالة اليدوية المستمرة. استومب بمعدل 1.0 و 1.5 لتر للفدان اعطت نسبة مئوية متوسطة لمكافحة الحشائش، استومب بمعدل 2.0 لتر للفدان اعطت نسبة مئوية جيدة لمكافحة الحشائش، بينما استومب بمعدل 3.0 لتر للفدان والازالة اليدوية المستمرة للحشائش اعطت نسبة مئوية ممتازة لمكافحة الحشائش. استومب بمعدل 3.0 لتر للفدان اعطت نسبة مئوية ممتازة لمكافحة الحشائش وكانت مساوية للازالة اليدوية المستمرة. كل معاملات مبيد الحشائش عدا (الجرعه المنخفضة) والازالة اليدوية المستمرة قللت معنويا الوزنالرطب للحشائش باجرام في المتر المربع. من بين معاملات مبيد الحشائش استومب بمعدل 2.0 و 3.0 لتر للفدان كانت احسن المعاملات واعطت وزن رطب للحشائش مساوي للازالة اليدوية المستمرة.

# CHAPTER ONE

# INTRODUCTION

Faba bean is an old crop known to humans as it was cultivated during the Babylonian period and the ancient Egyptians were one of the most important legumes in Palestine and most of the Mediterranean region. The faba bean was grown in prehistoric times in Europe and entered China about 100 years and from there to Japan and its entry into India is considered to be another for the other producing countries (Wafkhe and Abdulhamid , 1990).

The area of the Mediterranean basin and surrounding areas is the original home of Egyptian beans (Ali, 1995).

The *V. faba* L. is a crop of high economic value as a rich protein crop grown in an area of more than 6 million hectares.The most important producer countries are China, Ethiopia, Italy, Egypt, Morocco, Spain and Brazil. Much of this area is concentrated in Morocco and Egypt (yasin, 2012).it is cultivated in the Sudan and its cultivation is concentrated in the northern region especially in the northern state and the Nile River state where the yield of the pumps is derived from the Nile.

The above mentioned state produces 77% and 21% respectively of the total yield of Sudan. (Atef, 2013 and Tajaldin, 2005).the seed of faba bean contain 11% moisture, 2.3% protein, 20% oil, 60.2% carbohydrate, 3.4% mineral substances and 4.4% fiber. And 100g each of the following contents: 90mg calcium, 3.6mg iron, 4mg vitamin C and 100mg vitamin A.(Wafhe and Abdulhamid, 1990).

Different pests, especially weeds, are the main obstacles to agricultural production (Mukhtar,2011).

Weeds are plants that grow in appropriately and grow with different crop plants and reduce their production (Ali, 2007 and Ali TajEldeen, 1987). Losses of yield of crop due to weed competition were reported to be equal to total combined losses from insects and plant diseases.

Weeds cause large losses for various crops, for example reduced the production of faba bean by 41%_95 %( Rowyda, 2013). One of the most important weed that grows with the faba beans in Sudan, which is a malignancy is the *Orbanche crenata* which grows parasitic on the roots of the beans and absorbs food from the plant and reduces its growth and productivity.(Osman, 2007)

In Sudan faba bean received little attention and the available information is inadequate especially in area of weed control. Thus, this study was conducted to evaluate the effects of Pendimethalin on weed control and shoot dry weight (g) of faba bean.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Faba bean (*V. faba* L.):

### 2.1.1 Taxonomy:

Faba bean (***V.faba*** L.) belongs to the family Fabaceae, sub- family Papilionoidae, Order Fabales (Abbas *et* al., 2003 and Mohammad, 2010).

### 2.1.2 Common names:

The common names of *V. faba* are broad bean, field bean, horse bean and faba bean (Amal, 2009).

### 2.1.3 Economic importance:

Faba bean is an important leguminous crop in the Sudan. Millions of people particularly depend on faba bean as an important food for dietary protein and main table food for both breakfast and supper.Cultivated faba bean is used as a vegetable either green or dried, fresh or canned. It is a common breakfast food crops legume which contains the highest amount of protein generally twice the level found in cereal grains. Faba bean has been considered as meat extender or substitute and as a skim–milk substitute. It is sometimes grown for green manure, but generally for livestock feed.The Mediterranean region,china, Sudan and Ethiopia they are used as soups and stews and pester made of ground bean is deep fried with vegetable and spice (known as falafel in Lebanon). In India, the seeds are roasted eaten like peanuts. Faba bean also used as a cover crop for animal forage, the plants are large and produce amounts of biomass that can be tilled back in to the soil as green manure (Hussein, 2014)

## 2.2 Weeds:

### 2.2.1Definition:

A weed is a plant growing out of place, that is, a plant growing where it is not wanted, a plant interfering with the intended use of land, and a plant with negative value. It interferes with crop production, directly, through competition, parasitism and allelopathy or indirectly through hindering cultural and harvest practices (Lavabre, 1991; Ibrahim, 2005 and Suhair, 2012).

### 2.2.2 Classification:

- **The natural division of weeds:**

**Morphological, legislative and physiological characteristics:**

**Dicotyledons:**

And followed by a very large number of weeds, some of them perennial and some around and all characterized by the lattice are not parallel example (*Cyndon dactylon L.).*

A. **Monocotyledons:**

And followed by a very large number of weeds and all characterized by the lattice is not parallel example (*Portulaca oleracea). (*Abushabana, 2005)

- **The industrial division of weeds :**

1. Place of presence and consultation:

It helps to identify the nature of the place where certain grasses are located and are as in which they are spread.

**i.Aquatic grass:**

It grows either annual or partially or partially submerged or submerged example (*Eichornia crassipes*), (*Desmostachya bipinnata).*

**ii.Grass associated with certain crops:**

Example (*Orobanche crenata)* in faba bean and (*Lolium temulentum*) in wheat.

**iii. Grass spread in some types of land:**

(Ateyef 2013)

**2. The life cycle:**

Weeds are divided according to this method:

**A. Annual weeds:**

They complete their life cycle in one season or less than a year, most of which multiply with seeds example (*Avana fatua*) (Gamar, 2012).

**B. Biennial weeds :**

These are weeds their life cycle extends beyond the year and may last up to two years. Example (*Dacus carotus*).

**C. Prennial weeds:**

Their period life cycle lasts more than two years and may continue to grow indefinitely (Aboushabana, 2005; Ali, 2007; Suhair, 2012 and Mahmud, 1992)

3. **Divide accordingly to the relative damage:**

**A. Noxious weeds .**

**B. Semiharmful.**

**C. Common weed** (Mukhtar, 2014).

4. On physiological basis plants are classified according to photosynthetic pathway into $C_3$ plants and $C_4$ plants.

5. According to day length plants are classified into short-day, long-day and day-neutral.

6. According to undesirability they can be classified into noxious and poisonous plants.

7. By evolutionary strategy they can be classified into stress-tolerators, competitors and ruderals (Radosevich *et al.,* 1997 and Aldrich and Kremer, 1997).

2.2.3 **Economic importance:**

Weeds have been part of the agricultural science, since man first started cultivated crops, more than 10,000,000 years ago and they are still a major problem today.

Weeds encompass all types of undesirable plants trees, broad-leaved plants, grasses, sedges, ruches, aquatic plants and parasitic flowering plant (Abdel Marouf, 2004). Weeds cause greater losses than either insects or plant diseases. They are the major barrier to food production and economic development in many regions of the world particularly in underdeveloped countries, lacking machinery and chemicals (Tomador, 2002).

Plants are essential for human and other animal life on earth in that they alone capture energy from the sun and convert it in to food in the form of their seeds, leaves and root. Human life is further sustained by the medicines, building materials and fuel that they provide. Plants are central to many ecological processes such as climate regulation (including carbon dioxide absorption), soil fertility and the purification of both water and air (Bothaina, 2016).

Furthermore, aquatic weeds reduce the efficiency of irrigation canals by hindering water flow and encouraging siltation. Moreover, weeds interfere with crop production in various ways.

1) Weeds decrease yields by competing with the crop directly for the resources of the environment and inputs in terms of water, nutrients, light, space and / or carbon dioxide.

2) Reduce yields by releasing toxic substances or exudates which inhibit crop growth. This is called the allelopathic effect.

3) Act as an alternative hosts for insect pests and diseases that attack crop plants and cause indirect losses.

Delay maturity and slowdown the process of harvesting.

4) Reduce the value of land specially perennials such as Bermuda grass and field bindweed and parasitic ones such as broomrape and dodder.
5) Reduce farm loans.
6) Decrease human efficiency.
7) Increase costs of other pests control.
8) Reduce the quality of livestock products.
9) Increase the cost of labour and equipment.

(Ahmed, 2003; Alia, 2003; Abdel Marouf, 2004; Khalid, 2005; Mukhtar, 2006; Ali, 2007; Mohamed, 2009 and Suhair, 2012).

Increase in weed population has a direct impact on reduction in crop yield. The duration of weed competition and the time of weed removing have a great influence on crop growth and yield (Rao, 1983).

Weeds are not always harmful. Some weeds induce suicidal germination of some parasitic weeds such as *Striga hermonthica*. Weeds can also help in recycling soil nutrients. In addition, weeds are used as human food and animal feed. Moreover, some weeds are important in traditional medicine such as Italian senna and thorn apple (Hamada, 2000).

**2.3 Effect of weeds in different crops:**

The global loss of food production due to weed was estimated to be 287 million tons per annum accounting for 11.5% of total world food production (Parker and fryer, 1975).

Losses due to weed are highest about 25% with ordinary control operations in the least developed crop production system and lowest about 50% in the most highly developed system(Abdelmarouf, 2004).

Grass competition reduced rice yield in Biro between 34%_ 68% and in Latin America reduced maize production by 53% while in the USA reduced the productivity of sugarcane by 76% (Muktar, 1998%). Average yield losses due to weeds wear between 6% and 15% for main crops in the Sudan (Braun et al, 1991).

In Sudan, uncontrolled weed growth was found to decrease cane yield by 44%_50% (Omer and Elamian, 1998). Unrestricted weed growth reduced maize grain yield field bean by 90% and 40%_73% respectively (Dafalla, 2006 and Khogali *et al.*, 2007).

Unrestricted weed growth reduced garlic yield by 22%_26% (Elsadig and Abdalla, 1997). Adam (1988) and Adam (1989) showed that, weed infestation reduced onion bulb yield and potato yield by 62% and 50% respectively.

losses of about 21.4%_71.4% in cane yield due to weed competition reported in previous researches in sugarcane (Mohammed and Elamin, 2008).

Losses in sugarcane yield due to weed infestation were 58.1% (Omer and Elamin, 1998).

Unrestricted weed grow the reduced sorghum grain yield by 63%_71% (Hassan, 2006 and Elfatih, 2006).

Yield reduction from nut grass infestation was 58% in soy bean, 6% in cowpea, 12% in sorghum and 6% in maize (Ali, 2003). Unrestricted weed growth reduced cane yield by 56.5% (Omer, 1997).And yield of many food and fodder crops is caused by root-parasitic flowering plants a considerable loss in growth. Roots- parasitic weeds cause damage on the host while they are still below the ground. Several Orobanche species have been described as economically significant pest in south and East Europe, West Asia and North Africa. They cause losses ranging from 50-100% (Dawoud, 1995). In Sudan, Ishag (1979) stated that the extent of reduction in yield of crops due to weed competition can vary from as low as18% to as high as 83%. According to Beshir and kock (1981) unrestricted weed growth resulted in serious losses of 67-78% in cotton. Weeds through competition with crops for water, water, nutrients, light, space and $Co^2$ lead to direct yield losses. Weeds also decrease farm income by utilization of soil nutrients needed by growing crops, reduction in land value, impairing quality of produced crops through weed impurities, by increasing the cost of labour, equipment and irrigation, and reducing the quality and quantity of livestock through undesirable flavour. Entangling of some seeds in animal hair or hide reducing their values. Poisonous weeds are responsible for losses in livestock. Moreover, reduction in human efficacy through physical discomfort caused by allergy, poisoning, and suffering due to weed removalwas reported. Many weeds can interfere negatively with cultural practices andharvest of crop.

Some of them may be noxious, parasitic and or harbour pest and diseases (Crafts and Robbins, 1962; yassin, 1979; Rao, 1983 and Braun *et al*.,1991). Different crops have different susceptilities to weeds competition. In Kenana, similar or identical weed densities reduced the the yield of seed cotton, groundnut and grain sorghum by 74%, 73% and 47%, respectively (Hamdon, 1977). It was mentioned by Braun *etal*, 1991). that the potential yield losses of different crops through unrestricted weed growth was found to be 64-90% in cotton, 61-80% in Onion, 45% in transplanted Onion, 33%in soybean, 28%in wheat, 31-99% in egg plant and 49% in Iubia.

**2.4 Effect of weeds in legume crops:**

Uncontrolled population of weed reduced white bean yield by 70% (Tomador, 2002). The reduction of food legumes in Sudan is greatly constrained by weed which cause up to 80% reduction in seed yield (Soih, 1996).A yield loss of up to 80% in legume crops such as faba bean was caused by weeds (Khogali et al, 2007). The weed competition of the faba bean yield in the northern state led to asignificant decrease in its productivity from 22.48% to 37.3% in the first winter season and from 30.5% to 31.80% in the second season (Rowyda, 2013).

Non weed control resulted in a significant decrease in the productivity of faba beans by 58.80% and 56.81% and 56.81% in the first and second winter seasons respectively (Ateyf, 2013).

**2.5Weed control**

Weed control methods included preventive, culture, chemical and biological methods (Braun *el.al.,* 1991).

### 2.5.1 Prevention:-

Preventing the introduction of weed species better and less costly than controlling them after they are established. Measures that that should be taken quarantine system, seed sown must be clean. Harvesting equipment must be clean since this is the stage when many seeds are shed. Any wheels, draught animals and people's feet moving from infested field should be cleaned. Waste land around field boundaries should be kept clean of noxious weeds (Lavabre, 1991 and Radosevich *etal,* 1997).

### 2.5.2 Cultural methods:

Cultural weed control methods include cropping practices that favour the crop in preference to weed. These consist of hand weeding, mechanical weeding, tillage, burning, flooding, mulching and crop rotation.

### 2.5.2.1 Hand weeding:

Hand weeding is the cheapest method of control for small farmers. Hand weeding consists of hand pulling, hoeing and rouging of weeds. It is most common method of controlling weeds in the tropical world. Mowing is used to control weeds by cutting or shredding their foliage (Lavabre, 1991 and Radosevich *et al*., 1997).

### 2.5.2. 2 Mechanical methods:

Mechanical weeding includes all weed control practices where mechanical device is used for weed control with animals or fossil fuel as the source of energy.

### 2.5.2.2.1Tillage

Tillage is disturbance of the soil. A major of it is prevention and suppression of weeds, it suppresses weeds by exposing them to desiccation

through breaking, cutting, or tearing them from the soil, and by smothering them (Radosevich *etal*, 1997). Conservation tillage has been practiced in field crop production for decades, primarily to reduce soil erosion (Burgos and Talbert, 1996). Two distinct types of tillage for weed control purposes are usually carried out by farmers. These are delayed tillage and blind tillage. Delayed tillage involves preparing the seed bed and waiting until weed emerges before lightly cultivating the soil again and planting the crops seeds. Blind tillage is when crop seeds are planted after the usual land preparation and lightly cultivated after weeds have emerged but before crop emergence (Mahgoub, 2002).

**2.5.2.2.2 Burning**:

Burning has Lon, been used as a method of weeding, particularly in cotton fields. In the tropics, this practice still very widely spread, especially for destroying scrub or clearing forest for cultivation. It is also used in order to regenerate pastureland. However, burning has several disadvantages including none selective destruction of vegetation, partial destruction of fauna, profound alteration of biotope, destruction of forest in favor of non-improved pastureland. Moreover, burning adds to the green house effect there are for papoose while reat is used in weed control (I) fine used to destroyed dry tops of weeds (ii) Frame throwers and Frame cultivation in used steam boxes are weed to kile green shoot growth (iii)in cotton to destroyed weed in row (vi) Head occasionally in used in kiles buried seeds weed subterraneanorgans of perennial weeds (Lavabre, 1991 and Rsdosevich *etal*., 1997).

**2.5.2.2. 3 Flooding:**

Some weeds may be destroyed by flooding, but most seeds resist this treatment. This technique is used in paddy fields and is particularly useful

against nut sedge (*Cyperussp*.), but the whole plant must be kept under water, often for as long as a month. Certain weeds, however, manage to withstand this treatment by entering a dormant phase. The practice of submersion is now usually combined with a herbicide treatment (Mukhtar, 2006).Accomplished by surrounding the infestation with dikes weed control there with 6 to 10 in of water for 3 to 8 weeks. The in fested area showld be plowed before immersing. Flooding is effective only where the area is completely immersed for whole time of treatment. Flooding kells plant by excluding the air, plant which lowered oxygen consumption is able to survive.

**2.5.2.2.4 Crop rotation:**

From time immemorial, farmers have realized that sound crop rotation enables weed to be controlled. Generally, rotations adopted by small farmers are aimed primarily at maximizing weed control. Thus, fodder crops occupy an important place in the rotations in that, by means of successive cuts or grazing, weeds are prevented from flowering and most perennial weeds are curbed by smothering. Rotation involving different families of crop plant different times and with different cultivation preceding will help to reduce weed build-up e.g. *Strigahermonthica*, a common parasitic weed on sorghum, millet, sugarcane and maize. Wild sorghum (Adar) (*SorghumSudanese's* L.) is common in cultivated sorghum. *OrobcncheSpp*. are always associated with crops like broad been (*Viciafaba* L.), alfalfa or Lucerne (*meddicagosativa* L.), tomato (*lycopersiconesculentum* mill.) and egg plant (*Solanummeloongena* L.) *Cuscutasp*. is quite serious on alfalfa (lucerne), lentils (lens culinnaris medic) and chichpea (*Cicerarientinum* L.) (Lavabre, 1991; Radosevich *etal*., 1997 and ibrahim, 2005).

### 2.5.3 Biological control:

Biological control of weeds refers to the control or suppression of weeds by the action of one or more organisms, through natural means by manipulation of the weed, organism or environment (Ibrahim, 2005). All wheels as grass crop which control water weed, there are several other creatures which can damage weeds. Insects have been used, such as the cactoblastis moth on opuntia (prikly pears) in India or grass shoppers (*pauliniaacuminate*) on Paulina in Papua New Guinea (Lavabre, 1991; Radosevich et al.; 1997 and Ibrahim, 2005). Goats can be used to graze down woody weeds after a bush fallow phase. Organism used in this manner has been termed a bio-herbicide, or if the organism is a fungus, a mycoherbicide of developing interest is the use of mycoherbicids, such the fungus (*Collertotrichu gloesporoides*). Cultural weed control methods include cropping practices that favour the crop in for use paddy rice, by means of which the weeds are deliberately given a disease. Also some allelopathy plants can be used to control weeds Allelopathy is any direct or indirect, stimulatory, inhibitory effects of plant on another attained. Through production of chemical that enters the environment. In general allelochemicals active chemical responsible for rallelopathy are categorized as secondary plant products. Plants produce many such products that do not function directly in primary biochemical activities that growth, development, and reproduction these products, of very diverse chemical structures are now widely recognized to function as an integral part of the plants natural defense or survival mechanisms. Based on their Known chemistry, such chemicals can be expected to be harmful if present in sufficient concentration and in close proximity to neighboring seeds or growing plants. An example is the adverse effects of litter of some perennial plant species such as black walnut (*Juglans nigra*) reported in

temperate region. Soil previously infested with quack grass (*Agropyronrepens* L.) is inhibitory to growth of a alfalfa, (*Medicagosativa* L.), flax (*Linumusitatissimum* ), barley (Hordeum vulgare L.), oats (*Avenasativa* L.) and wheat (*Triticumaestivum* L.) (Mukhtar, 2006). Allelopathy has emerged as an intriguing method of using plants or plant residues to control weeds. Many smothering crops may be allelopathic to other species or themselves (autotoxic) therefore, the use of smother crops may be from of biological control that uses plants (Lavabre, 1991 and Radosevich et al., 1997).

### 2.5.4 Chemical weed control:

Chemicals that used for killing or adversely affecting weeds growth are known as herbicides, Herbicides are classified according to fencing groups. Mode of action, timing of application, relative to the stage of weed or crop growth and or as soil or foliar acting according to placement at the time of application. The practice by which undesirable vegetation (weeds) is killed with herbicides called chemical weed control in clues use of herbicides, herbicides mixture, adjutants and softener. Chemical methods include the use of herbicides method; include the use of organic and inorganic materials as foliar sprays, soil and water treatment, fumigants, a relative to the stem application, for selective and non - selective weed control. Though herbicides are powerful tools, it would be wrong to imply that their use is free of problems, they will not substitute for good husbandry, careful management or planning, they can only reinforce that (Babiker, 1982; Radosevich *etal*., 1997 and Mahgoub, 2002). Chemical weed control is effective and greatly reduces the labour requirements for weed control (Pleasant *etal*., 1994 and Babiker, et al., 2013).

## 2.6 Integrated weed management:

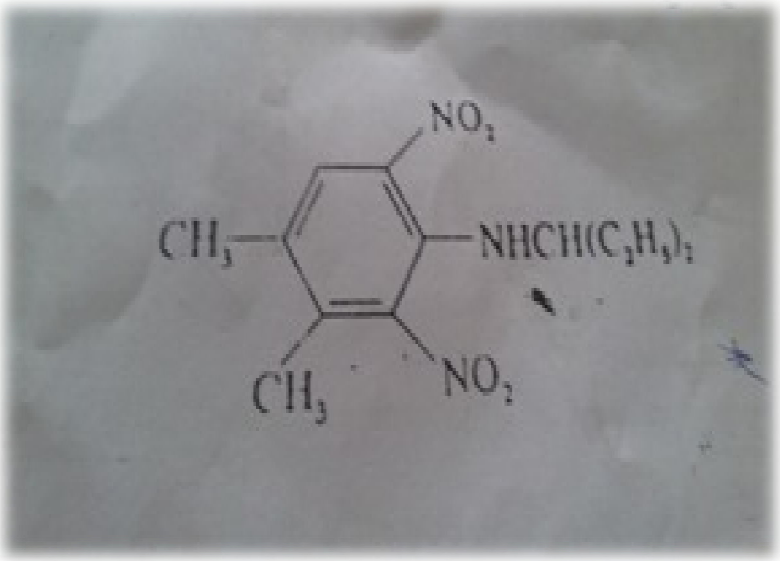
An integrated weed management programmed is adopted in crop protection (Braun *etal*, 1991). Proper weed management residues on a combination of as many proper weed management resides on a combination of as many practices as economically possible and feasible so as to allow crop to gain a competitive advantage over weeds. Management practices are not static and need modification as weed spectrum changes and new cultural practices are introduced. Scouting field to determine which weed species are present is a vital part of weed management programs. The individual preventive, cultural, biological or chemical methods of weed control employed separately are, but minor, forces to wards accomplishing the objective of most weed control strategies. It is only when these methods are integrated in such ways to reinforce one another that they become major deterrents to invading vegetations. Each manageable factor should be reviewed as a potential weed control method and used accordingly (Van Alebeek, 1989).

## 2.7 Herbicides used in this experiment:

- **Stomp:**

Chemical Family: Dinitroaniline

Structural formula




Common name: Pendimethalin

Molecular formula: C13H19N3O

Trade mark: Stomp, Herbadox, Prwol, Gogo and Way-Up.

Chemical name: [N-(1-ethyle Propyl)-2, 6- dinitro-3, 4- xylidine].

Photodecomposition of pendimethalin can occur, although the rate 2 Kg a.i. /ha decreases surface rapidly after the first 7days of exposure on the soil as much as17% of applied pendimethalin has reportedly bee losty in 7 days (Walker and Brown, 1983 and Zimdahl *et al.,* 1984). Stomp is soluble in most organic solvents, low soluble in water, immobile in soil. It is stable to alkaline and acidic conditions at normal ambient temperature. No storage losses during 12 months at 37º C It is non corrosive. It is strongly adsorbed to soil. Therefore, the potential for leaching or run-off is minimized. Its residues remain in the top layers of the soil and do not leach. It is selective weed control in number of crops (Mukhtar, (1998).Stomp as a dinitroaniline herbicide is not a translocated herbicide and its herbicidal effect is achieved by inhibiting root and shoot growth and development by interfering with cell division. It is as a preplanting

incorporated, a pre-emergence and post-emergence herbicide which effectively controls annual weeds, in cereal, rice, sunflower, cotton, sugarcane, vegetables, beans and other crops. It is more toxic to monocots than dicots (Mukhtar, (1998).

# CHAPTER THREE

# MATERIALS and METHODS

## 3.1 The experimental:

### 3.1.1 Location:

A field experiment was conducted during the winter season 2017/2018 at the Demonstration Farm of College of Agricultural Studies, Shambat, Sudan University of Science & Technology, Bahri Locality, Khartoum State, Sudan, located within Latitude 15° 40 N, and Longitude 32° 23 E and altitude 386 m above sea level) (Mukhtar, 1998).

### 3.1.2Climate:

In most months of the year Khartoum has a dry desert climate with the exception July and August, where severe tropical rain falls at just over 155mm (6.1 inches) per year on average.

In the winter, December to February, the weather is mildly mild, with temperatures dropping in the morning, at noon and after sunset. Temperatures range from 32 degrees Celsius (89.6 Fahrenheit) to 28 degrees Celsius (82.4 Fahrenheit).

## 3.2 land preparation, sowing and the layout of the experiment:

The land was ploughed, disc harrowed, leveled and divided into plots. Plot size was 3×2 m. Each plot was made of threeridges, two meters long each. Faba bean, cultivar was sown on 14/1/2018. Three seeds per hole were planted on ridges 60 cm a part and 20 cm between holes. In this experiment, design used was randomized complete block design (RCBD) with four replications. Stomp herbicide was applied as pre-emergence treatments at 1.0, 1.5, 2.0 and 3.0 l/f. After two weeks from sowing seedlings were thinned to two plants per hole. In weed free full season treatment, weeds were removed frequently by hand weeding to keep the

crop free from weeds up to harvest. However, in weedy full season treatment weeds were left to grow, unrestrictedly, with the crop until harvest. Herbicides were applied, immediatelyafter sowing, with a knapsack sprayer at a volume rate of 120 liters per feddan and a pressure of 4 bars with a flood jet nozzle, application of the herbicide was followed by irrigation. Irrigation water was applied environmental conditions.

**3.3Data collection:**

**3. 3. 1 Weed:**

**3. 3. 1. 1 Effect of herbicide treatments on weeds:**

In each plot effect of herbicide treatments on weeds was measured by counting total and individual weed species in meter square with a quadrate a month after sowing. Weed species and dry weights were also determined for both herbicide treatments and for untreated weedy (control) plots. The weed biomass (weed dry weight) per meter square in (g) for the collected weeds was also recorded after leaving them at glass-house temperature for one month then weighted by using triple beam balance. The predominant grass and broad-leaved weed species in the experimental site were also recorded.Weed control % was calculated as follows:

$$\frac{\text{Weed number in control plot} - \text{Weed number in treatment plot}}{\text{Weed number in control plot}} \times 100$$

**3.3.1 .2 Vegetative growth parameters:**

At 10 weeks from sowing 5 plants were randomly selected from the inner ridge in each plot to determine the mean shoot fresh weight (g)/ plant; roots were detached, and then weighed by using a triple beam balance.

**3.4 Statistical Analysis:**

The procedure described by Gomez and Gomez (1984) was used to estimate the analysis of variance (ANOVA), which was carried out on data obtained using the statistical analysis system (SAS) computer package for SAS Institute Inc., 1990, to detect significant effects among the treatments and populations compared. Mean squares for treatments or populations were calculated. Simple statistics including mean, standard deviation, standard error and coefficient of variation (C. V. %) were also calculated.

# CHAPTER FOUR

# RESULTSand DISCUSION

## 4.1 Effects of herbicidetreatments on weeds:

### 4. 1. 1 Effects on percentage graminae weed control:

The predominant weed species in the experimental site is presented in (Appendix table 1). In the experimental site broad-leaved weeds were predominant(Appendix Table 1). This result could be attributed to the use of graminae weed herbicides such as Topnour and Traxos by farmers more than broad-leaved weeds herbicides such as 2, 4- D. It also could attributed to the variation of soil typesof arable crops, the forming system of edaphic factors and because the broad-leaved weeds are few preference for feeding by animals than graminae weeds. The dominant weed species were *Brachairia reptans, B. eruciformis, Cynodon doctylon, Echinochloa colona, Euphorbia heterophylla, Abutilon pannsum, Gossypium herbaceum, Phyllanthus niruri, P. medraspatensis Portulaca guadrifeda, Chenopodium oltur, Rhynchosia memnonia, Amaranthus graecizans, Sonchus oleraceus, Convolvulus ayvensis, Solanum dubium, Portulaca guadrifeda.*

Pendimethalin at 1.0, 1.5 and 2.0 l/f gave moderate percentage graminae weed control while Pendimethalin at 3.0 l/f gave good percentage graminae weed control. The hand weeding control gave excellent gramine weed control (table 1).Among the herbicide treatments the best graminae weed control was achieved by Stomp at high rate (3.0 l/f). Similar results were found by Mukhtar (1998).

Table 1: Effects of herbicide treatments on percentage graminae weed controlat 4 weeks from application during winter season 2017/2018.

| Treatments | Herbicide rate (l/f) | Mean |
|---|---|---|
| Pendimethalin | 1.0 | 56.8 |
| Pendimethalin | 1.5 | 61.5 |
| Pendimethalin | 2.0 | 68.1 |
| Pendimethalin | 3.0 | 73.5 |
| Hand weeding | _ | 100 |
| Control | _ | 00 |

* Excellent: 80-100 * Good: 70-79

* Moderate: 50-69* Poor: less than 50

Pendimethalin at 1.0 l/f gave moderate percentage broad-leaved weed control, Pendimethalin at 1.5 l/f gave good percentage broad-leaved weed control whilePendimethalin at 2.0 and 3.0 l/f gave excellent percentage broad-leaved weed control. The hand weeding control gave excellent broad-leaved weed control. Pendimethalin at 2.0 and 3.0 l/f gave excellent percentage broad-leaved weed controlwhich was comparable to that found by the hand weeding control treatment (table 2).The same results were found by Mukhtar (1998).

Table 2: Effects of herbicide treatments on percentage broad-leaved weed control at 4 weeks from application during winter season 2017/2018.

| Treatments | Herbicide rate (l/f) | Mean |
|---|---|---|
| Pendimethalin | 1.0 | 61.3 |
| Pendimethalin | 1.5 | 73.1 |
| Pendimethalin | 2.0 | 82.9 |
| Pendimethalin | 3.0 | 89.1 |
| Hand weeding | _ | 100 |
| Control | _ | 00 |

* Excellent 80-100 * Good 79-70

* Moderate 69-50 * Poor less than 50

Pendimethalin at 1.0 and 1.5 l/f gave moderate percentage weed control,Pendimethalin at 2.0 I/f gave good percentage weed control while Pendimethalin.0 l/f and the hand weeding controlgave excellent percentage weed control (Table 3).Pendimethalin at 3.0 l/f gave excellent percentage weed control which was comparable to that obtained by the hand weeding control treatment. The same findings were found by Mukhtar (1998).

Table 3: Effects of herbicide treatments on percentage weed control at 4 weeks from application during winter season 2017/2018.

| Treatments | Herbicide rate (l/f) | Mean |
|---|---|---|
| Pendimethalin | 1.0 | 59.05 |
| Pendimethalin | 1.5 | 67.3 |
| Pendimethalin | 2.0 | 75.5 |
| Pendimethalin | 3.0 | 81.3 |
| Hand weeding | _ | 100 |
| Control | _ | 00 |

*Excellent: 80-100 * Good:70-79

*Moderate: 50-69 * Poor: less than 50

All herbicide treatments except Pendimethalin at low rate and the hand weeding control treatments resulted in a significant decrease in weed biomass ($g/m^2$) as compared to the control. Pendimethalin at low rate gave insignificant decrease in weed biomass ($g/m^2$) as compared to the control. This result could be due to the fact that recorded resistant weeds in this treated control were more than to that found in the unweeded control.Also this result could be attributed to the microorganisms which decompose this herbicide treatment to less toxicity.Among herbicide treatments Pendimethalin at 2.0 and 3.0 l/f were the best treatments which gave comparable to that obtained by the hand weeding control (Table 4). The same results were found by Atif (2013) and Babiker (1990). This significant reduction in weed biomass could be merely due to the effectiveness of this herbicide in controlling weeds.

Table 4: Effects of herbicide treatments on weed biomass ($g/m^2$) during winter season 2017/2018

| Treatments | Herbicide rate(l/f) | Mean |
|---|---|---|
| Pendimethalin | 1.0 | 2.6c |
| Pendimethalin | 1.5 | 2.7b |
| Pendimethalin | 2.0 | 3.1ab |
| Pendimethalin | 3.0 | 3.55a |
| Hand weeding | _ | 3.95a |
| Control | _ | 2.65c |
| C.V | _ | 7.19 |
| SE± | _ | 0.12 |

*Treatments means followed by same latters (s) are not significantly different at p (0.05) according to Duncan's Multiple Range Test.

All herbicide treatments except (Pendimethalin at low rate) and the hand weeding control treatmentsignificantly increased shoot fresh weight (g) / plant as compared to the control. Pendimethalin at 2.0 and 3.0 l/f treatments gave shoot fresh weight (g) / plant comparable to that obtained by the hand weeding control treatment (table 5). Similar findings were recorded by Babiker (1990). This significant increase in shoot fresh weight (g)/plant may be explained in the light of the fact that herbicide treatments were effective on weed control which prevented weed competition and freed faba bean plants to reach their potential length as more nutrients, water and space would be available to the crop.

Table 5: Effects of herbicide treatments on shoot fresh weight (g)/ plant during winter season 2017/2018.

| Treatments | Herbiciderate (L/F) | Mean |
|---|---|---|
| Pendimethalin | 1.0 | 10.4c |
| Pendimethalin | 1.5 | 11.6b |
| Pendimethalin | 2.0 | 12.4ab |
| Pendimethalin | 3.0 | 14.2a |
| Hand weeding | _ | 15.8a |
| Control | _ | 10.6c |
| C.V | _ | 28.7 |
| SE± | _ | 0.42 |

*Treatments means followed by same latters (s) are not significantly different at p (0.05) according to Duncan's Multiple Range Test.

- **CONCLUSIONSand RECOMMENDAIONS**

**The following conclusions were obtained:**

1- In the experimental site broad-leaved weeds were predominant.

2- Among the herbicide treatments the best graminae weed control was achieved by Stomp at high rate (3.0 l/f).

3- Pendimethalin at 2.0 and 3.0 l/f gave excellent percentage broad-leaved weed control which was comparable to that found by the hand weeding control treatment.

4- Stomp Pendimethalinat 3.0 l/f gave excellent percentage weed control which was comparable to that obtained by the hand weeding control treatment.

5- Pendimethalin at 2.0 and 3.0 l/f gave a significant decrease in weed biomass ($g/m^2$) and they were the best treatments which gave comparable to that obtained by the hand weeding control.

6- Pendimethalinat 2.0 and 3.0 l/f treatments significantly increased shoot dry weight (g) / plant and gave comparable to that obtained by the hand weeding control treatment.

**The following recommendation was obtained:**

*Weed control in faba bean shuld be carried out by Pendimethalin at 2.0 or 3.0 l/f as pre-emergence.

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Appendix 1: List of predominant weed species in the experimental site during winter season (2017/2018)

| Scientific name of weed species | English name | Local Arabic name | Family |
|---|---|---|---|
| *Brachiaria deflexa* | signal grass | Am faru | Poaceae |
| *Cynodon dactylon* L. | Bermuda grass | Nageel | Poaceae |
| *Brachiariaeruciformis* | Sweet signal grass | Um kuwayaat | Poaceae |
| *Echinochloa colona* | Barnyard grass | Defra | Poacceae |
| *Euphorbia aegyptiaca* | Milk weed | Umlebeina masria | Euphorbiaceae |
| *Convolvulus arvensis* | Field bindweed | Taber | Convolvulaceae |
| *Abutilon pannosum.* | Ragged mallow | Hambuk | Malvaceae |
| *Gossypium herbaceum* | Cotton | Gouton | Malvaceae |
| *Phyllanthus niruri* | Sampa sampalukan | Argana saghira | Euphorbiaceae |
| *Portulaca olearacea* | Purslane | Rigla | Portulacaceae |
| *Chenopodium album* | Bathua | eafane | Chenopodiaceae |
| *Rhynchosia memnonia* | Big Rhynchosia | Adan Elfar | Fabaceae |
| *Amaranthus viridis* L. | Pigweed | Lissan tair kabir | Amaranthaceae |
| *Amaranthus graecizans* | Whitepigweed | Lissan tair saghir | Amaranthaceae |
| *Sonchus oleraceus* | Sow thistle | Moleita baladi | Asteraceae |