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2005

Weed Research central Laboratory
Agricultural Research Center

# IPM Egyptian Experience in Weed Management in Winter Cereals and Legumes

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Content:

# Foreword

**Pre harvest losses due to weeds is represent by 14% from major crops as wheat, barley and faba bean (Garthef, 2003). In Egypt, populations increased dramatically and faced with growing demands for food. The prevention of yield losses due to weeds in wheat, barley, faba bean and lentils is one of the best ways for yield improvements. Successful approaches for research and technology transfer had been conducted during the last years by weed scientists in Weed Research Central Laboratory, Agricultural Research Center. Results of these activities had been recorded in five units in this publication.**

**Unit I included 7 topics about ecological, botanical and physiological studies which cover weed flora in wheat and faba bean botanical description of common Egyptian weeds, identification of weed seeds encounter winter crops, weed herbarium, wild oat germination, weed wheat interference and distribution of weeds and their impact in new land.**

**Unit II included 4 topics about developed options for weed management strategy in wheat, barley, faba bean and lentil.**

**Unit III included 2 topics about on farm activities and demonstration plots for wild oat and other weeds control under farmer condition.**

**Unit IV included one topic about socio economic studies on the impact and adoption of weed management in wheat fields in which wild oat was controlled during 1992-2002.**

**Unit V included two topics for weed identification and management in wheat and the other one for parasitic weeds identification and management.**

**Dr.E. E.Hassanein Dr.R.A.Abo Elenin Dr.A.T.Badawi**

# Preface

**Weed research is very important for agriculture and land reclamation in Egypt, Ministry of agriculture & land reclamation aims to solve farmer problems and maximize production and improve land and water resources through strategy of sustainable development, which is adopted by ministry of agriculture.**

**In this connection weeds are reported to cause production losses estimated by 14% while losses due to insect pests and plant diseases are estimated by 15 and 13% respectively. For this reason ministry of agriculture is very interested in research to generate technologies and transferring it to farmer fields to decrease these losses and increase their production and keep environment without pollution.**

**Integrated weed management is of great importance for realizing high yield of field crops. Major weed problems in wheat have to address narrow and broadleaf weeds especially wild oats, which started as a major problem by the middle of the eighties. Faba bean also suffers stresses of Orobanche as main constraint threatening this crop. The prevention of yields losses due to weeds in these two crops and other winter crops as lentil and barley is very important approach for increasing cereals and legumes by weed research scientists.**

**Although weed research in ARC started many years ago, yet much emphasis on effective weed management research in major field crops took place during the last two decades. In this respect, numerous data and results of backup research and applied research have been accumulated during the last several years. It is worthwhile to mention that progress on effective weed management in farmer's fields and consequently higher yield of major winter crops was realized due to close link and cooperation between researchers and extension staff. Thus research results were disseminated to farmer fields and the adoption and impact of such work was much appreciated by the agriculture community of Egypt.**

**This publication is meant to document the success story of weed management in Egypt. So that the experience as model of research and technology transfer can be shared by other scientists nationally and**

**internationally. Much appreciation is due to scientists, extension staff and farmers and above all ARC and Ministry of Agriculture EU and ICARDA and many others for their encouragement and financial support to whom this work is dedicated.**

**It give me a great pleasure to introduce this book which present one of many successes stories of Ministry of Agriculture in the field of wild oats and other weed management.**

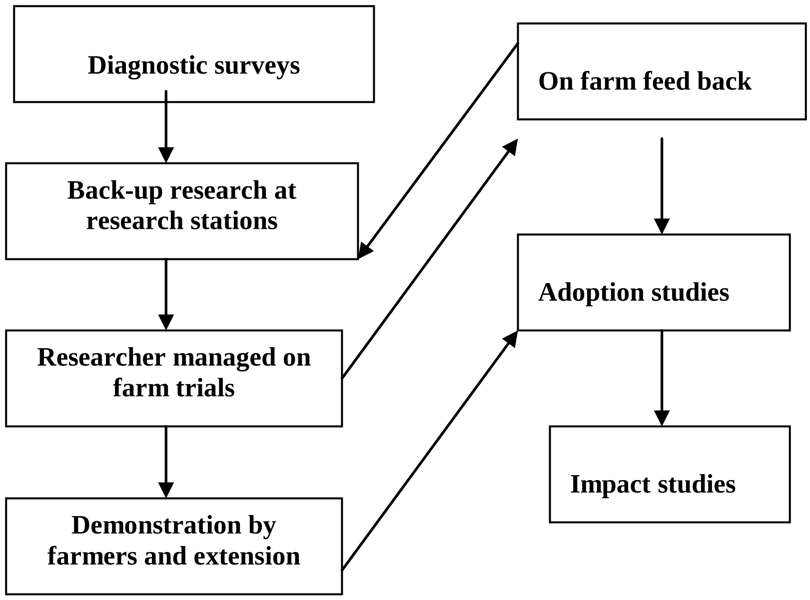
**I hope this will be helpful for researchers and farmers for developing sustainable agriculture in Egypt.**

**Minister of Agriculture and Land Reclamation**

**Eng. Ahmed Abd El-Monem Ellithy**

## Research Methodology and technology approach

A multidisciplinary research approach involving interaction between r`esearchers, extensionists and farmers in technology generation and transfer is followed. Research is conducted in three phases: back-up research, on farm verification and demonstrations. These are preceded by diagnostic surveys of weed problems which hinder wheat, barley, faba bean and lentil production and succeeded by adoption and impact studies. This, technology development and transfer starts with farmer and ended with farmer (Fig.1).




**Strategy for the development of improved technology of integrated weed management in winter cereals and legumes in Egypt**

Diagnostic surveys at the farmer levels are the initial activity to assess weed constraints, which hinder wheat production as wild oat problem or Orobanche in faba bean, then weed problems were considered and other weed problems at farmer level were considered.

The cooperation of researchers in various disciplines proved to be essential in the development of improved integrated weed management (IWM). Researchers contributed to such packages were weed scientists, taxonomists, expert system scientists and socio economists depending on research components to solve constraints facing farmers in weed management in winter cereals and legumes especially wheat, barley, faba bean and lentil.

## The three phases of research methodology are as follows:

### Back-up research:

Activities cover gaps in applied research knowledge. They include new areas of research or research to resolve constraints facing farmers' adoption of new technologies.

About weed management in three crops: as studies weed populations in wheat and faba bean fields, wheat crop interference, crop rotation patterns, seed contamination by weed seeds, weed germination, sowing methods, land preparation, seeding rates biological control, soil contamination by weed seeds sowing dates and herbicides in the purpose to generate weed management packages in these crops (Unit 1,2).

The national scientists carry out most of the back-up research at the research stations. The main objective of back-up research is to find solutions to problems identified in research and farmer managed on-farm trials in farmers' fields and to identify/ develops new low-cost management practices within the financial capacities of small farmers.

### Research – Managed On-farm Trials:

The objective of these trials is to evaluate the findings from the research stations under actual farmers conditions which include preceding crops as clover herrati methods or drilling and recommended herbicides in controlling wild oats and other weeds in wheat (Unit 3).

The organization, management and supervision of these trials remain with the research scientists. The treatments that are feasible and that provide better economic returns than those normally followed by farmers are subsequently included in farmers-managed demonstrations to expand the technology to all farmers.

## Farmer-managed Demonstrations:

This phase involves using the technologies already tested successfully, which included integrated wild oat control package in wheat (Unit 3&4) on farmers' fields. Farmers themselves under the supervision of researchers including socioeconomic and extension agents lay out large demonstrations. The demonstrations provide an opportunity to evaluate economic feasibility of new technologies at the commercial production level, and are an excellent tool for extension activities through the organization of field days during the growing season, large scale popularization fields are expanded to spread the recommended technology. The process is targeted to expose neighboring farmers to the advantages of the new technology.


**Map illustrate sites of research and demonstration activities in different governorates in Egypt**

# Unit I

# Ecological, botanical and physiological studies

# Chapter I - Weed flora of wheat fields

## Introduction

Information on the frequency and density of weed species is very important in the decision making of weed control management in wheat in Egypt. This will help in estimating the amount of herbicides needed for the different weed types and weed densities.

In Egypt, there are limited studies on weed flora distribution in wheat fields. Thus, the present surveys on weed densities and frequencies in 17 different governorates during 10 winter seasons were carried out to establish records of these weeds in wheat fields. The weed flora in such studies may help the extension activities in choosing the weed control method suitable for each location.

## Materials and methods

Weed samples from 6480 wheat fields were chosen at random by Hassanein et al (1992 – 2002), El Shandidy et al (1993& 1994) and Mohamed et al (1996) from 17 different governorates (Tables 1 & 2):

Number of the weed samples depended on the cultivated area which consisted of 4-5 districts or sections. Each district (section) included 10-25 villages and 8 fields in each village.

These samples were taken randomly from l/m$^2$ from each field, then identified to genera and species according to Tackhlom, 1974 and Boulos and El-Hadidi, 1984. Also, weed species were classified according to weed type into broad and narrow leaf weeds (grasses) and according to its life cycle into annual or perennial weeds.

The determination of weed infestation was carried out according to Abd El-Raouf *et al* (1993) and El-Khanagry (1993), by applying the following two equations:

$$\textbf{1-Frequency \%} = \frac{\textbf{Number of infested fields by each species in the district}}{\textbf{Number of investigated fields in the district}} \times 100$$

$$\textbf{2- Density \%} = \frac{\textbf{Number of individual plants of each species (m}^2\textbf{) in the district}}{\textbf{Number of infested fields in the district}} \times 100$$

**Table (1): Upper Egypt governorates for wheat weed survey during 1992/2002 seasons**

| No | Season | Governorate | Districts | No. of investigated fields |
|---|---|---|---|---|
| 1 | 1992/93 | Assiut | Five: Abnoub, Abo-Tig, El-Ghanayium, El-Qusyia and El-Sahyl | 360 |
| 2 | 1993/94 | Sohag | Five: Sohag, El-Maragha, El-Minshah, Dar El-Salam and Saqulta | 400 |
| 3 | 1994/95 | Qena | Five: Abo-Tisht, Dishna, Qena, Nagada and El-Oxur | 360 |
| 4 | 1995/96 | El-Fayoum | Five:, Tamia, El-Fayoum, Itsa, Sinores and Ibsheway | 400 |
| 5 | 1998/99 | Beni-Suef | Five: Samosta, El-Fashn, Beni-Suef, Ahnasia and the reclaimed lands | 400 |
| 6 | 1999/2000 | El-Minia | Five: Malawy ,Deir-Mawas, El-Minia, South and North reclaimed Lands | 400 |
| 7 | 2000/01 | El-Giza | Four: El-Saf, Giza, Aiat and Imbaba | 320 |
| 8 | 2001/02 | El-Wady El-Gedid | Five: El-Kharga, Paris, Mout, Balat and El-Farafra | 320 |
| Total | 8 | 8 | 39 | 2960 |

**Table (2): Lower Egypt governorates for weed survey in wheat during 1992/2000 seasons.**

| No | Season | Governorate | Districts | No. of investigated fields |
|---|---|---|---|---|
| 1 | 1992/93 | Kafr El-Sheikh | Six: Biala, Desouk, Sidi-Salem, Kelin, Kafer El-Sheikh and Metobus | 400 |
| 2 | 1993/94 | El-Behera | Five: Abo El-Matamir El-Dalangat, Hoash Isa, Kafr El-Dauar and Koam Hamada | 400 |
| 3 | 1994/95 | *North Sector of Tahrir Province | *Five: Marute, Bangar El-Sokar, Nahda, North Tahrir and South Tahrir | 400 |
| 4 | 1996/97 | New land in El-Ismaillia and El-Sharkia | Five Sections: Salhya El-Gadida, Wady El-Mollak, Abo-Souer, El-Kassasein and Qantara Shark | 400 |
| 5 | 1997/98 | *El-Alexandria | Five Sections: in right and left of El-Nasr canal | 400 |
| 6 | 1997/98 | El-Menofia | Four: Quesna, Ashmon, Talla and El-Bagour | 320 |
| 7 | 1998/99 | El- Gharbia | Five: Tanta Bassun Mahala, Zifta and Qotur | 400 |
| 8 | 1999/2000 | El-Qalubia | Five: El-Kanater, Shebin El-Kanater, Qalub, Toukh and El-Kanater El-Khayreia | 400 |
| 9 | 2000/01 | El-Dakahliya | Five: Mit-Ghamr Aga, Sherbein, Belkas and Dekernis | 400 |
| | **Total** | **9** | **45** | **3520** |

The scale reported by the above authors to determine the pressure of weed infestation was also used as follows:

1- Dominant weed => 20% (frequency). and => 20plants /$m^2$ (density).

2- Common weed =>10-20 %(frequency) and = 10-20plants /$m^2$ (density).

3- Rare weed =< 10% (frequency), and =< 10plants /$m^2$ (density).

## Results and discussion

## I- Upper Egypt

Tables 3 & 4 show results of weed survey of flora in wheat fields in Upper Egypt:

**In Qena governorate** a total of 33 weed species belong to 25 genera and 12 families were recorded. It fell into three categories e.g 23 species as annual broad leaf weeds, 9 species as annual narrow leaf weeds (grasses) and 1 species as perennial broad leaf weed. The detected weed species belong to the following families: Gramineae (9), Leguminosae (6) Cruciferae (3), Euphorbiaceae +9++(2), Chenopodiaceae (3), Caryophyllaceae (2), Polygonaceae (2) and Compositae (2). The other families i.e. Convolvuluceae, Primulaceae, Malvaceae and Umbelliferae were presented by one species. The dominant weeds according to frequency percentage were *Avena sterilis* 59.4, *Avena fatua* 53.9 and *Convolvulus arvensis* 26.7%.

**In Sohag governorate** a total of 33 weed species belong to 28 genera and 12 families were recorded. These weeds were classified into three categories i.e. 25 species as annual broad leaf weeds,7 species as annual narrow leaf weeds (grasses) and 1 species as perennial broad leaf weeds. The number of weed species in each family was as follows: Gramineae (7), Leguminosae (4), Cruciferae (4), Compositae (3), Chenopodiaceae (3) Caryophyllaceae (3), Euphorbiaceae (2) Polygonaceae (2) and one species only from the following families: Convolvulaceae, Malvaceae, Primulaceae and Solanaceae. The dominant weeds according to frequency percentage were *Avena fatua* 44.5, *Convolvulus arvensis* 37.8, *Sonchus oleraceus* 36.5, *Chenopodium album* 26.3 and *Brassica nigra* 24.5 %.

**In Assiut govenorate** a total of 32 weed species belong to 24 genera and 12 families were recorded. These weeds fell into three categories i.e. 27 species as annual broad leaf weeds, 4 species as annual narrow leaf weeds

**Table (3): The frequency of weed species in wheat fields in Upper Egypt from 1992/93 to 2001/02 winter seasons.**

| Season | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Families & Taxa** | **Assuit** | **Sohag** | **Qena** | **Fayoum** | **Beni Suef** | **Minia** | **Giza** | **El-Wady EL-Gadid** |
| **- Caryophllaceae** | | | | | | | | |
| *Spergularia marina* | 0.3 | 0.5 | 0.3 | 3.2 | | | 3.7 | 0.9 |
| *Stellaria apetalla* | | 1.0 | 1.9 | 0.2 | 0.7 | 2.5 | 6.6 | |
| *Silene rubella* | 0.3 | 0.3 | | 0.7 | 1.0 | 1.2 | | |
| **- Chenopodiaceae-** | | | | | | | | |
| *Beta vulgaris* | 14.3 | 11.8 | 16.1 | 13.3 | 17.0 | 8.5 | 17.5 | 5.6 |
| *Chenopodium album* | 16.3 | 26.3 | 17.8 | 3.2 | 4.0 | 18.0 | 14.7 | |
| *C. murale* | 6.6 | 3.5 | 0.8 | 6.0 | 7.0 | 5.7 | 8.4 | 2.9 |
| **- Compositae** | | | | | | | | |
| *Cichorium pumilum* | 1.4 | 1.3 | 1.3 | 1.5 | 0.2 | 0.2 | 2.8 | |
| *Matricaria recutita* | 1.3 | | | 6.7 | 4.2 | 0.5 | 0.3 | |
| *Senecio desfontainei* | 1.1 | 0.8 | | 0.2 | 4.0 | 7.7 | 1.2 | |
| *Sonchus oleraceus* | 44.6 | 36.5 | 18.3 | 11.2 | 42.7 | 40.0 | 41.9 | 15.6 |
| **- Convolvulaceae** | | | | | | | | |
| *Convolvulus arvensis* | 24.3 | 37.8 | 26.7 | 16.3 | 23.7 | 8.2 | 27.2 | 4.7 |
| **- Cruciferae** | | | | | | | | |
| *Brassica nigra* | 14.6 | 24.5 | 2.8 | 1.2 | 0.5 | 4.2 | 9.4 | 12.2 |
| *Capsella bursa-pastoris* | 2.0 | 0.5 | | | 1.2 | 1.7 | 6.6 | |
| *Coronopus squamatus* | | 0.5 | 0.3 | 1.0 | 1.2 | 1.0 | 6.2 | |
| *Eruca sativa* | 0.3 | 0.3 | | | 0.2 | | 1.2 | 4.1 |
| *Sinapis allionii* | 2.6 | | 5.0 | 1.0 | | | 2.8 | 2.5 |
| *Sinapis arvensis* | 14.6 | 24.5 | 2.8 | 1.2 | 0.5 | 4.2 | 9.4 | 12.2 |
| **- Euphorbiaceae** | | | | | | | | |
| *Euphorbia helioscopia* | 5.4 | 1.0 | 0.6 | 15.2 | 5.2 | 1.2 | 7.8 | |
| *E. peplus* | 1.1 | 2.3 | 1.4 | 0.5 | 1.0 | 1.7 | 6.9 | |
| **- Gramineae** | | | | | | | | |
| *Avena fatua* | 4.4 | 44.5 | 53.9 | 15.0 | 11.0 | 20.2 | 11.6 | 44.1 |
| *A. sativa* | | | 3.9 | 14.2 | 11.0 | 4.5 | 6.2 | 1.9 |
| *A. sterilis* | 2.2 | 12.0 | 59.4 | 45.6 | 17.5 | 23.2 | 15.0 | |
| *Lolium multiflorum* | | | 1.9 | 18.7 | | 0.2 | 3.4 | 11.6 |
| *L.temulentum* | | 0.3 | 1.1 | 4.2 | | | 0.9 | 2.2 |
| *Phalaris minor* | 0.2 | 0.8 | 0.3 | 2.7 | 5.7 | 1.2 | 1.9 | 10.6 |
| *P. paradoxa* | 0.4 | | 5.0 | 18.5 | 30.5 | 15.5 | 14.1 | 12.5 |
| *Poa annua* | | 1.3 | 0.6 | 1.2 | 1.2 | 6.5 | 10.3 | |

## Table (3) cont.:

| Season | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Families & Taxa** | **Assuit** | **Sohag** | **Qena** | **Fayoum** | **Beni Suef** | **Minia** | **Giza** | **El-Wady EL-Gadid** |
| ***Polypogon monspeliensis*** | | **2.5** | **3.1** | **13.2** | **10.5** | **3.5** | **6.9** | **6.9** |
| ***P. semiverticillatus*** | | **0.3** | | **0.2** | **0.5** | **0.7** | **2.5** | |
| **- Leguminosae** | | | | | | | | |
| ***Medicago intertexta*** | **5.1** | | **4.1** | **11.0** | **2.7** | **0.2** | **2.5** | **0.6** |
| ***M. polymorpha*** | **6.3** | **3.5** | **2.8** | **2.0** | **1.7** | **0.7** | **0.3** | **0.9** |
| ***Melilotu. indica*** | **9.1** | **16.5** | **5.3** | **9.0** | **10.7** | **16.5** | **9.7** | **15.0** |
| ***Trifolium resupinatum*** | **1.7** | **3.3** | **3.1** | **6.7** | **2.7** | **3.2** | **2.8** | **5.3** |
| ***Vicia monantha*** | **5.4** | | **1.7** | **2.0** | | **1.5** | **1.6** | **2.8** |
| ***V. sativa*** | **1.4** | **4.8** | **3.1** | **1.7** | | **1.0** | **0.9** | **0.3** |
| **- Malvaceae** | | | | | | | | |
| ***Malva parviflora*** | **8.0** | **4.3** | **4.7** | **3.0** | **8.7** | **12.5** | **5.6** | **2.8** |
| **- Polygonaceae** | | | | | | | | |
| ***Emex spinosus*** | **2.0** | **3.0** | **0.3** | **1.7** | **0.2** | **2.5** | **2.5** | **1.2** |
| ***Rumex dentatus*** | **1.1** | **1.0** | **3.3** | **10.7** | **6.2** | **2.5** | **14.7** | **0.3** |
| **- Primulaceae** | | | | | | | | |
| ***Anagallis arvensis*** | **1.7** | **2.8** | **0.3** | **10.0** | **4.7** | **8.0** | **17.5** | **2.2** |
| **- Solanaceae** | | | | | | | | |
| ***Solanum nigrum*** | **1.4** | **0.3** | | **1.2** | **0.2** | **0.2** | | |
| **- Umbelliferae** | | | | | | | | |
| ***Ammi majus*** | | | **1.1** | **7.0** | **1.0** | | **5.2** | **0.3** |

Taxa present in less than 5 governorates were omitted from the table.

**Table (4): The density of weed species in wheat fields in Upper Egypt from 1992/93 to 2001/02 winter seasons.**

| Season<br>Families & Taxa | Assuit | Sohag | Qena | Fayoum | Beni Suef | Minia | Giza | El-Wady EL-Gadid |
|---|---|---|---|---|---|---|---|---|
| **- Caryophllaceae** | | | | | | | | |
| ***Spergularia marina*** | **33.0** | **2.0** | **40.0** | **2.3** | | | **42.2** | **42.7** |
| ***Stellaria apetalla*** | | **10.5** | **39.8** | **64.0** | **16.7** | **26.8** | **25.9** | |
| ***Silene rubella*** | **1.0** | **2.0** | | **4.0** | **2.7** | **2.6** | | |
| **- Chenopodiaceae** | | | | | | | | |
| ***Beta vulgaris*** | **4.6** | **3.4** | **5.2** | **5.4** | **4.0** | **4.3** | **5.5** | **7.8** |
| ***Chenopodium album*** | **7.1** | **5.8** | **9.2** | **1.8** | **5.7** | **5.0** | **4.8** | |
| ***C.murale*** | **10.8** | **6.5** | **8.0** | **9.3** | **2.6** | **3.6** | **19.2** | **5.1** |
| **- Compositae** | | | | | | | | |
| ***Cichorium punmilum*** | **7.1** | **5.8** | **9.2** | **1.8** | **5.7** | **5.0** | **4.8** | |
| ***Matricaria recutita*** | **19.4** | | | **9.0** | **4.4** | **5.5** | **3.0** | |
| ***Senecio desfontainei*** | **2.5** | **6.7** | | **4.0** | **2.2** | **3.6** | **1.7** | |
| ***Sonchus oleraceus*** | **4.5** | **2.5** | **5.2** | **39.8** | **2.5** | **3.8** | **3.6** | **5.3** |
| **- Convolvulaceae** | | | | | | | | |
| ***Convolvulus arvensis*** | **3.4** | **4.6** | **6.9** | **3.2** | **3.8** | **3.2** | **6.7** | **3.8** |
| **- Cruciferae** | | | | | | | | |
| ***Brassica nigra*** | **2.3** | **1.6** | **1.3** | **0.6** | **1.0** | **1.6** | **3.8** | **2.1** |
| ***Capsella bursa -pastoris*** | **2.9** | **4.0** | | | **2.6** | **2.9** | **7.3** | |
| ***Coronopus squamatus*** | | **9.0** | **11.0** | **6.2** | **4.4** | **10.5** | **11.0** | |
| ***Eruca sativa*** | **3.0** | **1.0** | | | **1.0** | | **1.7** | **16.2** |
| ***Sinapis allionii*** | **1.5** | | **2.3** | **2.0** | | | **1.7** | **2.4** |
| ***S. arvensis*** | **1.0** | **1.8** | **1.6** | **2.3** | **1.7** | **1.8** | **1.9** | **2.9** |
| **- Euphorbiaceae** | | | | | | | | |
| ***Euphorbia helioscopia*** | **2.2** | **2.3** | **2.1** | **4.9** | **2.3** | **2.0** | **2.5** | |

## Table (4) cont.:

| Season | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Families & Taxa** | **Assuit** | **Sohag** | **Qena** | **Fayoum** | **Beni Suef** | **Minia** | **Giza** | **El-Wady EL-Gadid** |
| **E. *peplus*** | 1.0 | 3.0 | 10.6 | 5.0 | 1.5 | 8.5 | 7.1 | |
| **- Gramineae** | | | | | | | | |
| ***Avena fatua*** | 6.6 | 18.3 | 6.8 | 2.6 | 2.6 | 4.3 | 5.3 | 9.6 |
| ***A. sativa*** | | | 2.9 | 1.5 | 2.5 | 2.7 | 1.9 | 1.3 |
| ***A. sterilis*** | 2.2 | 7.2 | 5.5 | 10.5 | 4.8 | 7.9 | 22.7 | |
| ***Lolium multiflorum*** | | | 5.8 | 5.7 | | 1.0 | 5.2 | 24.2 |
| ***L. temulentum*** | | 6.0 | 1.8 | 2.7 | | | 7.3 | 2.0 |
| ***Phalaris minor*** | 0.3 | 7.7 | 5.0 | 12.0 | 11.7 | 6.5 | 4.9 | 8.9 |
| ***P. paradoxa*** | 0.7 | | 2.1 | 7.2 | 10.8 | 9.9 | 11.8 | 15.6 |
| ***Poa annua*** | | 17.6 | 33.5 | 8.0 | 7.8 | 5.1 | 24.8 | |
| ***Polypogon monspeliensis*** | | | 9.9 | 5.6 | 6.3 | 9.3 | 5.5 | 11.4 |
| ***P. semiverticillatus*** | | 4.0 | | 1.0 | 2.5 | 13.3 | 4.0 | |
| **- Leguminosae** | | | | | | | | |
| ***Medicago intertexta*** | 1.7 | | 3.3 | 3.0 | 2.4 | 1.0 | 2.4 | 6.0 |
| ***M. polymorpha*** | 1.2 | 2.9 | 3.0 | 2.6 | 1.6 | 2.0 | 3.0 | 3.0 |
| ***Melilotus indica*** | 2.3 | 4.4 | 2.3 | 3.1 | 1.6 | 5.4 | 6.4 | 10.8 |
| ***Trifolium resupinatum*** | 4.0 | 15.2 | 8.4 | 12.2 | 8.5 | 12.0 | 12.3 | 13.4 |
| ***Vicia monantha*** | 1.5 | | 1.3 | 2.5 | | 4.7 | 3.0 | 3.1 |
| ***V. sativa*** | 2.0 | 1.9 | 1.0 | 4.3 | | 2.0 | 2.0 | 1.0 |
| **- Malvaceae** | | | | | | | | |
| ***Malva parviflora*** | 1.3 | 1.9 | 3.4 | 3.1 | 7.8 | 3.7 | 4.8 | 3.2 |
| **- Polygonaceae** | | | | | | | | |
| ***Emex spinosus*** | 6.1 | 3.5 | 3.0 | 2.7 | 1.0 | 2.2 | 6.9 | 5.0 |
| ***Rumex dentatus*** | 2.5 | 2.3 | | 3.4 | 2.2 | 3.7 | 4.5 | 1.0 |
| **- Primulaceae** | | | | | | | | |
| ***Anagallis arvensis*** | | 3.5 | 4.0 | 5.5 | 9.0 | 9.2 | 10.9 | 14.3 |
| **- Solanaceae** | | | | | | | | |
| ***Solanum nigrum*** | 20.8 | 1.0 | | 2.5 | 1.0 | 1.0 | | |
| **- Umbelliferae** | | | | | | | | |
| ***Ammi majus*** | | | 2.5 | 3.4 | 3.2 | | 3.1 | 1.5 |

Taxa present in less than 5 governorates were omitted from the table.

(grasses) and 1 species as perennial broad leaf weed. The weed species belong to the following families: Leguminosae (6), Cruciferae (5), Gramineae (4), Chenopodiaceae (3), Compositae (2), Caryophyllaceae (2), Euphorbiaceae 2), Polygonaceae (2) and one species only from each of the families Convolvulaceae, Malvaceae, Primulaceae and Solanaceae. The dominant weeds according to frequency percentage were *Sonchus oleraceus* 44.6 and *Convolvulus arvensis* 24.3%.

**In El–Minia governorate** a total of 36 weed species belong to 27 genera and 12 families were recorded. These weeds fell into three categories i.e. 26 species as annual broad leaf weeds, 9 species as annual grass weeds and 1 species as perennial broad leaf weeds. The families: Gramineae, Leguminosae, Compositae, Cruciferae, Chenopodaceae, Euphorbiaceae and Polygonaceae were represented by 9, 6, 3, 3, 3, 2 and 2 species respectively; while, Convolvulaceae, Primuluceae and Solanaceae were represented by one species only. The dominant weeds according to frequency percentage were *Sonchus oleraceus* 40.0, *Avena sterilis* 23.2 and *Avena fatua* 20.2 %.

**In Beni Suef governorate** a total of 34 weed species belong to 27 genera and 13 families were recorded. These weeds fell into three categories i.e. 24 species as annual broad leaf weeds, 9 species as annual narrow leaf weeds (grasses) and 1 species as perennial broad leaf weeds. The families: Gramineae, Cruciferae, Leguminosae, Chenopodiaceae, Compositae, Euphorbiaceae and Polygonaceae were represented by 9, 5, 4, 3, 3, 2 and 2 species, respectively. Also, one species was recorded from the other families i.e. Convolvulaceae, Caryophyllaceae, Umbelliferae, Malvaceae, Primulaceae and Solanaceae. The dominant weeds according to frequency percentage were *Sonchus oleraceus* 42.7, *Phalaris paradoxa* 30.5 and *Convolvulus arvensis* 23.7 %.

**In El – Fayoum governorate** a total of 38 weed species belong to 28 genera and 13 families were recorded. These weeds fell into three categories i.e. 27 species as annual broad leaf weeds, 10 species as narrow leaf weed (grasses) and 1 species as perennial broad leaf weeds. The weed species belong to the following families: Gramineae (10), Leguminosae (6), Cruciferae (4), Compositae (3), Chenopodiaceae (3), Euphorbiaceae (2), Caryophyllaceue (2) and Polygonaceae (2) and one species only from following families: Convolvulaceae, Malvaceae, Primulaceae, Solanaceae and Umbelliferae. The dominant weeds according to frequency percentage were *Avena sterilis* 45.6 %.

**In El–Giza governorate** a total of 38 weed species belong to 28 genera and 12 families were recorded. These weeds fell into three categories i.e. 27 species as annual broad leaf weeds, 10 species as annual narrow leaf weeds (grasses) and 1 species as perennial broad leaf weed. The families: Gramineae, Cruciferae, Leguminosae, Compositae, Chenopodiaceae, Caryophyllaceae, Euphorbiaceae, Polygonaceae were represented by 10, 6, 6, 3, 3, 2, 2 and 2 species. Also, Convolvulaceae, Umblliferae, Malvaceae and Primulaceae were represented by one species only. The dominant weeds according to frequency percentage were *Sonchus oleraceus* 41.9 and *Convolvulus arvensis* 27.2 %.

**In El–Wady El–Gadid governorate** a total of 27 species belonging to 22 genera and 11 families were recorded. These weeds fell into three categories i.e. 18 species as annual broad leaf weeds, 7 species as annual narrow leaf weeds (grasses), 1 species as perennial broad leaf weeds and 1 species as perennial narrow leaf weeds. The families: Leguminosae, Gramineae, Cruciferae, Compositae, Chenopodiaceae and Polygonaceae, were represented by 7, 7, 4, 2, 2 and 2 species respectively. The other families: Caryophyllaceae, Convolvulaceae, Malvaceae, Primulaceae and Umbelliferae were represented by one species only. The dominant weeds according to frequency percentage was *Avena fatua* 44.1 %.

**Tables 5 & 6 show results of weed survey in wheat fields in the Nile Delta:**

**In El–Qalubia governorate** a total of 45 weed species belong to 35 genera and 16 families were recorded. These weeds were divided into three categories i.e. 32 species as annual broad leaf weeds, 12 species as annual narrow leaf weeds and 1 species as perennial broad leaf weed .The families: Gramineae, Cruciferae, Leguminosae, Chenopodiaceae, Caryophyllaceae, Compositae, Euphorbiaceae and Ploygonaceae were represented by 11, 7, 7, 4, 2, 2, 2 and 2 species, respectively. The other families were represented by one species i.e. Convolvulaceae, Umbelliferae, Labiatae, Malvaceae, Oxalidaceae, Plantaginaceae, Primulaceae and Solanaceae. The dominant weed according to frequency percentage was *Phalaris paradoxa* 22.0 %.

**In El–Ismaillia and El–Sharkia governorates** (New land) a total of 37 weed species belong to 31 genera and 14 families were recorded. These weeds were divided into three categories i.e. 25 species as annual broad leaf weeds, 11 species as annual narrow leaf weeds and 1 species as perennial broad leaf weed. The weed species belong to the following families: Gramineae (10), Leguminosae (7), Chenopodiaceae (4), Cruciferae (3), Compositae (2), Caryophyllaceae (2) and Polygonaceae (2). The following families were represented by one species only i.e. Convolvulaceae, Euphorbiaceae, Labiatae, Malvaceae, Primulaceae, Solanaceae and Umbelliferae. The dominant weeds according to frequency percentage were *Melilotus indica* 30.3 and *Avena sterilis* 28.8 %.

**In El–Dakahlia governorate** a total of 39 weed species belong to 30 genera and 15 families were recorded. These weeds were divided into four categories i.e. 26 species as annual broad leaf weeds, 11 species as annual narrow leaf weeds (grasses), 1 species as perennial broad leaf weed and 1 species as perennial narrow leaf weed. Families: Gramineae, Leguminosae, Chenopodiaceae, Cruciferae, Euphorbiaceae, Compositae and Caryophyllaceae were represented by 11, 7, 4, 3, 2, 2 and 2 species, respectively; while, Convolvulaceae, Labiatae, Malvaceae, Plantaginaceae, Polygonaceae, Primulaceae, Umbelliferae and Solanaceae were represented by one species only. The dominant weeds according to frequency percentage were *Phalaris minor* 28.7, *Rumex dentatus* 26.7 and *Polypogon monspeliensis* 22.2 %.

**In Alexandria governorate** a total of 35 weed species belong to 30 genera and 10 families were recorded. These weeds fell into three categories i.e. 24 species as annual broad leaf weeds, 10 species as annual narrow leaf weeds (grasses) and 1 species as perennial broad leaf weed. The families: Gramineae, Cruciferae, Leguminosae, Chenopodiaceae and Caryophyllaceae, were represented by 9, 8, 6, 4 and 3 species, respectively. Meanwhile the other families: Convolvulaceae, Malvaceae, Polygonaceae Primulaceae and Compositae were represented by one species only. The dominant weeds according to frequency percentage were *Avena sterilis* 52.5, *Convolvulus arvensis* 25.5 and *Phalaris minor* 21.5%.

**In El–Menofia governorate** a total of 44 weed species belong to 33 genera and 16 families were recorded. These weeds were divided into three categories i.e. 33 species as annual broad leaf weeds, 10 species as annual narrow leaf weeds and 1 species as perennial broad leaf weed.

**Table (5): The frequency of weed species in wheat fields in Lower Egypt from 1992/93 to 2001/02 winter seasons.**

| **Season**<br>**Families & Taxa** | **Kafer El-Sheikh** | **El-Behera** | **North Tahrir** | *** New land in Eastern Delta** | **Alexandria** | **Menofia** | **El- Gharbia** | **El-Qalubia** | **El-Dakahliya** |
|---|---|---|---|---|---|---|---|---|---|
| **- Caryophllaceae** | | | | | | | | | |
| ***Silene rubella*** | | **0.8** | **1.1** | **2.3** | **0.2** | **3.7** | **0.5** | **1.2** | **1.5** |
| ***Spergularia spp.*** | **1.2** | **4.9** | **3.0** | **2.0** | **0.2** | | **0.5** | **0.2** | **1.2** |
| ***Stellaria medica*** | | **4.7** | | | **0.2** | **1.6** | | **4.0** | |
| **- Chenopodiaceae** | | | | | | | | | |
| ***Chenopodium album*** | **3.1** | **8.1** | **3.5** | **9.0** | **8.2** | **8.7** | **5.0** | **12.5** | **10.5** |
| ***C.murale*** | **2.5** | **9.6** | **5.2** | **5.3** | **3.2** | **4.4** | **2.2** | **4.2** | **3.0** |
| ***Kochia indica*** | | **0.5** | **0.3** | **1.0** | **0.2** | | **0.2** | | **0.2** |
| **- Compositae** | | | | | | | | | |
| ***Cichorium punmilum*** | | **0.8** | | | | **2.5** | **0.2** | **0.2** | **1.2** |
| ***Senecio desfontainei*** | **0.2** | **2.9** | **10.9** | **23.0** | **0.7** | **0.9** | | | |
| ***Sonchus oleraceus*** | **0.2** | **0.3** | | **0.3** | | **0.5** | | **0.2** | **16.5** |
| ***Urospermum picroides*** | **0.2** | **1.3** | **0.5** | | | | **0.8** | | **0.5** |
| **- Convolvulaceae** | | | | | | | | | |
| ***Convolvulus aravensis*** | **2.5** | **5.2** | **12.0** | **2.8** | **25.5** | **18.7** | **25.2** | **15.5** | **7.2** |
| **- Cruciferae** | | | | | | | | | |
| ***Brassica nigra*** | **1.6** | **1.0** | **1.9** | | **6.2** | **6.6** | **1.2** | **2.2** | |
| ***Capsella bursa – pastoris*** | **0.4** | **3.6** | **0.3** | | **0.2** | **5.6** | **1.2** | **4.5** | **0.5** |
| ***Coronopus squamatus*** | **3.5** | **7.8** | **3.8** | | **0.2** | **4.4** | **4.0** | **5.5** | **5.0** |
| ***Enarthocarpus lyratus*** | | **2.9** | **10.3** | **3.3** | **2.7** | | | **1.2** | |
| ***Eruca sativa*** | | | **3.3** | **0.3** | **5.2** | **8.1** | | | |
| ***Sinapis allionii*** | | **2.3** | | | **2.0** | **1.8** | | **1.5** | |
| ***S. arvensis*** | | **1.8** | | | **1.0** | **1.2** | | **1.7** | **0.7** |
| **- Gramineae** | | | | | | | | | |
| ***Avena fatua*** | **2.8** | **19.0** | **17.7** | **19.3** | **12.5** | **28.7** | **2.2** | **10.2** | **1.0** |
| ***A. sativa*** | **5.2** | **7.8** | **32.3** | **11.3** | **0.5** | **8.7** | **17.8** | **18.0** | **14.0** |
| ***A. sterilis*** | **0.4** | **14.3** | **2.4** | **28.8** | **52.5** | **9.7** | **3.5** | **9.7** | **1.2** |
| ***Bromus spp*** | | **0.5** | **1.9** | **2.3** | **1.0** | | | **4.7** | |
| ***Lolium multiflorum*** | **0.8** | **11.7** | **40.8** | **15.8** | **19.2** | **1.6** | | **1.0** | **2.7** |
| ***L.temulentum*** | **1.8** | **3.9** | **0.8** | **2.8** | | **0.3** | **8.0** | **1.0** | **1.2** |
| ***Phalaris minor*** | **17.1** | **12.8** | **29.9** | **2.3** | **21.5** | **5.0** | **24.8** | **4.2** | **28.7** |
| ***P. paradoxa*** | **13.3** | **12.2** | **10.3** | **6.8** | **3.2** | **12.5** | **19.0** | **22.0** | **18.7** |
| ***Phragmites australis*** | **1.2** | **0.3** | **0.8** | | | | **3.0** | | **2.2** |
| ***Poa annua*** | **1.7** | | **3.3** | **0.3** | **0.2** | **7.1** | **3.5** | **8.5** | **1.5** |
| ***Polypogon monspeliensis*** | **22.9** | **18.7** | **16.3** | **6.8** | **0.2** | **0.6** | **21.2** | **8.2** | **22.2** |
| ***P. semiverticillatus*** | **0.2** | **0.5** | **2.7** | | | **0.3** | **1.8** | **1.0** | **0.2** |

## Table (5) cont.:

| Season | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Families & Taxa** | **Kafer El-Sheikh** | **El-Behera** | **North Tahrir** | *** New land in Eastern Delta** | **Alexandria** | **Menofia** | **El- Gharbia** | **El-Qalubia** | **El-Dakahliya** |
| **- Euphorbiaceae** | | | | | | | | | |
| ***Euphorbia helioscopia*** | **0.3** | | | | | **5.9** | **0.2** | **2.2** | **0.7** |
| ***E.peplus*** | | **2.1** | | **0.8** | | **3.3** | | **1.0** | **0.5** |
| **- Labiatae** | | | | | | | | | |
| ***Lamium amplexicaule*** | **0.2** | **1.6** | | **0.3** | | **2.2** | | **2.0** | **0.2** |
| **- Leguminosae** | | | | | | | | | |
| ***Medicago intertexta*** | **6.4** | **13.5** | **4.3** | **2.0** | **0.7** | **9.4** | **12.2** | **5.2** | **14.5** |
| ***M. polymorpha*** | **3.1** | **4.2** | **3.0** | **0.8** | | **10.9** | **2.2** | **1.5** | **5.5** |
| ***Melilotus indica*** | **17.1** | **14.6** | **15.5** | **30.3** | **6.2** | **0.9** | **7.0** | **8.5** | **1.2** |
| ***M. siculus*** | **17.1** | **10.9** | **6.5** | **7.5** | **0.5** | **3.1** | **6.5** | **3.0** | **15.5** |
| ***Trifolium resupinatum*** | **3.7** | **2.3** | **3.3** | **1.0** | **0.7** | **1.6** | **6.5** | **2.2** | **11.0** |
| ***Vicia. monantha*** | **1.7** | **3.1** | **3.0** | **1.8** | **12.7** | **1.8** | | **0.5** | |
| ***V. sativa*** | **6.8** | **4.7** | **4.1** | **3.3** | **8.5** | **2.2** | **6.0** | **2.0** | **9.7** |
| **- Malvaceae** | | | | | | | | | |
| ***Malva parviflora*** | **1.7** | **6.5** | **4.3** | **7.8** | **4.5** | **5.6** | **2.0** | **4.0** | **2.5** |
| **Oxalidaceae** | | | | | | | | | |
| ***Oxalis corniculata*** | | **0.5** | | | | **0.6** | **0.2** | **1.2** | |
| **- Plantaginaceae** | | | | | | | | | |
| ***Plantago major*** | **1.0** | | | | | **0.3** | **0.5** | **0.5** | **0.5** |
| **- Polygonaceae** | | | | | | | | | |
| ***Emex spinosus*** | | **6.5** | **12.6** | **14.8** | **3.0** | **0.6** | | **0.6** | |
| ***Rumex dentatutus*** | **20.0** | **18.5** | **10.0** | **0.5** | | **6.9** | **21.2** | **16.5** | **26.7** |
| **- Primulaceae** | | | | | | | | | |
| ***Anagallis arvensis*** | **20.8** | **18.0** | **8.4** | **3.8** | **6.5** | **14.1** | **11.2** | **12.5** | **17.2** |
| **-Solanaceae** | | | | | | | | | |
| ***Solanum nigrum*** | **0.2** | **0.3** | | **0.3** | | **0.5** | | **0.2** | **6.5** |
| **- Umbelliferae** | | | | | | | | | |
| ***Ammi majus*** | **1.2** | **3.1** | **0.3** | **5.3** | | **5.0** | **2.0** | **3.0** | **4.0** |

**Taxa present in less than 5 governorates were omitted from the table.**

**Table (6): The density of weed species in wheat fields in Lower Egypt from 1992/93 to 2001/02 winter seasons.**

| Season | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Families & Taxa** | **Kafer El-Sheikh** | **El-Behera** | **North Tahrir** | *** New land in Eastern Delta** | **Alexandria** | **Menofia** | **El- Gharbia** | **El-Qalubia** | **El-Dakahliya** |
| **- Caryophllaceae** | | | | | | | | | |
| ***Silene rubella*** | | **1.0** | **11.0** | **7.4** | **3.0** | **3.7** | **1.0** | **3.4** | **3.2** |
| ***Spergularia spp*** | **42.8** | **8.3** | **4.6** | **20.6** | **12.0** | | **18.0** | **60.0** | **28.2** |
| ***Stellaria medica*** | | **2.1** | | | **2.2** | **2.3** | | **1.7** | |
| **- Chenopodiaceae** | | | | | | | | | |
| ***Chenopodium album*** | **4.2** | **3.7** | **5.5** | **3.1** | **4.2** | **3.7** | **3.9** | **5.1** | **2.5** |
| ***C.murale*** | **2.1** | **10.1** | **12.8** | **2.7** | **3.1** | **2.6** | **3.8** | **2.2** | **3.4** |
| ***Kochia indica*** | | **1.0** | **1.0** | **2.6** | **11.0** | | **2.0** | | **2.0** |
| **- Compositae** | | | | | | | | | |
| ***Cichorium punulum*** | | **3.8** | | | | **3.5** | **1.1** | **1.0** | **1.8** |
| ***Senecio desfontainei*** | **1.0** | **2.2** | **6.2** | **3.3** | **2.0** | **2.3** | | | |
| ***Sonchus oleraceus*** | **2.0** | **4.2** | | **1.7** | | **3.0** | | **3.7** | **2.2** |
| ***Urospermum picroides*** | **1.0** | **1.4** | **1.0** | | | | **1.0** | | **1.5** |
| **- Convolnulaceae** | | | | | | | | | |
| ***Convolvulus aravensis*** | **1.9** | **3.8** | **6.8** | **3.4** | **4.5** | **4.3** | **4.0** | **5.7** | **2.4** |
| **- Cruciferae** | | | | | | | | | |
| ***Brassica nigra*** | **1.2** | **1.5** | **1.3** | | **2.8** | **1.8** | **2.0** | **7.4** | |
| ***Capsella bursa – pastoris*** | **69.5** | **8.2** | **20.0** | | **3.0** | **4.8** | **6.2** | **8.0** | **6.0** |
| ***Coronopus squamatus*** | **10.8** | **21.2** | **13.2** | | **2.0** | **5.9** | **10.6** | **13.4** | **7.0** |
| ***Enarthocarpus lyratus*** | | **3.6** | **3.2** | **2.8** | **4.3** | | | **1.6** | |
| ***Eruca sativa*** | | **5.7** | **2.0** | **4.0** | **2.6** | | | | |
| ***Sinapis allionii*** | | **2.1** | | | **2.2** | **2.3** | | **1.7** | |
| ***S. arvensis*** | | **2.1** | | | **2.2** | **2.0** | | **2.0** | **1.5** |
| **- Gramineae** | | | | | | | | | |
| ***Avena fatua*** | **2.7** | **2.9** | **3.0** | **5.2** | **7.4** | **8.6** | **2.2** | **8.6** | **2.5** |
| ***A. sativa*** | **3.3** | **1.7** | **1.2** | **1.6** | **5.0** | **2.1** | **2.6** | **3.7** | **2.2** |
| ***A. sterilis*** | **4.5** | **2.6** | **5.1** | **5.5** | **10.6** | **4.2** | **3.1** | **5.3** | **2.6** |
| ***Bromus spp*** | | **2.0** | **3.6** | **3.6** | **5.5** | | | **6.1** | |
| ***Lolium multiflorum*** | **5.8** | **24.2** | **14.9** | **13.3** | **20.9** | **4.8** | | **14.7** | **10.1** |
| ***L. temulentum*** | **6.8** | **2.0** | **2.0** | **1.8** | | **1.0** | **5.1** | **1.7** | **1.2** |
| ***Phalaris minor*** | **27.1** | **15.4** | **11.3** | **3.0** | **10.7** | **8.8** | **18.4** | **9.7** | **13.8** |
| ***P. paradoxa*** | **20.1** | **2.0** | **5.8** | **13.7** | **7.7** | **7.3** | **3.1** | **10.9** | **10.5** |
| ***Phragmites australis*** | **2.8** | **14.7** | **5.3** | | | | **5.0** | | **4.7** |
| ***Poa annua*** | **64.2** | | **38.1** | **10.0** | **3.5** | **5.9** | **13.3** | **21.0** | **25.3** |

## Table (6) cont.:

| **Season** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Families & Taxa** | **Kafer El-Sheikh** | **El-Behera** | **North Tahrir** | *** New land in Eastern Delta** | **Alexandria** | **Menofia** | **El- Gharbia** | **El-Qalubia** | **El-Dakahliya** |
| *Polypogon monspeliensis* | **32.6** | **54.3** | **10.3** | **5.6** | **12.0** | **9.5** | **8.8** | **7.7** | **12.4** |
| *P. semiverticillatus* | **2.0** | **45.0** | **8.6** | | | **2.0** | **5.0** | **4.0** | **4.0** |
| **- Euphorbiaceae** | | | | | | | | | |
| *Euphorbia helioscopia* | **21.0** | | | | | **3.5** | **2.0** | **3.2** | **1.3** |
| *E. peplus* | | **12.5** | | **1.3** | | **3.3** | | **3.0** | **2.5** |
| **- Labiatae** | | | | | | | | | |
| *Lamium amplexicaule* | **4.0** | **4.1** | | **1.0** | | **4.1** | | **2.0** | **3.0** |
| **- Leguminosae** | | | | | | | | | |
| *Medicago intertexta* | **1.9** | **2.7** | **2.8** | **6.5** | **4.0** | **2.6** | **3.9** | **2.7** | **4.4** |
| *M. polymorpha* | **5.7** | **3.4** | **2.5** | **3.3** | | **1.7** | **2.9** | **5.2** | **3.1** |
| *Melilotus. indica* | **7.2** | **5.7** | **3.6** | **9.5** | **2.4** | **5.5** | **3.2** | **6.8** | **2.7** |
| *M. siculus* | **5.1** | **3.8** | **1.9** | **2.8** | **3.0** | **1.5** | **6.1** | **2.8** | **4.2** |
| *Trifolium resupinatum* | **2.7** | **11.0** | **5.5** | **3.8** | **7.3** | **6.4** | **12.3** | **23.4** | **23.2** |
| *Vicia. monantha* | **1.9** | **1.3** | **1.8** | **1.9** | **3.3** | **6.7** | | **1.5** | |
| *V. sativa* | **2.0** | **2.1** | **1.7** | **1.5** | **4.6** | **2.3** | **2.2** | **5.2** | **2.1** |
| **- Malvaceae** | | | | | | | | | |
| *Malva parviflora* | **1.0** | **1.7** | **3.8** | **2.8** | **2.5** | **2.5** | **1.2** | **2.2** | **1.1** |
| **Oxalidaceae** | | | | | | | | | |
| *Oxalis corniculata* | | **6.3** | | | | **4.5** | **3.0** | **12.4** | |
| **- Plantaginaceae** | | | | | | | | | |
| *Plantago major* | **1.2** | | | | | **1.0** | **1.5** | **2.0** | **2.5** |
| **- Polygonaceae** | | | | | | | | | |
| *Emex spinosus* | | **5.5** | **5.5** | **4.1** | **1.3** | **2.0** | | **2.0** | |
| *Rumex dentatutus* | **3.3** | **4.9** | **2.9** | **1.5** | | **4.4** | **2.8** | **5.7** | **3.1** |
| **- Primulaceae** | | | | | | | | | |
| *Anagallis arvensis* | **10.0** | **13.0** | **9.1** | **8.9** | **3.6** | **6.4** | **5.2** | **8.7** | **4.5** |
| **-Solanaceae** | | | | | | | | | |
| *Solanum nigrum* | **1.0** | **1.0** | | **1.0** | | **5.0** | | **1.0** | **2.0** |
| **- Umbelliferae** | | | | | | | | | |
| *Ammi majus* | **2.0** | **2.6** | **3.0** | **2.4** | | **3.4** | **3.4** | **3.2** | **1.9** |

Taxa present in less than 5 governorates were omitted from the table.

The following families: Gramineae, Leguminosae, Cruciferae, Chenopodiaceae, Compositae, Caryophyllaceae, Umbelliferae, Euphorbiaceae and Polygonaceae were represented by 10, 7, 6, 3, 3, 2, 2, 2 and 2 species, respectively. The other families i.e. Convolvulaceae, Labiatae, Malvaceae, Plantaginaceae, Primulaceae, Solanaceae and Oxalidaceae were represented by one species only. The dominant weed according to frequency percentage was *Avena fatua* 28.7 % .

**In El–Gharbia governorate** a total of 35 weed species belong to 31 genera and 15 families were recorded. These weeds fell into four categories i.e. 22 species as annual broad leaf weeds, 11 species as annual narrow leaf weeds (grasses), 1 species as perennial broad leaf weed and 1 species as perennial narrow leaf weed. The families Gramineae, Leguminosae, Cruciferae Chenopodiaceae, Compositae, and Caryophyllaceae were represented by 10, 7, 3, 3, 2, 2 and 2 species respectively. The other 8 families i.e. Convolvulaceae, Euphorbiaceae, Malvaceae, Oxalidaceae, Plantaginaceae, Polygonaceae, Primulaceae and Umbelliferae were represented by one species only. The dominant weeds according to frequency percentage were *Convolvulus arvensis* 25.2 , *Phalaris minor* 24.8, *Polypogon monspliensis* 21.2 and *Rumex dentatus* 21.2 %.

**I**

**n Kafr El – Sheikh governorate** a total of 37 weed species belong to 28 genera and 14 families were recorded. These weeds fell into four categories i.e. 24 species as annual broad leaf weeds, 11 species as annual narrow leaf weeds (grasses), 1 species as perennial broad leaf weed and 1 species as perennial narrow leaf weed. The weed species belong to the following families: Gramineae (11), Leguminosae (7), Compositeae (3), Cruciferae (3), Chenopodiaceae (3) and Umbelleferae (2). The other families i.e. Caryophyllaceae, Convolvulaceae, Malvaceae, Plantaginaceae, Polygonaceae, Labiatae, Primulaceae and Solanaceae were represented by one species only. The dominant weeds according to frequency percentage were *Polypogon monspeliensis* 22.9, *Angallis arrensis* 20.8 and *Rumex dentatus* 20.0 %.

**In the North Sector of Tahrir Province (West Delta**) a total of 41 weed species belonging to 23 genera and 11 families were recorded. These weeds fell into four categories i.e. 28 species as annual broad leaf weeds, 12 species as annual narrow leaf weeds, 1 species as perennial broad leaf weed and 1 species as perennial narrow leaf weed. The weed species belong to the following families: Gramineae (12), Cruciferae (6), Leguminosae (7), Chenopodiaceae (4), Caryophyllaceae (3), Compositae (3) and Polygonaceae (2). Also, the following families were represented by one species only i.e. Convolvulaceae, Malvaceae, Umbelliferae, and Primulaceae. The dominant weeds according to frequency percentage were *Lolium multiflorum* 40.8, *Avena sativa* 32.3 and *Phalaris minor* 29.9%.

**In El – Behera governorate** a total of 47 weed species belong to 36 genera and 14 families were recorded. These weeds fell into four categories i.e. 33 species as annual broad leaf weeds, 11 species as annual narrow leaf weeds (grasses), 1 species as perennial broad leaf weed and 1 species as perennial narrow leaf weed .The weed species belong to the following families: Gramineae (12), Leguminosae (8), Cruciferae (7), Compositae (4), Chenopodiaceae (3), Caryophyllaceae (3), Euphorbiaceae (2) and Polygonaceae (2), Also, the following families were represented by one species only i.e. Convolvulaceae, Labiatae, Umbelliferae ,Oxalidaceae, Primulaceae and Solanaceae. The dominant weeds according to frequency percentage were *Sonchus oleraceus* 60.7, *Beta vulgaris* 56.5, *Anagallis arvensis* 56.0, *Phalaris minor* 43.4, *Rumex dentatus* 39.1, *Trifolium resupinatum* 36.9, *Convolvulus arvensis* 28.3, *Phalaris paradoxa* 28.3 , *Poa annua* 24.2 and *Polypogon monspeliensis* 23.9 %.

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## Abstract

Weed survey was carried out in 6480 wheat fields selected from 17 different governorates during 10 successive winter seasons (1992/93 – 2001/02). 41 weed species were recorded in Upper Egypt belonging to 32 genera and 13 families. The most dominant weeds were *Phalaris minor*, *Polypogon monspeliensis*, and *Avena sterilis* as annual grasses, *Rumex dentatus* as annual broad leaf weed and *Convolvulus arvensis* as perennial broad leaf weed. In the Nile Delta 52 weed species belonging to 41 genera and 16 families were detected. The most dominant weeds were *Avena sterilis*, *Phalaris minor* and *Polypogon monspeliensis* as annual grasses and *Convolvulus arvensis* as perennial broad leaf weed.

## الملخص العربى

تم حصر الحشائش لعدد 6480 حقل قمح مختارة عشوائيا في 17 محافظة لفترة 10 مواسم شتوية متعاقبة )2002/2001-1993/1992 (في كلا من مصر العليا والدلتا بمصر .ولقد وجد عدد 41 نوع من الحشائش تنتمي إلى 32 جنس و 13 عائلة نباتية و كانت أكثر الحشائش سيادة هي الفلارس وذيل القط والزمير كحشائش نجيلية والحميض والعليق كحشائش عريضة الأوراق بمحافظات الوجه القبلي ,بينما ينتشر عدد 52 نوع من الحشائش تنتمي إلى 41 جنس و 16 عائلة نباتية بالدلتا وكانت أكثر الحشائش سيادة هي الزمير والفلارس كحشائش نجيلية والعليق كحشيشة عريضة الأوراق بحقول القمح.

# Chapter 2: Weed flora of faba bean fields

## Introduction

Faba bean is an important food crop in Egypt, It suffers from weed competition and parasitism. Thus this work was carried out to study weed frequencies and densities in 9 governorates representing different geographical regions where faba bean is usually grown. This study may assist in the planning of weed management strategy.

*Materials and methods*

The weed survey was carried out in 9 governorates by ( Hassanein et al (1993, 1995, 1997, 1998, 1999), El Shandidy et al (1994, 1996) and Mohamed et al (1996)) where 496 fields were investigated to determine the frequency and density of weed species during 1992-93 to 1998-99 seasons. The governorates and districts, from which faba bean fields were chosen randomly to carry out the weed survey, are presented in table A.

The weed samples were taken randomly from $lm^2$ from each field, then classified into genera and species according to Tackhlom, 1974. The weed type (i.e. broad leaf or narrow leaf) and life's cycle, (i.e. annual or perennial) were also recorded .

For determining the weed infestation, the following two equations reported by El – Khanagry ( 1993 ) were used :

$$\text{1-Frequency } \% = \frac{\text{Number of infested fields by each species in the district}}{\text{Number of investigated fields in the district}} \times 100$$

$$\text{2- Density } \% = \frac{\text{Number of individual plants of each species } (m^2) \text{ in the district}}{\text{Number of infested fields in the district}} \times 100$$

**Table (A): Governorates, districts and number of faba bean fields surveyed in Upper and Lower Egypt from 1992/93 – 1998/99 seasons.**

| No | Season | Governorate | Districts | No. of investigated fields |
|---|---|---|---|---|
| 1 | 1992/93 | Kafr El-Sheikh | Three: Desouk, KafrEl-Sheikh and Metobus | 30 |
| 2 | 1992/93 | Assuit | Five: Abnub, Abu-Tig, El-Ghanayim, El-Qusiya and El-Sahil | 70 |
| 3 | 1993/94 | El-Behyra | Five: Abo-El-Matamir, El-Dalangat, Hoash Isa, Kafr El-Dauar and koam Hamada | 75 |
| 4 | 1994/95 | Qena | Five: Abo Tisht, Dishna, Qena, Nagada and Loxur | 31 |
| 5 | 1994/95 | East Deltta in new land in Sharkia and Ismallia | Four: Hossaneia, Aoulad-Sakr, and Qantar- Gharb and Qantra-Sharq | 42 |
| 6 | 1995/96 | El-Fayoum | Four: El-Fayoum, Itsa, Sonoris and Ibshwai | 44 |
| 7 | 1997/98 | El-Alexandria | Two sections : Right and Left of El-Nasr canal at Banger El-Sokar Province | 70 |
| 8 | 1997/98 | El-Menofia | Three: Quesna, Ashmon and Talla | 42 |
| 9 | 1998/99 | El-Gharbia | Five: Tanta, Bassun, El-Mahala, Zifta and Qotur | 40 |
| Total | 9 | 9 | 36 | 444 |

The following parameters created by the above authors to measure the infestation were also used:

1- Dominant weed > 20% (frequency). And > 20plants /m$^2$ (density).
2- Common weed >10-20% (frequency) and 10-20 plants/m$^2$ (density).
3- Rare weed < 10% (frequency). And < 10plants /m$^2$ (density).

## Results and discussion

Results in tables 7 & 8 show the frequencies and densities of weed species in 9 governorates as follows:

**In Assuit governorate** in 1992/93 season a total of 20 weed species belonging to 16 genera and 10 families were recorded. These species were divided into three categories i.e. 15 annual broadleaf weeds, 4 annual narrow leaf weeds (grasses) and 1 perennial broadleaf weed. The identified weeds belong to the following families: Cruciferae (3), Leguminosae (3), Gramineae (4), Chenopodiaceae (3) and Compositae (2). The other families i.e. Convolvulaceae, Malvaceae, Orobanchaceae, Polygonaceae and Primulaceae were represented by one species only.
The dominant weeds according to frequency percentage were *Sonchus oleraceus* ( 67.1% ) *Chempodium murale* ( 22.9% ).

**In Kafr El-Sheikh governorate** in 1992/93 season a total of 19 weed species belong to 14 genera and 8 families were recorded. These weeds fell into two categories i.e. 15 annual broadleaf weeds and 4 annual narrow leaf weeds (grasses); and belong to the following families: Leguminosae (5), Gramineae (4), Chenopodiaceae (3) and Cruciferae (2). The other families i.e. Compositae, Orobanchaceae, Malvaceae and Primulaceae were represented by one species only.

The dominant weeds according to frequency percentage were *Melilotus* indica 55.0 , *Polypogon monspeliensis* 40.0 , *Rumex dentatus* 40.0, *Anagallis arvensis 40*.0 , *Beta vulgaris* 30.0 *Coronopus squamatus* 20.0 and *Phalaris minor* 20.0 %.

**In El-Behyra govenorate** in 1993/94 season a total of 28 weed species belong to 20 genera and 11 families were recorded, and fell into four categories i.e. 17. These weed species belong to the following families: Gramineae (9), Leguminosae (5), Cruciferae (3), Chenopodiaceae (3) Polygonaceae (2) and Compositae (2). The other families i.e. Convolvulaceae, Malvaceae, Primulaceae and Umbelliferae were represented by one species only. The dominant weeds according to frequency percentage were *Remux dentatus* 39.7, *Sonchus oleraceus* 34.2 , *Polypogon monspeliensis* 34.2, *Anagallis arvensis* 30.1, *Beta vulgaris* 27.3 and *Phalaris paradoxa* 21.9 %.

**In Qena governorate** in 1993/94 season a total of 22 weed species belong to 19 genera and 9 families were recorded. These weeds were divided into three categories i.e. 14 annual broadleaf weeds, 7 annual narrow leaf weeds (grasses) and 1 perennial broadleaf weed. These above weed species were belong to the following families: Gramineae (7), Chenopodiaceae (3), Cruciferae (3), Leguminosae (3) and Compositae (2). The other families i.e. Convolvulaceae, Malvaceae, Orobanchaceae and Polygonaceae were represented by one species only. The dominant weeds according to frequency percentage were *Orobanche crenata* ( 64.5% ) , *Avena fatua* ( 38.7% ) , *Chenopodium album* ( 32.3% ) , *Sonchus oleraceus* ( 32.3% ), *Malva parviflora* ( 29.0% ), *Convolvulus arvensis* (25.8% ) , *Avena sterilis* ( 22.6% ) and *Polypogon monspeliensis* ( 22.6 % ) .

**In Eastern Delta** in 1995/96 season a total of 27 weed species belong to 22 genera and 11 families were recorded. These weeds were divided into three categories i.e. 17 annual broadleaf weeds, 9 annual narrow leaf weeds (grasses) and 1 perennial broadleaf weed.
These weed species represented the following families: Gramineae (9), Leguminosae (5), Compositae (3), Chenopodiaceae (3), Polygonaceae (2) and Cruciferae (2). The other families i.e. Convolvulaceae, Orobanchaceae, Primulaceae Umbelliferae and Polygonaceae were represented by one species only. The dominant weeds according to frequency % were *Lolium multiflorum* 61.9, *Avena sterilis* 42.9, *Polypogon monspeliensis* 38.0%, *Phalaris minor* 23.8 and *Convolvulus arvensis* 38.9% and *Beta vulgaris* 30.9%.

**In EL-Fayoum governorate** in 1996/97 season a total of 29 weed species belonging to 22 genera and 11 families were recorded, and divided into three categories i.e. 18 annual broadleaf weeds, 1 perennial broadleaf weed, 9 annual narrow leaf weeds (grasses) and 1 perennial narrow leaf weed. These weed species belong to the following families: Gramineae (9), Leguminosae (5), Compositae (3), Chenopodiaceae (3), Cruciferae (2) and Polygonaceae (2). The other families i.e. Convoluvlaceae, Malvaceae, Orobanchaceae, Primulaceae and Umbelliferae were represented by one species only.

The dominant weeds according to frequency percentage were *Beta vulgaris* (45.4%), *Rumex dentatus* (29.5%), *Sonchus aleraceus* (27.2%), *Anagallis arrensis* (25.0%) *Lolium multiflorum* (28.0%) *Melilotus indica* (20.4) , *Ammi majus* (20.4%) and *Avena sterilis* (20.4%).

**In Alexandria governorate** in 1997/98 season a total of 23 weed species belong to 18 genera and 10 families were recorded, and fell into three categories i.e. 14 annual broadleaf weeds, 1 perennial broad leaf weed and 8 annual narrow leaf weeds (grasses). These weed species represented the following families: Gramineae (8), Compositae (3), Chenopodiaceae (3), Leguminosae (2) and Cruciferae (2). The other families i.e. Convolvulaceae, Malvaceae, Polygonaceae, Primulaceae, and Umbelliferae were represented by one species only. The dominant weeds according to frequency percentage were *Avena sterilis* 47.1, *Lolium multiflorum* 32.8 and *Phalaris minor* 27.1 %.

**In El-Menofia governorate** in 1997/98 season a total of 22 weed species belonging to 16 genera and 10 families were recorded, and divided into three categories i.e. 14 annual broadleaf weeds, 7 annual narrow leaf weeds and 1 perennial broadleaf weed. These weed species belong to the following families: Gramineae (7), Cruciferae (3), Chenopodiaceae (3),and Leguminosae (3),. The other families i.e. Compositae, Convolvulaceae, Orobanchaceae, Polygonaceae Primulaceae and Malvaceae were represented by one species only. The dominant weeds according to frequency percentage were *Orobanche crenata* 47.6, *Sonchus oleraceus* 38.1, *Anagallis arvensis* 35.7 and *Chenopodium murale* 21.4 %.

**In EL-Gharbia governorate** in 1998/99 season a total of 25 weed species belonging to 18 genera and 10 families were recorded, and fell into four categories i.e. 14 annual broadleaf weeds species, 1 perennial broadleaf weed, 9 annual narrow leaf weeds species and 1 perennial narrow leaf weed. These weed species represented the following families: Gramineae (9), Leguminosae (5), Compositae (2) and Chenopodiaceae (3), and one species only belong to each of the following families i.e. Cruciferae. Convolvulaceae, Orobanchaceae, Polygonaceae, Primulaceae and Umbelliferae.

**Table (7): The frequency of weed species in faba bean fields in different 9 governorates, Egypt, from 1992/93 to 1998/99 winter seasons.**

| Families & Taxa | 1992/93 | | 1993/94 | | 1995/96 | | 1997/98 | | 1998/99 |
|---|---|---|---|---|---|---|---|---|---|
| | Assuit | Kafr El-Sheikh | El-Behera | Qena | E- Delta | Fayoum | Alexandria | Menofia | El- Gharbia |
| **- Chenopodiaceae** | | | | | | | | | |
| **Beta vulgaris** | 15.7 | 30.0 | 27.3 | 19.4 | 30.9 | 45.4 | 10.0 | 14.2 | 56.5 |
| ***Chenopodium album*** | 18.6 | 10.0 | 12.3 | 32.3 | 9.5 | 9.0 | 17.0 | 9.5 | 17.3 |
| ***C. murale*** | 22.9 | 15.0 | 17.8 | 9.7 | 7.1 | 11.3 | 10.0 | 21.4 | 19.6 |
| **- Compositae** | | | | | | | | | |
| **Cichorium pumilum** | 1.4 | | | 9.7 | 2.4 | 13.6 | 1.4 | | 8.7 |
| ***Sonchus oleraceus*** | 67.1 | 15.0 | 34.2 | 32.3 | 19.0 | 27.2 | 14.2 | 38.1 | 60.7 |
| **- Convolvulaceae** | | | | | | | | | |
| **Convolvulus aravensis** | 14.3 | | 2.7 | 25.8 | 38.0 | 11.3 | 11.4 | 16.7 | 28.3 |
| **- Cruciferae** | | | | | | | | | |
| **Coronopus squamatus** | 1.4 | 20.0 | 17.8 | 3.2 | 11.9 | 2.2 | | 4.7 | 17.4 |
| ***Brassica nigra*** | 1.4 | 5.0 | 1.3 | 3.2 | | 2.2 | 10.0 | 4.7 | |
| ***Sinapis arvensis*** | 1.4 | | 1.3 | 6.5 | | | 1.4 | 4.7 | |
| **- Gramineae** | | | | | | | | | |
| ***Avena fatua*** | 15.5 | | 8.2 | 38.7 | 19.0 | 11.3 | 12.8 | 7.1 | 8.7 |
| ***A. sativa*** | | | 4.1 | 3.2 | 4.7 | 2.2 | | 2.3 | 13.0 |
| ***A. sterilis*** | 10.2 | | 5.4 | 22.6 | 42.9 | 20.4 | 47.1 | 4.7 | 17.4 |
| ***Lolium multiflorum*** | | | 10.9 | 9.7 | 61.9 | 25.0 | 32.8 | 2.3 | |
| ***Phalaris minor*** | 1.4 | 20.0 | 12.3 | | 23.8 | 9.0 | 27.1 | 4.7 | 43.4 |
| ***P.paradoxa*** | | 5.0 | 21.9 | 19.4 | 7.1 | 18.1 | 14.2 | 16.7 | 28.3 |
| **Poa annua** | 2.9 | 10.0 | 8.2 | 9.7 | 2.4 | 6.8 | 1.4 | 14.2 | 24.2 |
| **Polypogon monspeliensis** | | 40.0 | 34.2 | 22.6 | 23.8 | 15.9 | 1.4 | | 23.9 |
| ***P. semiverticillatus*** | | | 1.3 | | 4.7 | 2.2 | 1.4 | | 8.7 |
| **- Leguminosae** | | | | | | | | | |
| **Medicago intertexta** | 1.4 | 15.0 | 16.4 | | 9.5 | 13.6 | | 2.3 | 7.4 |
| **M. polymorpha** | 11.4 | 10.0 | 8.2 | 6.5 | | 4.5 | | | 6.5 |
| ***Melilotus. Indica*** | 11.4 | 55.0 | 4.1 | 9.7 | 19.0 | 20.4 | 7.1 | 4.7 | 8.7 |
| ***M. siculus*** | | 10.0 | 15.0 | | 2.4 | 4.5 | | 2.3 | 8.7 |
| **Trifolium resupinatum** | | | 6.8 | 6.5 | 7.1 | 9.0 | 1.4 | | 36.9 |
| **- Malvaceae** | | | | | | | | | |
| **Malva parviflora** | 8.6 | 5.0 | 8.2 | 29.0 | | 15.9 | 8.5 | | 9.5 |
| **- Orobanchaceae** | | | | | | | | | |

**Table (7) cont.:**

| Families & Taxa | 1992/93 | | 1993/94 | | 1995/96 | | 1997/98 | | 1998/99 |
|---|---|---|---|---|---|---|---|---|---|
| | Assuit | Kafr El-Sheikh | El-Behera | Qena | East- Delta | Fayoum | Alexandria | Menofia | El- Gharbia |
| Medicago intertexta | 1.4 | 15.0 | 16.4 | | 9.5 | 13.6 | | 2.3 | 7.4 |
| Orobanche crenata | 15.0 | 10.0 | | 64.5 | 2.4 | 13.6 | | 47.6 | 6.5 |
| - Polygonaceae | | | | | | | | | |
| Emex spinosus | 1.4 | | 13.6 | | 21.3 | 2.2 | 5.7 | | |
| *Rumex dentatutus* | | 40.0 | 39.7 | 6.5 | 9.5 | 29.5 | | 2.3 | 39.1 |
| - Primulaceae | | | | | | | | | |
| Anagallis arvensis | 2.9 | 40.0 | 30.1 | | 14.3 | 25.0 | 14.2 | 35.7 | 56.0 |
| - Umbelliferae | | | | | | | | | |
| Ammi majus | | | 2.7 | | 4.7 | 20.4 | 1.4 | | 6.5 |

**Table (8): The density of weed species in faba bean fields in different 9 governorates, Egypt, from 1992/93 to 1998/99 winter seasons.**

| Families & Taxa | 1992/93 | | 1993/94 | | 1995/96 | | 1997/98 | | 1998/99 |
|---|---|---|---|---|---|---|---|---|---|
| | Assuit | Kafr El-Sheikh | El-Behera | Qena | E- Delta | Fayoum | Alexandria | Menofia | El- Gharbia |
| **- Chenopodiaceae** | | | | | | | | | |
| ***Beta vulgaris*** | 2.7 | 5.0 | 3.9 | 4.0 | 8.4 | 4.3 | 4.8 | 2.8 | 4.2 |
| **Chenopodium album** | 3.5 | 2.0 | 1.8 | 8.8 | 3.2 | 1.7 | 4.7 | 4.5 | 4.5 |
| ***C.murale*** | 2.5 | 1.7 | 5.2 | 4.3 | 3.6 | 5.4 | 3.2 | 4.8 | 3.3 |
| **- Compositae** | | | | | | | | | |
| ***Cichorium pumilum*** | 1.0 | | | 2.6 | 10.0 | 2.8 | 1.0 | | 2.0 |
| ***Sonchus oleraceus*** | 5.8 | 2.0 | 2.9 | 3.4 | 4.0 | 4.0 | 2.1 | 2.9 | 2.5 |
| **-Convolvulaceae** | | | | | | | | | |
| **Convolvulus aravensis** | 4.8 | | 6.0 | 11.4 | 5.9 | 10.2 | 5.1 | 2.0 | 5.2 |
| **- Cruciferae** | | | | | | | | | |
| **Coronopus squamatus** | 1.0 | 11.3 | 11.6 | 1.0 | 10.6 | 8.0 | | 2.0 | 10.9 |
| ***Brassica nigra*** | 1.0 | 3.0 | 1.0 | 1.0 | | 2.0 | 3.6 | 1.0 | |
| ***Sinapis arvensis*** | 3.0 | | 1.0 | 1.0 | | | 3.0 | 3.5 | |
| **- Gramineae** | | | | | | | | | |
| ***Avena fatua*** | 4.1 | | 1.0 | 2.3 | 3.2 | 1.6 | 3.5 | 1.0 | 2.0 |
| ***A. sativa*** | | | 1.5 | 2.0 | 2.5 | 1.0 | | 3.0 | 1.0 |
| ***A. sterilis*** | 4.1 | | 2.0 | 3.3 | 2.4 | 1.9 | 5.1 | 1.0 | 2.4 |
| ***Lolium multiflorum*** | | | 8.7 | 5.3 | 24.8 | 3.5 | 12.8 | 1.0 | |
| ***Phalaris minor*** | 2.0 | 39.8 | 69.4 | | 7.0 | 1.5 | 8.9 | 2.0 | 10.5 |
| ***P.paradoxa*** | | 100.0 | 5.3 | 2.7 | 7.6 | 5.1 | 18.7 | 16.1 | 8.6 |
| ***Poa annua*** | 2.0 | 100.0 | 96.0 | 2.9 | 3.0 | 13.3 | 20.0 | 9.6 | 16.4 |
| ***Polypogon monspeliensis*** | | 18.6 | 72.5 | 2.6 | 8.7 | 4.5 | 2.0 | | 8.8 |
| **Polypogon semiverticillatus** | | | 4.0 | | 6.6 | 27.0 | 16.0 | | 5.5 |
| **- Leguminosae** | | | | | | | | | |
| **Medicago intertexta** | 3.0 | 1.0 | 2.2 | | 4.7 | 3.0 | | 1.0 | 1.9 |
| ***M. polymorpha*** | 3.5 | 13.5 | 2.7 | 4.0 | | 1.5 | | | 4.0 |
| ***Melilotus indica*** | 1.4 | 12.9 | 3.0 | 3.6 | 2.6 | 4.6 | 1.8 | 4.5 | 4.0 |
| ***M. siculus*** | | 1.5 | 6.1 | | 1.0 | 3.0 | | 8.0 | 4.5 |
| ***Trifolium resupinatum*** | | | 21.6 | 4.5 | 15.3 | 9.7 | 8.0 | | 10.2 |
| **- Malvaceae** | | | | | | | | | |
| ***Malva parviflora*** | 1.3 | 1.0 | 1.8 | 3.5 | | 3.8 | 3.2 | | 3.2 |

**Table (8) cont.:**

| Families & Taxa | 1992/93 | | 1993/94 | | 1995/96 | | 1997/98 | | 1998/99 |
|---|---|---|---|---|---|---|---|---|---|
| | **Assuit** | **Kafr El-Sheikh** | **El-Behera** | **Qena** | **E- Delta** | **Fayoum** | **Alexandria** | **Menofia** | El- Gharbia |
| **- Orobanchaceae** | | | | | | | | | |
| **- Polygonaceae** | | | | | | | | | |
| ***Emex spinosus*** | **1.0** | | **2.1** | | **4.2** | **4.0** | **2.5** | | |
| ***Rumex dentatus*** | | **1.3** | **5.6** | **2.0** | **7.2** | **4.6** | | **2.0** | **4.4** |
| **- Primulaceae** | | | | | | | | | |
| ***Anagallis arvensis*** | **7.5** | **11.0** | **8.0** | | **14.3** | **5.9** | **6.9** | **7.1** | **8.8** |
| **- Umbelliferae** | | | | | | | | | |
| ***Ammi majus*** | | | **2.0** | | **1.5** | **2.6** | **4.0** | | **1.7** |

***Taxa present in lessthan 5 governorates were omitted from the table***

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## Abstract

Weed survey of 444 faba bean fields selected randomly from 9 different governorates during the period 1992/93 – 1997/98 winter seasons recorded 30 species belonging to 23 genera and 11 families. The most dominant weeds were *Beta vulgaris, Sonchus oleraceus, Rumex dentatus, Melilotus indica* and *Anagallis arvensis* as annual broad leaf weeds, *Avena sterilis, Phalaris minor* and *Polypogon monspeliensis* as annual grasses and *Convolvulus arvensis* as perennial broad leaf weed. *Orobanche* sp was dominant as parasitic weed in most governorates.

## الملخص العربي

تم إجراء حصر للحشائش المصاحبة لمحصول القول البلدى في 496 حقل مزروعة بالفول في 9 محافظات وذلك في الفترة من 92 /1993– 97/1998 ، أوضحت نتائج الحصر وجود 30 نوعا من الحشائش تنتمي إلى 23 جنس و 11 عائلة نباتية وكانت أكثر أنواع الحشائش سيادة هى السلق والجعضيض والحميض وعين الجمل كحشائش حولية عريضة الأوراق والعليق كحشيشة معمرة عريضة الأوراق والزمير والفلارس وديل القط كحشائش نجيلية ، وكان الهالوك سائدا كحشيشة متطفلة في معظم هذه المحافظات .

# Chapter 2: Botanical description of Egypyion weeds

## 3.1 Botanical description of common weeds in winter crops

A list of taxi belonging to families and genera were descried with colored photos. The description was in Arabic and English include: life cycle, leaf, flower and stem shapes et.al. (Hassanein et.al.). photos were taken by Hassanein and Ibrahim .

الوصف النباتى لأهم الحشائش الشائعة فى المحاصيل الشتوية :

**يشمل هذا دليلا لوصف 40 نوع من أهم الحشائش المصرية والتي تنتمي إلى عدد 18 عائلة نباتية و جنس نبات يشمل هذا الدليل على الاسم العربي والانجليزى و وصف نباتي يعتمد على دورة حياة الحشيشة و شكل الورقة والز هرة والساق )حسانين وأخرين (وصور ملونة لهذه الانواع ) حسانين و هاشم . (**

Caryophyllaceae **العائلة القرنفلية**

**Spergularia *spp*.** **الاسم النباتى**
Corn spurry **الاسم الإنجليزى**
أبو غلام **الاسم العربى**

**Description**

Annual herbs, procumbent stem, glabrous. Leaves linear, narrow or capillary. Densely leafy branchlets in the axils, thus appearing whorled. Flowers small. Petals white or pinkish, acutely lanceolate, shorter than sepals. Grow in salt soils.

**الوصف :**حشيشة حولية ، الساق مفترشة، خالية من الشعر .الأوراق خيطية ضيقة أو شريطية، متقابلة، وتتزاحم الأوراق عند مكان خروجها فتبدو على الشكل السوارى .الأزهار صغيرة الحجم فى نورات طرفية دالية سائبة .بتلات التويج صغيرة الحجم بيضاء أو وردية ورمحية الشكل ومستدقة وتوجد فى الأراضى الملحية.

Chenopodiaceae **العائلة الرمرامية**

*Beta vulgaris* L. **الاسم النباتى**
**Sea beet, wild beet** **الاسم الإنجليزى**
**حشيشة السلق** **الاسم العربى**

**Description**

Annual herb, stem erect, branched, sometimes hairy. Leaves alternate, entire, dark green rhombic to ovate–lanceolate, petiolated. Flowers arranged in leafy spikes. Perianth green, fine segments. Inflorescence with numerous spikes.

**الوصف :** حشيشة حولية ، الساق كثيرة التفريع من القاعدة وهى إما عارية من الشعر أو مكسوة بشعر خفيف والأوراق متبادلة، كاملة الحافة لونها أخضر داكن معنقة ، والأوراق العليا معينة الشكل إلى مستطيلة بيضاء، والأزهار تترتب فى نورات مورقة طويلة أسطوانية أو غير منتظمة، وللزهرة قنابة خضراء من خمس فصوص.

Chenopodiaceae العائلة الرمرامية

*Chenopodium album* L. الاسم النباتى
**White goosefoot, fat-hen, common lambsquarters** الاسم الإنجليزى
**الزربيح** الاسم العربى

**Description**

Annual, green or reddish, grooved, rigid erect stem. Leaves alternate, bluish with white mealy appearance on lower surface. Petiolated, lower leaves irregularly toothed, the upper ones lanceolate. Inflorescence in axillary and terminal clusters, Flowers white and mealy. Fruit with five segment perianths. Seeds black and smooth.

الوصف :**حشيشة حولية ، الساق صلبة خضراء مقلمة بلون أحمر ، والأوراق متبادلة تأخذ اللون الأبيض الدقيقى وخاصة السطح السفلى .الأوراق السفلى مسننة تسنين غير منتظم .وتوجد الأزهار فى تجمعات كثيفة من نورات دالية طرفية أو جانبية وتأخذ الأزهار اللون الأبيض الدقيقى أيضا . والثمرة لها غلاف من خمس فصوص حافتها غشائية ولونها أبيض دقيقى المظهر مع خضرة وتقفل على الثمرة.**

Chenopodiaceae العائلة الرمرامية

*Chenopodium murale* L. الاسم النباتى
**Ramram, goosefoot** الاسم الإنجليزى
**المنتنة - فساء الكلاب** الاسم العربى

**Description**

Annual herb, stem erect, branching. Leaves petiolated, rhombic, fleshy, broadly triangular, unequally and acutely toothed. Inflorescence densely clustered panicles in leaf axils and a branched terminal panicle. Seeds black and rough.

الوصف :**حشيشة حولية ، الساق قائمة متفرعة ، والأوراق معنقة "لحمية "ولها شكل المعين إلى البيضاوى ومسننة تسنين غير منتظم وقمتها حادة مستدقة وخالية من الشعر ، والأزهار فى تجمعات صغيرة طرفية أو جانبية من الداليات فى إبط الورقة، والبذور مجعدة وسوداء .**

Compositae العائلة المركبة

*Bidens pilosa* L. **الاسم النباتى**
**Black fellows, black jack, Spanish needle, New Zealand cowage** **الاسم الإنجليزى**
**إبرة العجوز** **الاسم العربى**

## Description

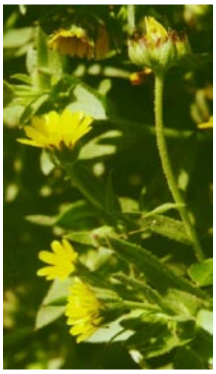
Annual herb, stem erect, leaves opposite, pinnatified to pinnatisect and undivided. Head on corymbose peduncles. The ray florets white, small, falling off soon after the florets are exposed and, therefore, usually only the yellow disc florets observed. The fruit achene with 2–4 bristles, the achenes cling to every kind of cloth.

**الوصف :**حشيشة حولية ، الساق مستقيمة، الأوراق متقابلة ريشية مركبة –تتجمع الأزهار فى نورات هامية – الأزهار الشعاعية بيضاء تتساقط ولا يتبقى إلا الأزهار القرصية الصفراء والثمرة فقيرة بها عدد 2 – 4 نتوءات إبرية خشنة وتلتصق بالأقمشة والملابس.

Compositae **العائلة المركبة**

**Calendula aegyptiaca Desf.** **الاسم النباتى**
**Field marigold** **الاسم الإنجليزى**
**عين البقر - الصفرة** الاسم العربى

## Description



Annual herb, branched, pubescent, erect or sub-erect stem. Leaves alternate, lower narrowed onto a petiole, upper sessile, linear–lanceolate, entire, acute. Flower heads solitary, terminal, ray and ligulate flowers, yellow. Achenes in 2–3 rows, usually of variable kinds.

**الوصف :**حشيشة حولية ، الساق متفرعة من القاعدة ، مستقيمة أو مفترشة ، والأوراق متبادلة على الساق – والأوراق مرتطيلة ضيقة – مستدقة الحافة وهى إما كاملة أو مسننة تسنين خفيف مع شعيرات قصيرة، والأوراق السفلى معنقة والعليا جالسة لها أذينات صغيرة و الأزهار فى رأس قرصية منفردة ، صفراء اللون و الثمار فقيرة مختلفة الشكل.

Compositae **العائلة المركبة**

*Cichorium pumpilum* Jacq. **الاسم النباتى**

**Chicory** DŏNMsăŭƆƀĂŭ
**شيكوريا–سريس** **الاسم العربى**

## Description

Annual herb, erect, divaricately branched stems, round, longitudinally grooved, rough. Leaves hirsute, alternate, half-clasping, the margin entire, shape lanceolate, upper leaves pinnately cut, with segments turned backward; terminal segment long, acute. Flowers in heads, lateral heads sessile, in pairs; terminal heads peduncled, solitary. The involucral outer bracts ovate–lanceolate, glandular, ray flowers three times as long as involucre, blue; disc flowers absent. Fruit achene.

**الوصف :**الساق مستقيمة – دائرية الشكل – يمتد بطول الساق أخدود – خشنة يصل طولها إلى حوالى 70سم و الأوراق متبادلة – الأوراق السفلى شبه جالسة أو بها عنق قصير – ريشية القطع وتتجه إلى الخلف ومستدقة الطرف "حاده "والأوراق العليا جالسة وقصيرة – وحافة الورق مسننة تسن ين غير منظم و الأزهار تتجمع فى هامات "رأس "والأزهار الجانبية جالسة وفى أزواج وفى الطرف منفردة ومعنقة – القنبعة الخارجية للرأس بيضية الشكل ومستدقة الطرف – والقنبعة الداخلية زوجية ومتساويتان فى الطول – والأزهار الشعاعية عديدة وزرقاء اللون والأزهار القرصية غا ئبة والثمرة غير منظمة الأوجه تحيطها حراشيف قصيرة الطول.

Compositae ƑŎȝŽiFäŀŲŽi
*Senecio desfontainei* Druce الاسم النباتى
Groundsel الاسم الإنجليزى
القريص **الاسم العربى**

## Description

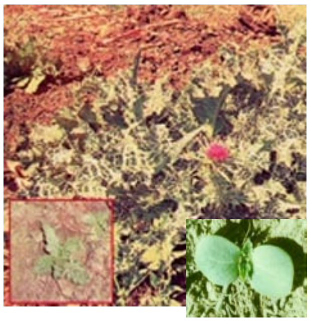
Annual herb, stem branched at the base, glabrous, leaves fleshy, pinnatisect, lobes narrow, margin revolute, inflorescence few-headed, ray flowers yellow and conspicuous, involucral bracts linear, acuminate, scarious-margined, longer than the achene.

**الوصف :**حشيشة حولية ، الأوراق لحمية وسميكة ومفصصة ريشيا حتى قرب العرق ا لأوسط ومكونة من فصوص ضيقة الحجم وحوافها تلتف بعض الشئ إلى الخلف، والأزهار تتجمع فى بضع نورات "رأسيه "وأزهارها الشعاعية صفراء اللون وبارزة بوضوح والقنابات خيطية مستدقة الطرف ذو حافة غشائية متساوية فى الطول مع بعض والقنابات الخارجية قصيرة الطول عند القاعدة ، الثمرة فقيرة ومشعرة مع زوائد شعرية أطول من الثمرة.

Compositae ƑŎȝŽiFäŀŲŽi
*Silybum marianum* (L) Gaertn **الاسم النباتى**

Mary's thistle **الاسم الإنجليزى**
شوك الجمل **الاسم العربى**

## Description



Annual stout herb, up to 2 m high, almost glabrous; stem, branched; leaves spiny, margins with white veins and spots; basal leaves very large, petiolate, forming rosettes, pinnatifid; upper leaves sessile, clasping, auriculate; heads large, involucral bracts broad, spiny; flowers purple; achenes with yellowish pappus.

الوصف :حشيشة حولية ، الساق غالبا خالية من الشعر وسميكة ومتفرعة ويصل طولها حتى 2 متر والأوراق عريضة وحوافها شوكية وعروقها بيضاء اللون مع تبرقش الورقة باللون الأبيض والأوراق السفلية عريضة وكبيرة الحجم ومعنقة ومكونة الشكل الوردى حول الساق ومشقوقة ريشيا والأوراق العليا جالسة ومطوقة للساق وأذينية والأزهار تتجمع فى نورات هامة "رأسية "كبيرة الحجم والقنابات عديدة وعريضة وشوكية والخارجية منها طويلة تصل إلى حوالى 10 سم محيطه بالنورة والأزهار بنفسجية ، والثمرة فقيرة مع زوائد صفراء اللون .

Compositae العائلة المركبة
*Sonchus oleraceus* L. **الاسم النباتى**
Sowthistle **الاسم الإنجليزى**
الجعضيض **الاسم العربى**

## Description

Annual herb, stem hollow, branched, usually glabrous, sometimes the leaves glabrous, lower leaves undivided with narrowly winged petiole, the upper larger, pinnatisect, base auriculate. Flowers ligulate, yellow, achenes oblanceolate, rugose, pappus.

**الوصف:** حشيشة حولية ، الساق مجوفة – قائمة ، والأوراق متبادلة وجالسة أذينية بها تفصيص غائر والفصوص مسننة و تتجمع الأزهار فى نورات دالية متفرعة أو خيمية ، البتلات صفراء شريطية الشكل و الثمرة بنية إلى بنية محمرة بها 3 أوجه مضلعة مع خصلة من الشعيرات البيضاء المستديمة مع البذرة.

Convolvulaceae **العائلة العليقية**
*Convolvulus arvensis* L. **الاسم النباتى**

Field bindweed | الاسم الإنجليزى
العليق | الاسم العربى

## Description

Perennial twining glabrous herb, with rhizomes penetrating deeply into the soil. Leaves hastate to linear, entire. Peduncle 1–3 flowered, sepals scarious-margined. Corolla white or pinkish, style 1, capsule 2–4 seeded.

الوصف :نبات معمر ذو ساق متسلقة أو مفترشة ولها ريزومات تنفذ فى التربة، الأوراق متبادلة ومعنقة و بها زغب، والورقة مثلثة وقمتها وحادة وقاعدتها قلبية إلى سهمية الشكل، ويحمل البرعم من 1 إلى 3 زهرة ويحمل الزهرة عنق أسطوانى ، سنبلات والكأس به 5 سبلات بيضاء ، الثمرة غشائية الحافة والبتلات 5 فصوص مكونة شكل القمع ولونها من الأبيض إلى البنفسجى مع بعض الاحمرار و الثمرة كبسولة وتحتوى على بذور )من 2 إلى 4.(

Cruciferae | FŇŴ ŽŀFžŀŭŷžŀ
*Capsella bursa-pastoris* (L.) *Medik.* | ƷÃŭ النباتى
Shepherd's purse | الاسم الإنجليزى
كيس الراعى | الاسم العربى

## Description

Annual erect herb; leaves alternate, clasping the stem, the margin entire or toothed, sagittate, basal leaves in a rosette, petiolated, lobed, often with large terminal lobe, upper leaves sessile, entire. Flowers in terminal racemes, elongated in fruit, stalked; calyx 4 sepals, minute, corolla 4 petals, white, longer than sepals. Pod, obcordate, flat, 2-celled, each cell with 8–12 seeds, seeds yellow light brown.

الوصف :حشيشة حولية ، الساق مستقيمة خالية من الشعر ذات تفريع قاعدى غزير والأوراق متبادلة ومطوقة للساق وحافة الورقة إما كاملة أو بها تسنين وتأخذ الأوراق السفلى الشكل الوردى لتزاحمها حول الساق مع تفصيص والفص الطرفى كبير –الأوراق العليا جالسة غير مفصصة والأزهار رأسية وطرفية ومعنقة وللزهرة 4 سبلات دقيقة الحجم و 4 بتلات بيضاء اللون وأطول من السبلات والثمرة خردلة قلبية الشكل ومكونة من كربلتين وبكل كربلة من 8 إلى 12 بذرة والبذرة صفراء إلى بنية فاتحة.

Cruciferae | FŇŴ ŽŀFžŀŭŷžŀ
*Coronopus squamatus* (Forssk.) Aschers | dăŀŭŞžƷÃŭ

Watercress **الاسم الإنجليزى**
حرّى **الاسم العربى**

## Description

Annual or biennial small herb, stem procumbent, glabrous, starting with a dense rosette of pinnatifid dark green leaves. Lower leaves pinnatipartite with pinnatifid narrow segments, upper leaves pinnatisect. Inflorescence short axillary racemes crowded in fruit. Petals minute and white. Fruit reniform short pedicelled to sessile, strongly reticulate or verrucose silicula, consisting of 2 compressed to globose indehiscent nutlets.

**الوصف :** حشيشة حولية أو ثنائية الحول عريضة الأوراق، ذات ساق مفترشة، عارية من الشعر، تتجمع حولها الأوراق الريشية التجزئ الخضراء الداكنة حيث تأخذ الشكل الوردي .الأوراق السفلى ريشية التفصيص تتجزأ إلى وريقات ريشية ذات فصوص ضيقة، الأوراق العليا مشقوقة ريشيا حتى العرق الوسطى.النورات راسمية قصيرة ومتزاحمة .بتلات التويج دقيقة وبيضاء اللون – الثمرة كلوية الشكل وشبكية أو خردلة مجعدة الأسطح ولها حامل قصير إلى جالسة وتحتوى الثمرة على 2 بندقة كروية الشكل ولا تتفتح عند النضج.

Cruciferae FŇMJ ŽiFaŬjŽi
*Raphanus raphanistrum* L. **الاسم النباتى**
Wild radish, white charlock **الاسم الإنجليزى**
فجل برى **الاسم العربى**

## Description

Annual herb, stem erect, branched. Stem and leaves covered with stiff hairs; leaves alternate, sessile, the margin irregularly toothed or serrate, blade more or less lanceolate (sometimes lobed), basal leaves petioled, with a large terminal and smaller lateral lobes. Flowers in terminal racemes, peduncle longer than the calyx. The calyx has 4 sepals, linear with stiff hairs, corolla has 4 petals, light yellow with purple to cream color and their veins colored. Fruit loment, beaked, with a lower seedless part, slender, and an upper part thick with 3–8 seeds, constricted between them, beak hairy, seedless.

**الوصف :** حشيشة حولية عريضة الأوراق، الساق مستديرة ومتفرعة والأوراق مغطاة بشعر خشن ومتبادلة وجالسة على الساق وحوافها مسننة تسنين غير منتظم أو مشرشرة وتأخذ الشكل الرمحى ويستدق الطرف بوضوح أو غير واضح، وقد تتجزأ الورقة إلى عدة فصوص على جوانبها صغيرة الحجم، تتجمع الأزهار فى نورات راسمية وللنورة عنق طويل وأطول من كأس الزهرة وللكأس أربع سبلات خيطية الشكل ذات شعر خشن وللتويج أربع بتلات ذات لون أبيض إلى أصفر خفيف مع عروق أرجوانية إلى كريمية اللون والثمرة قرن ذو منقار طويل شعرى ولا ينفتح القرن عند النضج ويحتوى على عدة بذور من 3 إلى 8 وتظهر على القرن إختناقات عند موضع البذور.

Cruciferae FŇMJ ŽiFaŬjŽi
*Sinapis arvensis* L. **الاسم النباتى**

Wild mustard, charlock — الاسم الإنجليزى
كبر– قرله – الخردل البرى — الاسم العربى

## Description

Annual herb, stem stiff at the base, erect. Leaves alternate, almost sessile, margin toothed; shape lanceolate, basal leaves petioled, toothed, lobed, with a large terminal lobe. Flower in terminal racemes, 4 sepals, 4 petals, yellow. Pod with 6–12 seeds. Seeds globose, brownish black.

**الوصف :** حشيشة حولية ، الساق مستقيمة ومتفرعة وبها شعر خشن عند القاعدة و الأوراق متبادلة ومسننه – الأوراق السفلى معنقة ومشعرة وبها تجزىء بسيط ومموجة أو تتجزأ حتى العرق الوسطى – الأوراق العليا قصيرة العنق أو جالسة والأزهار تتجمع فى نورات وبتلاتها الأربعة صفراء اللون والقرن به من 6 – 12 بذرة والبذرة كروية الشكل وبنية الى بنية مسودة .

Cruciferae — FNÑU ŽiFźlüqŽi
*Sisymbrium irio* L. — الاسم النباتى
London rocket — الاسم الإنجليزى
فجل الجمل — الاسم العربى

## *Description*

Annual herb, stem erect, branched. Leaves alternate, petiolated, lyrate-cleft into oblong lobes with a large terminal lobe. Flowers in dense terminal clusters, petals pale yellow. Stem elongates as fruit is formed. Pod erect, thin, constricted between seeds. Seeds minute, globose, brownish or yellowish.

**الوصف :** الســاق مستقيمة متفرعة وكثيرة التفريع ، وتستدق عند حمل الأزهار و الأوراق متبادلة على الساق ، الأوراق السفلية معنقة ومشقوقة ريشيا حتى العرق الأوسط للورقة ونصل الورقة مفصص تفصيص جائر وغير منتظم ، والأزهار بتلاتها صفراء أو شاحبة اللون ، وتتجمع فى نورات راسمية مشطية والثمرة كبسولة أو خردلة مستقيمة مكونة شكل قرن خيطى و البذور دقيقة الحجم وبيضية الشكل وهى إما بنية أو مصفرة.

Euphorbiaceae — العائلة السوسبية
*Euphorbia helioscopia* L. — الاسم النباتى

Sun spurge — الاسم الإنجليزى

سعدة — الاسم العربى

## Description

Annual herb, erect stem, glabrous, round, with milky sap. Leaves alternate, their margin serrate and their shape obovate, base cuneate, apex round, notched or acute, the lower leaves petioled. Flowers in terminal cymes, consist of a cup-shaped involucre including several male flowers and a single central female flower. Fruit of 3 carpels each with one seed.

**الوصف :** حشيشة حولية ذات ساق مستقيمة سميكة وخالية من الشعر وتحتوى على سائل لبنى والأوراق ملعقية الشكل ذات حواف مسننة تسنينا دقيقا والأوراق السفلية معنقة ومتبادلة ومتساقطة والعلوية متقابلة وجالسة والأزهار تتجمع فى نورات خيمية تحمل على أعناق طويلة "غالبا 5 "ويتفرع العنق من أعلى إلى 2 أو 3 أفرع وتحاط بالأوراق العلوية الجالسة وتأخذ النورة شكل فنجان وبداخلها العديد من الأزهار المذكرة وفى المركز زهرة واحدة مؤنثة مكونة من مبيض وقلم طويل وتتكون الثمرة من 3 كرابل وتحتوى على 3 بذور .

Fumariaceae

*Fumaria* spp. — الاسم النباتى

Small white fumitory — الاسم الإنجليزى

حشيشة الصبيان — الاسم العربى

## Description

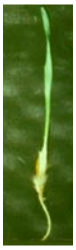
Glabrous herbs, stem delicate, branched from the base. Leaves alternate, petiolate, leaf segments narrowly linear to almost capillary lobes, lobes flat acute. Inflorescence in short few flowered racemes, the flower shortly pedicelled, the calyx from 2 minute sepals, corolla from 4 white or pinkish-white petals with a dark red blotch at the base, 6 stamens.

**الوصف :** حشيشة حولية ذات ساق خالية من الشعر رهيفة ومتفرعة من أسفل، الأوراق متبادلة، معنقة، مفصصة تفصيص ضيق وخيطى، خالية من الشعر .تتجمع الأزهار فى بضع نورات قصيرة راسمية وتكون الزهرة وحيدة التناظر حيث الكأس مكون من 2 سبلة دقيقة الحجم، وتويج من 4 بتلات ذات لون أبيض إلى الوردى وفى قاعدتها بقعة حمراء والبتلة الخلفية لها شكل المهماز ، وبها عدد 6 أسدية.

Gramineae — [illegible]

*Avena fatua* L. — الاسم النباتى

| | |
|---|---|
| Spring wild oats | الاسم الإنجليزى |
| زمير | الاسم العربى |



Description

Annual grassy weed. Stem reaches 120 cm in length, hairs are found in the base of the blade. Panicle in this species is symmetrical; lemma hairy; all the spikelets (usually 3) are awned; spikelets disarticulating from each other and from the glumes at maturity; grains falling off one by one at maturity.

ϘΝÜŽi5ƹ oÜ Cǝŭң–Ə$ɟ$ç –ɳcŽi5ƹ Ғǰ ŲΝ ҒʒΝB ƹ ΣÜ ƨ ŭ dŽDẋŽƨ Ü: Ʀ Ƌ DŽ
ҒЖǮk ҒŊŽi ˜ DŽ γƋ sŽi ϘΝŲ dŽΝ ҒŽɟƨ ŭ–ΝC ϘDŽ–Ҕ ! ĭ Ƨ 120 dŽiÜŽDŽγƋ lj
γƋ ƨɜc| ẋ 4 dŽγƋ ɜϘ ÜƄƹ ù DŽ 3 ǝŲΝ Ғŝб γÜ γÜŽi
–ɳCϘDŽ ΥҒ sŽiϘΝ ŰÜЌÜƎ ɳŽiÜҒ ɳ 5Ν ҒŝƄŽiù DŽ

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|---|---|
| Gramineae | ҒΝŽiҒŭŽi |
| *Avena sterilis* L. | الاسم النباتى |
| Sterile oats | الاسم الإنجليزى |
| زمير | الاسم العربى |

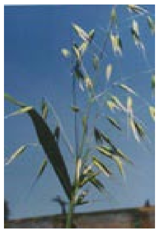
**Description**

Panicle one-sided and larger than the panicle of the previous wild oat species. Spikelets have 2 awn florets and an uppermost sterile spikelet that is not awned; spikelets disarticulating as one unit only from glumes at maturity; pedicel of the uppermost spikelet glabrous.

**الوصف :** النورة دالية تخرج من جانب واحد وأكبر فى الحجم من سابقتها وبالسنيبلات عادة 2 حبة مسفاة والثالثة العلوية عادة عقيمة و غير مسفاة وحبوب السنبلة تنفصل معا كوحدة واحدة عند النضج ويوجد شعر على عصافات الأزهار السفلى أما العلوية فليس بها شعر.

| | |
|---|---|
| Gramineae | ҒΝŽiҒŭŽi |
| *Avena sativa* L. | الاسم النباتى |

Oats الاسم الإنجليزى
شوفان الاسم العربى



## Description

Panicle symmetrically shaped and larger than the panicles of the previous two wild oat species. Spikelets large, mostly 2-flowered with two unequal awns not readily separating from the glumes. Lemma glabrous.

**الوصف :** النورة دالية متماثلة الشكل وحجمه ا أكبر من النوعين السابقين . وعدد الحبوب بالسنبلة أثنين فى العادة بها 2 سفا غير متساويتين فى الطول قد تصل إلى ثلاث .ولا يوجد شعر على عصافات "الحبتين" لا تنفصل الحبوب عن السنبلة عند النضج .

Gramineae [illegible]
*Lolium* spp. الاسم النباتى
Ryegrasses الاسم الإنجليزى
الصامة الاسم العربى

## Description

Annual tufted robust grasses. Culms stiff. Leaf blades acuminate. Inflorescence, rigid spike. Lemma of lower flower very turgid at maturity, awned or awnless.

**The more common species:**

***Lolium perenne* L.** (rigid ryegrass): Culm branched. Spikelets 4–12 flowered, lemmas awnless. Glume shorter than spikelet.

***Lolium multiflorum* Lam.** (Italian ryegrass): Culm not branched. Spikelets 10–20 flowered, awned. Glume shorter than spikelet.

***Lolium temulentum* L.** (poision ryegrass): Culm not branched. Spiklets 6–8 flowered, awnless. Glume longer than spikelets.

**الوصف :**حشيشة نجيلية ذات ساق مستقيمة خالية من الشعر يصل طولها من 50 إلى 100 سم أو أكثر – الجزء السفلى من الساق يتميز باللون الأحمر والأوراق متبادلة جالسة عند قاعدة الساق وتتكون الورقة من نصل وغمد بينهما لسين صغير وأذينتان والسطح الخارجى للنصل شديد اللمعان وتتجمع الأزهار فى سنابل طرفية وتوجد السنيبلات بالتبادل على محور السنبلة الخشن – السنيبلة بها 20 زهرة مستطيلة إلى رمحية الشكل ومغلقة بالعصافتان ويختلف حجمها حسب النوع.

[illegible] :-

*Lolium perenne* L.

السنيبلات غير مسفاة وعدد الأزهار من 4 إلى 12 زهرة .

2. *Lolium multiflorum* Lam.

السنيبلات مسفاة والسفا طويلة ، عديدة الأزهار من 10-20 زهرة .

3. *Lolium temulentum L.*

السنيبلات مسفاة والسفا قصيرة يصل طولها إلى مثل أو أقصر من عصافات الزهرة وحجم الحبة أكبر من الأنواع الأخرى وأقل في عدد الأزهار من الأنواع الأخرى.

Gramineae — العائلة النجيلية

*Phalaris paradoxa* L. — الاسم النباتى
Bristle-spiked canary grass, hood canary grass — الاسم الإنجليزى
فلارس "شعير الفار" — الاسم العربى

## Description

Annual grass, stem erect, sometimes branched. Leaves linear, ligule long and scarious. Spikelets 5–7 flowered, all sterile expect one fertile. Glumes of the fertile flower acute, toothed, not winged.

**الوصف** :حشيشة نجيلية حولية. الساق مستقيمة أحيانا متفرعة. الأوراق شريطية اللسين طويل غشائى. السنيبلات من 5 – 7 أزهار عقيمة عدا واحدة خصبة. القنابع للأزهار الخصبة مدببة ومسننة وغير مجنحة .

Gramineae — العائلة النجيلية

*Phalaris minor* Retz. — dzǓǗźiƸÃü
Little seed canary grass, lesser canary grass — الاسم الإنجليزى
شعير الفار — الاسم العربى

## Description

Like the preceding species. Number of flowers in spikelets 3–5, sterile expect one fertile. Glumes of the fertile flower few, tooth-winged.

الوصف :**مثل النوع السابق. عدد الأزهار بالسنبلة 3 – 5 عقيمة عدا واحدة. القنابع للأزهار الخصبة قليلة التسنين مجنحة .**

Gramineae العائلة النجيلية

*Poa annua* L. الاسم النباتى
Annual meadow-grass الاسم الإنجليزى
قمح العصافير الاسم العربى

## Description

Annual, bright green grass, stem erect or prostrate, glabrous and smooth. Leaf blades narrowly linear, upper sheath longer than its blade. Spikelets sessile with scarious ligules, inflorescence contains 5–8 florets, awnless, open panicle, pyramidal shape.

**الوصف :**حولية نجيلية، الساق قائمة أو مفترشة .الورقة شريطية والنصل ضيق وغمد الورقة العليا أطول من النصل وللورقة لسين غشائى .النورة سنبلة مفتوحة هرمية الشكل والسنيبلة جالسة تحتوى على 5 – 8 زهيرات غير مسفاة .

Gramineae العائلة النجيلية

*Polypogon monspeliensis* (L.) Desf. الاسم النباتى
Beard grass DŏNMŏāŭƐŏĀŭ
ديل القط الاسم العربى

## Description

Annual grass, stem glabrous, erect. Leaf blades narrow, dark green; ligule long, scarious, acute point. Flowers in cylinder, dense, soft panicle. Spikelets with long-awned glumes and lemmas.

**الوصف :**حولية نجيلية ذات ساق مستقيمة - خالية من الشعر – نصل الورقة رفيع أخضر داكن .اللسين غشائى طويل وتتجمع الأزهار مكونة سنابل تأخذ الشكل الأسطوانى لتزاحم السنيبلات – ذات سنبيلات مسفاة بسفا طويل على القنابع والعصيفات.

| | |
|---|---|
| Leguminosae | **العائلة البقولية** |
| *Medicago intertexta* (L.) Mill. | **الاسم النباتى** |
| Medic | *DǎNMšäŭƸĀŭ* |
| **النفل** | **الاسم العربى** |

## Description

Annual, prostrate, branched herb. Leaves trifoliate, petiolate and stipulate. Leaflets small, obovate to rhomboidal, serrate. Flowers in axillary, few flowered racemes (1–3), small, yellow, papilionate. Pods villous, globose. Seeds large, kidney-shaped, black color.

**الوصـف** :حشيشة حولية متفرعة مفترشة ذات أوراق مركبة متفرعة ثلاثية الوريقات لها عنق وأذينات .الوريقات بيضية الشكل إلى معينة مسننة . النورة إبطية راسمية 1-3 زهرة والبتلات صفراء والثمرة :قرنة لولبية زغبية كروية الشكل والبذرة كبيرة كلوية الشكل سوداء اللون .

| | |
|---|---|
| Leguminosae | **العائلة البقولية** |
| *Melilotus indica* L. | **الاسم النباتى** |
| Sweet clover, India melilot | **الاسم الإنـجليزى** |
| حندقوق | **الاسم العربى** |

## Description

Annual herb. Stem erect, branched. Leaves alternate, trifoliate. Leaflets obovate or oblong dentate, serrate in the upper half. Flowers in axillary racemes (20–30), papilionate, yellow. Legume small, globose. Seeds yellow, small.

**الوصـف :**حشيشة حولية ، الساق مستقيمة متفرعة والأوراق مركبة من 3 وريقات معنقة والوريقة بيضية الشكل أو أهليجية ، والجزء العلوى للوريقة مسننة والأزهار صغيرة الحجم صفراء فراشية فى نورات راسمية عديدة الأزهار )20-30( والثمرة قرن مستديرة والبذور صفراء صغيرة.

Leguminosae — العائلة البقولية
**الاسم النباتى** *Vicia monantha Retz.*
**الاسم الإنجليزى** Syrian vetch
**الاسم العربى** دحريج

## Description

Annual herb, stem erect or procumbent, much branched below. Leaves short-petioled, stipulate, climbing with 5–8 pairs of leaflets and a terminal branched tendril. Leaflets oblong–linear, sparingly hairy. Inflorescence in axillary racemes, 2–4 flowers, rarely 1 or 5, pedicelled flower violet–blue; corolla from 1.5 to 2 cm. Pod oblong, compressed, glabrous, yellow at ripening. Seeds spherical, brownish, smooth.

**الوصف :** حشيشة حولية ذات ساق قائمة أو متسلقة بالمحاليق – غزيرة التفريع من أسفل .الأوراق ذات أعناق قصيرة، أذينية، والورقة مركبة من 5 – 8 أزواج من الوريقات مع محلاق طرفى للورقة متفرع . الوريقات مطاولة ضيقة ومشعرة .النورات إبطية راسمية بها من 2 – 4 زهرة ونادرا ما تكون 1 أو 5 أزهار وبتلات التويج بنفسجية إلى زرقاء من 1.5-2 سم .الثمرة قرن مطاول وخالى من الشعر ولونه أصفر عند النضج .البذور كروية وملساء بنية .

Malvaceae — العائلة الخبازية
**الاسم النباتى** *Malva parviflora* L.
**الاسم الإنجليزى** Cheese weed, little mallow
**الاسم العربى** خبيزة

## Description

Annual herb, stem branched, prostrate or sub-erect. Leaves alternate, long-petiolate, stipulate, orbiculate–cordate, palmately shallow-lobed, dentate. Flowers on short, axillary peduncles, solitary or in pairs or a number of them crowded at the nodes. Flowers small, each with an epicalyx of 3-lobed, small, linear scales. Sepals 5, united, 5-lobed from about the middle. Petals 5, free, white or bluish, as long as or longer than the calyx. Fruits schizocarpic.

**الوصف :**حولية ذات ساق متفرعة مفترشة أو شبه قائمة الأوراق متبادلة وتأخذ الشكل الدائرى فى الجانب الخارجى مسننة ولها أعناق طويلة .الأزهار فى مجموعات صغيرة من 2 إلى 5 زهرة وللزهرة عنق قصير وبها 3 تحت كأس خيطية وأقصر من الكأس حيث سبلات الكأس كبيرة من خمسة فصوص .البتلات بنفسجية اللون أو بيضاء والثمرة قرصية عديدة الكرابل ولونها بنى والبذرة كروية الشكل .

العائلة الحماضية Polygonaceae
**الاسم النباتى** *Emex spinosus* (L.) Campd.
**الاسم الإنجليزى** Prickly dock
**الاسم العربى** ضرس العجوز

## Description

Annual herb, stem branched, erect or sub-erect, often red. Leaves glabrous, alternate, petioled, ovate–cordate, entire. Flowers small, in axillary clusters consisting of pedicellate male and sessile female flowers. Fruit single-seeded nutlet, enclosed within the hardened perianth, which is triangular-shaped, pitted, with recurved, rigid spines.

**الوصف** :حولية ذات سـاق كثيرة التفريع وهى شبه مستقيمة أو مستقيمة – والأوراق متبادلة معنقة والورقة قلبية أو بيضية الشكل وكاملة الحافة .الأزهار صغيرة الحجم وفى تجمعات من الأزهار المؤنثة جالسة والمذكرة معنقة والثمرة مفردة وبندقة ويحيط بها غلاف ثمرى صلد به نقر مثلثة الشكل وعليه أشواك صلدة.

**العائلة** Papaveraceae
dǚĭŝźĭƔĀŭ *Papaver rhoeas* L.
**الاسم الإنجليزى** Corn poppy, field poppy
**الاسم العربى** **أبو النوم – الخشخاش–زغليل**

## Description

Annual herb, stem erect, bristly-hairy, contains a milky sap. Leaves alternate, deeply divided into toothed lobes, the basal leaves petiolated, the upper leaves sessile. Flowers large, solitary, calyx with 2 sepals, corolla with 4 red petals with a dark spot at base. Fruit smooth, oval capsule, glabrous, the top disc of the capsule is flat with 8–12 rays. Seed numerous, very fine, purplish black.

الوصف :حشيشة حولية ذات ساق قائمة ، يوجد عليها شعر رفيع صلد ويحتوى على سائل لبنى . الأوراق متبادلة، الورقة مجزأة تجزئ عميق إلى فصوص مسننة، الأوراق السفلية معنقة والعليا جالسة . الأزهار كبيرة الحجم، فردية ، للكأس 2 سبلة ، وللتويج 4 بتلات لونهم أحمر داكن مع بق ع سوداء فى القاعدة – الثمرة كبسولة ملساء فى قمتها قرص مفلطح مكون من 8 إلى 12 شعاع .البذور عديدة دقيقة الحجم ولونها أسود قرمزى.4

Solanaceae [illegible]
*Solanum nigrum* L. **الاسم النباتى**
***Black nightshade*** **الاسم الإنجليزى**
عنب الديب **الاسم العربى**

## Description

Annual herb, stem erect, glabrous or pubescent. Leaves alternate, petiolate , ovate–lanceolate, entire or undulate. Flowers in axillary cymes, 5 sepals, united; corolla rotate with very short tube, 5-lobed, white. Fruit black, globular berries, many seeded.Seeds ovate, flat. Green fruits poisonous.

**الوصف :** حشيشة حولية ذات ساق مستقيمة ملساء إلى شعرية، الأوراق متبادلة، معنقة، بيضاوية – رمحية متموجة الحافة .الأزهار إبطية – للزهرة كأس من خمس سبلات خضراء متحدة والتويج مكون من أنبوب قصير جدا ذو خمسة فصوص على شكل دائرى وبيضاء اللون – الثمرة عنبة كروية سوداء اللون وتحتوى على عديد من البذور .البذور بيضية الشكل منضغطة .والثمار الخضراء سامة.

*Umbelliferae* **العائلة الخيمية**

***Ammi majus L.*** **الاسم النباتى**
***Common bishop's weed*** **الاسم الإنجليزى**
الخلة **الاسم العربى**

## Description

Annual herb, stem erect, glabrous, branched in the upper part. Leaves divided into 2–3, very variable in growth habit and leaf dissection. Inflorescence in compound umbels, umbel 15–60 rays, every ray from 15 to 20 white florets.

**لوصف** :حشيشة حولية .الساق مستقيمة خالية من الشعر وكثيرة التفريع فى الجزء العلوى والأوراق لها أشكال مختلفة النورة خيمية مركبة من 15 إلى 60 شعاع ويحمل كل شعاع ما بين 15 – 20 زهيرة بيضاء .

**Urticaceae** **العائلة الحريقية**

*Urtica urens* L. **الاسم النباتى**
***Small nettle*** **الاسم الإنجليزى**
الحريق **الاسم العربى**

## Description

Annual, stem erect, 4-angled, branched from the base, with scattered stinging hairs. Leaves petioled, opposite, leaf blade broadly ovate, hairy, margin prominently toothed, leaf petiole longer than blade or as long as blade. Flowers in spike, green perianth without petals, male and female flowers present on the same inflorescence (monoecious). Fruit achene, ovate, flattened, slightly compressed, yellow–green.

الوصف : **حشيشة حولية ، الساق مستقيمة مربعة، تتفرع من أسفل، بها بعض الشعيرات المتفرقة لاسعة، الأوراق معنقة، متقابلة ، نصل الورقة عريض بيضى والحواف مسننة، عنق الورقة أطول أو مساوى لنصل الورقة .النورة سنبلة – الأزهار المذكرة والمؤنثة توجد على نفس النورة بدون بتلات "وحيدة المسكن ."الثمرة فقيرة تأخذ الشكل البيضى مفلطحة خضراء مصفرة.**

## 3.2 Identification of some weed seeds encountering wheat seeds

8 weed species seeds which were identified in wheat seeds, are described. Photos and morphological characteristics depend on shape, colour and hairs were followed according to Kholosy *et al* (2002) and supplied photos by Hassanein. These species are *Avena fatua, Beta vulgaris, phalaris minor, Lolium temulentum, Rumex crispus, Medicago polymorpha*, *Melilotus indica* and *Convolvulus arvensis*.

***Class : Monocotyledoneae***
***Family : I- Gramineae***
***Avena spp***
Grains are oblong, usually with silky hairs, grooved on one face, about 1/3 inch long, and is pale yellowish color.

***1- Avena fatua***

The grain enclosed by the lemmas or hulls, covered with stiff brown hairs and have a ring of rigid brown hairs at base, they bear a stiff awn about an inch which is both twisted and bent

***2- Phalaris minor***

The grains tightly enclosed with the lemma and palea. Glumes compressed, boat – like, each with a prominently winged keel with one – few teeth. Fertile lemma indurate, shortly silky – hairy, with one scale – like, lemma attached near the base

***3- Lolium temulentum***

The grain is slender, brown, boat-shaped, with a deep groove on the inner side, the palea is closely adherent to it, making it about as heavy as a kernel of wheat and difficult to separate from the grain when threshed with it

Class : Dicotyledoneae

***Family : I- Polygonaceae***

***- Rumex crispus***

The seed about 1/12 inch long, triangular – shaped, glossy and reddish – brown to black.

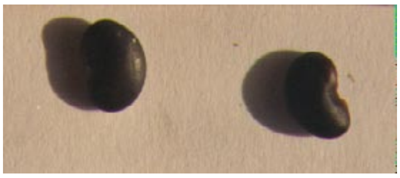
***Family : II. Leguminosae***

***1-Medicago spp***

Seeds are very small, remaining with the pods which act as the disseminates. Pods kidney – shaped or flat – coiled or spiny, globular – coiled .

***1.a- Medicago polymorpha***

The seeds are kidney – shaped, yellowish or tan, 1/8 inch long, somewhat sticky, and not slightly twisted as in the case of alfalfa seed.



***2- Melilotus indica***

The seed is egg shaped, about 1/20 to 1/16 inch long, dark greenish – brown, and has a rough surface .

***Family : III-Convolvulusceae***

***- Convolvulus arvensis***

Seeds are dark grayish brown and covered with raised dots or pimples, about one – eighth of an inch long or 4 mm x 2mm, pear – shaped, rough, with one side flat and the other rounded or somewhat resembles a quarter of a sphere. Fruit is 4 – seeded, irregularly dehiscent capsule.

***Family : IV– Chenopodiaceae***

***- Beta vulgaris***

Fruit indurate and seeds are black, reticulate , horizontal , glossy.

## Reference:

**Kholosy A.S., H.M. Ibrahim and E.E. Hassanein (2000).** Identification of some weed seeds encountering the winter crops. Nile Valley Program for Wild Oats and other winter crops $10^{th}$ Ann. Meet, 22-24 Sept., Cairo, Egypt pp 175 – 182.

**Hassanein E.E., H.M. Ibrahim, A.S. Kholosy, H.T. Al-Marsafy and R.A. Abo Elenin (2000).** Manual of weed identification and control in wheat I.S. B.N. 977-330 – 008-0 $2^{nd}$ print 2000/11836 Al Amin Prentice, Cairo, Egypt.

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# Chapter 4: Weed herbarium

## Introduction

In the simplest sense, the herbarium is a collection of pressed and dried specimens usually arranged according to a classification system. A modern herbarium includes diverse collections of flowering plants from different crops, irrigation & drainage canals, lakes and rivers, in addition to gymnosperms, ferns, mosses, liverworts, lichens, fungi, algae and fossils. Other resources found in the herbarium are microscope slides, photographs, micrographs, seeds, wood specimens, field notebooks and botanical illustrations and paintings. Collections of weeds in a herbarium is acting as a reference center, documentation facility and data storehouse for research and training. The herbarium will provide all data about the weeds in Egypt, identification, geographical distribution, life cycle, synonyms, local names and habitats. Also; the examination of herbarium specimens may indicate that a species contains plants that do not compatible with normally characters which listed in manuals. Therefore, the herbarium probably was helpful for discovering new species or suggesting more further studies. For these reasons weed collections were prepared and kept in 3 weed herbaria belonging to Weed Research Central Laboratory in cooperation with Flora of Egypt section ARC.

## Methodology :

Weed specimens were selected carefully as intact and complete plants especially and identified according to Tackholm (1974).

Small annual species and some herbaceous perennials, underground parts of herbaceous perennials such as rhizomes, roots and bulbs were collected. Representative leaves and reproductive structures are essential. The flowers, fruits and seed of flowering plants are especially important, since most keys for identification use reproductive characters. With large herbs, shrubs and trees, the different kinds of foliage will be helpful. Individuals should be selected to be representative of all phases of the natural population. Insect damaged plant material should be avoided. Plant locations and records habitat information and the characters, which may be change by drying as the color of flowers. Plant specimens were pressed as soon as possible after they are collected. At the end of the day or by the next morning, then the specimens must be transferred (still in their own sheets of newspaper) to a drying press. By this time, the specimens will have relaxed and may be slightly rearranged to improve the quality of the specimens. The final appearance of the specimen depends on how it pressed and dried. Each specimen should be arranged to look more or less natural form and show the essential botanical details. Necessary, overlapping of leaves and other plant parts must be avoided, this caused a slow drying and lower specimen quality. Whenever possible, at least one leaf (or parts of a compound leaf) should be arranged with the lower side uppermost. This will allow observation of the lower leaf surface even when the specimen is mounted. All soil and trash should be removed from underground parts of plant before pressing. Then, Data recorded the time of collection, locality, elevation, information about the plants habitat and collection number. In order to protect plants from insect attacks, they must be dipped in poison after drying. The solution used for this purpose consists of 150 g. mercury chloride and 350 g. ammonium chloride, dissolved in as little water as possible and to this added 10 liters of alcohol 96%. After the plant poisoning may remain in press still a day or two in order not to get wrinkled. Then, it is ready to be mounted.

The process of fixation the plant specimen to a stiff paper by means of gum called mounting. A standard stiff paper is used in the herbaria of Egypt. Finally, a label fixed in the lower right corner of the sheet, this label contains the data of the specimen which includes, the latin name, family name, synonyms, local names, habitat, locality, date of collection, number of collection, name of collector, date of determination and some other special remarks.

## Achievements

Weed herbaria were established by Hassanein et al (1994, 1996 and 1998). Giza weed herbarium was initiated in 1998 and located at Weed Research Central Laboratory, Agricultural Research Center, Giza. Giza herbarium is referred to by the symbol CAIM. It included 54 families classified into 188 genera, 276 species and 819 specimens. Sakha weed herbarium initiated in 1993 season and was located at Sakha Research Station, Kafr El-Sheikh governorate. This herbarium is referred to by the symbol CAIMS It includes 33 families classified into 105 genera, 150 species and 649 specimens. Sids weed herbarium which initiated in 1996 and located at Sids Research Station, Beni Suf governorate. This herbarium is referred to by the symbol CAIMU. It includes 35 families classified into 116 genera, 165 species and 413 specimens

In each of the three herbaria, the families arranged according to Engler`s System and species within each family have been alphabetically arranged. The text of weed specimen are shown as follow.

| Herbarium Taxa | Herbaria | | | Life cycle |
|---|---|---|---|---|
| | Giza | Sakha | Sids | |
| **I- Petridophyta** | | | | |
| **Adiantaceae** | | | | |
| **Adiantum capillus-veneris** | + | | | **P** |
| ***Azolaceae*** | | | | |
| **Azola ssp** | + | | | **P** |
| **Marsileaceae** | | | | |
| **Marsilea aegyptiaca** | + | | | **P** |
| **II- Angiospermae** | | | | |
| **A. Dicotyledoneae** | | | | |
| **Urticaceae** | | | | |
| ***Urtica urens*** | + | + | + | **A** |
| **Santalaceae** | | | | |
| **Thesium humile** | + | | | **A** |
| **Polygonaceae** | | | | |
| ***Emex spinosus*** | + | + | + | **A** |
| ***Polygonum bellardii*** | | + | | |
| ***P. equisetiform*** | + | + | + | |
| ***P. persicaria*** | + | | | |
| ***Rumex crispus*** | + | + | + | **A** |
| ***R . dentatus*** | + | + | + | **A** |
| ***R . vescarius*** | + | + | + | **A** |
| **Nyctaginaceae** | | | | |
| ***Boerhavia diffusa*** | + | + | + | **P** |
| **Aizoaceae** | | | | |
| ***Aizon canariensis*** | + | | | **A** |
| ***Mesemberianthemum crystalinum*** | + | + | + | **A** |
| ***M . forsskalei*** | + | + | + | **A** |
| ***M . nodiflorum*** | + | + | + | **A** |
| ***Trianthema portulacastrum*** | + | + | + | **A** |
| **Portulacaceae** | | | | |
| ***Portulaca grandiflora*** | + | | | **P** |
| ***P. oleraceus*** | + | + | + | **A** |
| **Caryophyllaceae** | | | | |
| ***Dianthus cyri*** | + | | | **A** |
| ***Herniaria hirsuta*** | + | | | **A** |

| Herbarium Taxa | Herbaria | | | Life cycle |
|---|---|---|---|---|
| | Giza | Sakha | Sids | |
| *Spergularia diandra* | + | + | + | A |
| *Stellaria media* | + | + | + | A |
| *Silene rubella* | + | + | + | A |
| *S. conoidea* | + | + | + | A |
| **Chenopodiaceae** | | | | |
| *Atriplex semibacata* | + | | | A |
| *Bassia muricata* | + | | | A |
| *Beta vulgaris* | + | + | + | A |
| *Blackiella inflata* | + | + | + | A |
| *Chenopodium album* | + | + | + | A |
| *C. ambrosioides* | + | | | A |
| *C. ficifolium* | + | | | A |
| *C. murale* | + | + | + | A |
| *Kochia indica* | + | + | + | A |
| *Salsola kali* | + | + | + | A |
| *Sueda pruinosa* | + | | | A |
| *S.vera* | + | | | A |
| **Amaranthaceae** | | | | |
| *Alternanthera sessilis* | + | + | + | A |
| *Amaranthus caudatus* | + | | | A |
| *A. hybridus* | + | + | + | A |
| *A. graceizans* | + | | | A |
| *A. tricolor* | + | | + | A |
| *A. viridis* | + | | | A |
| **Ranunculaceae** | | | | |
| *Ranunculus rionii* | | | + | A |
| *R. sceleratus* | + | + | + | A |
| *R. trachycarpus* | + | + | | A |
| **Nymphaeceae** | | | | |
| *Nymphaea coerulea* | + | | | P |
| **Ceratophyllaceae** | | | | |
| *Ceratophyllum demersum* | | + | + | P |
| **Papavaraceae** | | | | |
| *Argemone mexicana* | + | | | A |
| *Papaver rhoeas* | + | | | A |
| **Nymphaeceae** | | | | |

| Herbarium Taxa | Herbaria | | | Life |
|---|---|---|---|---|
| | Giza | Sakha | Sids | cycle |
| **Fumariaceae** | | | | |
| ***Fumaria densiflora*** | + | + | | **A** |
| ***F. parviflora*** | + | + | + | **A** |
| **Cleomaceae** | | | | |
| ***Gynandropsis gyanandra*** | + | | | **A** |
| **Cruciferae** | | | | |
| ***Brassica nigra*** | + | + | + | **A** |
| ***B. rapa*** | | + | | **A** |
| ***B. turnefortii*** | + | + | + | **A** |
| ***Capsella bursa-pastoris*** | + | | + | **A** |
| ***Cardaria draba*** | + | | | **P** |
| ***Carrichtera annua*** | + | | | **A** |
| ***Coronopus didimus*** | + | | | **A** |
| ***C. niloticus*** | | + | + | **A** |
| ***C. squamatus*** | + | + | + | **A** |
| ***Enarthocarpus lyratus*** | | + | | **A** |
| ***Eruca sativa*** | + | + | + | **A** |
| ***Erucaria hispanica*** | + | | | **A** |
| ***Lepidium sativum*** | | + | + | **A** |
| ***Matthiola longipetala*** | + | | | **A** |
| ***Raphanus raphanistrum*** | + | + | | **A** |
| ***Roripa islandica*** | | + | | **B** |
| ***Sinapis alba*** | + | | | **A** |
| ***S. allionii*** | | + | + | **A** |
| ***S. arvensis*** | + | + | + | **A** |
| ***Sisyimbrium irio*** | + | + | + | **A** |
| ***S. orientalis*** | + | | | **A** |
| **Leguminosae** | | | | |
| ***Acacia nilotica*** | + | | | **P** |
| ***Alhagi maurorum*** | + | | + | **P** |
| ***A. peregrinus*** | + | + | + | **A** |
| ***Hippocrepis cyclocarpa*** | + | | | **A** |
| ***Lathyrus annuus*** | | + | + | **A** |
| ***L. aphaca*** | | + | | **A** |
| ***L. hirsutus*** | | | + | **A** |
| ***Lotus arabicus*** | + | | | **P** |
| ***L . corniculatus*** | + | + | + | **A** |

| Herbarium Taxa | Herbaria Giza | Sakha | Sids | Life cycle |
|---|---|---|---|---|
| *L. polyphyllos* | + | | | **P** |
| *Lygos raetum* | + | + | + | **P** |
| *Medicago aschersoiana* | + | | | **A** |
| *M. intertexta* | + | + | + | **A** |
| *M. polymorpha* | + | + | + | **A** |
| *M. sativa* | + | + | + | **P** |
| *M. truncatula* | + | | | **A** |
| *Melilotus alba* | + | + | + | **P** |
| *M. indicus* | + | + | + | **A** |
| *M. siculus* | + | + | + | **A** |
| *Onobrychis crista-galli* | + | + | + | **A** |
| *Ononis vaginalis* | + | + | + | **P** |
| *Pisum sativum* | | + | | **A** |
| *Prosopis fracata* | + | + | + | **P** |
| *Rhynchosia minima V. memnonia* | + | + | + | **P** |
| *Scorpiurus muricatus* | + | + | + | **A** |
| *Sesbania sesban* | + | | | **P** |
| *Trigonella hamosa* | | + | + | **A** |
| **T. laciniata** | | + | + | **A** |
| *T. stellata* | + | | | **A** |
| *Vicia faba* | + | | | **A** |
| *V. monantha* | + | + | + | **A** |
| *V. sativa* | + | + | + | **A** |
| **Oxalidaceae** | | | | |
| *Oxalis corniculata* | + | | | **P** |
| *O. pes-carpae* | + | | | **P** |
| **Zygophyllaceae** | | | | |
| *Fagonia mollis* | + | | | **P** |
| *Tribulus terrestris* | + | | | **A** |
| *Zygophyllum album* | + | | | **P** |
| *Z. coccineum* | + | | | **P** |
| *Z. simplex* | + | | | **A** |
| *Nitrariaceae* | | | | |
| *Nitraria retusa* | + | + | + | **P** |
| **Euphorbiaceae** | | | | |
| *Chrozophora plicata* | + | | | **A&P** |
| *Euphorbia arguta* | + | + | + | **A** |
| *E. geniculata* | + | | + | **A** |

| Herbarium Taxa | Herbaria | | | Life cycle |
|---|---|---|---|---|
| | Giza | Sakha | Sids | |
| ***E. heliscopia*** | + | + | + | **A** |
| ***E. hirta*** | + | | + | **A** |
| ***E. hypercifolia*** | + | | | **A** |
| ***E. paralias*** | + | | | **P** |
| ***E. peplus*** | + | + | + | **A** |
| ***E. prostrata*** | + | | + | **A** |
| **Sapindaceae** | | | | |
| **Cardiospermum halicacabum** | + | | | **A** |
| **Tiliaceae** | | | | |
| **Corchorus olitorius** | + | | | **A** |
| **Malvaceae** | | | | |
| **Abutilon pannosum** | + | + | + | **P** |
| ***A. theophrasti*** | | + | | **A** |
| ***Hibiscus trionum*** | | | + | **A** |
| ***Malva nicaeensis*** | | + | + | **A** |
| ***M. parviflora*** | + | + | + | **A** |
| ***M. sylvestris*** | + | | + | **P** |
| ***Sida alba*** | + | | + | **P** |
| **Tamricaceae** | | | | |
| **Tamarix nilotica** | + | | | **P** |
| **Onagraceae** | | | | |
| **Epilobium hirsutum** | + | | | **P** |
| ***Jussiaea repens*** | + | | | **P** |
| **Umbelliferae** | | | | |
| **Ammi majus** | + | + | + | **A** |
| ***A. visnaga*** | + | | | **A** |
| ***Anethum graveolens*** | + | | | **A** |
| ***Apium leptophyllum*** | + | + | + | **A** |
| ***Coriandrum sativum*** | + | + | + | **A** |
| ***Torollis radiata*** | + | + | + | **A** |
| **Primulaceae** | | | | |
| **Anagallis arvensis** | + | + | + | **A** |
| **Gentianaceae** | | | | |
| **Centaurium putcherllum** | + | + | + | **A** |
| **Asclepiadaceae** | | | | |
| **Calotropis procera** | + | | | **P** |

| Herbarium Taxa | Herbaria Giza | Sakha | Sids | Life cycle |
|---|---|---|---|---|
| ***Cynanchum acutum*** | + | | | **P** |
| **Primulaceae** | | | | |
| **Anagallis arvensis** | + | + | + | **A** |
| **Rubiaceae** | | | | |
| **Galium tricornitum** | + | + | | **A** |
| ***Crucianella maritime*** | + | + | + | **P** |
| **Convolvulaceae** | | | | |
| **Convolvulus althaeoides** | + | | | **P** |
| ***C.arvensis*** | + | + | + | **P** |
| ***C.fatmensis*** | | | | **A** |
| ***C.lanatus*** | + | | | **P** |
| ***Cressa cretica*** | + | | | **P** |
| ***Ipomoea cairica*** | + | + | + | **P** |
| ***I.dissecta*** | + | + | + | **P** |
| ***I.eriocarpa*** | + | + | + | **A** |
| ***I.hederacae*** | + | + | + | **A** |
| ***I.pes – caprae*** | + | + | + | **P** |
| ***I.Stolonifera*** | + | + | + | **P** |
| ***I.Tricolor*** | + | + | + | **P** |
| **Cuscutaceae** | | | | |
| **Cuscuta campestris** | + | | | **A** |
| ***C.epilimum*** | + | | | **A** |
| ***C.pedicellata*** | + | | | **A** |
| ***C.planiflora*** | + | | | **A** |
| **Boraginaceae** | | | | |
| **Borago officinalis** | + | | | **P** |
| ***Heliotropium bacciferum*** | + | | | **P** |
| **Verbenaceae** | | | | |
| ***Lippia nodiflora*** | + | + | + | **P** |
| ***Verbena officinalis*** | | + | + | **P** |
| **Avicenniaceae** | | | | |
| ***Avicennia marina*** | + | | | **P** |
| **Labiatae** | | | | |
| **Lamium amplexicaule** | + | + | + | **A** |
| ***Marrubium alysson*** | + | | | **P** |
| **Mentha microphlla** | + | + | + | **P** |
| ***Salvia lanigera*** | + | | | **P** |

| Herbarium Taxa | Herbaria Giza | Sakha | Sids | Life cycle |
|---|---|---|---|---|
| **Solanaceae** | | | | |
| **Datura innoxia** | | | + | **A** |
| ***D.tatula*** | + | | + | **A** |
| ***Hyoscyamus alba*** | + | | | **P** |
| ***H.muticus*** | + | | | **P** |
| ***Lycium shawii*** | + | | | **P** |
| ***Nicotiana glauca*** | | + | | **P** |
| ***N.plumbaginifolia*** | + | | | **A** |
| ***Solanum nigrum*** | + | + | + | **A** |
| ***Withania sominfera*** | + | + | + | **P** |
| **Scrophulariaceae** | | | | |
| **Bacopa monnieri** | + | | | **P** |
| ***Verbuscum letournexii*** | + | | | **P** |
| **Veronica anagallis-aquatica** | | + | + | **P** |
| ***V.polita*** | + | | | **A** |
| ***Orobanchaceae*** | | | | |
| **Orobanche aegyptiaca** | + | | | **A** |
| ***O.crenata*** | + | + | + | **A** |
| ***O.ramosa*** | + | | | **A** |
| ***Plantaginaceae*** | | | | |
| ***Plantago cryposides*** | + | | | **A** |
| ***P.coronopus*** | + | | + | **A&.P** |
| ***P. lagopus*** | + | + | + | **A** |
| ***P. major*** | + | + | + | **A** |
| ***P. pumila*** | + | | + | **A** |
| **Compositae** | | | | |
| ***Achillea santolina*** | + | + | + | **P** |
| ***Ambrosia naritima*** | + | + | + | **A** |
| ***Anacyclus alexandrinus*** | + | + | + | **A** |
| ***Artemisia monosperma*** | + | + | + | **P** |
| ***A. vulgaris*** | + | + | + | **P** |
| ***Aster squamatus*** | + | + | + | **P** |
| ***Bidens pilosa v. radiata*** | + | + | + | **A** |
| ***Calendula micrantha*** | + | + | + | **A** |
| ***Caraduus pycnocephalus*** | | + | + | **A** |
| ***Centaurea alexandrina*** | + | | | **P** |
| ***C. calcitrapa*** | | + | | **P** |

| Herbarium Taxa | Herbaria | | | Life |
|---|---|---|---|---|
| | Giza | Sakha | Sids | cycle |
| *Chrysanthemum coronarium* | + | | | A |
| *Cichorium pumilum* | + | + | + | A |
| *Conyza dioscoridis* | + | | | P |
| *C. linifolia* | + | | | A |
| *Cotula cinerea* | + | | | A |
| *Echinopus hussoni* | + | | | P |
| *Eclipta alba* | + | | | A |
| *Ethulia conyjoides* | | + | + | A |
| *Filago desertorum* | + | | | A |
| *Gnaphalium lateo – album* | + | + | + | A |
| *Ifloga spicata* | + | | + | A |
| *Inula crithmoides* | + | + | + | P |
| *Launea nudicaulis* | + | | | P |
| *Matricaria recutita* | + | + | + | A |
| *Onopordum alexandrinum* | + | | | B |
| *Phagnalon rupestre* | + | | | P |
| *Pulicaria arabica* | + | | | A |
| *Reichardia tingitana* | + | + | + | A |
| *Scozonera alexandria* | + | | | P |
| *Senecio aegyptiaca* | + | | + | A |
| *S. desfontanei* | + | + | + | A |
| *S. vulgaris* | + | + | | A |
| *Silybium marianum* | | + | + | P |
| *Sonchus asper* | | + | | A |
| *S.oleraceus* | + | + | + | A |
| *Tagetes minuta* | + | | | A |
| *Urospermum picroides* | + | + | + | A |
| *Xanthium brasilicum* | + | | | A |
| *X.spinosum* | + | | | A |
| **Hydrocharitiaceae** | | | | |
| **Halophila stipulaceae** | + | + | + | P |
| **Potamogetonaceae** | | | | |
| **Potamogeton crispus** | + | | + | P |
| **P. nodosus** | + | | + | P |
| **Liliaceae** | | | | A |
| **Asphodelus fistulosus** | + | | + | P |
| **A. microcarpus** | + | | + | |

| Herbarium Taxa | Herbaria | | | Life |
|---|---|---|---|---|
| | Giza | Sakha | Sids | cycle |
| **Alliaceae** | | | | |
| **Allium roseum v. tourneuxii** | + | | | **P** |
| ***Nothoscordon inodorum*** | + | | | **P** |
| **Amaryllidaceae** | | | | |
| **Pancratium maritimum** | + | | | **P** |
| **Pontederiaceae** | | | | |
| **Eichhornia crassipes** | + | + | + | **P** |
| **Juncaceae** | | | | |
| **Juncus acutus** | + | + | + | **P** |
| ***J. bufonius*** | + | + | + | **A** |
| ***J. rigidus*** | + | + | + | **P** |
| ***J. subulatus*** | + | + | + | **P** |
| ***Gramineae*** | | | | |
| ***Achrachne racemosa*** | + | + | + | + |
| ***Aristida adscensionis*** | + | + | + | **A** |
| ***Astenatherum forsskalii*** | + | | | **P** |
| ***Avena fatua*** | + | + | + | **A** |
| ***A. sativa*** | + | + | + | **A** |
| ***A, sterilis*** | + | + | + | **A** |
| ***Brachiaria eruciformis*** | + | + | + | **A** |
| ***B. reptans*** | + | | + | **A** |
| ***Bromus rigidus*** | | + | + | **A** |
| ***B. repens*** | + | | | **A** |
| ***B. unioloides*** | + | + | + | **A** |
| ***Chloris virgata*** | + | | + | **A** |
| ***Cutandia dichotoma*** | + | | | **A** |
| ***Cynodon dactylon*** | + | | | **P** |
| ***Dactyloctenium aegyptium*** | + | | + | **A** |
| ***Dichanthtium annulatum*** | + | | + | **P** |
| ***Digitaria sanguinalis*** | + | | | **A** |
| ***Dinebra retroflexa*** | + | | + | **A** |
| ***Diplachne fusca*** | + | | | **P** |
| ***Echinochloa colonum*** | + | + | + | **A** |
| ***E. crus galli*** | + | | | **A** |
| ***Eleusine indica*** | + | | + | **A** |
| ***Eragrostisa aegyptiaca*** | + | | | **A** |
| ***Hordeum leporinum*** | + | + | + | **A** |

| Herbarium Taxa | Herbaria | | | Life |
|---|---|---|---|---|
| | Giza | Sakha | Sids | cycle |
| *Imperata cylindrica* | + | | | P |
| *Lolium multiflorum* | + | + | + | A |
| *L. perenne* | + | + | + | A |
| *L. temulentum* | + | + | + | A |
| *Panicum coloratum* | + | | + | P |
| *P. repens* | + | | + | P |
| *Parapholis marginata* | + | | | A |
| *Paspalum dilatatum* | + | | + | P |
| *P. disticum* | + | | + | P |
| *Phalaris minor* | + | + | + | A |
| *P. paradoxa* | + | + | + | A |
| *Phragmites australis* | + | + | + | P |
| *Poa annua* | + | + | + | A |
| *Polypogon monspeliensis* | + | + | + | A |
| *P. semiverticilatus* | + | + | + | A |
| *Saccharum spontaneum. aegyptiacum* | + | | | P |
| Schismus barbatus | + | | + | A |
| *Setaria glauca* | + | | + | A |
| *S. verticillata* | + | | + | A |
| *S. viridis* | + | | + | A |
| *Sorghum virigatum* | + | | | P |
| *Stipa capensis* | + | | | A |
| *Stipagrostis ciliata* | + | | | P |
| *Tretical* | + | | | A |
| *Urochloa panicioides* | + | + | + | A |
| *Vossia cuspidate* | + | + | + | P |
| **Typhaceae** | | | | |
| *Typha domingensis* | + | | | P |
| **Cyperaceae** | | | | |
| *Cyperus articulatus* | + | + | + | P |
| *C. longus* | + | | | P |
| *C. papyrus* | + | | | P |
| *C. rotundus* | + | | | P |
| *Scirpus tuberosus* | + | + | + | P |

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## Abstract :

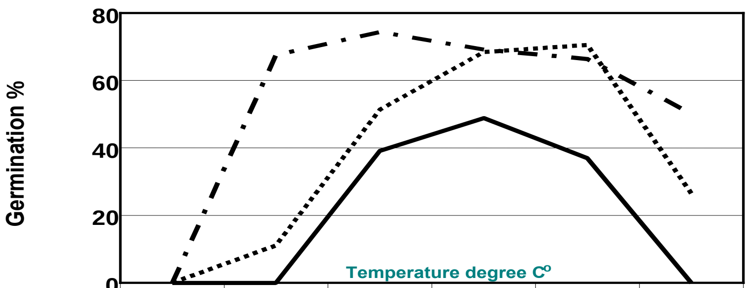
Three weed herbaria were established in the Weed Research Laboratory at Giza, Sakha and Sids. They include weed specimens belonging to 55 families 188 genera and 276 species. Detailed of the three herbaria are included. This look is very useful of people work in weed research and extension.

**الملخص**

تم انشاء ثلاث معاشب فى المعمل المركزى لبحوث الحشائش بمحافظات الجيزة وسخا وسدس. حيث تشمل عائلات تنتمى إلى 55 عائلة نباتية و 188 جنس نباتى و 276 نوع نباتى حيث تفيد هذه المعاشب فى البحوث والارشاد فى مجال مكافحة الحشائش

## Effect of temperature on weed germination

Generally, weed appearance and their activities depend mainly on the variation of daily temperature during summer or winter. Undoubtly, weed germination and its relationship with temperature is the key of weed management. For this reason several studies were carried out in the laboratory and in the field to study this relation. Thus five laboratory experiments were conducted in an incubator to study the effect of temperature on seed germination of wild oat species. Temperature degrees tested were 10, 15, 20, 25 and 30 $^{o}$C (Hassanien *et al*, 1996). Caryopses of wild oat species of *A. fatua*, *A. sterilis* and *A. sativa* were tested. Results indicated that no *A. fatua* seeds germinated at 10 or 30 $^{o}$C. Both *A. sterilis* and *A. sativa,* however, can germinate in a range of temperatures between 10 and 30 $^{o}$C. The optimum temperatures were 20 – 25 $^{o}$C for all species Fig.(1).




| | 5 | 10 | 15 | 20 | 25 | 30 |
|---|---|---|---|---|---|---|
| **A.sterilis** - - - | 0 | 11.1 | 51.4 | 68.4 | 70.5 | 26.5 |
| **A.sativa** -.- | 0 | 67.5 | 74.3 | 69.1 | 66.4 | 50.1 |
| **A.fatua** — | 0 | 0 | 39.1 | 48.8 | 36.9 | 0 |

**Fig.(1):Effect of temperature degree on the germination percentage of wild oats species.**

### Emergence of wild oat seedling

Table (1) mention that all the three wheat cultivars namely Sakha 69, Giza 164, and Beni suef emerged completely after nine days from sowing meanwhile, the emergence of wild oat spp. differed from one species to another. In general, the three species started to emerge later than wheat by 7 days with *Avena fatua* and *Avena sterilis* and 9 days with *Avena stavia* and arrived to complete emergence later by 15 and 17 days from sowing, respectively, Ibrahim *et al* (1993) .

**Table (1): Comparative emergence of wheat and wild oat seedling (pots, Giza, (1992/ 93, 1993 / 94 and 1994 / 95 seasons) .**

| *Emergence (%) | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 17 |
|---|---|---|---|---|---|---|---|---|
| **1992 / 93** | | | | | | | | |
| **Wheat** | | 80 | 88 | 100 | | | | |
| **Wild oat** | | 0 | 4 | 31 | 51 | 72 | 100 | |
| **1993 / 94** | | | | | | | | |
| **Wheat** | 26.3 | 77.5 | 90.0 | 100 | | | | |
| **Wild oat** | 0.0 | 0.0 | 4.3 | 31.3 | 46.3 | 73.8 | 100 | |
| **1994 / 95** | | | | | | | | |
| **a- Wheat** | | | | | | | | |
| **- Sakh 69** | 30 | 70 | 90 | 100 | | | | |
| **- Giza 164** | 27 | 75 | 85 | 100 | | | | |
| **- Beni souf** | 25 | 70 | 87 | 100 | | | | |
| **b- Wild oat** | | | | | | | | |
| **- *Avena fatua*** | | | 9 | 35 | 50 | 80 | 100 | |
| **- *A. sativa*** | | | | 5 | 40 | 60 | 82 | 100 |
| **- *A. sterilis*** | | | 7 | 30 | 45 | 75 | 100 | |

*** Mean of 6 reps .**

Appearance related to winter and summer crops was monitored during two years i.e. 1997-1999 at Mallawy Research Station to study the development of different seasonal weed species (Hassanien *et al* 1998 and 1999). The results indicated that 11 weed species germinated and appeared during the summer season at 22 – 37.4 $^{o}$C temperature (March) and grew well within 8 months. They completed their life cycle at 26.5 $^{o}$C – 33 $^{o}$C temperature (November) and are considered as summer weeds. These are: *Portulaca oleracea, Xanthium spinosum, Sida alba, Corchorus olitorius, Euphorbia prunifolia, Amaranthus sp., Ipomoea sp., Solanum nigrum, Hibiscus trionum, Dinebera retroflexa, and Echinochloa colonum.* On the other hand, 16 weed species germinated and appeared at about 33 $^{o}$C temperature (September and October) and stayed alive to May and June. They completed their cycle at 20 – 32 $^{o}$C temperature, therefore they are considered as winter weeds. These are: *Ammi majus, Anagalis arvensis, Capsella bursa-pastoris, Cichorium pumilum, Beta vulgaris, Rumex dentatus, Medicago polymorpha, Vicia sativa, Melilotus indica, Euphorbia peplus, Chenopoduim album, Avena spp., Phalaris minor, Cuscuta planiflora, and Orobanche crenata*.

Besides summer and winter weeds, two weed species *Plantago major and Coronopus niloticus* can grow well throughout the year, therefore they are considered as perennial weeds.

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**Ibrahim, H.M.; M.K. Zahran E.E. Hassanein and A.S. Kholosy (1993).** Study of wild oat competition with wheat. NVRSRP for wild oats control in cereals and some other winter crops. 1st Ann. Meet. Cairo, Egypt. pp 1-9.

## Abstract

Optimum temperature of the three wild oat species germination was 20-25 $^{o}$C . Avena fatua species can germinate in temperature range between 10-30 $^{O}$C, and mean while the range A. sterilize or A. sativa van germinate in wider temperate serge between 10-30 $^{o}$C. in general wild oat species need 15 days for to compacted germination and wheat a days only. Summer weeds germinate and complete life cycle in 26-33 $^{o}$C and winter weeds need temperature range between 20-32 $^{o}$C .

**الملخص العربي**

درجة الحرارة المثلى لإنبات أنواع الزمير تتراوح ما بين 20-25 م$^{5}$ كما ينبت نوع الزمير A.Fatna فى مدى أضيق من درجات الحرارة (10-30م$^{5}$) (عن النوعين A.sativa , A.Psterilis
كما تنمو الحشائش الصيفية فى مدى 26-30 م$^{5}$ والحشائش الصيفية فى مدى 20-32م$^{5}$ .

# Chapter 6: Weeds / wheat interference

## Introduction

Weeds are a major constraint that affect yield of wheat. The reduction of wheat grain yield was shown as 44 – 60 % by weeds (Dallas and John - 1992; Elian *et al*, 1994; AL – Marsafy *et al*; 1995 and EL – Maghraby *et a*l; 1995). Yadav *et al* (1984) reported that *phalaris spp* when it was allowed to compete with the crop till the end of the season depleted N, P and K by 91.2, 19.4 and 54.6 kg/ha respectively. Moreover researchers reported that wheat grain yield suffer severely from the heavy infestation of *Phalaris spp , Avena fatua , Melilotus spp* and *Medicago spp* as common annual weeds in wheat fields (Harker and Blackshow, 1991 ; Swan, 1971 and Martin and Field, 1988. In Egypt recent weed survey indicated that there are three wild oat species namely *Avena fatua , A . sativa and A . sterilis*. Grassy weeds i.e. wild oat and phalaris spp cause crop yield reduction especially wild oat (Thruston, 1962). The objectives of this investigation were to determine: (a) the period required for weed free maintenance after wheat emergence to produce maximum yield, (b) the length of time which can be allowed for weeds to compete with wheat without reducing the yield, (c) the losses in wheat yield due to weed competition.

## Results and discussion

### 1- Determination critical period of weed/wheat competition

Table (1) show the results of eleven field experiments which were conducted in five field research station in Egypt namely Sakha, EL–Gimmeza, Shandweel, Kom–Osheem, and EL–Nubaria to determine yield losses due to weed/wheat competition (El-Maghraby et al 1994&1995; El-Meshad 1994&1995; Al-Marsafy et al, 1995 and Kholosy and Shabbaan 1998). Dominant weed species were *Avena spp* and *Phalaris spp* as grassy weeds, El-Wekil et al (1996) *Anagallis arvensis, Ammi majus, Beta vulgaris Chenopodium album* and *Sonchus oleraceus* as broad leaved weeds. The removal of all weeds increased significantly grain yield of wheat. The losses due to weeds / wheat competition for all season at different locations ranged between 19.8- 89.4 % compared to weed free for all season due to various densities and species or types of weeds. The best grain yield was obtained by the removal of weeds for all season. Wheat yield tolerated weed competition

**Table (1): Determination yield losses due to weed competition and critical periods of wheat competition in 1993 / 94 to 1997 / 98 seasons period .**

| Weed interference WAS | 1993 /1994 | | 1994 / 1995 | | | 1995 / 96 | | | | 1997/1998 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sakha | El Gimmeza | Sakha | El Gimmeza | Shandweel | Sakha | El Gimmeza | Kom Oshem | Shandweel | Shandweel | Nubariah |
| Weeded all season | 5.41 | 7.28 | 7.00 | 7.39 | 5.67 | 5.61 | 4.23 | 6.38 | 6.29 | 7.08 | 4.70 |
| Weeded for 3 - 4 | - | - | 6.80 | 5.50 | - | 6.05 | 4.15 | 6.12 | 4.00 | 5.88 | 4.70 |
| Weeded for 5 - 6 | - | - | 6.30 | 6.20 | 6.96 | 6.26 | 3.73 | 6.02 | 5.30 | 5.76 | 4.54 |
| Weeded for 7 - 8 | - | - | 6.40 | 7.00 | 6.57 | 5.75 | 3.43 | 5.95 | 5.69 | 6.02 | 4.62 |
| Weeded for 9 - 10 | - | - | 4.50 | 7.43 | 6.52 | 5.95 | 3.00 | 5.60 | 5.92 | 6.01 | 4.50 |
| Weeded for 11 – 12 | - | - | - | - | 5.70 | 6.16 | 2.55 | 3.48 | 5.73 | 6.23 | 4.48 |
| Weeded for 13 - 15 | - | - | - | - | 3.98 | - | - | - | 5.55 | 6.36 | - |
| Weeded after 3 - 4 | 5.03 | 7.98 | 5.8 | 6.88 | - | 6.33 | 4.08 | 4.64 | 6.70 | 7.02 | 4.35 |
| Weeded after 5 – 6 | 4.85 | 7.29 | 6.3 | 6.94 | 6.44 | 5.97 | 3.95 | 3.91 | 6.01 | 6.98 | 4.37 |
| Weeded after 7 - 8 | - | - | 5.9 | 5.95 | 7.17 | 5.03 | 3.43 | 2.14 | 5.43 | 6.11 | 4.40 |
| Weeded after 9 – 10 | 4.47 | 5.26 | 5.7 | 4.82 | 4.55 | 4.60 | 2.98 | 1.19 | 4.23 | 5.89 | 4.29 |
| Weeded after 11 - 12 | 4.25 | 3.62 | - | - | 3.12 | 4.19 | 1.70 | - | 404 | 5.61 | 3.71 |
| Weeded after 13 – 15 | 3.86 | 2.00 | - | 3.58 | 3.47 | - | - | - | 4.08 | 5.21 | - |
| Weedy check | 3.36 | 1.19 | 3.8 | - | 3.17 | 2.48 | 0.45 | 1.64 | 3.29 | 5.68 | 3.76 |
| L. S. D. | 0.37 | 0.89 | 1.19 | 0.71 | 1.22 | 1.14 | 0.42 | 0.93 | 1.53 | N. S. | N. S. |
| Fresh weight g / $m^2$ of weeds | 604.0 | 5446.0 | 2994.0 | 1970.0 | 1524.0 | 2760.0 | 2777.5 | 1032.0 | *825.0 | 785.0 | 1170.0 |

WAS = weaks after sowing

for 4 weeks after planting without any losses in grain yield, the yield however started to decrease gradually with the increase of weed competition period. It was also observed that lengthening weed free period after wheat emergence increased grain yield. The critical period for weed / wheat competition appeared at 3.5 weeks after wheat emerged (i.e. fifth week from sowing). Thus, weed free maintenance after the fifth weeks from sowing is required for optimum wheat yield. This may be due to the ability of wheat plants after 6 weeks to intercept the sunlight. If weeds are left to compete with wheat more than 6 weeks the severity of competition will increase because of the depletion of nutrients from the soil by the increased demands by both weeds and wheat, on the other hand, grassy weeds especially *Phalaris spp.* has a high capacity in the N. P and K depletions (Yadav *et al*, 1984). In addition, at the late ages (more than 6 weeks), *Phalaris spp.* plants exceed wheat plants in height and this will help weeds to intercept the sun light at this stage.

## 2- Ability of wild oat species & wheat competition

Data in table (2) obtained from five experiments conducted by (Ibrahim and. EL- Khanagry (1994)). for 2 successive seasons ( 1994 – 95 & 1995 – 96 ) at Giza, in these experiments twenty seeds of both wild oats and wheat were separately sown simultaneously on Nov. 8th, at depth of 3 cm. Emerged seedlings were counted every other 2 days during a period of 15 days in both seasons. According to treatments in table (2). Results pointed out that plant height of wild oat *spp*. affected the three wheat cultivars. Thus wheat plant height tended to decrease as a result of wild oat spp. competition. *Avena fatua* gave the highest decrease in plant height with Sakha 69, Giza 164 and Beni Suef the three wild oat spp decreased wheat plant height by 8.6, 3.5, 3.5, 7.5, 2.1, 4.0, 8.3, 7.1 and 7.1 percent compared to wheat alone, respectively. Such effect was also clear on number of wheat spikes / plant which decreased by 28, 23,19, 41, 47, 41, 36, 38 and 36 percent with Sakha 69, Giza 164 and Beni suef compared to wheat grown without wild oat respectively.

The effect of wheat on wild oat spp. presented in table (2) showed that wheat varieties decreased plant height and number of panicles of the three studied *wild oats spp*. These results showed that there is an interaction between wild oat spp. and wheat varieties indicating that the decrease in number of wheat spikes/plant due to wild oat species competition was higher than the percentage of the reduction in number of wild oat panicles/ plant due to wheat varieties competition. This mean that wild oats is more competitive than wheat as shown in 1994/95 season results. Naturally, wheat sowing alone gave the highest values of plant growth characteristics than wheat / *Avena spp.*,Thus *A..sativa* / wheat competition gave the lowest values of spikes/row (34) and plant height (95cm); as for *A . fatua* / wheat and *A. sterilis* / wheat competition, the results showed the same effect on the number of spikes / row (39 and 38), spike weight (1.96 and 1.75g) and 1000 kernels weight (33 and33g) ,respectively, but wheat grain yield was78 and 67 g/row, respectively and wheat grain losses was 23 and 24 % respectively Table (2).

It is noticed from Table (2) that *Avena sterilis* had the highest values of both panicles number and tillers (4.5 and 8 /plant, respectively) compared to other species. Furthermore, wheat / *A. sterilis* gave the next high value of both the number of panicles and tillers (4.1 and 7.4 /plant). Meanwhile wheat / *A. sativa* and wheat / *A. fatua* gave the lowest values of number of panicles (2.4 and 3 /plant, respectively) and tillers (5.1 and 4.9 / plant, respectively) Clearly, each of the three *A. species* gave the highest value of tillers and the lowest value of plant height compared to the same species sown with wheat, due to the effect of wheat/*Avena spp.* competition.

Ibrahim et al (1993 & 1994) reported that there is an evident correlation between wild oat density and wheat plant development and production. It is quite clear that the heavier the wild oat density rate the more the decline in wheat grain yield occurred with significance in both seasons. The relative values of grain weight of wheat was 42.20 and 46 when the density of 6 wheat / 6 wild oats was used in 1992/93 and 1993/94 seasons, respectively (table 3).

Wild oat plants when raised with wheat plants simultaneously (i.e. sown in the same time) grow well enough to compete with associated wheat plants and affect – seriously the components of wheat plants development and production in both seasons. Delayed emergence of wild oat seedlings due to late sowing appeared to diminish wild oat / wheat competition and consequently gave a desirable increase in wheat grain yield. On the other hand, wheat / wild oat competition did not affect wild oat plants greatly when both species were sown in the same time in both seasons. When wild oats sowing was delayed for 3 weeks weed plants were weak end unable to cause the adverse effect on wheat plants. This may be due to the smothering effect of the advanced growing wheat plants on the newly emerged wild oat seedlings.

In this connection, Martin and Field (1988) pointed out that wild oat was more competitive than wheat when the two species were sown simultaneously. They added that when wild oat was sown 3 or 6 weeks later than wheat, wheat was more competitive than wild oat and the production of wild oat panicles was prevented.

**Table (2): Effect of *Avena spp.* and wheat varieties on weed /crop competition during 1994 / 1995 and 1995 / 1996 season.**

| Wheat varieties | *Avena spp* | *Avena spp* growth characters | | wheat crop | |
|---|---|---|---|---|---|
| | | Plant height (cm) | no. of panicles / plant | Plant height (cm) | no. of spikes / plant |
| | | **Pots experiment in 1994 / 95 season** | | | |
| | *Avena fatua* | 125.0 | 4.1 | 96.0 | 6.5 |
| Sakh69 | *Avena sativa* | 125.0 | 4.5 | 101.3 | 6.0 |
| | *Avena sterilis* | 113.0 | 4.4 | 101.3 | 7.3 |
| | *Check* | 145.0 | 4.4 | 105.0 | 9.0 |
| Giza164 | *Avena fatua* | 126.0 | 4.7 | 98.0 | 5.0 |
| | *Avena sativa* | 111.0 | 3.4 | 103.8 | 4.5 |
| | *Avena sterilis* | 113.0 | 2.9 | 101.8 | 5.0 |
| | *Check* | 137.0 | 3.7 | 106.0 | 8.5 |
| Beni suef | | | | | |
| | *Avena fatua* | 109.0 | 3.6 | 96.3 | 5.0 |
| | *Avena sativa* | 110.0 | 3.0 | 97.5 | 4.8 |
| | *Avena sterilis* | 125.0 | 3.7 | 97.5 | 5.8 |
| | *Check* | 135.0 | 4.1 | 105.0 | 7.8 |
| L. S. D. | | 6.3 | N. S. | 6.5 | 1.7 |
| C. V. | | 7.6 | 19.8 | 4.5 | 18.8 |
| | | **Field experiment in 1995 / 96 season** | | | |
| | | | | | / row |
| | *Avena fatua* | 116.0 | 3.0 | 95.0 | 39.0 |
| Sakh69 | *Avena sativa* | 129.0 | 2.4 | 95.0 | 34.0 |
| | *Avena sterilis* | 119.0 | 4.1 | 96.0 | 38.0 |
| | Wheat | -- | -- | 94.0 | 41.0 |
| Without competition | *Avena fatua* | 102.0 | 3.9 | -- | -- |
| | *Avena sativa* | 105.0 | 3.4 | -- | -- |
| | *Avena sterilis* | 10.3 | 4.5 | -- | -- |
| L. S. D. | | N. S. | 0.5 | N. S. | N. S. |
| C. V. | | 13.9 | 18.7 | 2.6 | 10.8 |

**Table (3) : Effect of Wild Oat density on yield and yield components of Wheat (Pots, Giza, 1992/ 1993 and 1993/ 1994).**

| Density pattern ( Wheat /wild oats) | 6/6 | 6/5 | 6/4 | 6/3 | 6/2 | 6/1 | 6/0 | 0/6 | Actual value of 100 | L.S.D 5% | C.V |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Wheat** : | Relative values in 1992 / 93 | | | | | | | | | | |
| Ears number | 31.0 | 42.8 | 42.8 | 46.2 | 54.5 | 75.2 | 100 | … | 6.0 | 16.7 | 12.7 |
| Ears weight | 40.7 | 47.9 | 54.7 | 55.5 | 71.2 | 82.6 | 100 | … | 6.8 g | 17.8 | 20.1 |
| Grain weight | 42.2 | 46.4 | 51.7 | 57.4 | 84.5 | 93.4 | 100 | … | 7.1 g | 9.83 | 11.0 |
| | | | | | | | | … | | | |
| | | | | | | | | ---- | | | |
| | | | | | | | | - | | | |
| **Wheat** : | Relative values in 1993 / 94 | | | | | | | | | | |
| Ears number | 53.0 | 75.0 | 90.0 | 69.0 | 90.0 | 90 | 100 | … | 4.3 plt | 11.0 | 9.1 |
| Ears weight | 49.0 | 70.0 | 84.0 | 66.0 | 87.0 | 92 | 100 | … | 9.4 g. | 24.0 | 20.7 |
| Grain weight | 46.0 | 62.0 | 68.0 | 62.0 | 82.0 | 93 | 100 | … | 6.49 g. | 23.0 | 2.8 |
| | | | | | | | | … | | | |
| | | | | | | | | … | | | |
| | | | | | | | | … | | | |
| **Wild oat** : - | Relative values in 1992 / 93 | | | | | | | | | | |
| Plant height | 99.2 | 97.10 | 97.10 | 98.19 | 97.10 | 88.02 | … | 100 | 137.8 | 9.8 | 14.0 |
| Plant weight | 95.4 | 91.48 | 75.18 | 42.34 | 27.74 | 34.55 | … | 100 | cm. | 29.4 | 39.9 |
| Panicles | 97.2 | 95.50 | 62.92 | 60.67 | 48.31 | 31.46 | … | . | 17.12 g. | 25.3 | 12.7 |
| length | 90.3 | 85.54 | 74.70 | 48.19 | 44.58 | 30.12 | … | 100 | 53.71 | 35.1 | 29.7 |
| Panicles | | | | | | | … | 100 | 3.46 g. | | |
| weight | | | | | | | … | | | | |
| | | | | | | | … | | | | |
| | | | | | | | … | | | | |
| **Wild oat** : - | Relative values in 1993 / 94 | | | | | | | | | | |
| Plant height | 93.0 | 91.0 | 87.0 | 85.0 | 77.0 | 75.0 | … | 100 | 140.8 g. | 7.0 | 5.60 |
| Plant weight | 83.0 | 54.0 | 46.0 | 41.0 | 33.0 | 32.0 | … | 100 | 30.39 | 8.0 | 11.0 |
| Panicles | 81.0 | 80.0 | 78.0 | 71.0 | 66.0 | 53.0 | … | 100 | 32.3 | 13.0 | 12.1 |
| length | 64.0 | 55.0 | 50.0 | 33.0 | 23.0 | 11.0 | … | 100 | cm. | 10.0 | 14.0 |
| Panicles | | | | | | | … | | 6.2 g. | | |
| weight | | | | | | | … | | | | |
| | | | | | | | … | | | | |
| | | | | | | | … | | | | |

## 3- Economic evaluation of wheat yield losses due to weed competition:

In a field investigation at Sakha Research Station in 1997, results showed that yield of wheat decreased as the number of weeds per unit area increased; ( table 4 ), thus 50 weeds/m$^2$ decreased yield by 13.2% at a loss of 894 LE/ha, increasing to 34.7% with 100 weeds/m$^2$ at a loss of 2393 LE/ha. In another study in farmers' fields in Kafr El-Sheikh and Sharkia governorates in 1997,(table 5) weed densities of 50 and 100 weeds/m$^2$ caused respective yield losses in wheat fields estimated by 1.61 and 3.95 t/ha in Kafr El-Sheikh and 1.5 and 2.37 t/ha in Sharkia Hassanein et al (2000). In another field experiment at Sakha Research Station in 1994 data not presented, results indicated that 10 and 100 canary grass weeds/m$^2$ decreased wheat yield by 9.3 and 58.1%, respectively El-Maghraby et al 1994. In a pot experiment, a 6 to 6 ratio of the densities of wheat plants to wild oats decreased wheat yield by 54%, while the ratio of 6 wheat to 1 wild oat decreased wheat yield by 7%. Studies also revealed that wild oats which germinate at the time of wheat germination give more reduction in wheat yield than wild oat flushes which germinate later (Ibrahim et al. 1995).

**Table (4): Effect of weed density on wheat productivity at Sakha station 1997.**

| Weed density No./m$^2$ | Wheat yield t/ha | Yield losses | | Value in L.E. |
|---|---|---|---|---|
| | | t/ha | Reduction % | |
| 0 | 9.24 | - | - | - |
| 50 | 8.02 | 1.22 | 13.2 | 894 |
| 100 | 6.03 | 3.21 | 34.7 | 2352 |

**Table (5): Effect of weed density on wheat productivity in Kafr El-Sheikh and Sharkia governorates 1997.**

| Weed density No./m$^2$ | Kafr El-Sheikh | | | | Sharkia | | | |
|---|---|---|---|---|---|---|---|---|
| | Wheat yield t/ha | Wheat yield losses t/ha | Reductio n % | Losses LE | Wheat yield t/ha | Wheat yield losses t/ha | Reduction % | Losses LE |
| 0 | 6.91 | - | - | - | 7.16 | - | - | - |
| 50 | 5.3 | 1.61 | 23.2 | 1180 | 6.11 | 1.05 | 14.7 | 769 |
| 100 | 2.96 | 3.95 | 57.1 | 2895 | 5.69 | 1.49 | 20.5 | 1077 |

*Conclusion*

Wheat yield losses due to weed competition are estimated at 20% in the presence of 50 weed /$m^2$ and 38.8% in the presence of 100 weed / $m^2$; the losses keep on increasing with the increase of weed density as well as with the duration of weed competition.
It is necessary to remove weeds not latter than 4–5 weeks after sowing wheat to maintain wheat productivity.

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## Abstract

During five years from 1993/94 to 1997/98 winter seasons, eleven experiments at five different locations i.e. Sakha, EL–Gimmeza, Shandweel, Kom-Osheem and EL–Nubaria Research Stations were conducted to study the effect of weed/wheat competition on grain yield and to determine the critical period of weed competition. The obtained results indicated that losses due to weed competition ranged between 19.8 to 89.5% compared to all season weed-free treatments. The best grain yield was obtained from all season hand weeding treatment at different locations. The critical period of competition was pronounced in the interval 6 weeks .The optimum yield was obtained when weeds were allowed to compete not more than 4-6 weeks.

The nature of growth and competition between wild oat species and wheat cultivars indicated that at the first three month from sowing wild oat plants were shorter than wheat plant and then increased in length to be higher than wheat thereafter until harvest. Both wild oat and wheat species compete with each other and wild oat was found to be more competitor than wheat. Wild oat species decreased significantly the number of wheat spikes. However wheat / *Avena spp*. competition significantly decreased also the number of panicles of wild oats / plant. The study also showed that :-

1-The heavier the density of wild oat plants present with wheat plants, the more losses in the crop production occurred.

2-The density patterns (wheat / wild oat) as 6/6, 6/5, 6/4, 6/3, 6/2, 6/1, and 6 wheat plants only decreased grain yield by 54, 38, 22, 38, 16, 7 and zero %, respectively in 1993 season.

3- Relationship between number of weeds and wheat yield reduction indicated that 50 weeds/m$^2$ can decrease wheat yield by 20% and increased to 38.8 when weed densities reached 100 m$^2$ or LE 2352/ha. This **mean that there was a** need for weed control in wheat to sustain wheat production.

## الملخص العربي

## تأثير منافسة الحشائش علي محصول القمح

تم اقامة عدد 16 تجربة حقلية خلال سبعة سنوات من 1993 /94 إلي 2000/1999 الموسم الشتوي في 6 مواقع مختلفة )سخا ، الجميزة ، شندويل ، كوم أوشيم ، محطة بحوث النوبارية والجيزة وذلك لدراسة تأثير منافسة الحشائش علي محصول حبوب القمح كذا تحديد الفترة الحرجة لمنافسة هذه الحشائش لمحصول القمح .
أثبتت النتائج المتحصل عليها أن النقص الناتج من منافسة الحشائش لمحصول ا لقمح يتراوح ما بين 19.8- 89.5 %مقارنة بالمعاملة الخالية من الحشائش طوال الموسم، كما وجد أن الفترة الحرجة للمنافسة بين الحشائش والمحصول تنحصر في الأسابيع الستة الأولي من زراعة المحصول .كما تم دراسة طبيعة التنافس بين أنواع الزمير والقمح المنزرع خلال 1994 /95 في أصص وفي عام 1995 /96 في قطع 50×50 سم في الصوب في الجيزة ، وقد أثبتت الدراسة أن أول ثلاثة شهور من زراعة الزمير كانت نباتات الزمير أقصر من القمح ولكنها تزايدت في الطول عن القمح بعد هذه المرحلة وحتى الحصاد .كذلك يوجد تنافس بين كل من الزمير والقمح ,لكن القدرة التنافسية للزمير كانت أعلي منها في القمح حيث أدى التنافس إلي نقص معنوي في عدد سنابل القمح وعدد داليات الزمير .كما تم دراسة العلاقة بين كثافات الحشائش والنقص في المحصول الناتج منها.
ومن الدراسة أيضا وجد الآتي -:

كلما زادت كثافة الزمير المصاحب لنباتات القمح كلما زادت الخسائر في انتاجية المحصول .
التنافس بين كثافات مختلفة من القمح +الزمير بالنسب التالية 6+6، 6+5، 6+4 ، 6+3 ، 6+2 ، 6+1 ، 6 نباتات قمح فقط أدت إلي نقص محصول الحبوب بمقدار 54 ،38 ،22، 38، 16، 7و صفر علي التوالي في موسم 1993.
أن وجود عدد 50 حشيشة/م2 يؤدي إلى نقص في محصول القمح يقدر بمقدار 20 %وتزيد هذه النسبة لتصبح 38.8 %عند كثافة حشائش 100م2 أي ما يصل إلى 2352 جنيه للهكتار مما يستخلص منه ضرورة مكافحة الحشائش في القمح للمحافظة على انتاجيته.

## Chapter 7: Economic and technical studies in weed distribution and its economic impact and management in the new lands

For monitoring weed problem and losses due to weed infestation in different field and horticultural crops in the new lands at El-Bustan, West Nubaria and Bangar El-Sukkar (Sugar beet) area, socioeconomic study was conducted by Nassar et al (1998) and six economic criteria were calculated to evaluate the total revenues, variable cost, gross margin, net benefits and benefits of the two group cases. The study revealed that losses due to weed infestation were 20.3, 21.3, 14.8, 11.5, 20, 6, 19.4 and 18% for wheat, faba bean, tomato, citrus, potato, maize and groundnut, respectively Detailed data on weed distribution the production management practices to compare the farmer infested fields with farmers fields free of weeds in both field and horticulture crops were recorded. The decrease in net benefits was similar to the losses in yield of the latter crops. The main troublesome weeds in winter crops in the new land were *Emex spinosus*, *Lolium spp*. wild oats in wheat and *Orbanche* in faba bean and pea, and *Cenchrus biflurom Protulaca olereacea, Echinochloa colonum, Cynodon dactylon and Amaranthus spp.* in summer crops. Integrated control of such weeds is needed to avoid productivity losses in the following crops due to weed infestation and economic losses. (Tables 1, 2, 3, 4)

**Table (1): Frequency means percentage for different weed species in new land fields, West El-Nubria, 1997/98 seasons.**

| Family | Taxa | Wheat | Faba bean | Clover | Peas | Potatoes |
|---|---|---|---|---|---|---|
| **Chenopodiaceae** | **Beta vulgaris** | **59** | **19** | **6** | **11** | **100** |
| | **Chenopodium spp** | **49** | **74** | **36** | **67** | **100** |
| **Compositae** | | | | | | |
| | **Chichorium pumilum** | **5** | **0** | **82** | | |
| | **Senecio vulgaris** | **10** | **4** | **14** | **33** | **0** |
| | **Sonchus oleraceus** | **21** | **15** | **15** | **44** | **0** |
| ***Cruciferae*** | **Capsella bursa-pastoris** | **3** | **4** | | | **0** |
| | **Sinapis arvensis** | **15** | **4** | **81** | **0** | **100** |
| | **Sisymbrium irio** | **2** | **0** | **0** | **0** | **0** |
| **Gramineae** | **Avena *spp*** | **21** | **33** | **14** | **11** | |
| | **Lolium spp** | **87** | **85** | **80** | **44** | |
| | **Phalaris spp** | **7** | **4** | **0** | **0** | |

**Table (1): cont.**

| Family | Taxa | Wheat | Faba bean | Clover | Peas | Potatoes |
|---|---|---|---|---|---|---|
| | Polypogon monspeliensis | 8 | 0 | | | |
| Leguminosae | Medicago polymorpha | 30 | 11 | | 22 | |
| | Melilotus indica | 18 | 42 | 6 | | |
| | Vicia spp | 23 | 40 | 0 | | |
| Malvaceae | *Malva parviflora* | | 4 | | 56 | |
| *Orobanchaceae* | Orobanche crenata | | 53 | 0 | 0 | |
| Polygonaceae | Emex spinosus | 87 | 63 | 83 | 89 | |
| *Portulaceae* | Portulaca oleracea | | | | | 100 |
| *Primulaceae* | Anagallis arvensis | 28 | 35 | 4 | 56 | |
| *Umbelliferae* | Ammi majus | 9 | 33 | | | |
| Amarathaceae | *Amaranthus spp* | 47 | 35 | 100 | 63 | 69 |
| Chenopodiaceae | Beta vulgaris | 0 | 0 | 0 | 25 | 6 |
| | Chenopodium spp | 0 | 0 | 0 | 88 | 44 |
| Compositae | Bidens pilosa | | | | 13 | 25 |
| | Conyza linifolia | 7 | 0 | 0 | 13 | 25 |
| | Senecio vulgaris | 0 | 0 | | 0 | 38 |
| | Sonchus oleraceus | 0 | 0 | | 25 | 25 |
| | Xanthium strumarium | 7 | | 0 | | |
| Convolvulaceae | Convolvulus arvensis | 54 | 0 | 0 | 38 | 69 |
| *Cruciferae* | Sinapis arvensis | | | | 25 | 38 |
| | Sisymbrium irio | | | | 0 | 0 |
| Cyperaceae | Cyperus esculentus | 7 | 12 | 0 | 38 | 50 |
| *Gramineae* | Chencrus biflours | 54 | 77 | 67 | 63 | 50 |
| | Cynodon dactylon | 68 | 15 | 33 | 63 | 94 |
| | Dactyloctenium agyptium | | 4 | 0 | | |
| | Dinbra retroflexa | | 4 | 0 | | |
| | Echinochloa colonum | 68 | 54 | 67 | | |
| *Portulaceae* | Portulaca oleracea | | 100 | 100 | 88 | 25 |
| *Solanaceae* | Solanum nigrum | 13 | 7 | | 0 | 25 |

**Table (2): Frequency mean percentage for different weed species in winter and summer crops in new land fields, El-Bustan, 1997/98 season.**

**Winter crops**

| Family | Taxa | Wheat | Faba bean | Clover | Peas |
|---|---|---|---|---|---|
| Chenopodiaceae | Beta vulgaris | 0 | 0 | 0 | 3 |
| | Chenopodium spp | 14 | 0 | 33 | 31 |
| Compositae | Senecio vulgaris | 13 | 0 | 13 | 28 |
| | Sonchus oleraceus | 3 | 0 | 0 | 0 |
| | Xanthium strumarium | | | | |
| *Cruciferae* | Sinapis arvensis | 36 | 0 | 29 | 20 |
| | Sisymbrium irio | 59 | 100 | 77 | 64 |
| Gramineae | Avena *spp* | 0 | 0 | 4 | 0 |
| | Lolium *spp* | 42 | 100 | 50 | 75 |
| | Phalaris *spp* | 3 | 0 | 0 | 3 |
| Leguminosae | Medicago polymorpha | 18 | 0 | | 0 |
| | Melilotus indica | 12 | 0 | 0 | |
| | Malvaceae | | | | |
| Polygonaceae | Emex spinosus | 94 | 100 | 38 | 97 |
| Primulaceae | Anagallis arvensis | 0 | 0 | 0 | 17 |

**Table (2): cont.**
**Summer crops**

| Family | Taxa | Potatoes | Maize | Peanut | Citrus | Apple |
|---|---|---|---|---|---|---|
| Chenopodiaceae | Beta vulgaris | 0 | | | 0 | 0 |
| | Chenopodium spp | 17 | | | 25 | 0 |
| Compositae | Chichorium pumilum | | | | | |
| | Conyza linifolia | | 0 | 0 | 50 | 0 |
| | Senecio vulgaris | 6 | | | 13 | 50 |
| | Sonchus oleraceus | 6 | | | 0 | 0 |
| | Xanthium strumarium | | 17 | | | |
| Convolvulaceae | Convolvulus arvensis | | 0 | 0 | 50 | 50 |
| Cruciferae | Capsella buas - pastaris | 0 | | | | |
| | Sinapis arvensis | 17 | | | 50 | 0 |
| | Sisymbrium irio | 44 | | | 0 | 50 |
| Cyperaceae | Cyperus esculentus | | 0 | 11 | 25 | 50 |
| Gramineae | Avena *spp* | | | | | |
| | Chencrus biflours | | 67 | 75 | 100 | 100 |
| | Cynodon dactylon | | | | 59 | 0 |
| | *Echinochloa colonum* | | 48 | 58 | | |

| Family | Taxa | Potatoes | Maize | Peanut | Citrus | Apple |
|---|---|---|---|---|---|---|
| | **Lolium spp** | 56 | | | 0 | 50 |
| **Leguminosae** | **Medicago polymorpha** | | | | 17 | 0 |
| | **Melilotus indica** | | | | 17 | 0 |
| **Malvaceae** | **Malva parviflora** | | | | 13 | 0 |
| ***Polygonaceae*** | **Emex spinosus** | 6 | | | 50 | 100 |
| ***Portulaceae*** | **Portulaca oleracea** | | 100 | 100 | 50 | 50 |
| ***Primulaceae*** | **Anagallis arvensis** | 11 | | | 38 | 0 |
| ***Solanaceae*** | **Solanum nigrum** | | 26 | 5 | 0 | 0 |
| | ***Echinochloa colonum*** | | 48 | 58 | | |

**Table (3): Frequency means percentage for different weed species in winter crops in new land fields, Bangar El-Sokar, 1997/98 seasons.**

| Family | Taxa | Wheat | Faba bean | Clover |
|---|---|---|---|---|
| **Chenopodiaceae** | **Beta vulgaris** | 12 | 29 | 17 |
| | **Chenopodium spp** | 14 | 26 | 14 |
| **Compositae** | **Chichorium pumilum** | 0 | 0 | 35 |
| | **Conyza linifolia** | | | |
| | **Sonchus oleraceus** | 3 | 5 | 20 |
| | **Xanthiuon strumarium** | | | |
| **Convolvulaceae** | **Convolvulus arvensis** | 51 | 40 | 50 |
| **Cruciferae** | **Sinapis arvensis** | 40 | 48 | 53 |
| **Cuscutaceae** | **Cuscuta spp** | | | 25 |
| **Gramineae** | **Avena spp** | | 76 | 9 |
| | **Lolium spp** | | 68 | 35 |
| | **Phalaris spp** | | 16 | 15 |
| | **Polypogon monspeliensis** | 5 | 5 | |
| **Leguminosae** | **Medicago polymorpha** | 13 | 3 | |
| | **Melilotus indica** | 27 | 31 | 40 |
| | **Vicia spp** | 14 | 10 | 5 |
| **Primulaceae** | **Anagallis arvensis** | 13 | 35 | 0 |

**Table (4): Economic evaluation of the effect of weed control on field and horticultural crop (Average of the 3 zones).**

| Crop | Weed infestation | Mean yield (ardab /Fedda) | Total revenue (LE /feddan) | Total costs (LE /feddan) | Net benfit (LE /feddan) | Profitability % |
|---|---|---|---|---|---|---|
| Wheat | Infested | 14.13 | 1560.4 | 1339.2 | 221.2 | 17 |
| | Uninfested | 17.73 | 1995.8 | 1283.7 | 712.1 | 55 |
| Faba bean | Infested | 8.75 | 1750.7 | 1123.7 | 627 | 56 |
| | Uninfested | 11.13 | 2218.6 | 1093.5 | 1125.1 | 103 |
| Clover | Infested | 78.62 | 1152.9 | 1041.3 | 111.6 | 11 |
| | Uninfested | 92.33 | 1385 | 1044 | 4341 | 33 |
| Barley | Infested | 6 | 490 | 1029.5 | -(539.5) | -(52) |
| | Uninfested | 7.5 | 622.5 | 1037 | -(415.5) | -(40) |
| Groundnut | Infested | 14.35 | 1400.6 | 1246 | 154.6 | 12 |
| | Uninfested | 17.5 | 1680.4 | 1174.5 | 505.9 | 43 |
| Maize | Infested | 17.04 | 1233.1 | 1219.7 | 13.35 | 1 |
| | Uninfested | 21.13 | 1582.7 | 1196.7 | 386 | 32 |
| Seame | Infested | 3.4 | 1222.5 | 1054.3 | 168.3 | 16 |
| | Uninfested | 4.21 | 1515 | 1005.8 | 509.3 | 51 |
| Main yield (t/feddan) | | | | | | |
| Winter greenpea | Infested | 2.348 | 1421 | 1123.7 | 297.4 | 26 |
| | Uninfested | 2.825 | 1785 | 1166.5 | 618.5 | 53 |
| Winter tomato | Infested | 10.75 | 2866.3 | 2058 | 808.3 | 39 |
| | Uninfested | 12.5 | 3985 | 2275 | 1710 | 75 |
| Winter potato | Infested | 10.52 | 2991.5 | 2745.8 | 245.6 | 9 |
| | Uninfested | 13.25 | 3469.6 | 2582.5 | 887.1 | 34 |
| Winter onion | Infested | 4.25 | 1424.8 | 1415.5 | 9.3 | 0 |
| | Uninfested | 5.38 | 1794.3 | 1376 | 418.3 | 30 |
| Winter cucumber | Infested | 7.0 | 5600 | 4431 | 1169 | 26 |
| | Uninfested | 9.0 | 6300 | 5180 | 1120 | 22 |
| Winter eggplant | Infested | 7.0 | 2450 | 1671.5 | 778.5 | 47 |
| | Uninfested | 8.0 | 3200 | 1774 | 1120 | 80 |

**Table 4: continued**

| Crop | Weed infestation | Mean yield (ardab /Fedda) | Total revenue (LE /feddan) | Total costs (LE /feddan) | Net benfit (LE /fedda) | Profitability % |
|---|---|---|---|---|---|---|
| Marrow | Infested | 4.61 | 2305 | 1739.3 | 565.7 | 33 |
| | Uninfested | 5.58 | 2702.4 | 1795.7 | 906.7 | 50 |
| Summer tomato | Infested | 11.66 | 3697.3 | 1907.2 | 1790 | 94 |
| | Uninfested | 14 | 4621.3 | 1796 | 2825.3 | 157 |
| Summer potato | Infested | 10.63 | 4206.6 | 2744.4 | 1462.3 | 53 |
| | Uninfested | 12.5 | 5031.6 | 258.7 | 2444.3 | 94 |
| Summer | Infested | 4.25 | 2550 | 1896.5 | 563.5 | 34 |
| Cucmber | Uninfested | 5.25 | 3150 | 1537 | 1613 | 105 |
| Summer | Infested | 6.56 | 2726.9 | 1749.3 | 977.6 | 56 |
| Eggplant | Uninfested | 8 | 3200 | 1741 | 1459 | 84 |
| Pepper | Infested | 4.55 | 2853.5 | 1974.5 | 879 | 45 |
| | Uninfested | 5.5 | 35450 | 180.5 | 1569.5 | 83 |
| | Main yield (t/feddan) | | | | | |
| Citus | Infested | 5.75 | 3750 | 3207.5 | 542.5 | 17 |
| | Uninfested | 6.5 | 4225 | 3028 | 1197 | 40 |
| Melon | Infested | 450 | 1550 | 1441 | 109 | 8 |
| | Uninfested | 560 | 2240 | 1403 | 837 | 60 |
| Sweet melon | Infested | 6.6 | 2772 | 1641.1 | 1157.9 | 72 |
| | Uninfested | 8 | 3360 | 1658 | 1702 | 103 |

## الملخص العربي

تم عمل دراسة لبعض مشاكل الحشائش والخسائر الناجمة عنها في مختلف المحاصيل الحقلية والبستانية بالأراضي الجديدة في البستان وغرب النوبارية وبنجر السكر وتم عمل تحليلات اقتصادية باستخدام ست مؤشرات اقتصادية عن العوائد والتكاليف والعوائد الكلية والعوائد الصافية ولمجموعتين من الحالات .

أفادت الدراسة أن هناك فقد واضح في المحصول ناجم عن تواجد الحشائش في حقول المزارعين مقارنة با لحقول الخالية من الحشائش حيث انحصرت مشاكل الحشائش في المحاصيل الشتوية في حشائش الزمير وضرس العجوز والصامة في القمح والهالوك في الفول والبسلة وحشائش ساندبار والرجلة وأبو ركبة والنجيل البلدي المعمر وعرف الديك في المحاصيل الصيفية وكانت الخسائر تتراوح ما بين 20.3 و21.3 و 14.8 و 11.5 و 20.6 و 19.4و 18 %في محاصيل القمح والفول البلدى والطماطم والموالح والبطاطس والذرة والفول السودانى على التوالى .

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# Unit II
# Weed management

## Chapter 1: Options for weed management strategy in Wheat Introduction

Recently, wheat in Egypt suffers from troublesome weeds especially *Avena* spp *wild oat, Phalaris spp., Lolium sp.* and broadleaf weeds causing great yield reduction. Integrated weed management is needed for solving this problem through testing various options of prevention, cultural practices, crop rotations and the use of current recommended herbicides in research stations and farmer condition to generate suitable weed management packages in wheat as follows:

## 1- Preventing method

### 1.1- Use clean wheat seeds:

Planting clean wheat seeds is very important to prevent introduction of weeds to new fields. Wheat seeds were considered to be the most important agent for the introduction of weeds (Salisbury 1**961).**

Many seeds of weeds species were found to encounter wheat seeds. In studies carried out by many researchers for 400 wheat samples (500 g/sample) by Hassanein et al (1994 and 1995) in Sohag, Salem et al (1996) in Kafr El Sheikh and Kholosy et al (1998) in Behera governorates such weeds were *Avena* spp, *Anagallis arvensis*, *Beta vulgaris*, *Convolvulus arvensis*, *Emex spinosus*, *Lathyrus hirsutus Medicago* spp and *Melilotus indica*. Table (1). The highest contaminated percentage of weed seed samples with *Avena spp* was 30% in Sohag, with *Medicago spp* and *Melilotus* were 25 and 34% , respectively, in Kafr El- Sheikh and with *Emex spinosus* was 25% in Behyra.

Data in Table (2) by Kholosy et al (1999) show that clover in crop sequences had a role on weed control and decreased wheat contamination by weed seeds. Wild oats (*Avena* spp) is a serious problem on a worldwide scale and is commonly spread especially in the new areas, which were free before (Phillipson *et. al*. 1972). This is attributed to continuous cropping with wheat only, moving in seed and straw of cereals (Elliot and Attwood 1970, Wilson 1970 and Elliott, 1972). Thus, cleaning wheat seeds prior wheat sowing is considered as an important measure for weed management in wheat.

**Table (1): Degree of contamination in wheat farmer wheat seed, contaminated % and number of weed seeds / kg of wheat in some governorates.**

| Governorates / Weed species No/kg | Sohag 1993/94 | | Kafr El-Sheikh 1995/96 | Behera 1997/98 | |
|---|---|---|---|---|---|
| | % of Contaminated sample (179) | No. of weed seeds/kg | % of Contaminated sample(150) | % of Contaminated sample (71) | No. of weed seeds/kg |
| *Avena spp.* | 29.6 | 61.8 | 10.2 | 14.8 | 11.0 |
| *Anagallis arvensis* | 0.0 | 0.0 | 2.8 | 0.0 | 0.0 |
| *Beta vulgaris* | 20.4 | 25.0 | 0.0 | 13.0 | 35.4 |
| *Convolvulus arvensis* | 5.2 | 20.0 | 0.0 | 8.2 | 10.0 |
| *Emex spinosus* | 0.6 | 25.0 | 0.0 | 24.6 | 80.1 |
| *Lathyrus hirsutus* | 2.4 | 9.5 | 0.0 | 19.5 | 15.6 |
| *Medicgo spp.* | 4.6 | 15.0 | 25.2 | 2.6 | 8.5 |
| *Melilotus indica* | 4.2 | 113.0 | 33.6 | 2.6 | 5.0 |

## 2- Crop pattern for effective weed management

Some measures of control have been achieved by including forage crops in a crop rotation combined with delayed seeding. While, this method helps to prevent wild oat numbers from increasing, it takes a long time actually to reduce wild oat population (Bowden, 1971). Using an adequate cropping program over 4 years, reduced wild oat populations (Frenandez – Quintanill et al, 1984). In a continuous control of *Avena fatua* every year for 4 years maintained *A. fatua* seedling populations at 3 plants /m$^2$ or less. Failure to control *A. fatua* annually increased weed population > 200 plants / m$^2$ by the fourth year. Population of wild oats increased in wheat / wheat rotation (2000 plants/m$^2$) by the fourth year whereas in canola / barley rotation, population increased only by 40 plants/m$^2$ or less (O'Danovan, 1988). Rotational control techniques are effective mean to reduce infestation of wild oat. Weed management is a control point of coordination of many farm operations.

`` Effective weed management involves the integration of crop sequences with other biological, physical and chemical techniques to promote crop dominance over weeds (El-Akkad, 1994). Rotational management strategies affected the growth of the weed population (Davies et al., 1997). Weed interferes with crop plants by decreasing yields and causing other detrimental effects; thus weed control either by cultural or by chemical methods is therefore an essential measure in crop protection (Schmid, 1997). Reduction in weed effects through adapted crop management (prevention) involves any aspect of management that favors the crop relative to the weed i.e. crop rotations (Bastiaans et al., 1997 and Wu et al., 1999). Weed management has always been a key issue in most agricultural production systems (Kropff and Walter 2000). The objective of the present long – term studies was to study weed control strategy by rotating the winter crops clover, wheat, faba bean and canola with suitable weed control compatible with farmer need and capacity under old and new land conditions where seven crop patterns were used in seven experiments as follows:

**Table (2): Effect of crop sequences on the number seeds of weed species /kg of wheat grain (rotation experiment, at Nubaria Research Station during 1998-99) season.**

| **Preceding winter Crops & weed control treatment** | | Weeds species | | | | |
|---|---|---|---|---|---|---|
| | | ***Avena spp.** | ***Emex spinosus*** | ***Convolvulus arvensis*** | ****Other weeds** | **Total** |
| Wheat | Wheat | | | | | |
| **Sinal** | **Sinal** | **1524** | **9** | **20** | **3** | **1556** |
| **Grasp** | **Grasp** | **1.25** | **28** | **101** | **6** | **136** |
| **Sinal&Grasp** | **Sinal&Grasp** | **24** | **0** | **0** | **16** | **40** |
| **H.W.** | **H.W.** | **585** | **29** | **44** | **21** | **680** |
| **Unweeded** | **Unweeded** | **718** | **109** | **452** | **0** | **1279** |
| **Faba bean** | Wheat | | | | | |
| **Amex + HH** | **Sinal** | **198** | **4** | **5** | **10** | **217** |
| **HH+ Fusilade** | **Grasp** | **6** | **73** | **111** | **3** | **193** |
| **HH+ Grasp** | **Sinal&Grasp** | **15** | **0** | **8** | **0** | **23** |
| **H.H.** | **H.W.** | **119** | **35** | **20** | **0** | **174** |
| **Unweeded** | **Unweeded** | **640** | **49** | **199** | **4** | **892** |
| **Clover** | **Wheat** | | | | | |
| | **Sinal** | **96** | **6** | **12** | **6** | **120** |
| **Three** | **Grasp** | **9** | **35** | **80** | **26** | **150** |
| **Cuttings** | **Sinal&Grasp** | **6** | **0** | **3** | **0** | **9** |
| | **H.W.** | **35** | **22** | **35** | **0** | **92** |
| | **Unweeded** | **45** | **16** | **16** | **0** | **77** |

*** *Avena spp* were *A . fatua and A. sterilis***
**** Other weeds were *Phalaris* sp , *lolium* sp and *Vicia* sp**

## I- Two – Year’s rotations:

In table (3) three field experiments were conducted at Sakha in North Delta (Al Maghraby et al 1994) ,and Mallawi (Hassanein et al 1994), and Shandaweel ( Al- Marsafy et al 1994) in Upper Egypt , to study the effect of preceding crops i.e. berseem, faba bean and wheat and other weed control methods on wheat productivity. The results ensure the benefits of clover as a preceding crop to wheat, thus this crop greatly reduced the amount of wild oat or canary grass associated with wheat planted after clover. The grain yield produced from this treatment was significantly higher than those produced from faba bean/ wheat and wheat/wheat sequences. The use of Grasp in wheat either alone or combined with one hand removal in the first season was found to be with considerable benefit. Similarly, hand removal (twice) in wheat the first year was comparable to other weed control treatments.

On the other hand, the role of preceding summer crops i.e. rice and cotton on weed control and wheat production was also studied in six field trials carried out during 1995/96 in Sakha by Abd El-Hamid et al (1996, 1997) and 1995/96 in Gimmeza by El- Mashed et al (1996, 1997)

Data in table (4) revealed that the fresh weight of annual grassy weeds (Phalaris spp.) greatly increased in wheat preceded by rice compared to that in wheat preceded by cotton. On the other hand, Arelon 50% at the rate of 2.98 L/ha alone or combined with hand weeding once or twice significantly reduced the fresh weight of annual grasses compared to that of the weedy check in wheat preceded by rice or cotton. This significant reduction in weed biomass resulted in a significant increase in grain yield of wheat preceded by rice or cotton. Moreover, wheat yielded significantly more when preceded by cotton than when preceded by rice.

## II- Four-year rotations:

Four rotation experiments in a long – term study were carried out at Shandaweel Res. St., Sohag governorate in Upper Egypt from 1991 / 92 to 1994 / 95 winter seasons (Al-Marsafy and Hassanein, 1993; Al Marsafy et al, 1994; Al-Marsafy and Hassanein, 1995), Mallawi Res. St., El-Minia governorate in Middle Egypt from 1992 /93 to 1994 /95 winter seasons (Hassanein et al 1993, 1994 & 95), Sakha Res. St., Kafr El-Sheikh in North Delta from 1992/93 to 1994/95 seasons (Al-Maghraby et al, 1993; Salem et al, 1995) and El-Nubaria Res. St., in West Delta, El-Behera governorate from 1997/98 to 2000/01 seasons (Kholosy et al 1998, 1999, 2000 & 2001 These experiments were designed as split plot with four replicates as follows: In main plots: there were three winter crops i.e. wheat, clover and faba bean, in addition to canola in El-Nubaria Res. St..In sub plot: there were four or five weed control treatments depending on the crop except with the cutting in clover as shown in tables A,B,C and D.

**Table (3) : Effect of preceding winter crops with different weed control treatments on weeds ($g/m^2$) and wheat grain yield (t/ha)at Sakha, Mallawi and Shandaweel 1993/94) season**

| No | Preceding winter crop & weed control treatments in1992/93 season | | Sakha | | Mallawi | | Shandaweel | |
|---|---|---|---|---|---|---|---|---|
| | | | Fresh weight of weeds ($g/m^2$) | Wheat grain yield (t/ha) | Fresh weight of weeds ($g/m^2$) | Wheat grain yield (t/ha) | Fresh weight of wild oat ($g/m^2$) | Wheat grain yield (t/ha) |
| 1 | Clover | Cutting | 424 | 5.0 | 269 | 4.29 | 625 | 3.5 |
| 2 | Wheat | Unweeded | 1215 | 1.2 | 1404 | 1.78 | 3153 | 1.1 |
| 3 | Wheat | Handweeding (twice) | 909 | 1.5 | 868 | 3.30 | 1707 | 2.2 |
| 4 | Wheat | Grasp or Arelon | 556 | 3.0 | 980 | 3.65 | 2094 | 2.1 |
| 5 | Wheat | Grasp or Arelon+ Handweeding | 406 | 3.3 | 851 | 3.87 | 1480 | 2.3 |
| 6 | Faba bean | Unweeded | 799 | 2.2 | 1491 | 2.19 | 3875 | 1.1 |
| 7 | Faba bean | Handweeding (twice) | 675 | 2.6 | 1305 | 3.74 | 630 | 2.5 |
| 8 | Faba bean | Igran | 624 | 3.8 | 1265 | 3.43 | 3224 | 1.0 |
| 9 | Faba bean | Igran + Handhoeing (once) | 399 | 4.2 | 1154 | 3.75 | 2430 | 2.5 |
| | L.S.D. 5 % | | 306 | 1.0 | | 0.30 | | 0.9 |

**Table (4): Effect of the preceding summer crops and weed control treatments on fresh weight of grassy weeds and wheat grain yield, t/ha at Sakha and Gimmeza and Sakha 1996/97 seasons.**

| Treatments | Sakha 1995/96 | | | | Gimmaza 1995/96 | | | | Sakha 1996/967 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F.wt. of grass, g/m2 | Wheat grain yield (t/ha) | F.wt. of grass, g/m2 | Wheat grain yield (t/ha) | F.wt. of grass, g/m2 | Wheat grain yield (t/ha) | F.wt. of grass, g/m2 | Wheat grain yield (t/ha) | F.wt. of grass, g/m2 | Wheat grain yield (t/ha) | F.wt. of grass, g/m2 | Wheat grain yield (t/ha) |
| | Preceding summer crop | | | | | | | | | | | |
| | Rice | | Cotton | | Rice | | Cotton | | Rice | | Cotton | |
| Arelon | 73 | 4.7 | 5 | 7.6 | 147 | 5.9 | 25 | 7.4 | 14 | 4.5 | 5.0 | 4.8 |
| Arelon + H.W | 45 | 6.8 | 4 | 7.7 | 79 | 6.4 | 6 | 7.8 | 11 | 4.0 | 4.0 | 5.4 |
| Handweeding | 168 | 4.4 | 16 | 7.4 | 159 | 4.5 | 55 | 6.0 | 142 | 3.5 | 16.0 | 5.1 |
| Weedy check | 575 | 3.1 | 124 | 5.1 | 676 | 1.4 | 158 | 4.3 | 294 | 3.4 | 124.0 | 4.3 |
| L.S.D | 49 | 0.56 | 17 | 1.2 | 122 | 0.95 | 31 | 0.81 | 44 | N.S | 16.8 | N.S |

The crop varieties and their agriculture practices were carried out according to the locations. The first three experiments had 64 plots while the fourth one had 80 plots. The plots of the site stayed the same throughout the duration of the trials and maize was sown at all summer seasons.

**Table (A): Crop sequences and weed control treatments in Shandaweel (rotation experiment 1).**

| **1991/92** | | **1992/93** | | **1993/94** | | **1994/95** |
|---|---|---|---|---|---|---|
| **Wheat** | | **Wheat** | | **Wheat** | | **Wheat** |
| 1- Unweeded<br>2- H. weeding twice<br>3- Grasp<br>4- Brominal | → | 1- Unweeded<br>2- H. weeding twice<br>3- Grasp<br>4- Grasp + h. weeding once | → | 1- Unweeded<br>2- H. weeding twice<br>3- Grasp<br>4- Grasp + h. weeding once | → | Unweeded<br>Unweeded<br>Unweeded<br>Unweeded |
| Clover | | **Clover** | | **Clover** | | **Wheat** |
| 1- Unweeded<br>2- H. weeding twice<br>3- Basagran<br>4- Fusilade | → | 1- Unweeded<br>2- H. weeding twice<br>3- Unweeded<br>4- Unweeded | → | 1- Unweeded<br>2- H. weeding twice<br>3- Unweeded<br>4- Unweeded | → | Unweeded<br>Unweeded<br>Unweeded<br>Unweeded |
| Clover | | Wheat | | **Clover** | | **Wheat** |
| 1- Unweeded<br>2- H. weeding twice<br>3- Basagran<br>4- Fusilade | → | 1- Unweeded<br>2- H. weeding twice<br>3- Grasp<br>4- Grasp + h. weeding once | → | 1- Unweeded<br>2- H. weeding twice<br>3- Unweeded<br>4- Unweeded | → | Unweeded<br>Unweeded<br>Unweeded<br>Unweeded |
| Faba bean | | Clover | | **Wheat** | | **Wheat** |
| 1- Unweeded<br>2- H. hoeing twice<br>3- Igran<br>4- Fusilade | → | 1- Unweeded<br>2- H. weeding twice<br>3- Unweeded<br>4- Unweeded | → | 1- Unweeded<br>2- H. weeding twice<br>3- Grasp<br>4- Grasp + h. weeding once | → | Unweeded<br>Unweeded<br>Unweeded<br>Unweeded |

Basagran 50% ASL 1.19 l/ha. Igran 80% WP 2.98 kg/ha. Fusilade 12.5% EC 1.19 l/ha. Brominal 24% EC 2.38 l/ha. Grasp 10% EC 2.38 l/ha.

**I- In Shandaweel Res., St.:**

Crop and weed control sequences combination in Shandaweel rotation during 1991/92 –1994/95 and 1995/96 seasons Table A. Results in 1991/92 season in table (5), indicated that wild oat infestation reached 624 seedling and 853 g/m$^2$ in unweeded check. Hand weeding and Grasp herbicide couldn't control more than 52.5 and 52.9% of wild oat, respectively. The grain yield was 1.603 and 1.559 t/ha as compared to 0.602 t/ha for the check treatment. Such yields were relatively low due to the heavy wild oats infestation at the start of rotation experiment in 1991 / 92 season.

In 1992/93 season Results in table (6) showed that the highest percentage of wild oats control was estimated by 99.2 and 98.9 % and the highest wheat grain yield by 152 and 170% as obtained from wheat plots with hand weeding or treated with Grasp after 2 successive years from the same plots of wheat in clover / wheat sequence as compared with untreated plots of wheat in wheat /wheat sequence. On the other hand, wild oats infestation in untreated wheat plots in wheat / wheat sequence was higher (1256 g/m $^2$) than in clover / wheat sequence (154 g/m$^2$) and wheat grain yield from the respective previous sequences was 2.130 and 4.344 t/ha.

Data of 1993/94 season in table (7) show that wild oat infestation in the unweeded control treatment in non rotated wheat (W/W/W) was 4954 g/m$^2$ and decreased significantly to only 176 g/m$^2$ or 96.4% in unweeded wheat that rotated with faba bean/clover/wheat (F/C/W). Hand weeding of wild oat in this rotation was more efficient than in (W/W/W) sequence where wheat yield tend to increase from 0.3 t/ha in unweeded treatments to 1.524 in the hand-weeding treatment compared to 4.714 t/ha in (F/C/W) sequence. The integration between Grasp use and hand weeding is more useful than using Grasp only. Wheat grain yield was more exposed to contamination by wild oat seeds in non rotated wheat (W/W/W) than rotated wheat (F/C/W).

**Table (5): Effect of weed control treatment on wild oat control and wheat yield in Shandaweel, in 1991/1992 seasons.**

| Weed control treatments | * Fresh weight of wild oat (g/m$^2$) | Wheat yield (t/ha) |
|---|---|---|
| **Unweeded** | **853** | **0.602** |
| **Hand weeding** | **405** | **1.603** |
| **Grasp** | **402** | **1.559** |
| **L.S.D. at 5%** | | **0.502** |

* Wild oats infestation in Unweeded check was 624 seedlings/ m$^2$.

**Table (6): Effect of crop sequences and weed control treatments on wild oat control and wheat yield at Shandaweel, 1992/93 season.**

| Crop sequence & weed control treatment | | Wild oat weight ($g/m^2$) | Wheat grain yield (t/ha) |
|---|---|---|---|
| **(1991/92)** | **(1992/93)** | | |
| **Wheat:** | **Wheat:** | | |
| **Un weeded** | **Un weeded** | **1255.5** | **2.130** |
| **Hand weeding** | **Hand weeding** | **18.5** | **3.999** |
| **Grasp** | **Grasp** | **124.3** | **4.428** |
| **Brominal** | **Grasp + Hand weeding** | **173.3** | **4.642** |
| Mean | | 399.9 | 3.800 |
| **Clover:** | **Wheat:** | | |
| **Un weeded** | **Un weeded** | **153.5** | **4.344** |
| **Hand weeding** | **Hand weeding** | **9.8** | **5.368** |
| **Basagran** | **Grasp** | **13.8** | **5.761** |
| Mean | | 50.3 | 5.198 |
| **Fusilade** | **Grasp + Hand weeding** | **24.0** | **5.320** |
| **L.S.D.at 5%** | | **1022** | **1.452** |

**Table (7): Effect of crop sequences and weed control treatments on wild oat control and grain yield in wheat at Shandaweel 1993/94 seasons.**

| Crop sequence & weed control methods | | | Wild oat ($g/m^2$) | Wheat grain yield (t/ha) |
|---|---|---|---|---|
| **1991/92** | **1992/93** | **1993/94** | | |
| **Wheat** | **Wheat** | **Wheat** | | |
| **Un weeded** | **Un.W.** | **Un.W.** | **4954** | **0.300** |
| **Hand weeded** | **H.W.** | **H.W.** | **861** | **1.524** |
| **Grasp** | **Grasp** | **Grasp** | **1817** | **1.515** |
| **Brominal** | **Grasp+H.W.** | **Grasp+H.W.** | **929** | **1.195** |
| Mean | | | **2140** | **1.133** |
| **Faba bean** | **Clover** | **Wheat** | | |
| **Un weeded** | **Un.W.** | **Un.W.** | **176** | **3.932** |
| **Hand hoeing** | **H.W.** | **H.W.** | **164** | **4.714** |
| **Igran** | **Un.W.** | **Grasp** | **140** | **3.500** |
| **Fusilade** | **Un.W.** | **Grasp+H.W.** | **187** | **4.429** |
| Mean | | | **167** | **4.144** |
| **L.S.D. at 5 % level for :** | | | | |
| **Crop sequence (A)** | | | **1213** | **0.680** |
| | **Between B within A** | | **1538** | **0.764** |

Data of 1994/95 season in table (8) indicated that the highest weight of wild oats was recorded in untreated and non-rotated wheat for four seasons being 1408 g/m$^2$, meanwhile the lowest value (102 g/m$^2$) was obtained in untreated and clover/clover/clover/wheat sequence. On the other hand, weed control treatments accompanied with the three sequences clover/clover/clover/wheat,clover/wheat/clover/wheat and faba bean/clover /wheat/wheat gave moderate weight of wild oats i.e. 57.8, 198.8 and 961 g/m$^2$, respectively, and wheat grain yield reached 4.53, 3.89 and 1.18 t/ha, while the weed control treatment accompanied the wheat/wheat / wheat / wheat / sequence gave 1388 g/m$^2$ wild oats and very low grain yield of 0.45 t/ha .

**Table (8): Effect of crop sequences and weed control treatments on wild oat and wheat yield, Shandaweel, 1994/95 seasons.**

| Crop sequence & weed control methods | | | | Weight of wild oat (g/m$^2$) | Wheat grain yield (t/ha) |
|---|---|---|---|---|---|
| **1991/92** | **1992/93** | **1993/94** | **1994/95** | | |
| **Wheat** | **Wheat** | **Wheat** | **Wheat** | | |
| **Un weeded** | **Un.W.** | **Un.W.** | **Un.W.** | **1408** | **0.32** |
| **Hand weeding** | **H.W.** | **H.W.** | **Un.W.** | **1264** | **0.48** |
| **Grasp** | **Grasp** | **Grasp** | **Un.W.** | **1520** | **0.31** |
| **Brominal** | **G.+H.W.** | **G.+H.W.** | **Un.W.** | **1358** | **0.69** |
| ***Mean*** | | | | **1387.5** | **0.45** |
| **Clover** | | | **Wheat** | | |
| **Un weeded** | **Clover 3(Cut)** | **Clover 3(Cut)** | **Un.W.** | **102** | **4.43** |
| **Hand weeding** | | | **Un.W.** | **40** | **4.21** |
| **Basagran** | | | **Un.W.** | **13** | **4.80** |
| *Fusilade* | | | **Un.W.** | **76** | **4.68** |
| ***Mean*** | | | | **57.8** | **4.53** |
| **Clover** | **Wheat** | | **Wheat** | | |
| **Un weeded** | **Un.W.** | **Clover 3(Cuts)** | **Un.W.** | **194** | **4.00** |
| **Hand weeding** | **H.W.** | | **Un.W.** | **335** | **3.37** |
| **Basagran** | **Grasp** | | **Un.W.** | **216** | **3.89** |
| **Fusilade** | **G.+H.W.** | | **Un.W.** | **50** | **4.31** |
| ***Mean*** | | | | **198.8** | **3.89** |
| **Faba bean** | | **Wheat** | **Wheat** | | |
| **Un weeded** | **Clover 3(Cuts)** | **Un.W.** | **Un.W.** | **881** | **0.85** |
| **Hand hoing** | | **H.W.** | **Un.W.** | **1144** | **0.85** |
| **Igran** | | **Grasp** | **Un.W.** | **1042** | **1.09** |
| **Fusilade** | | **G.+H.W.** | **Un.W.** | **778** | **1.93** |
| ***Mean*** | | | | **961.3** | **1.18** |
| **L.S.D. 5% level for: Crop sequence** | | | | **279.0** | **0.48** |
| **Between weed control crop sequence** | | | | **N.S** | **0.61** |

## II- Mallawi Res. St.:

Different crop and weed control treatments on wild oat and wheat productivity in 1992/93 – 1994/95 seasons are shown in table (B).

**Table (B): Crop sequences and weed control treatments in Mallawi (rotation experiment II).**

| 1992/93 | | 1993/94 | | 1994/95 |
|---|---|---|---|---|
| **Wheat** | | **Wheat** | | **Wheat** |
| 1- Unweeded<br>2- Hand weeding twice<br>3- Grasp *<br>4- Grasp + hand weeding once | → | 1- Unweeded<br>2- Hand weeding twice<br>3- Grasp<br>4- Grasp + hand weeding once | → | Unweeded<br>Unweeded<br>Unweeded<br>Unweeded |
| **Clover** | | **Clover** | | **Wheat** |
| 1- Cutting<br>2- Cutting<br>3- Cutting<br>4- Cutting | → | 1- Cutting<br>2- Cutting<br>3- Cutting<br>4- Cutting | → | Unweeded<br>Unweeded<br>Unweeded<br>Unweeded |
| **Clover** | | **Wheat** | | **Wheat** |
| 1- Cutting<br>2- Cutting<br>3- Cutting<br>4- Cutting | → | 1- Unweeded<br>2- Hand weeding twice<br>3- Grasp<br>4- Grasp + hand weeding once | → | Unweeded<br>Unweeded<br>Unweeded<br>Unweeded |
| **Faba bean** | | **Wheat** | | **Wheat** |
| 1- Unweeded<br>2- Hand hoeing<br>3- Igran<br>4- Igran + hand weeding once | → | 1- Unweeded<br>2- Hand weeding twice<br>3- Grasp<br>4- Grasp + hand weeding once | → | Unweeded<br>Unweeded<br>Unweeded<br>Unweeded |

In the first 1992/93 season, in the unweeded treatment *Avena* spp and *Phalaris* sp. as annual grassy weeds were found to be 6.9 t and 1.2 t as fresh weight /ha, respectively, meanwhile *Sonchus oleraceus*, *Medicago polymorpha*, *Melilotus indicus*, *Ammi majus* and *Beta vulgaris* as annual broadleaf weeds were by 4.7 t fresh weight /ha (Table 9). Grasp herbicide was very effective against grassy weeds. Grasp plus hand weeding once, hand weeding twice and Grasp alone reduced the total of grasses and broadleaf weeds by 90.9, 76.8 and 64.5%, respectively, and increased wheat grain yield by 67.6, 49 and 60.7 % respectively, compared with un weeded check.

**Table (9): The effect of crop sequence and weed control treatments on the fresh weight of annual weeds (g/m$^2$) and wheat grain yield (t/ha) Mallawi 1992/93 season.**

| Crops sequence & weed control treatments | Fresh weight of annual weeds (g/ m$^2$) | | | | | Wheat grain yield (t/ha) |
|---|---|---|---|---|---|---|
| | *Avena* spp. | *Phalaris* sp. | Total | *Broadleaf weeds | Total | |
| **Un weeded** | **687.6** | **115.3** | **802.9** | **468.4** | **1271.3** | **5.37** |
| **Hand weeding** | **142.5** | **38.3** | **180.8** | **114.2** | **295.0** | **8.0** |
| **Grasp** | **24.7** | **0.0** | **24.7** | **426.6** | **451.3** | **8.63** |
| **Grasp + H.W.** | **20.6** | **0.0** | **20.6** | **95.3** | **115.9** | **9.0** |
| **L.S.D. at 5%** | **111.0** | **NS** | **33.2** | **38.0** | | **1.17** |

*** Broadleaf weeds:** *Ammi majus, Beta vulgaris, Medicago polymorpha, Melilotus indicus* and *Sonchus oleraceus*.

In 1993/94 season table (10) show that wheat preceded by clover was the best sequence in controlling weeds i.e. wild oats, canary grass and broadleaf weeds at 60.4, 73.8 and 57.0 %, respectively, compared to faba bean/ wheat sequence; which were 56.8, 78.2 and 56.4 %, respectively, against wheat/wheat sequence. Data presented indicated that frequent cutting of breseem as forage crop reduced existence of broad leaf and grasses (Hassanein *et al* 1994). Also clover/wheat sequence gave the highest increase of wheat grain yield being 1.22 t/ha (32.6%) and 0.91 t/ha (22.6 %), respectively, compared with wheat / wheat and faba bean / wheat sequences. Using Grasp herbicide accompanied with hand weeding in the two seasons of wheat/wheat sequence gave the highest reduction grasses (97.4%) and broad leaf weeds (79.4%) and increase wheat grain yield by 2.83 t/ha (153.8 %) compared with unweeded check. Using Igran herbicide along with hand hoeing in faba bean and Grasp with hand weeding in wheat of faba bean / wheat sequence gave the highest reduction grasses (97.0 %) and broad leaf weeds (80.8 %) and increase wheat grain yield by 2.76 t / ha (124.3 %) compared to unweeded check.

Data of 1994/95 seasons in table (11) clearly revealed that clover/ clover/ wheat (C/C/W) is the best sequence for weed control and wheat grain yield. It gave 100% control on grassy weeds as wild oats and canary grass and 50.3 % control on broad – leaved weeds, with wild oats dominate over all the weeds. Such sequence gave the highest wheat grain yield i.e. 5.603 t/ha as compared to wheat/ wheat/ wheat sequence (W/W/W) as the fresh weight of wild oats, canary grass and broad – leaved weeds recorded 1514, 61 and 169 g/m$^2$, respectively, and gave the lowest wheat grain yield by (2.413 t/ha).

**Table (10): Effect of winter crops sequences and weed control treatments on number and fresh weight of weeds (g/m$^2$) and grain yield of wheat (t/ha) Mallawi 1993/94.**

| Winter crop sequence & Weed control treatments 1992/1993 | 1993/1994 | Broad leaf weeds | Grassy Weeds: Avena spp. | Grassy Weeds: Phalaris sp. | Total | Wheat grain yield (t/ha) |
|---|---|---|---|---|---|---|
| Wheat | Wheat | | | | | |
| **Un weeded** | **Un weeded** | **578** | **614** | **235** | **850** | **1.84** |
| **Hand weeding (twice)** | **Hand weeding** | **158** | **202** | **77** | **279** | **3.81** |
| **Grasp** | **Grasp** | **666** | **43** | **0** | **43** | **4.58** |
| **Grasp + Hand weeding** | **Grasp + Hand weeding** | **119** | **22** | **0** | **22** | **4.67** |
| **Mean** | | **380.3** | **220.3** | **78** | **298.3** | **3.73** |
| **Clover** | **Wheat** | | | | | |
| **Cut** | **Un weeded** | **166** | **95** | **17** | **112** | **4.94** |
| **Faba bean** | **Wheat** | | | | | |
| **Un weeded** | **Un weeded** | **590** | **677** | **191** | **868** | **2.22** |
| **Hand hoeing (twice)** | **Hand weeding (twice)** | **161** | **216** | **67** | **283** | **4.22** |
| **Igran** | **Grasp** | **677** | **39** | **0** | **39** | **4.70** |
| **Igran + Handhoeing once** | **Grasp + Handweeding** | **114** | **26** | **0** | **26** | **4.98** |
| **Mean** | | **385.5** | **239.5** | **64.5** | **304** | **4.78** |
| **L.S.D.at 5%** | | **24.1** | **42.7** | **48.5** | **20.7** | **0.39** |

Concerning clover / wheat / wheat sequence (C/W/W), it came second regarding weed grasses control and wheat grain yield, thus it gave 75.8 % control of grassy weeds and wheat grain yield of 3.961 t/ha. These results indicate that clover for two successive seasons (C/C/W) is more effective than (C/W/W) especially in case of heavy weeds infestation especially with wild oats.

On the contrary, the heaviest infestation with annual grassy and broadleaf weeds was found where the crop rotation included faba bean as precedent crop for one winter season (1992-93) and followed by wheat for two successive seasons i.e. 1993/95 and 1994/95 (F/W/W) the values of fresh weight of grassy and broadleaved weeds in this sequence were 1758 and 165 and 1798 g/m$^2$. Such sequence gave wheat grain yield of 2.468 t/ha without any significant difference from that obtained in non rotated wheat (W/W/W) i.e. 2.413 t/ha.

**Table (11): Effect of crop sequences and weed control treatments on weeds and wheat grain yield (t/ha), Mallawi Res.St, 1994/95.**

| Crop sequence and weed control methods | | | Fresh weight of annual weeds (g/m$^2$) | | | | wheat grain yield (t/ha) |
|---|---|---|---|---|---|---|---|
| 1992/93 | 1993 / 94 | 1994/95 | Broad leaf weeds | Canary grass | Wild oats | Total | |
| **Wheat** | **Wheat** | **Wheat** | | | | | |
| **Un weeded** | **Un.W.** | **Un.W.** | **60** | **123** | **3380** | **3563** | **0.889** |
| **Hand weeding twice** | **H.W.** | **Un.W.** | **125** | **79** | **2170** | **2374** | **2.825** |
| **Grasp** | **Grasp** | **Un.W.** | **294** | **32** | **287** | **613** | **2.921** |
| **Grasp + H.W.** | | **Un.W.** | **197** | **10** | **218** | **425** | **3.016** |
| **Mean** | | | **169** | **61** | **1514** | **1744** | **2.413** |
| **Clover** | **Clover** | **Wheat** | | | | | |
| **Cut** | **Cut** | **Un.W.** | **84** | **0** | **0** | **84** | **5.603** |
| **Clover** | **Wheat** | **Wheat** | | | | | |
| Cut | **Un.W.** | **Un.W** | **208** | **34** | **421** | **663** | **2.318** |
| | **H.W.** | **Un.W** | **189** | **22** | **301** | **512** | **4.381** |
| | **Grasp** | **Un.W** | **182** | **17** | **101** | **300** | **4.508** |
| | **Grasp + H.W.** | **Un.W** | **130** | **0** | **84** | **214** | **4.635** |
| **Mean** | | | **177.3** | **18.3** | **226.8** | **422.4** | **3.961** |
| **Faba bean** | **Wheat** | **Wheat** | | | | | |
| **Unweeded** | **Un.W.** | **Un.W** | **141** | **231** | **3035** | **3407** | **0.952** |
| **Hand hoeing twice** | **H.W.** | **Un.W** | **82** | **198** | **2196** | **2476** | **2.857** |
| **lgran** | **Grasp** | **Un.W** | **253** | **103** | **1059** | **1415** | **2.984** |
| **lgran + H.W.** | **Grasp + H.W.** | **Un.W** | **185** | **106** | **900** | **1191** | **3.080** |
| **Mean** | | | **165.3** | **159.5** | **1798** | **2123** | **2.468** |
| **L.S.D. at 5%** | | | **31** | **NS** | **112** | | **0.310** |

## III- In Kafr El-Sheikh Res. St: -

Different crop sequences and weed management in long term study of Sakha experiments in 1992/93 – 1994/95 seasons are shown in table (C).

**Table (C): Crop sequences and weed control treatments in Sakha (rotation experiment III).**

| 1992/93 | | 1993/94 | | 1994/95 |
|---|---|---|---|---|
| **Wheat** | | **Wheat** | | **Wheat** |
| 1- Unweeded<br>2- H. weeding twice<br>3- Arelon<br>4- Arelon.+ h. weeding once | → | 1- Unweeded<br>2- H. weeding twice<br>3- Arelon<br>4- Arelon+ h. weeding once | → | Unweeded<br>Unweeded<br>Unweeded<br>Unweeded |
| **Clover** | | **Clover** | | **Wheat** |
| 1- Unweeded<br>2- H. weeding twice<br>3- Fusilade<br>4- Fusilade+ h. weeding once | → | 1- Unweeded<br>2- H. weeding twice<br>3- Fusilade<br>4- Fusilade + h. weeding once | → | Unweeded<br>Unweeded<br>Unweeded<br>Unweeded |
| **Clover** | | **Wheat** | | **Wheat** |
| 1- Unweeded<br>2- H. weeding twice<br>3- Fusilade<br>4- Fusilade+ h. weeding once | → | 1- Unweeded<br>2- H. weeding twice<br>3- Arelon<br>4- Arelon+ h. weeding once | → | Unweeded<br>Unweeded<br>Unweeded<br>Unweeded |
| **Faba bean** | | **Wheat** | | **Wheat** |
| 1- Unweeded<br>2- H. hoeing twice<br>3- Igran<br>4- Igran + h. hoeing once. | → | 1- Unweeded<br>2- H. weeding twice<br>3- Arelon<br>4- Arelon+ h. weeding once | → | Unweeded<br>Unweeded<br>Unweeded<br>Unweeded |

Arelon 50% FL at 2.98 l/ha.
Fusilade 12.5% EC at 1.19 l/ha.
Igran 80% WP at 2.98 kg/ha.

In the first 1992/93 season, Arelon herbicide was very effective against canary grass, Arelon plus hand weeding once, Arelon alone and handweeding twice reduced the total of canary grass and broadleaf weeds by 95.9, 94.2 and 84.9%, respectively, and increased wheat grain yield by 59.2, 45.5 and 39.3%, respectively, compared to unweeded check.(Table 12)

In 1993/94 seasons results in table (13) show that wheat preceded by clover / wheat was the superior sequence on controlling weeds and increasing wheat grain yield. Such sequence reduced the fresh weight of canary grass by 89% and 89.6 % and increased wheat grain yield by 33.5% and 17.6% compared to untreated treatment in faba bean / wheat and wheat / wheat sequences, respectively. On the other hand, weed control treatments used significantly affected canary grass and broadleaf weeds under the three mentioned sequences. Arelon herbicide alone or accompanied with hand weeding were the best treatments on reducing weeds especially canary grass and resulted in the highest grain yield of wheat under the three previous sequences.

Data in 1994/95 season (Table14) show that canary grass and broadleaf weeds recorded the highest fresh weight values in wheat/ wheat/wheat sequence. Meanwhile, the two sequences of clover / clover /wheat and clover / wheat / wheat recorded the lowest fresh weight of canary grass as the dominant weed.Concerning wheat yield, the highest reduction in the fresh weight of weeds resulted in the highest wheat. Thus, clover/ clover/ wheat sequence recorded the highest yield values .

**Table (12): The effect of crops sequence and weed control treatments on the fresh weight of weeds (g/m$^2$) and wheat grain yield (t/ha), at Sakha in 1992/93 seasons.**

| Crops sequence of weed control treatment 1992/93 wheat | Fresh weight of annual weeds (g/m$^2$) | | | Wheat grain yield (t/ha) |
|---|---|---|---|---|
| | ***Phalaris* sp.** | ***Broad leaf weeds** | **Total** | |
| **Weedy check** | **2635** | **194** | **2829** | **3.982** |
| **Hand weeding twice** | **308** | **118** | **426** | **5.545** |
| **Arelon** | **80** | **83** | **163** | **5.795** |
| **Arelon + H.W. once** | **117** | **0.0** | **117** | **6.339** |
| **I.S.D. at 5%** | **310.2** | **NS** | **355** | **0.925** |

*** Broad leaf weeds:** *Anagallis arvensis, Ammi majus , Beta vulgaris, Coronopus squamatus, Cichorium punmilum* and *Melilotus indica .*

**Table (13): Effect of winter crop sequence and weed control treatments on fresh weight of weeds (g/m$^2$) in wheat, Sakha Res.St., 1993/94 winter season.**

| Crop sequence and weed control methods 1992/93 | 1993/94 | Canary grass | Total broad leaved | Total weeds | Grain yield t/ha |
|---|---|---|---|---|---|
| **Wheat** | **Wheat** | | | | |
| **Weedy check** | **Weedy check** | **1413.0** | **99** | **1512** | **2.290** |
| Hand weeding twice | **Hand weeding twice** | **121.3** | **33** | **154.3** | **5.330** |
| **Arelon** | **Arelon** | **27.5** | **3** | **30.5** | **6.572** |
| **Arelon + Hand weeding** | **Arelon + Hand weeding** | **13.8** | **13** | **26.8** | **6.781** |
| **L.S.D.** | | **407.1** | **54** | **365** | **0.835** |
| **Clover** | **Wheat** | | | | |
| | **Weedy check** | **52.5** | **190** | **242.5** | **5.634** |
| | **Hand weeding twice** | **67.5** | **45** | **112.5** | **6.080** |
| **4 Cuts** | **Arelon** | **21.3** | **6.2** | **27.5** | **6.625** |
| | **Arelon + Hand weeding** | **22.5** | **1.5** | **24** | **6.339** |
| **L.S.D.** | | **N.S.** | **103.92** | **137.9** | **N.S.** |
| **Faba bean** | **Wheat** | | | | |
| **Weedy check** | **Weedy check** | **1288** | **119** | **1407** | **1.660** |
| **Hand weeding twice** | **Hand weeding twice** | **136.5** | **66** | **202.5** | **4.152** |
| **Igran** | **Arelon** | **36.5** | **31** | **67.5** | **6.018** |
| **Igran + Hand hoeing** | **Arelon + Hand weeding** | **38** | **2.5** | **40.5** | **6.643** |
| **L.S.D.** | | **689** | **N.S.** | **719.8** | **0.72** |

**Table (14): Effect of winter crop sequence and weed control treatments on the fresh weight ($g/m^2$) of annual weeds and wheat grain yield (t/ha) in Sakha in 1994/95 season.**

| Crop sequence and weed control methods | | | Fresh weight of annual weeds ($g/m^2$) | | | Grain yield (ton/ha) |
|---|---|---|---|---|---|---|
| 1992/93 | 93/94 | 94/95 | Canary grasses | Broad-leaf | Total | |
| **Wheat** | **Wheat** | **Wheat** | | | | |
| Unweeded | Un. W. | Un. W. | 3275 | 988 | 4263 | 1.918 |
| Hand weeded | H. W. | Un. W. | 2150 | 169 | 2319 | 2.620 |
| Arelon | Arelon | Un. W. | 2175 | 575 | 2750 | 3.093 |
| Arelon+H.W | A.+H.W. | Un. W. | 850 | 469 | 1319 | 2.965 |
| **Clover** | **Clover** | **Wheat** | | | | |
| Unweeded | Un. W. | Un. W. | 1275 | 1250 | 2525 | 4.000 |
| Hand weeded | H. W. | Un. W. | 700 | 663 | 1363 | 4.058 |
| Fuzilade | Fuzilade | Un. W. | 194 | 519 | 713 | 4.090 |
| F+H.W. | F.+H.W. | Un. W. | 156 | 150 | 306 | 4.073 |
| **Clover** | **Wheat** | **Wheat** | | | | |
| Unweeded | Un. W. | Un. W. | 1500 | 881 | 2381 | 2.857 |
| Hand weeded | H. W. | Un. W. | 1100 | 219 | 1319 | 3.008 |
| Fuzilade | Arelon | Un. W. | 1306 | 763 | 2069 | 3.795 |
| F+H.W. | A.+H.W. | Un. W. | 525 | 888 | 1413 | 3.470 |
| **Faba bean** | **Wheat** | **Wheat** | | | | |
| Unweeded | Un. W. | Un. W. | 2563 | 1019 | 3581 | 2.528 |
| H.H. | H. W. | Un. W. | 1925 | 238 | 2163 | 2.825 |
| Igran | Arelon | Un. W. | 975 | 313 | 1288 | 3.160 |
| Igran + H.H. | A.+H.W. | Un. W. | 775 | 756 | 1481 | 3.813 |
| L.S.D. at 5% | | | 1425 | N.S | 1885 | 0.827 |

## IV- Nubariah Research ST 4th experiment

Different crop sequences and weed control treatment in long term in El-Nubaria Res. St. 1997/98 – 2000/01 is shown in table (D).

**Table (D): Crop sequences and weed control treatments in El-Nubaria (rotation experiment V).**

| 1997/98 | | 1998/99 | | 1999/2000 | | 2000/01 |
|---|---|---|---|---|---|---|
| **Wheat** | | **Wheat** | | **Wheat** | | **Wheat** |
| 1- Unweeded | | 1- Unweeded | | 1- Unweeded | | Unweeded |
| 2- H. weeding twice | | 2-Straw burning | | 2- H. weeding twice | | Unweeded |
| 3- Sinal | → | 3- Sinal | → | 3- Sinal | → | Unweeded |
| 4- Grasp | | 4- Grasp | | 4- Grasp | | Unweeded |
| 5- Sinal + Grasp | | 5- Sinal + Grasp | | 5- Sinal + Grasp | | Unweeded |
| Canola | | **Clover** | | **Clover** | | **Wheat** |
| 1- Unweeded | | 1- Three cuts | | 1- Four cuts | | Unweeded |
| 2- H. hoeing twice | | 2- Three cuts | | 2- Four cuts | | Unweeded |
| 3- Amex + H. hoeing | | 3- Three cuts | → | 3- Four cuts | | Unweeded |
| 4- H. hoeing +Fusilade | → | 4- Three cuts | | 4- Four cuts | → | Unweeded |
| 5- Gesagard | | 5- Three cuts | | 5- Four cuts | | |
| Clover | | **Wheat** | | **Clover** | | **Wheat** |
| 1- Three cuts | | 1- Unweeded | | 1- Four cuts | | Unweeded |
| 2- Three cuts | → | 2-H.weeding twice | → | 2- Four cuts | → | Unweeded |
| 3- Three cuts | | 3- Sinal | | 3- Four cuts | | Unweeded |
| 4- Three cuts | | 4- Grasp | | 4- Four cuts | | Unweeded |
| 5- Three cuts | | 5- Sinal + Grasp | | 5- Four cuts | | Unweeded |
| Faba bean | | **Wheat** | | Faba bean | | **Wheat** |
| 1- Unweeded | | 1- Unweeded | | 1- Unweeded | | Unweeded |
| 2- Hand hoeing twice | | 2- H. weeding twice | | 2- Hand hoeing twice | | Unweeded |
| 3- H. hoeing + Grasp | → | 3- Sinal | → | 3- H. hoeing + Grasp | → | Unweeded |
| 4- H. hoeing + Fusilade | | 4- Grasp | | 4- H. hoeing + Fusilade | | Unweeded |
| 5- Amex + hand hoeing | | 5- Sinal + Grasp | | 5- Amex + H.hoeing | | Unweeded |

Sinal 10% SC at 95.2 cc/ha. Grasp 10% EC at 2.38 l/ha.
Gesagard 50% WP at 2.38 kg/ha Amex 48% EC at 4.76 l/ha
Fusilade 12.5% EC at 1.19 l/ha

Data of 1997/98 season in table (15) indicate that treating wheat with Sinal gave 99.5 % reduction of broad leaf weeds, Sinal + Grasp gave 42.5% reduction in grasses while hand weeding gave 54.1 % reduction in total weeds, compared to untreated check. All weed control treatment increased significantly grain yield of wheat by 1.69 t/ha in the case of Sinal + Grasp (1.169 t/ha) compared to unweeded check.

**Table (15): Effect of weed control treatments on fresh weight of weeds ($g/m^2$) in wheat, El-Nubaria Res. St., 1997/98 winter season.**

| Weed control treatments | Fresh weight of annual weeds ($g/m^2$) | | | Yield (ton/h) |
|---|---|---|---|---|
| | Broad-leaved weeds | Grasses | Total | |
| **Wheat** | | | | |
| **Sinal at 95.2 cc/ha** | **1.5** | **1000** | **1002** | **1.600** |
| **Grasp at 2.38 L/ha** | **1021** | **490** | **1511** | **1.844** |
| **Sinal at 95.2 cc/ha + Grasp at 2.38 L/ha** | **71.8** | **463** | **535.3** | **2.687** |
| **Hand weeding twice** | **9.5** | **492** | **501.5** | **1.951** |
| **Un weeded check** | **286.8** | **805.3** | **1092** | **1.518** |
| **L.S.D.** | **335.7** | **NS** | **NS** | **0.496** |

Results of 1998/99 winter season in table (16) indicate that clover/wheat sequence was the most effective in reducing the fresh weight of both broad leaf and grassy weeds by 50%, followed by faba bean/wheat sequence being 10.2% compared to wheat/wheat sequence. Also, clover/wheat sequence gave the highest grain yield of wheat being 3.182 t/ha (120.5 %) followed by faba bean/wheat sequence (1.645 t/ha 14%). The combination of Sinal and Grasp was the best treatment in reducing broad leaf and grassy weeds and increasing wheat grain yield in all the three tested winter crops. This treatment reduced the fresh weight of the total weeds by 93.0, 91.3 and 70.1% compared with unweeded check in clover/wheat, wheat/wheat and faba bean/wheat sequences respectively; and increased wheat grain yield by 3.027, 2.940 and 2.912 t/ha in wheat/wheat, faba bean/wheat and clover/wheat sequence, respectively.

**Table (16): Effect of winter crops sequence and weed control treatments on fresh weight of weeds (g/m$^2$) and grain yield of wheat (ton/ha), El-Nubaria Res.St., 1998/99 winter season.**

| Crop sequence & Weed control treatments | | Fresh weight of annual weeds (g/m$^2$) | | | Yield (ton/ha) |
|---|---|---|---|---|---|
| 1997/98 | 1998/99 | Broad-leaved weeds | Grasses | Total | |
| **Wheat** | **Wheat** | | | | |
| **Sinal** | **Sinal** | **0** | **2896** | **2896** | **0.360** |
| **Grasp** | **Grasp** | **3742** | **70.5** | **3812** | **2.294** |
| **Sinal + Grasp** | **Sinal + Grasp** | **4** | **362** | **366** | **3.384** |
| **Hand weeding twice** | Hand weeding | **776.5** | **3033** | **3810** | **0.819** |
| **Un weeded** | **Un weeded** | **458.5** | **3755** | **4213** | **0.357** |
| **Mean** | | **996.2** | **2023** | **3019** | **1.443** |
| **Faba bean** | **Wheat** | | | | |
| **Amex + H.H.** | **Sinal** | **0** | **3097** | **3097** | **1.339** |
| **H.H. + Fusilade** | **Grasp** | **2990** | **69.5** | **3060** | **2.185** |
| **H.H. + Grasp** | **Sinal + Grasp** | **0** | **118.5** | **1185** | **3.321** |
| **Hand weeding twice** | **Hand weeding** | **26.8** | **2222** | **2249** | **1.000** |
| **Un weeded** | **Un weeded** | **836.5** | **3132** | **3969** | **0.381** |
| **Mean** | | **770.7** | **1728** | **2712** | **1.645** |
| **Clover** | **Wheat** | | | | |
| | **Sinal** | **0** | **1819** | **1819** | **2.399** |
| | **Grasp** | **2650** | **107.5** | **2758** | **2.875** |
| **4 Cuts** | **Sinal + Grasp** | **3.5** | **153** | **156.5** | **5.232** |
| | **Hand weeding** | **274** | **318.5** | **592.5** | **3.083** |
| | **Un weeded** | **1163** | **1062** | **2225** | **2.320** |
| **Mean** | | **818** | **692** | **1510** | **3.182** |
| **L.S.D. at 5% for :** | | | | | |
| **Crops sequence (A)** | | **NS** | **714** | **726.6** | **0.586** |
| **Weed control treatments (B)** | | **501.3** | **886.4** | **905.1** | **0.399** |
| **Interaction AxB** | | **NS** | **NS** | **NS** | **0.848** |

Results of 1999/2000 season in table (17) indicate that in wheat/wheat/Wheat sequence, the continuous use of Sinal for three seasons, gave excellent control for broadleaf weeds but increased grassy weeds from 1000 g/m$^2$ in the first season to 3820 g/m$^2$ in the third one. This shift in weed infestation was accompanied by a decline in wheat yield from 1.6 t/ha in the first season to 0.168 t/ha in the third. The continuous use of Grasp caused an increase in broadleaf weed density from 1021 to 3341 g/ m$^2$ in the first and third seasons, respectively, and accompanied with a wheat yield decline from 1.844 to 0.838 t/ha. The continuous control of both broadleaf and geassy weeds Sinal + Grasp succeeded to balance the density of these weeds (535 g/ $m^2$) and sustain the wheat productivity more than any other weed treatment (2.687 to 2.009 t/ha in the first and third seasons, respectively).

**Table (17): Effect of winter crop sequence and weed control treatments on fresh weight of weeds (g/m$^2$) and grain yield of wheat (ton/ha.) , El-Nubaria Res.St., 1999/2000 winter season).**

| Crops sequences & Weed control treatments | | | Fresh weight of annual weeds (g/m$^2$) | | | Yield (ton/ha) |
|---|---|---|---|---|---|---|
| 1997/98 | 1998/99 | 1999/2000 | Broad-leaf weed | Grasses | Total | |
| **Wheat** | **Wheat** | **Wheat** | | | | |
| **Sinal** | **Sinal.** | **Sinal.** | **0** | **3820** | **3820** | **0.168** |
| **Grasp** | **Grasp.** | **Grasp.** | **3341** | **0** | **3341** | **0.838** |
| **Sinal + Grasp** | **Sinal + Grasp** | **Sinal + Grasp** | **9** | **529** | **538** | **2.009** |
| **Hand weeding twice** | **H. W.** | **H. W.** | **11** | **4590** | **4601** | **0.062** |
| **Unweeded** | **Un.W.** | **Un.W.** | **1458** | **3265** | **4723** | **0.012** |
| **L.S.D. at 5%** | | | **1134** | **1939** | **2438** | **0.282** |

As shown in table (18), results of 2000/2001 season indicate that canola / clover / clover / wheat, clover / wheat / clover /wheat and faba bean / wheat /faba bean / wheat sequences significantly decreased the heavy weeds infestation and increased wheat grain yield compared with wheat/wheat/wheat/wheat sequence. The respective previous sequences decreased the fresh weight of annual weeds by 69.9, 31.9 and 14.4% and increased wheat grain yield by 212.3, 99.1 and 43.3% compared with wheat sown for four seasons continuously.

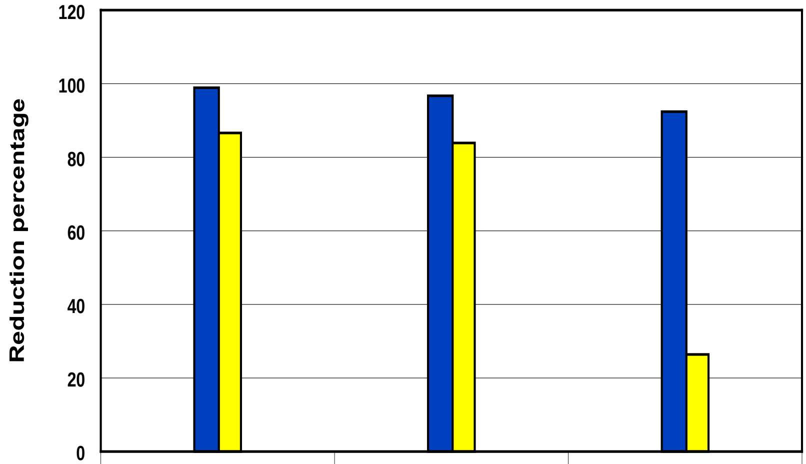
On other hand, the weed control treatments had a significant effect on reducing the weeds population and increasing wheat yield under the four previous sequences. Metosulam at 95.2 cc/ha followed by tralkoxydim at 2.38 l / ha used for the first three seasons in wheat / wheat / wheat / wheat sequence gave the highest reduction on fresh weight of annual weeds by 65.4% and the highest increasing of wheat grain yield by 0.762 t/ha (184.1%) compared with the unweeded treatment. Hand hoeing or hand weeding in faba bean / wheat / faba bean / wheat sequence gave the highest reduction in the fresh weight of weeds by 40.7%, while the highest increasing in wheat grain yield was obtained with hand hoeing followed by fluzifop-butyl in faba bean and tralkoxydim in wheat by 0.687 t/ha (82.7 %) compared with the unweeded treatment. Clover cutting 3-4 times seasonally and metosulam plus tralkoxydim in wheat used for the first seasons of clover / wheat / clover / wheat sequence gave the highest reduction on fresh weight annual weeds by 38.6% and the highest increasing wheat grain yield by 1.155 t/ha (108.1 %) compared with the unweeded treatment. Clover cutting 3-4 times seasonally in canola / clover / clover / wheat sequence gave the highest reduction on weeds and the highest increasing in wheat grain yield compared with the other three previous sequences and masked the effect of weed control treatments weeds in canola..

**Table (18): Effect of winter crops sequence and weed control treatments on number and fresh weight weeds /m$^2$ and grain yield of wheat (fourth winter seasons 2000/01) ,EL-Nubaria Res.St.**

| Crop sequence & weed control treatments | | | | Fresh weight of annual weeds / m$^2$ | | | Number of | | Wheat grain Yield (ton/ha) |
|---|---|---|---|---|---|---|---|---|---|
| 1997/98 | 1998/99 | 1999/2000 | 2000/01 | Broad leaved | Grasses | Total | Avena Panicles /m$^2$ | Wheat spikes /m$^2$ | |
| **Wheat** | **Wheat** | **Wheat** | **Wheat** | | | | | | |
| **Sinal** | **Sinal** | **Sinal** | **Un-weeded** | **2885** | **803.0** | **3688** | **271** | **223** | **0.762** |
| **Grasp** | **Sinal** | **Sinal** | | **3899** | **761.5** | **4661** | **44** | **208** | **1.075** |
| **Sinal + Grasp** | **Grasp** | **Grasp** | | **1161** | **689.0** | **1850** | **76** | **334** | **1.176** |
| **Hand weeding twice** | **S+G** | **S+G** | | **1799** | **1121.0** | **2920** | **222** | **100** | **0.485** |
| **Unweeded** | Un.W | Un.W | | **2669** | **2683.0** | **5352** | **237** | **120** | **0.414** |
| **Faba bean** | **Wheat** | **Faba bean** | **Wheat** | | | | | | |
| **Amex + H.H** | **Sinal** | **Sinal** | **Un-weeded** | **1607** | **861.0** | **2468** | **2** | **91** | **0.899** |
| **H.H + Fusilade** | **Grasp** | **Sinal** | | **3002** | **433.0** | **3435** | **41** | **261** | **1.518** |
| **H.H.+ Grasp** | **S+G** | **Grasp** | | **2996** | **828.0** | **3824** | **74** | **247** | **1.158** |
| **H. Hoeing twice** | **HW** | **S+G** | | **1874** | **388.0** | **2262** | **57** | **261** | **1.199** |
| ***Unweeded*** | **Un.W** | Un.W | | **3444** | **370.0** | **3814** | **42** | **120** | **0.831** |
| **Clover** | **Wheat** | **Clover** | **Wheat** | | | | | | |
| **3 cuts** | **Sinal** | **4 cuts** | **Un-weeded** | **3223** | **21.0** | **3244** | **30** | **455** | **1.777** |
| | **Grasp** | | | **1792** | **26.0** | **1818** | **12** | **127** | **1.158** |
| | **S+G** | | | **1594** | **51.0** | **1645** | **17** | **350** | **2.223** |
| | **HW** | | | **3014** | **183.0** | **3197** | **34** | **241** | **1.56** |
| | ***Un.W*** | | | **2511** | **169.0** | **2680** | **12** | **143** | **1.068** |
| **Canola** | **Clover** | **Clover** | **Wheat** | | | | | | |
| ***Gezagard*** | **3 cuts** | **4 cuts** | **Un-weeded** | **1108** | **160.0** | **1268** | **15** | **307** | **2.304** |
| **Amex + H.H** | | | | **1080** | **10.0** | **1090** | **21** | **478** | **2.595** |
| **H.H + Fusilade** | | | | **887** | **80.5** | **968** | **6** | **423** | **2.714** |
| **HH twice** | | | | **1571** | **68.0** | **1639** | **6** | **200** | **2.086** |
| **Unweeded** | | | | **435** | **66.0** | **600** | **28** | **315** | **2.518** |
| ***L.S.D. at 5% for*** | | | | | | | | | |
| ***Crops sequence*** | | ***A*** | | **1181** | **620** | **1213** | **40.1** | **84.1** | **0.65** |
| **Weed control treatments** | | **B** | | **N.S** | **N.S** | **N.S** | **44.6** | **81.6** | **0.28** |
| **Interaction between** | | **AxB** | | **N.S** | **N.S** | **N.S** | **89.3** | **168.2** | **0.82** |

## 2- Effect of crop rotation and weed control treatments on weed seeds contamination in soil (seed bank).

Wild oat seed inflow in the soil after three years of crop rotation in naturally heavily infested soil with wild oat seeds was studied during first and second years after the end of the rotation at Shandaweel Table 19 (Al-Marsafy *et al* 1996). Results indicated that the soil was less contaminated with wild oat seeds in plots of crop sequences which included clover as a cutting crop than soil in plots of non-rotated wheat. The reduction percentage for the sequence of clover/clover/clover, clover/wheat/clover and faba bean/clover/wheat in the first year were higher than second year, Fig.(1).




| | Clover / Clover / Clover | C / Wheat / C | Faba bean / C / W |
|---|---|---|---|
| 1995/96 | 86.6 | 83.9 | 26.4 |
| 1994/95 | 98.9 | 96.7 | 92.4 |

Fig.(1):Effect of sequance crops on reduction percentage of wild oat in wheat fieldsat inShandaweel,during 1994/95 and 1995/96.

The renewal of contamination by wild oat seeds in the soil in all crop sequences was similar at the end of the second year at harvest, which may be attributed to the shedding of mature wild oat seeds. Thus, we recommend using clover/wheat crop sequences accompanied with rouging of wild oat plants before seed shedding in the soil.

**Table (19): Effect of crop sequences and weed control treatments on wild oat seed bank dynamic, at Shandaweel, 1994/95 and 1995/96 seasons.**

| Crop sequence & weed control methods | | | | | No. of wild oat seeds/500g soil | | | |
|---|---|---|---|---|---|---|---|---|
| Preceding winter crops | | | | | At sowing | | At harvest | |
| 1991/92 | 92/93 | 93/94 | 94/95 | 95/96 | 94/95 | 95/96 | 94/95 | 95/96 |
| *Wheat* | *Wheat* | *Wheat* | Wheat | Wheat | | | | |
| Unweeded | Un.W. | Un.W. | Un.W | Un.W | 23.25 | 34.50 | 80.75 | 46.00 |
| H.weeded | H.W. | H.W. | Un.W | Un.W | 26.25 | 75.25 | 70.75 | 45.25 |
| Grasp | Grasp | Grasp | Un.W | Un.W | 32.25 | 88.00 | 105.25 | 28.25 |
| Brominal | G.+H.W. | G.+H.W. | Un.W | Un.W | 10.00 | 49.25 | 136.25 | 37.25 |
| Mean | | | | | 22.94 | 61.75 | 98.25 | 39.19 |
| Clover | Clover | Clover | Wheat | Wheat | | | | |
| Unweeded | Un.W. | Un.W. | Un.W | Un.W | 0.00 | 7.25 | 9.75 | 72.75 |
| H.weeded | H.W. | H.W. | Un.W | Un.W | 0.00 | 12.50 | 8.00 | 51.75 |
| Basagran | Un.W. | Un.W. | Un.W | Un.W | 0.00 | 8.75 | 21.50 | 56.75 |
| Fusilade | Un.W. | Un.W. | Un.W | Un.W | 1.00 | 4.50 | 6.25 | 52.00 |
| Mean | | | | | 0.25 | 8.25 | 11.38 | 58.31 |
| Clover | Wheat | Clover | Wheat | Wheat | | | | |
| Unweeded | Un.W. | Un.W. | Un.W | Un.W | 0.75 | 13.50 | 10.25 | 51.75 |
| H.weeded | H.W. | H.W. | Un.W | Un.W | 0.25 | 5.75 | 9.50 | 64.25 |
| Basagran | Grasp | Un.W. | Un.W | Un.W | 0.25 | 15.00 | 4.25 | 38.50 |
| Fusilade | G.+H.W. | Un.W. | Un.W | Un.W | 1.75 | 5.50 | 9.50 | 27.50 |
| Mean | | | | | 0.75 | 9.94 | 8.38 | 45.50 |
| Faba bean | Clover | Wheat | Wheat | Wheat | | | | |
| Unweeded | Un.W. | Un.W. | Un.W | Un.W | 1.50 | 21.25 | 67.00 | 77.75 |
| H.weeded | H.W. | H.W. | Un.W | Un.W | 2.25 | 71.25 | 73.00 | 43.25 |
| Basagran | Un.W. | Un.W. | Un.W | Un.W | 2.00 | 54.50 | 66.75 | 39.50 |
| Fusilade | Un.W. | Un.W. | Un.W | Un.W | 1.25 | 34.75 | 33.25 | 35.25 |
| Mean | | | | | 1.75 | 45.44 | 60.00 | 48.94 |
| L.S.D. Between A | | | | | 6.69 | 15.20 | 28.22 | N.S. |
| L.S.D. at 5% Between B within A | | | | | 8.25 | 32.87 | N.S | N.S. |

Monitoring of wild oat seed bank under different crop sequences under farmer conditions Twenty-five sites in Assuit governorate (old land) and Bangar El-Sukkar area (new land) were chosen to determine the relationship between the population of wild oat seeds in the soil (seed bank) and the preceding winter crop (Yehia et al 1195, 1996 and 1999). Table (20) shows that the average number of wild oat seeds/ft$^2$ varied between 304 to 514.2 in fields where wheat was preceded by wheat, and between 26.9 to 46 seeds/ft$^2$ when wheat was preceded by clover. These results indicated that sowing clover for one season reduced the seed bank of wild oats by about 89%. These results indicate that using a suitable rotation, i.e. clover as the preceding winter crop, is important for reducing the population of wild oat seeds in the soil.

**Table (20): Average number of wild oats/ft$^2$ as affected by the preceding winter crop at different sites in Assuit and Bangar El-Sukkar area.**

| Governorate | Average number of wild oat seeds/ft$^2$ | | |
|---|---|---|---|
| | Preceding winter crop | | |
| | No. of sites | Wheat | Clover |
| **Assuit 1994 / 95** | **(5)** | **514.2** | **33.4** |
| **Assuit 1995 / 96** | **(10)** | **361.5** | **26.9** |
| **Bangar El-Sukkar 1998 / 99** | **(10)** | **304.0** | **46.0** |

## Economic analysis

Table (21) showed the economic analysis for wheat production after different crops sequences as clover/clover/clover/ wheat, or faba bean / clover/ wheat wheat in long term experiment of crop rotation conducted at shandaweel Station from 1991/92 to 1994/95, Mallawi Station 1992/93 to 1994/95) and Sakha Station from1992/93to 1993/94 seasons. Results indicated that the wheat production and net benefit after clover / clover/ clover or clover wheat clover sequences were 4.53t/ha and L.E 1028 and 3.89 t/ha and LE 644 compared to 1.18 t/ha and minus value (LE 881) for non rotated wheat in Shandaweel rotation. In Mallawi rotation the respective values for the former crop sequences were 5.6 t/ha and LE 1175; 3.981 t/ha and LE 285 and 2.4 t/ha with minus value (LE 547). In Sakha rotations the values were 4.0 t/ha and LE 255 for clover/clover/wheat and compared to 2.6 t/ha and minus value (LE 481) for non-rotated wheat.

**Table (21) : Economic analysis of the three rotation experiments at Shandaweel Res. St., Mallawi Res. St.and SakhaRes.St on wheat.**

| Station | Crop Sequence & seasons | | | | Wheat yield ton/ha | Price LE/ton | Return LE | Straw Heml/ha | Price LE/ heml | Return LE | Gross Income LE | Total Cost LE | Net Profit LE | The profitability % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1991/92 | 1992/93 | 1993/94 | 1994/95 | | | | | | | | | | |
| Shandaweel | Wheat | Wheat | Wheat | Wheat | 0.45 | 567 | 255 | 2.14 | 27.8 | 59.5 | 314.5 | 1733 | -1419 | -82 |
| | Clover | Clover | Clover | wheat | 4.53 | 567 | 2569 | 21.57 | 27.8 | 600 | 3169 | 2141 | 1028 | 48 |
| | Clover | Wheat | Clover | Wheat | 3.89 | 567 | 2206 | 18.52 | 27.8 | 515 | 2721 | 2077 | 644 | 31 |
| | Faba been | Clover | Wheat | Wheat | 1.18 | 567 | 669 | 5.62 | 27.8 | 156 | 825 | 1806 | -981 | -54 |
| Mallawi | | Wheat | Wheat | Wheat | 2.413 | 520 | 1255 | 8.752 | 27.8 | 243 | 1498 | 2045 | -547 | -27 |
| | | Clover | Clover | Wheat | 5.603 | 520 | 2915 | 20.322 | 27.8 | 565 | 3480 | 2305 | 1175 | 51 |
| | | Clover | Wheat | Wheat | 3.961 | 520 | 2061 | 14.367 | 27.8 | 399 | 2460 | 2195 | 265 | 12 |
| | | Faba been | Wheat | Wheat | 2.468 | 520 | 1284 | 8.952 | 27.8 | 249 | 1533 | 2055 | -522 | -25 |
| Sakha | | Wheat | Wheat | Wheat | 2.649 | 520 | 1377 | 10.225 | 26 | 266 | 1643 | 2124 | -481 | -23 |
| | | Clover | Clover | wheat | 3.082 | 520 | 1603 | 11.897 | 26 | 309 | 1912 | 2167 | -255 | -12 |
| | | Wheat | Clover | Wheat | 4.055 | 520 | 2109 | 15.652 | 26 | 407 | 2516 | 2264 | 255 | 11 |
| | | Clover | Wheat | Wheat | 3.283 | 520 | 1707 | 12.672 | 26 | 329 | 2036 | 2187 | -151 | -7 |

## 3- Land preparation/sowing methods

Land preparation by giving sowing irrigations and plowing after weed establishment to reduce weed population was studied extensively through conducting series of experiments as follow:

The effect of continuous flooding for three different periods on the occurrence of wild oats in wheat was studied by (Zahran and Al Marsafy 1994 and Zahran et al 1994). Two experiments were carried out at Gimmeza, Shandaweel in 1993/94 winter season. Results in Shandaweel indicated that the tested flooding periods for 15, 10 and 5 days accounted for the reduction of weeds by 91.2, 76.7 and 77.0%, respectively compared with non-flooding. There were no significant difference among the flooding periods, but all out yielded the check (non – flooding) significantly. At Gimmeiza, 15-day flooding period tended to decrease the fresh weight of all weeds species; as a result, wheat grain yield was markedly affected (table 22).

**Table (22): Effect of flooding on weeds and wheat grain yield in Gimmeiza and Shandaweel 1993/94.**

| Flooding Period | Gimmeza | | | | | Shandaweel | |
|---|---|---|---|---|---|---|---|
| | Total number of weed species/m$^2$ (30 DAS) | | | Total F. W. (g/ m$^2$) | Yield (t/ha) | Wild Oats (g/m$^2$) | Wheat Grain Yield (t/ha) |
| | Grasses | Broad–leaved | Total | | | | |
| 15 days | 121 | 158 | 279 | 2047 | 6.95 | 158 | 0.51 |
| 10 days | 102 | 117 | 219 | 1694 | 6.99 | 419 | 0.48 |
| 5 days | 78 | 136 | 213 | 2238 | 4.50 | 413 | 0.67 |
| Control | 707 | 434 | 1141 | 5267 | 1.32 | 1799 | 0.08 |
| LSD (5%) | NS | NS | - | NS | 1.90 | 1044 | 0.35 |

**DAS = Days after sowing**
**NS = Not significant**

Another field trial was conducted at Shandaweel by (Al Marsafy et al 1996) in the 1995/96 seasons to detect the role of integration between flooding, sowing method and herbicide on reducing wild oat infestation in wheat fields. Results indicated that flooding for five days integrated with the *Herati* method and Grasp decreased the weight of the grassy weed mixtures by 96.9% and increased wheat grain yield by 183.1% over the *Afir* method as a check (Table 23).

**Table (23): Effect of sowing method on weeds and wheat grain yield in Shandaweel, 1995/96 season.**

| Treatments | Broad-leaved weeds ($g/m^2$) | Grassy weeds ($g/m^2$) | Total ($g/m^2$) | Wheat Grain yield t/ha |
|---|---|---|---|---|
| Flooding for 5 days then planting with Herati method + Grasp | 886.5 | 186.7 | 1073.2 | 5.69 |
| Pre – sowing irrigation then planting with Herati method at 2.38 L/ha | 456.9 | 272.3 | 729.2 | 5.7 |
| Afir sowing method (check) | 779.9 | 5983.2 | 6763.2 | 2.01 |
| L.S.D at 5% level | NS | 1425.4 | 1581 | 0.63 |

During 1998/1999 and 1999/2000 winter seasons four field experiments were conducted in Mallawi and Shandaweel during 1998/99 and 1999/2000 winter seasons by Al Marsafy et al (1999&2000) and Hassanien et al (1999&2000) to study the effect of pre- sowing irrigation and sowing methods on weeds and wheat productivity. Results exert that giving pre-sowing irrigation twice followed by plowing and sowing with *Afir* method can control weeds and increase wheat yield productivity to compared untreated check Table (24). In Mallawy Research Station in 1998/99 pre sowing irrigation twice followed by plowing and planting with the *Herrati* method gave the largest reduction in grasses and broadleaf weeds (total weight decreased by 97.5 and 94.4%, respectively) and significantly increased wheat grain yield by 173 and 157%. The next best effect was accomplished by the same treatments but using the *Afir* method. Flooding for 5 days and planting with the *Herrati* method gave 57.8% reduction in total weeds and 132% increase in wheat yield. These results indicate that cultural practices can solve the weed problem in wheat fields without the use of chemicals. In Shandaweel Research Station the wild oat infestation was decreased by the following treatments compared to planting with the *Afir* method (check): (1) pre- sowing irrigation /plowing /pre-sowing irrigation then planting with the *Herrati* sowing method (91% reduction), (2) flooding for 5 days then planting with the *Herrati* sowing method (91% reduction), and (3) pre- sowing irrigation/plowing /pre-sowing irrigation then planting with the Afir sowing method (87.4% reduction). The respective increases in wheat grain yield were 1.609, 1.377, and 1.321 t/ha. The *Herrati* method gave the largest increases in wheat grain yield than the *Afir* method, with one pre- sowing irrigation and flooding for 5 days then planting. During the 1999/2000 winter seasons in Mallawy Research Station Pre – sowing irrigation, plowing, pre- sowing irrigation and then planting with *Her Herrati* or *Afir* drilling were the best cultural practices that controlled annual broadleaf and grassy weeds by more than 95%. The resulting respective grain yield were 4.63 and 4.34 t/ha, which were the highest. Flooding for 5 days with *Herrati* sowing was the treatment that gave the next best control of annual broadleaf and grassy weeds by 85.3 and 80.2%, respectively, and resulted in a grain yield of 4.07 t/ha, which was much higher than that of the check (1.92 t/ha). The potential of six combinations of cultural methods i.e. using pre-sowing irrigation followed by *Afir* drilling or *Herrati* method; false irrigation / ploughing / pre-sowing irrigation followed by *Afir* drilling or *Herrati* and flooding for 5 days followed by *Afir* drilling or *Herrati* method was studied at Shandaweel Research Station as an alternative to herbicide use under a level of weed infestation (phalaris spp/*Avena* spp./ *Ammi majus* and *Chenopodium album*) estimated at 14.5 t/ha. The best treatment for weed control (by 83.8%) and improved wheat grain yield (by 1.6 t/ha) with false irrigation then ploghing with *Afir* drilling.

To study the role of sowing methods by drilling or broadcasting one field experiment was conducted in Gimmeza station by Elian *et al* 1995 during 1994 and 1995 seasons Table (25).

Results revealed that narrowing row spaing to 10 cm decreased weed population in wheat and consequently improved wheat productivity due to the decrease of weed competition.

## 4- Sowing date:

The effect of sowing date on *Phalaris* occurrence and efficacy of Arelon and hand weeding on wheat was investigated by in 1992/93 and 1993/94 winter seasons at Gemmeiza and Sakha Research Stations. The highest fresh weight of broad-leaved weeds was obtained with November 15 and December 15 wheat sowing dates. The maximum weed density of *Phalaris* minor occurred with November 15 or 30 wheat sowing dates. The lowest grain yield was obtained with December 30. Arelon was most effective in reducing fresh weight of grassy weeds and thus realizing the highest grain yield, (Tables 26,27).

Another experiment was conducted in naturally infested fields with wild oat during 1992/93 and 1993/94 winter seasons by Al Marsafy and Michael (1993) and Mekhail (1994) at Mallaway Research Station to investigate the effect of sowing date on wild oats control and wheat grain yield.

**Table (24) : Effect of sowing methods and flooding on wild oat infestation and grain yield at Mallawy and Shandaweel Research Stations, 98/99 and 99/2000 winter season.**

| Treatment | Mallawy | | | | | Shandaweel | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Brodleaf weeds ( g/m$^2$) | Grassy weeds (g/m$^2$) | Gain yield (t/ha) | F.W of weeds (g/m$^2$) | Grain yield (t/ha) | F.W of weeds (g/m$^2$) | Grain yield ( t/ha) | F. W of weeds (g/m$^2$) | Grain yield (t/ha) |
| | 1998 / 99 | | | 99/2000 | | 98 / 99 | | 99/2000 | |
| Pre - sowing irrigation then planting with *Afir* drilling sowing method | 522.8 | 492.8 | 3.75 | 636.3 | 2.86 | 53.3 | 1.262 | 452.5 | 4.345 |
| Pre - sowing irrigation then planting with *Herati* drilling sowing method | 473.5 | 366.3 | 4.16 | 549.5 | 3.30 | 59.5 | 1.529 | 540.5 | 4.107 |
| Pre - sowing irrigation / ploughing / false irrigation then planting with Afir drilling sowing method | 42.8 | 37.0 | 6.60 | 72.8 | 4.34 | 18.5 | 1.741 | 235.0 | 4.845 |
| Pre - sowing irrigation / ploughing /false irrigation then planting with *Afir* sowing method | 19.3 | 16.8 | 7.02 | 47.2 | 4.63 | 12.3 | 2.029 | 502.3 | 4.333 |
| Flooding for 5 days then planting with Afir drilling sowing method | 471.8 | 354.0 | 5.63 | 339.8 | 3.74 | 91.0 | 1.202 | 564.8 | 4.207 |
| Flooding for 5 days then planting with *Herati* drilling sowing method | 361.0 | 283.3 | 5.97 | 271.5 | 4.07 | 11.3 | 1.797 | 444.0 | 4.417 |
| Afir drilling sowing method (check) | 928.5 | 672.3 | 2.57 | 1604.3 | 1.92 | 136.0 | 0.420 | 1448.8 | 3.167 |
| L.S.D | 22.7 | 22.3 | 0.4 | 20.4 | 0.6 | 43.8 | 0.3 | 266.4 | 0.8 |

**Table (25): Effect of interrow spacing on the fresh weight of weeds g/m$^2$ and wheat grain yield t/ha in El-Gimmeza 1994 and 1995 seasons.**

| Treatments | Fresh weight | | | | | |
|---|---|---|---|---|---|---|
| | Broad leaved weeds | Grasses | Grain yield t/ha | Broad leaved weeds | Grasses | Grain yield t/ha |
| | 1994 Season | | | 1995 Season | | |
| **Interrow 10 cm** | **559** | **391** | **7.9** | **480** | **333** | **7.3** |
| **Interrow 15 cm** | **1217** | **733** | **7.5** | **657** | **417** | **6.4** |
| **Interrow 20 cm** | **2704** | **3578** | **3.1** | **1076** | **639** | **5.4** |
| **Broad cast** | **2140** | **814** | **4.1** | **625** | **455** | **6.2** |
| **L.S.D** | | | **1.10** | | | **1.40** |

Results revealed that delaying the sowing date was associated with an increase in fresh weight of wild oats. Average fresh weight of wild oats associated with the three sowing dates of 15 and 30 Nov and 15 Dec were 7.5, 9.0 and 10 t/ha, respectively. On the other hand, wheat grain production decreased with delaying sowing date, thus the respective yield for the three sowing dates in unweeded treatments were 2.21, 1.89 and 1.45 t/ha. As for the weed management treatments, clear positive effects on wild oat were observed with Grasp followed by hand weeding (twice). Both treatments accounted for significant reduction of 85 and 67% respectively in weed fresh weight. Moreover, wheat grain yield increased by 146 and 115%, respectively. The Grasp treatment significantly out yielded hand weeding giving 0.59 t/ha more grain. The largest weight (8.2 t/ha) of wild oats was obtained from the unweeded check.

In naturally infested fields with wild oats, a proper experiment was conducted at Shandaweel Research Station by Al Marsafy et al (1994) during 1993/94-winter season to determine the relationship between sowing date and weed control treatment on wild oats and wheat grain yields. The average fresh weight of wild oats that survived all treatments were 27.5, 18.6 and 7.0 t/ha with the respective sowing dates of 28 Nov 1993, 14 Dec 1993 and 3 Jan 1994. The respective mean grain yields were 0.92, 0.98 and 0.5 t/ha. Grasp at 2.38 L/ha and hand weeding twice (25 and 40 days after sowing) controlled wild oats by 51.47 and 53.47 and 53.42 %, and increased the average wheat grain yields by 103 and 69% %, respectively. Delaying sowing date was distinctly inferior.

**Table (26): Effect of sowing dates and weed control on *phalaris* spp. and wheat grain yield at Gimmeza and Sakha 1992/93 and 1993/94.**

| Sowing date | 1992/93 | | 1993/94 | | | |
|---|---|---|---|---|---|---|
| | Gimmeza | | Gimmeza | | Sakha | |
| | Phlaris $g/m^2$ | Wheat yield t/ha | Phlaris $g/m^2$ | Wheat yield t/ha | Phlaris $g/m^2$ | Wheat yield t/ha |
| **15/11 Arelon 2.98 l/ha** | **169** | **5.8** | **242** | **6.2** | **385** | **3.4** |
| **Hand weeding twice** | **360** | **4.6** | **465** | **6.0** | **392** | **2.0** |
| **Unweeded** | **109** | **1.3** | **2073** | **1.3** | **1340** | **0.6** |
| **30/11 Arelon 2.98 l/ha** | **155** | **5.4** | **153** | **6.0** | **273** | **3.3** |
| **Hand weeding twice** | **341** | **5.3** | **122** | **5.1** | **180** | **3.7** |
| **Unweeded** | **1184** | **1.2** | **1736** | **1.7** | **1150** | **2.4** |
| **15/12 Arelon 2.98 l/ha** | **164** | **5.0** | **89** | **4.8** | **348** | **4.6** |
| **Hand weeding twice** | **380** | **4.1** | **87** | **4.6** | **202** | **3.9** |
| **Unweeded** | **1104** | **1.2** | **1177** | **1.2** | **1525** | **3.5** |
| **30/12 Arelon 2.98 l/ha** | **140** | **4.5** | **87** | **4.8** | **344** | **4.4** |
| **Hand weeding twice** | **324** | **3.1** | **77** | **4.2** | **172** | **3.9** |
| **Unweeded** | **823** | **0.9** | **808** | **1.6** | **1110** | **3.2** |
| **Sowing date av. 15/11** | **441** | **3.9** | **924** | **4.5** | **705** | **2.0** |
| **30/11** | **560** | **4.0** | **670** | **4.3** | **534** | **3.1** |
| **15/12** | **549** | **3.4** | **434** | **3.5** | **391** | **3.9** |
| **30/12** | **429** | **2.9** | **324** | **3.5** | **542** | **0.6** |
| **Weed control Arelon 2.98 l/ha** | **127** | **5.2** | **143** | **5.4** | **337** | **4.0** |
| **Hand weeding twice** | **351** | **4.3** | **188** | **50** | **237** | **32** |
| **Unweeded** | **478** | **1.2** | **1436** | **1.6** | **281** | **2.2** |
| **LSD between weed controls** | **141** | **0.6** | **111** | **0.40** | **536** | **0.23** |
| **LSD between sowing date** | **153** | **0.6** | **149** | **0.45** | **NS** | **0.40** |
| **LSD between weed controls x sowing date** | **77** | **0.3** | **235** | **0.77** | **NS** | **0.5** |

**Table (27): Effect of sowing dates and weed control on wild oat and wheat at Mallawi and Shandaweel (1992/93 and 1993/94 seasons).**

| Weed control treatment | 1992/93 | | | | 1993/94 | | | |
|---|---|---|---|---|---|---|---|---|
| | Mallawi | | Shandaweel | | Mallawi | | Shandaweel | |
| | Wild oat $g/m^2$ | Wheat yield t/ha | Wild oat $g/m^2$ | Wheat yield t/ha | Wild oat $g/m^2$ | Wheat yield t/ha | Wild oat $g/m^2$ | Wheat yield t/ha |
| **15/11 Grasp** | - | - | - | - | 237 | 4.5 | 1571 | 1.3 |
| *Hand weeding* | - | - | - | - | 129 | 5.1 | 2130 | 1.1 |
| **Unweeded** | - | - | - | - | 747 | 2.2 | 4561 | 0.5 |
| **30/11 Grasp** | 22.1 | 9.2 | 138 | 2.0 | 294 | 3.9 | 1078 | 0.9 |
| *Hand weeding* | 21.5 | 9.0 | 179 | 1.8 | 134 | 4.6 | 156 | 1.4 |
| **Unweeded** | 21.6 | 9.2 | 161 | 1.1 | | 1.9 | 2969 | 0.6 |
| **15/12 Grasp** | 111 | 8.3 | 179 | 0.9 | 348 | 3.5 | 1162 | 0.4 |
| *Hand weeding* | 113 | 8.2 | 347 | 0.3 | 141 | 3.9 | 298 | 0.7 |
| **Unweeded** | 114 | 7.2 | 2434 | 0.4 | 996 | 1.5 | 661 | 0.4 |
| **30/12 Grasp** | 639 | 6.0 | 503 | 0.4 | - | - | - | - |
| *Hand weeding* | 688 | 6.1 | 564 | 0.2 | - | - | - | - |
| **Unweeded** | 763 | 5.3 | 1149 | 0.4 | - | - | - | - |
| **Sowing date av. 15/11** | - | - | - | - | 371 | 3.9 | 2754 | 0.9 |
| **30/11** | 258 | 7.8 | 1.1 | 1.6 | 441 | 3.5 | 1863 | 1.0 |
| **15/12** | 274 | 7.8 | 0.8 | 0.5 | 495 | 3.0 | 704 | 0.5 |
| **30/12** | 299 | 6.9 | 0.6 | 0.4 | - | - | - | - |
| **Weed control Grasp** | 22 | 8.8 | 2.3 | 1.1 | | 4.0 | 1270 | 0.9 |
| *Hand weeding* | 113 | 7.9 | 321 | 0.8 | 134 | 4.6 | 1323 | 1.0 |
| **Unweeded** | 696 | 5.8 | 0.6 | 0.6 | 879 | 1.9 | 2727 | 0.5 |
| **LSD for sowing dates** | 64 | NS | 421 | 0.5 | 21 | 0.3 | 280 | 0.4 |
| **LSD for weed control treatments** | NS | 0.07 | 650 | NS | 33 | 0.3 | 230 | 0.3 |
| **LSD between sowing date x weed control treatments** | NS | 0.5 | 690 | NS | 51 | NS | NS | NS |

## 5- Hand weeding

Table (28) show results of four field experiments conducted during 1994/95, 1995/96, 1996/97 and 1999/2000 winter seasons by Al-Marsafy and Kholosy (1995, 1996) Al-Marsafy and Kholosy et al (2000) to determine the suitable number and time of hand weeding on controlling grassy weeds in wheat. Results indicated that hand weeding twice at 20 and 45; 30 and 60 or 45 and 60 days after sowing was very effective in controlling all grassy weed mixtures as *Phalaris* spp., *Lolium* spp. *Avena* spp. and increased grain yield.

**Table (28): Effect of timing of hand weeding treatment on controlling annual grassy weeds and grain yield of wheat at Shandaweel Research Station, 1995/96 until 1999/2000 season.**

| Days after sowing | 1994/95 | | 1995/96 | | 1996/97 | | 1999/2000 | |
|---|---|---|---|---|---|---|---|---|
| | Fresh weight (g/m$^2$) | Grain yield t/ha | Fresh weight (g/m$^2$) | Grain yield t/ha | Fresh weight (g/m$^2$) | Grain yield of wheat (t/ha) | Fresh weight (g/m$^2$) | Grain yield of wheat (t/ha) |
| 30 | 611 | 4.7 | 808 | 5.1 | | | 425 | 6.3 |
| 45 | 576 | 4.2 | 568 | 5.5 | 475 | 4.70 | 127 | 6.7 |
| 60 | 767 | 4.0 | 990 | 5.4 | | | 211 | 7.8 |
| 30 & 45 | 310 | 5.4 | 620 | 5.8 | 499 | 5.73 | 107 | 7.1 |
| 45 & 60 | 190 | 4.9 | 530 | 6.3 | 282 | 5.05 | 118 | 7.0 |
| 30 & 60 | 642 | 4.3 | 514 | 7.2 | 338 | 5.10 | 144 | 6.3 |
| Unweeded | 1356 | 2.4 | 1430 | 4.4 | 3358 | 2.49 | 2021 | 6.1 |
| L.S.D | 413.2 | 1.06 | 575.1 | 1.3 | 308 | 0.75 | 814.3 | NS |

## 6- Herbicides

Five field experiments were conducted during 1992/93 growing season by Hassanein et al (1993) at Kom Oshim, Mallawi, Shandaweel, Gemmiza and Nubaria to investigate the efficacy of some grassy herbicides against annual grassy weeds in wheat. The experimental sites were naturally infested with grassy weeds, particularly *Avena spp., Lolium spp.* and *Phalaris spp.*

Results revealed that the application of Topik 24 %WP 0.238 kg/ha, Dopler 25% at 2.975 L/ha, Grasp 25% EC + Ataplus (mineral 0:1) at 0.952 + 0.952 L/ha, Assert 24% at 2.023 L/ha and Puma super 7.5% at 1.19 L/ha were the most effective herbicides against annual grassy weeds and significantly increased wheat grain yield Table (29).

**Table (29) : Effect of some new graminicides on annual grasses control and wheat yield in 1992/93 winter seasons**

| Weed control treatments | Rate/hectar | Kom Oshim | | Mallawi | | Shandaweel | | Gimmeza | | | El-Nubaria | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Wild oat $g/m^2$ | Grain yield t/ha | Wild oat $g/m^2$ | Grain yield t/ha | Wild oat $g/m^2$ | Grain yield t/ha | Wild oat $g/m^2$ | Phalaris sp | Grain yield t/ha | Wild oat $g/m^2$ | Grain yield t/ha |
| Topik 24 % EC | 0.238 kg | 1.9 | 5.4 | 13.7 | 9.0 | 25.0 | 1.4 | 101.3 | 85.0 | 6.0 | 266.7 | 6.6 |
| Assert 25% EC | 1.904 L | 1.7 | 5.4 | 62.5 | 8.0 | 484.0 | 1.0 | 135.0 | 238.0 | 4.0 | 333.3 | 6.8 |
| Assert 25% EC | 2.023 L | 1.5 | 5.7 | 45.6 | 8.3 | 314.0 | 1.3 | 93.5 | 171.5 | 5.0 | 500.0 | 7.3 |
| Grasp 25% + Atplus | 0.774L + 0.744L | 5.1 | 5.3 | 49.5 | 8.1 | 133.0 | 1.5 | 172.0 | 201.8 | 4.0 | 200.0 | 3.8 |
| Grasp 25% + Atplus | 0.833L + 0.833L | 4.8 | 4.4 | 31.0 | 8.6 | 69.5 | 1.1 | 128.8 | 168.0 | 4.9 | 0.0 | 5.4 |
| Grasp 25% + Atplus | 0.952L + 0.952L | 2.2 | 3.9 | 24.8 | 8.4 | 83.4 | 1.3 | 94.0 | 128.0 | 5.2 | 0.0 | 5.8 |
| Grasp 10% EC | 2.83 L | 11.1 | 4.9 | 22.3 | 9.0 | 206.3 | 0.8 | 172.5 | 140.3 | 4.2 | 933.3 | 4.5 |
| Puma-S 75% EW | 0.952 L | 20.6 | 4.9 | 71.8 | 7.4 | 36.2 | 1.4 | 251.5 | 281.0 | 3.9 | 400.0 | 6.5 |
| Puma-S 75% EW | 1.071 L | 18.3 | 4.8 | 50.5 | 8.3 | 20.2 | 1.5 | 225.5 | 225.3 | 4.6 | 333.3 | 6.6 |
| Puma-S 75% EW | 1.190 L | 11.9 | 4.4 | 40.8 | 8.4 | 33.5 | 1.4 | 171.0 | 144.3 | 5.0 | 533.3 | 6.4 |
| Dopler 250 g + 23 g/L | 1.785 L | 10.7 | 5.2 | 67.4 | 7.0 | 231.1 | 1.0 | 118.0 | 51.3 | 5.7 | 133.3 | 5.5 |
| Dopler 250 g + 23 g/L | 2.38 L | 8.1 | 4.7 | 46.8 | 7.6 | 29.4 | 1.6 | 62.8 | 14.3 | 5.8 | 533.3 | 5.2 |
| Dopler 250 g + 23 g/L | 2.975 L | 6.8 | 3.9 | 39.6 | 8.2 | 43.1 | 1.4 | 15.3 | 9.3 | 6.1 | 33.3 | 5.6 |
| Handweeding | | 48.6 | 3.9 | 126.4 | 7.4 | 23.0 | 0.6 | 326.0 | 380.3 | 3.1 | 300.0 | 5.6 |
| Control | | 60.0 | 3.0 | 694.4 | 6.0 | 1766.5 | 0.3 | 634.8 | 911.8 | 1.0 | 1300.0 | 3.8 |
| L.S.D. | | 8.1 | 1.1 | 18.6 | 0.6 | 420.3 | N.S | 45.7 | 41.9 | 0.7 | N.S. | 2.1 |

Another four field experiments were conducted by El-Meshad et al (1993) during 1992/93 growing season to study the efficacy of some herbicides applied at 4, 7, and 8 weeks after sowing (WAS) against wild oats, at Shandaweel and Mallawi. Other experiments were conducted to investigate the effect of some herbicides applied at 2, 3, 4, and 5 WAS on broadleaf weeds at Sakha and Gemmeiza Research Stations. Results revealed that hand weeding, Grasp 10% at 2.38 L/ha and Suffix 20% EC 2.97 L/ha were the effective treatments against wild oats when applied at 4 WAS and this was reflected by given the highest grain yield /ha. Meanwhile, Arelon 50% at 2.97 L/ha, Brominal 24% at 2.38 L/ha, Granstar 75% at 19 g/ha and Modown 48% at 1.42 L/ha were effective against broad leaf weeds when applied at 3, 4, 3 and 2 WAS, respectively and affected wheat grain yield significantly (Table 30, 31).

**Table (30): Effect of the time of herbicidal application on wild oat and wheat at Shandaweel and Mallawi during 1992/93 season.**

| Treatments L/ha | Time of application (WAS) | Mallawi | | Shandaweel | |
|---|---|---|---|---|---|
| | | Wild oat g/m$^2$ | Wheat yield t/ha | Wild oat g/m$^2$ | Wheat yield t/ha |
| Grasp 2.38 | 4 | 33.7 | 9.10 | 238 | 2.214 |
| Grasp 2.38 | 7 | 39.9 | 10.49 | 796 | 1.226 |
| Grasp 2.38 | 8 | 24.4 | 11.94 | 1089 | 1.156 |
| Suffix 2.98 | 4 | 78.2 | 8.38 | 632 | 1.726 |
| Suffix 2.98 | 7 | 115.3 | 9.82 | 710 | 0.845 |
| Suffix 2.98 | 8 | 87.7 | 10.93 | 2445 | 1.118 |
| Hand weeding twice | -- | 61.5 | 10.52 | 251 | 1.777 |
| Unweeded | -- | 395.2 | 7.24 | 1719 | 1.377 |
| LSD 5% | | 32.6 | 0.904 | 934 | 0.813 |

Four field experiments were conducted during 1998/99 and 1999/2000 (Hassanein et al, 1999; Shebl and Abd El-Hamid 1999 & 2000) growing seasons at Sids and Sakha Agriculture Research Stations to study the effect of some wheat cultivars and some recommended herbicides on annual weeds and wheat grain yield. Split plot design was followed, where wheat cultivars were arranged at the main plots and weed control treatments were arranged randomly at the sub main plots. The studied wheat cultivars were Sids 1, Sids 2, Sids 9, Sakha 68 and Sakha 61 (at Sids station) and Sids 1, Gemmeiza 5, Gemmeiza 7, Sakha 61 and Sakha 69 (at Sakha station) Tables (32, 33, 34).

Weed control treatments under this study were Sinal, Sencor, Arelon, Grasp and Topik in addition to hand weeding (twice). Results revealed that wheat cultivars did not affect the annual weeds significantly. However, it affected wheat grain yield, hence Gemmeiza 7, Gemmeiza 5, Sakha 69 and Sids 2 achieved the highest wheat grian yield. All studied weed control treatments were effective against annual weeds and increased wheat grain yield significantly if compared to the untreated check. There was no phytotoxicity appeared on wheat cultivars as a result of the studied herbicides

**Table (31): Effect of the time of herbicidal application on broad leaf of weeds and wheat yield at Gimmeza and Sakha, 1992/93 seasons.**

| Treatments | Time of application (WAS) | Gimmeza | | Sakha | |
|---|---|---|---|---|---|
| | | Broadleaf weeds $g/m^2$ | Wheat yield t/ha | Broadleaf weeds $g/m^2$ | Wheat yield t/ha |
| Brominal at 2.38 t/ha | 2 | 93 | 3.4 | - | - |
| Brominal at 2.38 t/ha | 3 | 72 | 3.4 | 18.3 | 5.5 |
| Brominal at 2.38 t/ha | 4 | 18 | 3.0 | 2.5 | 6.1 |
| Brominal at 2.38 t/ha | 5 | - | - | 115 | 4.4 |
| Arelon at 2.97 t/ha | 2 | 68 | 5.5 | - | - |
| Arelon at 2.97 t/ha | 3 | 79 | 4.9 | 2.5 | 6.7 |
| Arelon at 2.97 t/ha | 4 | 191 | 4.1 | 7.5 | 6.0 |
| Arelon at 2.97 t/ha | 5 | - | - | 9.8 | 5.5 |
| Granstar at 19 g/ha | 2 | 31 | 3.4 | - | - |
| Granstar at 19 g/ha | 3 | 37 | 3.9 | 13.8 | 5.6 |
| Granstar at 19 g/ha | 4 | 95 | 4.0 | 2.0 | 6.1 |
| Granstar at 19 g/ha | 5 | - | - | 32.3 | 5.2 |
| Modown at 1.43 t/ha | 2 | 269 | 3.4 | - | - |
| Modown at 1.43 t/ha | 3 | 359 | 3.0 | 59 | 5.0 |
| Modown at 1.43 t/ha | 4 | 438 | 3.2 | 29 | 5.6 |
| Modown at 1.43 t/ha | 5 | - | - | 16 | 5.5 |
| IPFLO at 2.98 t/ha | 2 | 49 | 5.1 | - | - |
| IPFLO at 2.98 t/ha | 3 | 79 | 5.1 | 3.5 | 4.6 |
| IPFLO at 2.98 t/ha | 4 | 196 | 4.4 | 3.0 | 5.8 |
| IPFLO at 2.98 t/ha | 5 | - | - | 1.0 | 5.0 |
| Handweeding twice | - | 218 | 3.3 | 29.6 | 5.3 |
| Unweeded | - | 1495 | 1.3 | 222.8 | 4.8 |
| LSD 5% | | 652 | 0.5 | 92.6 | NS |

**Table (32): Effect of wheat varieties and weed control treatments on the fresh weight of grassy weeds (g/m$^2$) and wheat grain yield (t/ha) at Sids during 1998/99 season.**

| Items | Grassy weeds (g/m$^2$) | Wheat grain yield (t/ha) |
|---|---|---|
| **a- varieties:** | | |
| **Sids 1** | **8.1** | **5.6** |
| **Sids 2** | **8.2** | **6.2** |
| **Sids 9** | **8.1** | **4.7** |
| **Sids 69** | **15.1** | **6.6** |
| **Sids 61** | **6.6** | **5.7** |
| **LSD at 5 %** | NS | **0.2** |
| **b- Weed control treatments:** | | |
| Grasp 10% EC at 2.38 t/ha | **1.7** | **5.6** |
| Topostar 15% WP at 33.5 g/ha | **1.4** | **6.0** |
| **Arelon 50 % FL at 2.4 t/ha** | **4.0** | **6.5** |
| **Handweeding twice** | **1.8** | **6.3** |
| **Unweeded** | **32.2** | **4.3** |
| **LSD at 5 %** | **5.3** | **0.3** |

Interaction between varieties and weed control treatments NS.

**Table (33): Effect of wheat varieties and weed control treatments on the fresh weight of broadleaf weeds (g/m2) and wheat grain yield (t/ha) at Sids during 1998/99 seasons.**

| Items | Broadleaf weeds (g/m$^2$) | Wheat grain yield (t/ha) |
|---|---|---|
| **a- varieties:** | | |
| **Sids 1** | **110** | **5.6** |
| **Sids 2** | **91.0** | **6.5** |
| **Sids 9** | **98.0** | **5.5** |
| **Sids 69** | **113.0** | **6.8** |
| **Sids 61** | **117.0** | **5.7** |
| **LSD at 5 %** | NS | **0.3** |
| **b- Weed control treatments:** | | |
| **Sinal 10% SC 95 cc/ha** | **62.3** | **6.0** |
| **Sencor 70% WP 142.9 g/ha** | **84.2** | **6.4** |
| **Arelon 50 % FL at 2.98 t/ha** | **77.4** | **6.6** |
| **Handweeding twice** | **63.6** | **6.5** |
| **Unweeded** | **241.0** | **4.2** |
| **LSD at 5 %** | **36.5** | **0.3** |

Interaction between varieties weed control treatment NS.

**Table (34): Effect of wheat varieties and weed control treatments on weeds and wheat in Sakha, during 1998/99 and 1999/2000 seasons.**

| Season | 1998/99 | | 1999/2000 | |
|---|---|---|---|---|
| Items | Broad leaf weeds ($g/m^2$) | Wheat grain yield (t/ha) | Broad leaf weeds ($g/m^2$) | Wheat grain yield (t/ha) |
| **a- varieties:** | | | | |
| 1- Sids 1 | 334.1 | 4.9 | 167.6 | 4.8 |
| 2- Gimmeza 5 | 843.6 | 2.9 | 124.7 | 5.9 |
| 3- Gimmeza 7 | 907.8 | 3.4 | 222.5 | 5.9 |
| 4- Sakha 61 | 597.3 | 4.1 | 182.8 | 4.7 |
| 5- Sakha 69 | 374.5 | 4.3 | 124.7 | 4.9 |
| LSD at 5 % | 235.3 | 1.2 | NS | NS |
| **b- Weed control treatments:** | | | | |
| 1- Grasp 10% EC at 2.38 t/ha | 279 | 4.1 | 54 | 5.6 |
| 2- Topik 15% WP at 335 g/ha | 216 | 4.2 | 30 | 5.5 |
| 3- Arelon 50%FL at 2.98 t/ha | 211 | 4.3 | 58 | 6.1 |
| 4- Sinal 10% SC at 95 cc/ha | 1027 | 4.0 | 68 | 5.3 |
| 5- Sencor70%WP at 145 g/ha | 840 | 4.1 | 87 | 5.3 |
| 6- Handweeding twice | 246 | 4.4 | 139 | 5.1 |
| 7- Weedy check | 1461 | 2.5 | 716 | 3.9 |
| LSD at 5 % | 140 | 1.2 | 85 | NS |

Interaction between wheat varieties and weed control treatment NS.

## Abstract:

Series of 35 field experiments in research stations in 1992-2000 period about the effect of preceding crops rotation patterns, sowing method, land preparation, sowing dates, herbicides, varieties tolerance to herbicides and the wheat seed contamination by weeds under 400 farmer's level on weed control and wheat productivity, the purpose of this work is to generate wild oat and other weeds management package in wheat. Main findings revealed that wheat clean seeds is needed to prevent weed dispersal in wheat fields where results indicated that about 10-29.6 % of farmer wheat seeds samples contaminated with 11-62 seeds of wild oat seeds/kg of wheat seeds. Another weed seeds were involved as *Anagallis arvensis, Beta vulgaris, convolvulus arvensis* , *Exmex spinosus, lathyrus hirsutus* and *Melilotus indica* where the degree of contamination varied from governoroate to another goverorate.

The suitable crop pattern for obtaining wheat clean seeds for weed seeds is to grow wheat in rotation included clover in rotation with wheat and controlling chemically both grassy and broadleaf weeds.

Brominal, Granstar and Sinal are effective herbicides against broadleaf weeds in wheat and Topik, Puma-s, Grasp, Assert and Suffix are recommended for controlling wild oat and grassy weeds in wheat fields. There is no phytotoxicity appeared on Sid 1, Gimmeza 5, Gimmeza 7, Sakha 61, Sakha 69 wheat varieties to the recommended herbicides Sinal, Brominal, Sencor, Arelon, Grasp and Topik.

Giving pre-sowing irrigation once or twice and followed by plowing and sowing wheat can control weed and increase wheat productivity.

Handweeding twice at 20 and 45, 30 and 60 or 45 and 60 days after sowing were effective in controlling grassy weeds mixture of *Avena sp*, *Lolium sp* and *Phalaris sp* and wheat grain yield.

It is clear that clover / clover / wheat, clover / wheat / clover / wheat and faba bean / wheat / faba bean / wheat sequences decreased wheat weeds competition and increased wheat yield through reducing weeds infestation and decreasing seed bank in soil than in case of non rotated wheat.

Using the combined herbicides under wheat sowing continuously is very important to sustain wheat production.

For minimizing weeds population and maximizing potential wheat production, it is necessary using clover rotated with wheat and integrating with effective weed control methods and decreasing wheat seed contamination and reducing seed bank of weeds especially wild oats.

## الملخص

تم إقامة سلسلة من 35 تجربة حقلية بمحطات البحوث في الفترة من 1992-2001 لدراسة تأثير المحصول السابق والنمط المحصولى المتبع وطريقة الزراعة وإعداد وخدمة الأرض ومواعيد الزراعة والمبيدات وحساسية أصناف القمح للمبيدات من حيث مواعيد اضافتها وتلوث تقاوى القمح ببذور الحشائش لتوليد حزم توصيات لمكافحة الحشائش في محصول القمح وكانت أهم النتائج التى تم التوصل اليها -:

ضرورة الزراعة بتقاوى خالية من بذور الحشائش بغربلتها لمنع انتشار الحشائش حيث وجد أن حوالى 10-29.6 %من تقاوى القمح ينتشر بها الزمير بكمية تتراوح ما بين 11-62 حبة زمير / كجم تقاوى ، كما توجد بذور عين الجمل والسلق والعليق وض رس العجوز والدحريج والنفل والتى تختلف باختلاف المحافظة ولقد وجد أن أفضل تتابع محصولى لتقليل بذور الحشائش بتقاوى القمح هي زراعة القمح بالتبادل مع البرسيم مع إجراء المكافحة الكيماوية للحشائش النجيلية وعريضة الأوراق بمحصول القمح .

اعطاء رية سابقة للزراعة مرة أو مرتين متبوعة بالحرث ثم زرعة القمح حراثى أو عفير يمكنها من مكافحة الحشائش وزيادة انتاجيةمحصول القمح .

يعتبر أنسب وقت لإجراء المكافحة اليدوية للحشائش النجيلية في القمح هو ما بين 30-60 يوم بعد الزراعة على أن تجرى النقاوة مرتين في هذه الفترة .

تعتبر مبيدات توبيك بوما سوبر وجراسب مبيدات فعالة ضد الزمير والحشائش النجيلية الأخرى في القمح وأنسب أوقات اضافة لها ما بين 30-45 يوماً بعد الزراعة والبرومينال والسينال والجرانستار مبيدات فعالة ضد الحشائش عريضة الأوراق عند اضافتها بعد شهر من الزراعة كما أن جميع أصناف القمح المستخدمة مثل سدس 1 ، جميزة 5 ، جميزة 7 ، سخا 61 ، وسخا 69 غير حساسة لجميع المبيدات المذكورة .

الخلاصة

ؤدى استخدام التعاقبات المحصولية التى تشمل تعاقبات البرسيم /البرسيم والقمح أو البرسيم /قمح / برسيم /قمح أو فول بلدى /قمح /فول بلدى /قمح فعالة في تقليل منافسة الحشائش لمحصول القمح وتحسين صفات التربة .

أن استخدام مبيدات الحشائش عريضة الأوراق والنجيلية في القمح ضرورية للمحافظة على انتاجية المحصول لسنوات طويلة .

يتسخلص من ذلك أنه لتقليل كثافات الحشائش وتقليل مخزون بذور بالتربة وزيادة انتاجية القمح بشكل مستدام فإنه من الضرورى استخدام البرسيم بالتبادل مع القمح متكاملاً مع طرق الزراعة بإعطاء رية قبل الزراعة وحرث الأرض مع استخدام المكافحة الكيماوية للحشائش النجيلية وعريضة الأوراق و تحت ظروف الأراضى الجديدة والقديمة .

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## Chapter 2: Weed control in barley

Nine field experiments were conducted in EL-Nubaria and EL-Gimmeza Research Station. Eight experiments were conducted in EL-Nubaria in 1993/94 and 1995/96 seasons by Kholosy and El-Meshad (1994 & 1995) and Kholosy et al (1996) and one experiment at EL-Gimmeza Res. St. in 1994/95, to evaluate the effect of some herbicides either individual or combinations on weed control and grain yield of barley .

Data in tables 1 revealed that bromoxynil (Brominal 24% EC) at 2.38 l/ha gave significant reduction on annual broadleaf weeds and increased grain yield significantly in most experiments. Tralkoxydim (Grasp 10% EC) at 2.38 l/ha gave significant reduction on annual grassy weeds i.e. *Avena* spp and *Phalaris* spp accompanied with increase in grain yield significantly in most cases. Brominal at 2.38 l/ha and Grasp at 2.38 l/ha either tank mixture or combination with one two weeks interval caused wide spectrum of weed control of both broadleaf and grassy weeds and increase grain yield compared with the individual herbicide. Also, L- flamrop- isopropyl (Suffix 20% EC) at 2.98 l/ha gave good control for *Avena* spp. only with increase in grain yield Brominal at 2.38 l/ha and Suffix at 2.98 l/ha either tank mixture or combination with two-four weeks interval can control *Avena* spp plus annual broadleaf weeds and cause more increase in grain yield compared with the individual herbicide.

Study the efficacy of some herbicides on controlling annual broadleaf weeds in barley results obtained by Hassanein and Kholosy (1997), Kholosy et al (1998) and Kholosy and Ibrahim (1999) in (Table 2) show the efficacy of metribuzin (Sencor 70%) at 119 and 142.8 g/ha and metosulam (Sinal 10% EC) at 71.4 and 95.2 cc/ha on controlling annual broadleaf weed (87-100%) and increasing grain yield of barley (0.03 to 0.88 t/ha) and superior handweeding twice in both seasons in addition to tribenuron- methyl (Granstar 75% Df) at 19.0 g/ha as the recommended herbicide in the second season. These results suggest that Sinal can be used safety in addition to Granstar to control annual broadleaf weeds in barley under new land condition.

**Table (1): Effect of weed control treatments on annual weeds in g fresh weight g/m$^2$ and grain yield (t/ha) in barley at El-Gimmeza Res., and El-Nubaria St., from 1993/94,1994/95 and 1995/96 winter seasons.**

| Season | El-Nubaria 1993/94 | | | | El-Nubaria 1994/95 | | | | El-Gimmeza 1995/96 | | | | El-Nubaria 1995/96 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Weed control treatments | Fresh weight of annual weeds (g/m$^2$) | | | Grain yield (ton/ha) | Fresh weight of annual weeds (g/m$^2$) | | | Grain yield (ton/ha) | Fresh weight of annual weeds (g/m$^2$) | | | Grain yield (ton/ha) | Fresh weight of annual weeds (g/m$^2$) | | | Grain yield (ton/ha) |
| | Broad-leaved | Grassy weeds | Total weeds | | Broad-leaved | *Phalaris minor* | Total weeds | | Broad-leaved | *Grassy weeds* | Total weeds | | Broad-leaved | Grassy weeds | Total weeds | |
| Bromoxynil | 12.3 | 655.4 | 680 | 4.095 | 0 | 429.3 | 429.3 | 3 | 28.3 | 1705.5 | 1734 | 0.55 | 68 | 132.3 | 200.5 | 3.17 |
| Tralkoyxdim | 486.1 | 373.7 | 846 | 3.5 | 1017 | 156 | 1173 | 2.71 | 745.3 | 186 | 931.3 | 1.15 | 126 | 35.5 | 161.5 | 2.78 |
| L-flamprop- isopropyl | 459.8 | 357.2 | 1277 | 3.5 | - | - | - | - | 745.3 | 1166 | 1912 | 0.28 | 192 | 43.5 | 235.5 | 2.73 |
| * Bromoxynil+ tralkoyxdim | 4.1 | 167.4 | 176 | 4.667 | 0 | 22.5 | 22.5 | 5.31 | 20.3 | 423 | 443.3 | 1.23 | 25.5 | 16 | 41.5 | 2.97 |
| * Bromoxynil+ L-flamprop-isopropyl | | | | | | | | | 48 | 1103 | 1151 | 0.4 | 11.5 | 45 | 65.5 | 2.8 |
| **Bromoxynil + tralkoyxdim | | | | | 0 | 83.8 | 83.8 | 5.43 | 23.3 | 116.8 | 140.1 | 1.6 | 17 | 22 | 39 | 3.25 |
| **Bromoxynil+ L-flamprop-isopropyl | | | | | | | | | 27.3 | 106.7 | 1094 | 0.93 | 11.5 | 65 | 76.5 | 3.11 |
| Hand weeding | 98.7 | 261.6 | 414 | 3.452 | 125.8 | 76 | 201.8 | 3.5 | 140.8 | 474.3 | 615.1 | 0.83 | 35.5 | 81.5 | 117 | 3 |
| Unweeded | 632 | 812.4 | 2077 | 0.952 | 1168 | 397.5 | 1565 | 1.7 | 935.5 | 1688.8 | 2624 | 0.25 | 130 | 88.5 | 218.5 | 2.01 |
| L.S.D. at 5% | | | | | | 75.3 | 167.3 | 0.86 | 92.2 | 255.2 | 307.5 | 0.28 | 103.4 | N.S | 148.8 | N.S |

* Bromoxynil+ tralkoyxdim or L-flamprop-isopropyl (tank mixture)

**Bromoxynil+ tralkoyxdim or L-flamprop-isopropyl (followed by one week)

**Table (2): Effect of weed control treatments on controlling broad-leaved weeds g/m$^2$ and grain yield t/ha. in barley in El-Nubaria, Res., St., during 1996/97, 1997/98 and 1998/99 winter seasons.**

| Weed control treatments | Rate /ha. | 1996/97 season | | 1997/98 season | | 1998/99 season | |
|---|---|---|---|---|---|---|---|
| | | weight of broad-leaved weeds (g/m$^2$) | Grain yield (ton/ha) | Fresh weight of weeds (g/m$^2$) | Grain yield (ton T/ha.) | weight broad leave of weeds (g/m$^2$) | Grain yield (t/ha) |
| Metribuzin | 119 g | 0 | 0.950 | 5 | 3.423 | 12.0 | 2.619 |
| Metribuzin | 142.8g | 0 | 0.860 | 3 | 3.640 | 21.5 | 2.393 |
| Metosulam | 71.4cc | 215 | 0.792 | 25 | 3.273 | 0 | 3.000 |
| Metosulam | 95.2cc | 140 | 0.709 | 7 | 3.728 | 0 | 2.476 |
| Tribenuron-methyl | 19.09 | 314.5 | 0.643 | - | - | 0 | 2.381 |
| Hand weeding | twice | | | 59 | 2.945 | 32.0 | 2.548 |
| Unweeded | | | | 1259 | 2.850 | 166.0 | 2.443 |
| L.S.D. at 5% | | N.S | N.S | 368 | N.S | N.S | N.S |

Effect the integration between weed control treatments and seeding rates on weed control and grain yield of barley was studied in two experiments, by Kholosy and Hassanein (2000) and Kholosy and Nassar (2001). Results in table (3) show that there was no significant effect of seeding rates at 71.4, 95.2, 119.1 and 142.9 kg/ha either on weed control or grain yield of barley in both seasons. The herbicidal treatments either metosulam at 9.5 g/ai/ha or followed by tralkoxydim (Grasp 10% EC) at 2.38 l/ha or metosulam at 9.5 g/ai cc/ha followed by Clodinafop-proparygl (Topik 15% WP) at 50 g/ha gave the highest significant reduction on the fresh weight of the above mentioned weeds by 97.8 and 99.9 %, respectively and gave the highest increasing in grain yield by 0.61 and 1.64 t/ha, respectively. In addition, these treatments exceeded handweeding twice in both seasons .On other hand, the interaction between seeding rates and weed control treatments didn’t reach significant effect level either on weed control or grain yield.

**Table (3): Effect of seeding rates and weed control treatment on controlling annual weeds g/m$^2$ and grain yield t/ha. in barley in El-Nubaria, Res., St., during 1999/2000 and 2000/01 winter seasons.**

| Seeding rates kg/ha. | 1999/2000 season | | | | 2000/01 season | | | |
|---|---|---|---|---|---|---|---|---|
| | Fresh weight of annual weeds (g/m$^2$) | | | Grain yield (ton /ha) | Fresh weight of annual weeds(g/m$^2$) | | | Grain yield (ton /ha) |
| | Broad-leaved | Grassy weeds | Total weeds | | Broad-leaved | Grassy weeds | Total weeds | |
| 71.4 | 196 | 327 | 523 | 2.005 | 349 | 237 | 587 | 2.704 |
| 95.2 | 135 | 196 | 331 | 2.286 | 310 | 112 | 422 | 2.709 |
| 119.1 | 160 | 299 | 459 | 2.244 | 201 | 153 | 355 | 3.085 |
| 142.9 | 65 | 135 | 200 | 2.196 | 174 | 195 | 369 | 3.027 |
| LSD at 5% | NS | NS | NS | NS | NS | NS | NS | NS |
| Metosulam 95.2 cc+ tralkoyxdim 2.38L | 0.0 | 19.3 | 19.3 | 2.397 | | | | |
| Metosulam 95.2cc+ clodinafop-propargyl 33.3g | | | | | 0.3 | 0.7 | 1.0 | 3.851 |
| Hand weeding twice | 124 | 126 | 250 | 2.365 | 72 | 245 | 317 | 2.571 |
| Unweeded | 318 | 572 | 891 | 1.787 | 704 | 277 | 982 | 2.210 |
| L.S.D. at 5% | 120 | 263 | 300 | 0.339 | 180 | 152 | 243 | 0.469 |

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## Abstract:

The application of Brominal (2.38 L/ha), Granstar (19 g/ha) Sinal (9.52 g/ha) post emergence were effective against broadleaf weeds and Grasp and Suffix, against grasses especially wild oat and improving grain yield in barley.

### الملخص العربى

تم اختبار مجموعة من المبيدات لمكافحة الحشائش عريضة الأوراق والنجيلية فى الشعير في سلسلة تجارب أجريت في الفترة ما بين عام 1993-1998. أثبتت النتائج أن مبيدات البرومينال (2.38 لتر/هكتار (و جرانستار 19 جم وسينال 9.5 جم للهكتار وسنكور ضد الحشائش عريضة الأوراق في الشعير بينما كان المبيد جراسب 2.38 لتر /فدان وسافيكس 2.58 لتر /هكتار فعالين ضد الزمير والفلارس وصاحب ذلك زيادة فى إنتاجية المحصول .

# Chapter 3: Options for integrated weed management in faba bean

## 1. Integrated *Orobanche* management in the faba bean crop.

## Introduction:

*Orobanche crenata* (Forsk) can cause a reduction in faba bean *(Vicia faba* L.) yield ranging from 5 to 24%, depending on the severity of infestation. As a result, farmers lose yield, income, and in some cases even the option to grow broomrape susceptible crop. Heavy infestation of *O.crenata* in Egypt forced a reduction of 29% in the cropping area of faba bean between 1968 and 1978 (Sauerborn, 1991). The economic impact of broomrape can be attributed to its parasitic life style, which has both a direct detrimental effect on the host plant and a specialized biology that resists conventional weed control strategies. The lack of single effective control method for this weed calls for an integrated pest management (IPM) approach that uses multiple strategies to limit broomrape infestation and alleviate damage to this crop. For these reasons the work continue to develop technologies for controlling broomrape and disseminate the generated technologies to large sectors of farmers in Egypt to improve faba bean production.

## 1.1. Sensitivity of faba bean to *Orobanche* infestation measured by different approaches

There are many scales to assess the reaction of different plant towards *Orobanche spp.* and identifying resistant ones, Raju (1996) in India used scale which had score less than 10% of plants infested, > 1 *Orobanche* spikes / plant and > 10 g fresh of *Orobanche* to attach plant tobacco considered as tolerant/resistant to *Orobanche cernnua*. Sillero et al (1996) estimated the reaction of infection by *Orobanche* to faba bean by estimating number of *Orobanche* / faba bean shoots relatively to the number surrounded susceptible spp., meanwhile other researchers estimated reaction of *Helianthus* spp. to *Orobanche cernata* by using incidence % of Orobanche and degree of attack or severity by estimating number of *Orobanche* spikes/host plant, (Dominguez et al, 1996; Alonso et al, 1996). Another researchers indicated that to assess resistance / susceptibility of *Vicia faba* cultivars to *Orobanche* depending on infection with *Orobanche* fruiting and % of yield losses, (Zaiton et al,1991)

Thus, the present work was designed by Hassanein et al (1996) to determine the degree of faba bean cultivars susceptibility by estimating (1) *Orobanche* incidence %, (2) *Orobanche* severity and (3) the degree of faba bean yield losses due to *Orobanche* infestation through a set of experiments carried out as follow: One pot experiment of artificially infested soil in Giza and four field experiments in naturally infested fields with *Orobanche* in Giza and Shandaweel stations were conducted to evaluate the response of six faba bean cultivars. The experimental plot size was 10.5 $m^2$ included four ridges 3.0x 0.6 m arranged in a complete block design with four replicates. Cultivars were obtained from food legume research section ARC. At harvest, average of infested hills of faba bean were counted. The severity of infection was obtained by estimating number of emerged broomrape as well as weight of *Orobanche* spikes/ faba bean plant. In one experiment at Giza and another experiment in shandaweel station Giza 429 and Giza 402 were sprayed with glyphosate and compared to treatments without spray to estimate the yield losses in both the two varieties due to *Orobanche* infection. The degree of faba bean varieties susceptibility was estimated according to the scale used by Zaiton (1991) and Raju 1996.

## 1.2. *Orobanche* incidence and severity scales:

Depending on *Orobanch* incidence % of infested. faba bean plants and *Orobanche* severity i.e. number or weight of spikes / faba bean plant the results in Tables (1 & 2) show that only Giza 843 variety reaction, varied from high to low infestation depending on *Orobanche* incidence %, severity based on *Orobanche* number and weight of *Orobanche* spikes/faba bean plant, respectively, meanwhile the rest of the varieties were highly reaction depending on *Orobanche* incidence to varied from high to moderate and moderately reaction depending on *Orobanche* severity.

**Table (1): Faba bean varieties reaction to *Orobanche* (pot experiment) in Giza, 1995/96 winter season.**

| **Variety** | ***Orobanche* incidence (%) of infested/ plants** | ***Orobanche* severity** | | **No. of pods / plant** |
|---|---|---|---|---|
| | | **No. of Spikes/ plant** | **Weight of Spikes/ plant** | |
| Giza blanka | **80.0** | **4.8** | **34.3** | **0.65** |
| **Giza 3** | **100.0** | **7.75** | **18.19** | **0.38** |
| **Giza 674** | **86.3** | **5.27** | **24.1** | **1.72** |
| **Giza 429** | **100** | **4.65** | **22.6** | **1.00** |
| **Giza 843** | **36.4** | **1.36** | **6.0** | **4.91** |

**Table (2): Distribution of reaction of faba bean varieties to *Orobanche crenata* according to Raju (1996) scale ( pot experiment in giza in 1996).**

| Reaction | Score | Variety |
|---|---|---|
| Plant infested % | | |
| **T** | **<10** | |
| **L** | **11-25** | |
| **M** | **26-50** | **Giza 843 (36.4)** |
| **S** | **51-75** | |
| **HS** | **>75** | **Giza blanka, Giza 3, Giza 674, Giza 429** |
| No. of Orobanche spikes/plant | | |
| **T** | **<1** | |
| **L** | **1.1-3** | **Giza 834 (1.36)** |
| **M** | **3.1-6** | **Giza blanka , Giza 674, Giza 429 (4.65-7.8)** |
| **S** | **6.1-11** | **Giza 3** |
| **HS** | **>11** | |
| Weight of Orobanche spikes / plant | | |
| **T** | **<10** | **Giza 843 ( 6 g / plant )** |
| **L** | **11-25** | **Giza 3, Giza 674, Giza 429** |
| **M** | **26-50** | **Giza blanka** |
| **S** | **50-75** | |
| **HS** | **>75** | |

T = Tolerant, L = low, M = Medium, S = Susceptible, HS = High Susceptible

In field experiment at Giza data in tables (3&4) show that *Orobanche* incidence % of all studied varieties was more than 90% indicating that the reaction to *Orobanche* by these varieties was very high. Depending on the reduced number and weight of *Orobanche*/plot both the Giza 429 and Giza 843 were considered to be of medium reaction.

**Table (3): Faba bean varietals response to *Orobanche* infestation, field experiment, Giza 1995/96 winter season.**

| Variety | *Orobanche* incidence (%) | ***Orobanche* infestation** | | | | Faba bean seed yield (t/ha) |
|---|---|---|---|---|---|---|
| | | *Orobanche* No/10.5 $m^2$ | % of check | *Orobanche* weight kg/10.5 $m^2$ | % of check | |
| **Giza blanka (check)** | **97.0** | **479.0** | **100** | **0.612** | **100** | **0.479** |
| Giza 3 | **97.4** | **570.0** | **118.9** | **0.774** | **126.7** | **0.991** |
| **Giza 429** | **92.4** | **191.0** | **39.9** | **0.440** | **71.9** | **2.457** |
| **Giza 843** | **92.1** | **229.1** | **47.8** | **0.410** | **67.0** | **2.254** |
| **L.S.D.** | | **244** | | **N.S.** | | **0.773** |

**Table (4): Distribution of reaction faba bean varieties to *Orobanche crenata* reaction according to Raju (1996) scale field experiment, Giza 1996.**

| Reaction | Score | Variety |
|---|---|---|
| ***Orobanche* incidence %** | | |
| **T** | **< 10** | |
| **L** | **11-25** | |
| **M** | **26-50** | |
| **S** | **50-75** | |
| **HS** | **>75** | **Giza blanka, Giza3, Giza843, Giza429** |

Results in tables (5&6) depending on *Orobanche* incidence indicate that all varieties are of very high reaction under Shandaweel condition. Depending on *Orobanche* severity (number of spikes / plot), all varieties considered to be of medium reaction. Concerning the effect on yield, there is no yield obtained due to *Orobanche* infestation. Similar observation with variety Giza 674 in Assuit (El-Sherbeeny et al 1994), also Giza 2, Giza 402 and Giza 674 were infested by 12.3,18.6 and 18.1 spikes/m$^2$, respectively under Assuit conditions.

## 2. Variety tolerance:

Variety tolerance was measured by the correlation between *Orobanche* spike number or weight / faba bean plant or the tolerance the reduction in yield of variety under *Orobanche* infestation compared to the yield equation of free plants according to:

$$\text{Tolerance} = \frac{\text{Relative yield of variety under } \textit{Orobanche} \text{ infestation}}{\text{Variety free from } \textit{Orobanche}} \times 100$$

**Table (5): Faba bean varieties susceptibility to *Orobanche* infection Shandaweel 1995.**

| Variety | Infestation rate | | *Orobanche* incidence % | *Orobanche* severity | |
|---|---|---|---|---|---|
| | No. 10.5 m$^2$ | Weight kg/10.5 m$^2$ | | No/plant 10.5 m$^2$ | Weight faba (0) |
| Giza blancka | 101.5 | 0.159 | 100 | 1.75 | 5.2 |
| Giza 3 | 205.8 | 0.695 | 100 | 1.48 | 14.23 |
| Giza 674 | 262.5 | 0.853 | 100 | 2.28 | 7.28 |
| Giza 429 | 312.3 | 1.785 | 100 | 1.10 | 1.68 |
| Giza 843 | 287.3 | 1.829 | 100 | 2.38 | 14.93 |
| Giza 402 | 198.5 | 0.678 | 100 | 1.70 | 6.10 |
| LSD | | | | 0.801 | 8.93 |

**Table (6): Distribution of faba bean varieties by *Orobanche* in Shandaweel 1996.**

| Reaction | Score | Shandaweel st. |
|---|---|---|
| | **Orobanche incidence %** | |
| **T** | **< 10** | |
| **L** | **11-25** | |
| **M** | **26-50** | |
| **S** | **50-75** | |
| **HS** | **>75** | **Giza blanka, Giza3, Giza 674 Giza 429, Giza843, Giza402** |
| | **Emerged spikes faba bean /plant** | |
| **T** | **<1** | |
| **L** | **1.1-3** | **Giza blanka, Giza3** |
| **M** | **3.1-6** | **Giza 6.74, Giza429, Giza 843,** |
| **S** | **6.1-11** | **Giza402** |
| **HS** | **>11** | |

## 2.1. Correlation study:

442,276 and 500 faba bean plants were taken from under *Orobanche* natural infestation soil in Giza 1997/98 and Shandaweel 2000/2001 winter seasons. *Orobanche* spikes infesting faba bean varieties Giza 843, Giza 674, Giza 667 and Giza 3 were hand pulled at harvest and number and weight of *Orobanch* spikes / faba bean plant and faba bean yield g/plant were estimated and the correlation between number and weight of *Orobanche* spikes with faba bean seed yield were determined by Hassanein et al (1998) and Al-Marsafy et al 2000 & 2001).

Tables (7, 8) revealed negative correlation between both number and weight of *Orobanche* spikes/faba bean plant. 1, 5 and 10 *Orobanche* spikes decreased faba bean seed yield of the variety susceptibility Giza 3 show more than the other tested varieties as Giza 843, Giza 673, Walley and Giza 667 cv.

Tolerance study comparison between Giza 429 & Giza 402 depending on *Orobanche* infestation according to susceptibility index (Zaiton et al): (1991) depending on relationship between *Orobanche* infestation and yield losses results in field at Giza station revealed that infestation by *Orobanche* reduced yield of Giza 429 by 45.9% and Giza 402 yield by 90.3% in Shandaweel. Thus, these varieties are considered as susceptible or highly susceptible to *Orobanche* infestation under Upper Egypt condition.Tables 9&10

**Table (7) : Relationship between weight of *Orobanche* spikes and faba bean seed yield / plant (g) at Shandaweel Res. St. 2000/2001 season at Giza.**

| Giza 1997/98 | | | | | | Shandaweel 1998/99 | | | Shandaweel 2000/2001 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Giza 843 | | | Giza 674 | | | Walley | | | | | | |
| | | | | | | | | | Giza 667 cv. | | Giza 3 cv. | |
| Wt of Orobanche (g)/faba bean plant | Wt of faba bean plant/ (g) | Reduction% | Wt of Orobanche (g)/faba bean plant | Wt of seed yield (g) /faba bean plant | Reduction% | Wt of Orobanche spikes (g) /Faba bean plant | Faba bean seed yield g/plant | Reduction% | Faba bean seed yield g /plant | Reduction% | Faba bean seed yield g/plant | Reduction% |
| 0 | 20.6 | … | 0 | 26.0 | … | 0 | 12.23 | - | 20.05 | - | 11.14 | - |
| 5 | 13.9 | 32 | 5 | 18.6 | 28 | 1 | 11.72 | 4.1 | 17.6 | 12.2 | 9.63 | 13.6 |
| 10 | 9.3 | 55 | 10 | 12.6 | 52 | 2 | 11.23 | 8.1 | 15.3 | 23.7 | 8.22 | 26.2 |
| 15 | 6.8 | 67 | 15 | 8.1 | 69 | 3 | 10.76 | 12 | 13.13 | 34.5 | 6.91 | 38 |
| 20 | 6.8 | 67 | 20 | 5.0 | 81 | 4 | 10.29 | 15.8 | 11.1 | 44.7 | 5.69 | 48.9 |
| 25 | 7.8 | 62 | 25 | 3.4 | 87 | 5 | 9.84 | 19.5 | 9.2 | 54.1 | 4.57 | 59 |
| … | … | … | 30 | 3.2 | 88 | 6 | 9.4 | 23.1 | 7.44 | 62.9 | 3.55 | 68.1 |
| … | … | … | 35 | 4.4 | 83 | 7 | 8.98 | 26.6 | 5.82 | 71 | 2.63 | 76.4 |
| … | … | … | … | … | … | 8 | 8.56 | 30 | 4.34 | 78.4 | 1.8 | 83.8 |
| … | … | … | … | … | … | 9 | 8.16 | 33.2 | 3 | 85.1 | 1.07 | 90.4 |
| … | … | … | … | … | … | 10 | 7.78 | 36.4 | 1.79 | 91.1 | 0.45 | 96.0 |
| Cofficient of correlation | 0.32 | | | | -6.46 | | -0.30 | | -0.48 | | -0.06 | |

**Table (8) : Relationship between number of *Orobanche* spikes and faba bean seed yield/plant (g) Shandaweel Res. St., 2000/2001 season.**

| No. Of Orobanche spikes /Faba bean plant | 1997/1998 | | | | 1998/99 | | 2000/2001 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Seed yield (g) /plant. | | | | | | Faba bean seed yield / plant (g). | | | |
| | Giza 843 | | Giza 674 | | Walley | | 667 | | Giza 3 | |
| | P | % | P | % | P | R | P | R % | P | R % |
| 0 | 33.2 | … | 26.8 | | 13.37 | 0 | 19.58 | - | 11.06 | - |
| 1 | 27.1 | 18 | 22.6 | 15 | 11.45 | 14.4 | 16.14 | 17.6 | 8.45 | 23.6 |
| 2 | 22 | 34 | 18.9 | 29 | 9.73 | 27.2 | 13.13 | 32.9 | 6.16 | 44.3 |
| 3 | 18 | 45 | 15.6 | 42 | 8.19 | 38.5 | 10.55 | 47.1 | 4.2 | 62.1 |
| 4 | 15.1 | 55 | 12.7 | 53 | 6.85 | 48.8 | 8.4 | 57.1 | 2.56 | 76.9 |
| 5 | 13.2 | 60 | 10.2 | 62 | 5.7 | 57.4 | 6.68 | 65.9 | 1.24 | 88.8 |
| 6 | 12.4 | 63 | 8.2 | 69 | 4.74 | 64.6 | 5.39 | 72.5 | 0.24 | 97.8 |
| 7 | 12.7 | 82 | 6.6 | 75 | 3.97 | 70.3 | 4.52 | 76.9 | 0.0 | 100 |
| 8 | … | … | … | | 3.39 | 74.6 | 4.09 | 79.1 | 0.0 | 100 |
| 9 | … | … | … | | 3 | 77.6 | 4.08 | 79.2 | 0.0 | 100 |
| 10 | … | … | … | | 2.81 | 79.0 | 4.51 | 77 | 0.0 | 100 |
| **Coefficient of correlation** | -0.27 | | -0.41 | | -0.325 | | -0.386 | | -0.562 | |

**Table (9): Yield losses to *Orobanche* infection in faba bean varieties at Giza and Shandaweel, fields, 1996.**

| Site | variety | *Orobanche* infestation no. /10.5m$^2$ | | | Faba bean productivity | | |
|---|---|---|---|---|---|---|---|
| | | infestation | Glyphosate treatment | Orobanche roduction % | infestation | Glyphosate treatment | Yield roduction % |
| Giza | Giza429 | 369.5 | 92.5 | 75.0 | 1.041 | 1.9 | 45.9 |
| Shandaweel | Giza402 | 269.8 | 0.5 | 99.8 | 0.205 | 2.1 | 90.3 |

**Table (10): Index of susceptibility of Vicia faba cultivars to *Orobanche* according to Zaiton et al 1991.**

| Orobanche reaction | Infection with orobanche | Fruiting of orobanche | % of yield losses | Faba bean variety |
|---|---|---|---|---|
| Immune | …. | …. | 00 | |
| Resistant | + | …. | 00 | |
| Tolerant | + | + | < 20 | |
| Susceptible | + | + | 20-50 | Giza 429 |
| Highly Susceptible | + | + | > 50 | Giza 402 |

From the pervious results depending on *Orobanche* incidence % scale all varieties have very high reaction to *Orobanche* in all stations except with Giza 843 which considered to have a medium reaction to *Orobanche*. Concerning *Orobanche* severity all varieties considered to have low to medium reaction, and non of them could be considered as resistant or tolerant varieties (Less than 10% *Orobanche* incidence, less than > 1 spike/faba bean plant and > 10 g of *Orobanche* spikes / faba bean plant). This mean that resistant or tolerant in faba bean is limited, Wegnmann (1996) indicated that there is some tolerant in faba bean against *O.crenata*, however true resistance until now has not been identified and Wegmann (1986) attributed that faba bean has less severe reaction to *Orobanche* in irrigated fields where the host has a better osmotic adaptation. For avoiding confusion for the degree of varieties tolerance or resistance a clear scale was established to estimate the degree of resistance or tolerance depending on the following three parameters.Table 11

$$\text{1- \textbf{\textit{Orobanche}} \textbf{incidence \%}} = \frac{\text{No. of infested host plants by } \textit{Orobanche}}{\text{Total number of host plant}} \times 100$$

**2- *Orobanche* severity** = Average number of spikes / host plant

**3- Yield losses of host plant**

**Table (11): The suggested scale of *Orobanche* infection in host plants to *Orobanche* .**

| Host susceptibility to *Orobanche* infection | *Orobanche* incidence (%) | *Orobanche* severity no of spikes/host plant | Yield losses |
|---|---|---|---|
| **Highly susceptible (HS)** | **100** | **10** | **100** |
| **Moderately susceptible (MS)** | **70-90** | **7-9** | **70-90** |
| **Moderately tolerant (MT)** | **40-60** | **4-5** | **40-60** |
| **Tolerant (T)** | **0-30** | **1-3** | **10-30** |
| **Resistant (R)** | **> 10** | **1 > 2** | **No. Effect** |
| **Immune (I)** | **0** | **0** | **No. Effect** |

## 3. Soil solarization

One field experiment was conducted by Hassanein et al (1999) in Giza Station, to evaluate the efficacy of soil solarization on weeds included *Orobanche* and faba bean where two treatments in 4 replicates in heavy infested field with *Orobanche* tables (12, 13). The soil was covered in August by polyethylene plastic thickness 5*mu* for 6 week as compared to 5 check (non solarized soil). Faba bean was sown in November with variety Giza 3. Soil samples were potted in 30 cm diameter pots. Results in table (12) show that soil solarization by polyethylene decreased both number and weight of *Orobanche* spikes / plot by 53.0and 34.4% respectively. This caused an increase in number and weight of pods by 170.4 and 115 %, respectively. As for the effect of solarization on seed bank in soil results indicated that most of annual winter weeds species were susceptible to soil solarization and decreased by 88%. The effect of soil solarization decreased number of *Orobanche* seeds available for germination by about 46 %. In general weed species susceptible to solarization were *Sonchus oleraceus*.

*Beta vulgaris*, *Ammi majus*, *Lolium multiflurom Avena sterilis* and *Polypogon monsplensis*.

**Table (12): Effect of soil solarization on *Orobanche* and faba bean yield at Giza station, 1998/99 and seed bank.**

| Soil solarization | *Orobanche* No/plot ($m^2$) | *Orobanche* weight/plot (g) ($m^2$) | Faba bean yield | |
|---|---|---|---|---|
| | | | No. of pods /plot area ($2m^2$ ) | Weight of pods /plot kg/($2m^2$ ) |
| **Solarized** | **59.8** | **229** | **314** | **1.245** |
| **Non solarized** | **127.3** | **349** | **116.1** | **0.549** |
| **Significant at 5% level** | * | * | * | * |

**Table (13): Effect of soil solarization on weed seed bank in soil, 1999.**

| Soil solarization | No of emerged weeds /pot ( average 20 pots ) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Ammi majus* | *Beta vulgaris* | *Chenopodium albm* | *Polypogon monsplensis* | *Avena spp* | *Sonchus oleraceus* | *No. of Orobanche spike* | Total |
| **Solarized** | **0** | **0** | **0.5** | **0.05** | **0** | **0** | **2.6** | **3.15** |
| **Non–solarized** | **0.75** | **0.1** | **2.4** | **0.4** | **0.05** | **1.05** | **4.8** | **9.55** |

## 4. Effect of preceding cotton crop on *Orobanche* .

Previous studies have indicated that cotton roots may excrete exudates which stimulate *Orobanche* seeds to germinate without the host, which will cause the *Orobanche* seeds to die. This preliminary work was conducted by Hassanein and Ibrahim (2001) to study the effect of cotton as the summer crop preceding faba bean on *Orobanche* control. Results revealed the reduction in the number and weight of broomrape spikes by 52.2 and 42.9%, respectively (Table 14).

**Table (14): Effect of cotton as preceding crop on *Orobanche* infestation in faba bean 2000/01 (pot experiment).**

| Preceding crop | No. of *Orobanche* spikes/pot | Weight of *Orobanche* spikes (g/pot) |
|---|---|---|
| ***Cotton*** | **40.0** | **29.3** |
| Without cotton | **83.8** | **51.3** |

## 5. Sowing date.

A field experiment was conducted during 1999/2000 winter season in naturally infested fields with *Orobanche* spp. seeds by Hassanein et al (2000) at Sids Agricultural Research Station to study the effect of sowing date (1, 15 and 30 November), and the application of glyphosate 2 and 3 times at 21-day intervals on the number and dry weight of *Orobanche* sp. and seed yield of faba bean. Results revealed that the late sowing date (30 November) reduced the number and dry weight of *Orobanche* sp. and increased faba bean seed yield. Application of glyphosate at the rate of 0.179 L/ha, two or three times, decreased the number and dry weight of *Orobanche* sp. and increased seed yield of faba bean. The lowest number and dry weight of *Orobanche* spikes was obtained with the first sowing date (1 November) and glyphosate application three times, while the highest seed yield was obtained with the second sowing date (15 November) and glyphosate application three times (Tables 15 and 16).

## 6. Irrigation

Table (17) show that number and dry weight of broomrape spikes were significantly affected by the interaction between irrigation and different times of glyphosate application and shortening irrigation periods decrease relatively *Orobanche* infestation.

**Table (15): Effect of sowing date and time of glyphosate application on the number and dry weight of broomrape and seed yield of faba bean at Sids St., (1999/2000)**.

| Treatment | Broomrape spikes/plot (10.5 $m^2$) | | Seed yield (t/ha) |
|---|---|---|---|
| | No. of spikes | Dry weight | |
| **Sowing date** | | | |
| 1 November 1999 | 289 | 183 | 1.82 |
| 15 November 1999 | 52 | 266 | 2.02 |
| 30 November 1999 | 4 | 16 | 2.38 |
| LSD at 5% | n.s. | n.s. | 0.11 |
| **Times of glyphosate application** | | | |
| Untreated | 81.5 | 444.8 | 1.50 |
| Glyphosate 2 x 0.179 L/ha | 2.0 | 14.9 | 2.24 |
| Glyphosate 3 x 0.179 L/ha | 1.1 | 6.5 | 2.47 |
| LSD at 5% level | 30.9 | 137.0 | 0.13 |

**Table (16): The interaction effect between sowing date and times of glyphosate application on the number and dry weight of broomrape and seed yield of faba bean (1999/2000).**

| Sowing date | Times and rates/ha of glyphosate application | Broomrape spikes/plat ($10.5\ m^2$) | | Seed yield (t/ha) |
|---|---|---|---|---|
| | | No. of spikes | Dry weight of spikes (g) | |
| 1 November 1999 | Untreated | 82 | 527 | 1.18 |
| | 2 x 0.179 L/ha | 2 | 17 | 1.91 |
| | 3 x 0.179 L/ha | 0.5 | 5 | 2.63 |
| 15 November 1999 | Untreated | 154 | 773 | 1.09 |
| | 2 x 0.179 L/ha | 2 | 17 | 2.40 |
| | 3 x 0.179 L/ha | 1 | 7 | 2.54 |
| 30 November 1999 | Untreated | 8 | 33 | 2.22 |
| | 2 x 0.179 L/ha | 2 | 10 | 2.40 |
| | 3 x 0.179 L/ha | 1 | 7 | 2.51 |
| LSD at 5% level | | 47 | 283 | 0.229 |

**Table (17): The interaction effect between irrigation and Roundup application on broomrape control, yield and its components in 2000/01 season.**

| 2000/01 | | | | |
|---|---|---|---|---|
| Irrigation intervals | Times of glyphosate application (WAS) | No. of broomrape/ $m^2$ spike | Weight of broomrape/$m^2$ spike ($g/m^2$) | Faba bean Seed yield (ard/fed) |
| 2 | 6 & 8 | 2.1 | 26.3 | 6.32 |
| | 8 & 10 | 1.2 | 9.8 | 6.33 |
| | 6 & 8 & 10 | 0.6 | 3.0 | 6.59 |
| | 7 & 10 & 13 | 0.0 | 0.0 | 6.75 |
| | Hand pulling (twice) | 4.5 | 24.8 | 5.94 |
| | Untreated (check) | 15.6 | 148.3 | 4.36 |
| 4 | 6 & 8 | 2.4 | 20.5 | 5.78 |
| | 6 & 8 & 10 | 1.6 | 12.0 | 5.63 |
| | 7 & 10 & 13 | 0.7 | 8.3 | 6.01 |
| | Hand pulling (twice) | 0.3 | 2.8 | 6.20 |
| | Untreated (check) | 11.4 | 66.5 | 5.62 |
| | | 27.1 | 181.8 | 4.26 |
| 6 | 6 & 8 | 4.4 | 36.8 | 5.72 |
| | 8 & 10 | 1.9 | 12.3 | 5.79 |
| | 6 & 8 & 10 | 0.7 | 7.0 | 6.02 |
| | Hand pulling (twice) | 0.3 | 2.8 | 6.75 |
| | Untreated (check) | 13.9 | 73.9 | 4.81 |
| | | 35.7 | 197.0 | 3.85 |
| L.S.D at 5% level | | 2.71 | 50.30 | 0.56 |

## 7. Hand pulling :

One field experiment was conducted by Al-Marsafy et al (2000 & 2001) at Shandaweel Research Station in Sohag governorate in the 1999 and 2000 winter seasons to study the role of hand-pulling on *Orobanche* spp. in heavily infested fields of faba bean. Results in 1999/2000 season, indicated that glyphosate application 3 times at the rate of 64 g a.i./ha after flowering at 3-week intervals gave 88.6% control of *Orobanche* (Table 18).

The next best treatments were the application of glyphosate twice and/or *Orobanche* hand-pulling twice 30 and 110 days after sowing. These respective treatments increased faba bean seed yield by 416, 372 and 312% compared to the untreated check. In 2000/2001 season hand-pulling three times, 90, 110 and 130 days after sowing, and glyphosate herbicide at 64 g a.i./ha, three times beginning at the flowering stage with a 21 days interval between applications, reduced the number and fresh weight of *Orobanche* spikes by 92.8 and 97.6%, 80.8 and 79.3%, respectively. Handweeding at three times and glyphosate at 64 g a.i./ha at three times increased faba bean seed yield by 105 and 104 t/ha, respectively, compared to the untreared check.

**Table (18): Effect of *Orobanche* handpulling on *Orobanche* and faba bean at Shandaweel in 1999/2000 and 2000/2001seasons.**

| Orobanche *hand puling time (DAS)* | **1999/2000** *Orobanche* **($10.5m^2$)** | | **Seed yield t/ha** | **2000/2001** *Orobanche* **(10.5 $m^2$)** | | **Seed yield (t/ha.)** |
|---|---|---|---|---|---|---|
| | **No.** | **weight (g)** | | **No.** | **weight (g)** | |
| **90** | **185** | **696** | **1.045** | **138** | **219** | **1.360** |
| **110** | **162** | **667** | **1.036** | **95** | **161** | **1.291** |
| **130** | **150** | **597** | **1.302** | **27** | **40** | **1.644** |
| **90&110** | **102** | **267** | **1.165** | **100** | **148** | **1.908** |
| **90, 110 &130** | **122** | **339** | **1.433** | **21** | **13** | **2.087** |
| **Glyphosate 2 x 64 g. a. i. /ha.** | **80** | **226** | **1.710** | **134** | **277** | **1.407** |
| **Glyphosate 3 x 64 g. a. i. /ha.** | **71** | **211** | **1.913** | **57** | **120** | **2.079** |
| **Untreated ( check ).** | **394** | **1424** | **0.460** | **299** | **584** | **1.039** |
| **L.S.D. at 5%** | **57** | **266** | **0.499** | **59** | **133** | **0.413** |

## 8. Natural product for controlling Orobanche crenata in faba bean

A primary pot experiment was carried out by Kholosy and Hassanein (2001) in a wire-house at the central weed research laboratory in Giza to evaluate the role of *jift*, a by product of olive oil mills, in controlling broomrape (*Orobanche crenata*) in faba bean. Two *jift* formulations as a liquid and solid forms were used, each at three concentration: 1, 2, and 3%. The results did not show significant differences between the treatments in both broomrape control and faba bean yield. Therefore, more studies are needed, especially that *jift* is a natural product that is promising for the control of broomrape, in the leguminous crops.

## 9. Effect of application time and rate of glyphosate (Roundup) on *Orobanche* control in faba bean

A field experiment was conducted by Al-Marsafy et al 2000 &2001 in naturally infested fields with *Orobanche* at Shandaweel Research Station in Sohag governorate in 1999/2000 and 2000/2001 winter seasons to determine the optimum time and rate of glyphosate (Roundup) application to control *Orobanche* in faba bean. Results revealed that the lowest number and dry weight of *Orobanche* spikes and highest yield of faba bean were obtained by spraying glyphosate 3 times at 178 cc/ha 4, 6 and 8 weeks after sowing, or 3 times at 83 cc/ha 6, 8 and 10 weeks after sowing (Table 19).

In 2001/02 winter season one field experiment was conducted in the wire house of Sakha Agricultural Research Station, Kafr El-Sheikh governorate, by Shalaby and Abd El Hamid (2002) to study the effect of Orobane 1% SL and Roundup 48% WSC on broomrape control in faba bean. The experimental site was infested with broomrape (estimated at 30 broomrape spike/m$^2$). Orobane and Roundup resulted in 100% broomrape control, while hand-pulling reduced both the number and fresh weight of broomrape spikes by 91 and 93% respectively (Table 19). These respective treatments improved the final faba bean seed yield by 0.740,0.300 and 0.040t/ha compared to the untreated plots, which gave 1.725t/ha Table 20.

**Table (19): Effect time of application on *Orobanche* control and yield of faba bean at Shandweel Research Station, 1999/00 season.**

| No. | Glyphosate rate / ha. and time of application. (W.A.S.) | 1999/2000 *Orobanche* spikes /10.5 m² No. | 1999/2000 *Orobanche* spikes /10.5 m² Dry weight g | 1999/2000 Seed yield t/ha | 2000/2001 *Orobanche* spikes /10.5 m² N | 2000/2001 *Orobanche* spikes /10.5 m² Dry weight g | 2000/2001 Seed yield t/ha |
|---|---|---|---|---|---|---|---|
| 1 | 2 x 83 cc at 4 & 6 | 127 | 353 | 1.391 | 108 | 170 | 2.139 |
| 2 | 2 x 83 cc at 6 & 8 | 93 | 142 | 1.641 | 46 | 112 | 2.050 |
| 3 | 3 x 83 cc at 4 , 6 & 8 | 43 | 80 | 1.538 | 79 | 137 | 2.273 |
| 4 | 3 x 83 cc at 6, 8 & 10 | 44 | 27 | 2.088 | 11 | 16 | 2.391 |
| 5 | 2 x 178 cc at 4 & 6 | 49 | 77 | 1.454 | 95 | 174 | 2.020 |
| 6 | 2 x 178 cc at 6 & 8 | 49 | 83 | 1.577 | 58 | 89 | 1.805 |
| 7 | 3 x 178 cc at 4 , 6 & 8 | 3 | 2 | 1.520 | 51 | 52 | 2.061 |
| 8 | 3 x 178 cc at 6 , 8 & 10 | 15.0 | 15 | 1.761 | 11 | 18 | 2.220 |
| 9 | 2 x 83 cc at 4 & 6 + 178 cc / 8 | 67.3 | 92 | 1.701 | 83 | 65 | 2.228 |
| 10 | 178 cc at 4 + 2 x 83 cc at 6 & 8 | 36 | 44 | 1.608 | 47 | 71 | 2.010 |
| 11 | Hand pulling twice | 56 | 132 | 1.268 | 70 | 107 | 1.910 |
| 12 | Untreated ( check ) | 260 | 550 | 0.693 | 157 | 293 | 1.521 |
| L.S.D. at 5% level | | 67 | 197 | 0.703 | 51 | 72 | 0.333 |

**Table (20): Effect of some broomrape control treatments on characters of broomrape spikes and seed yield of faba bean, 2001/02.**

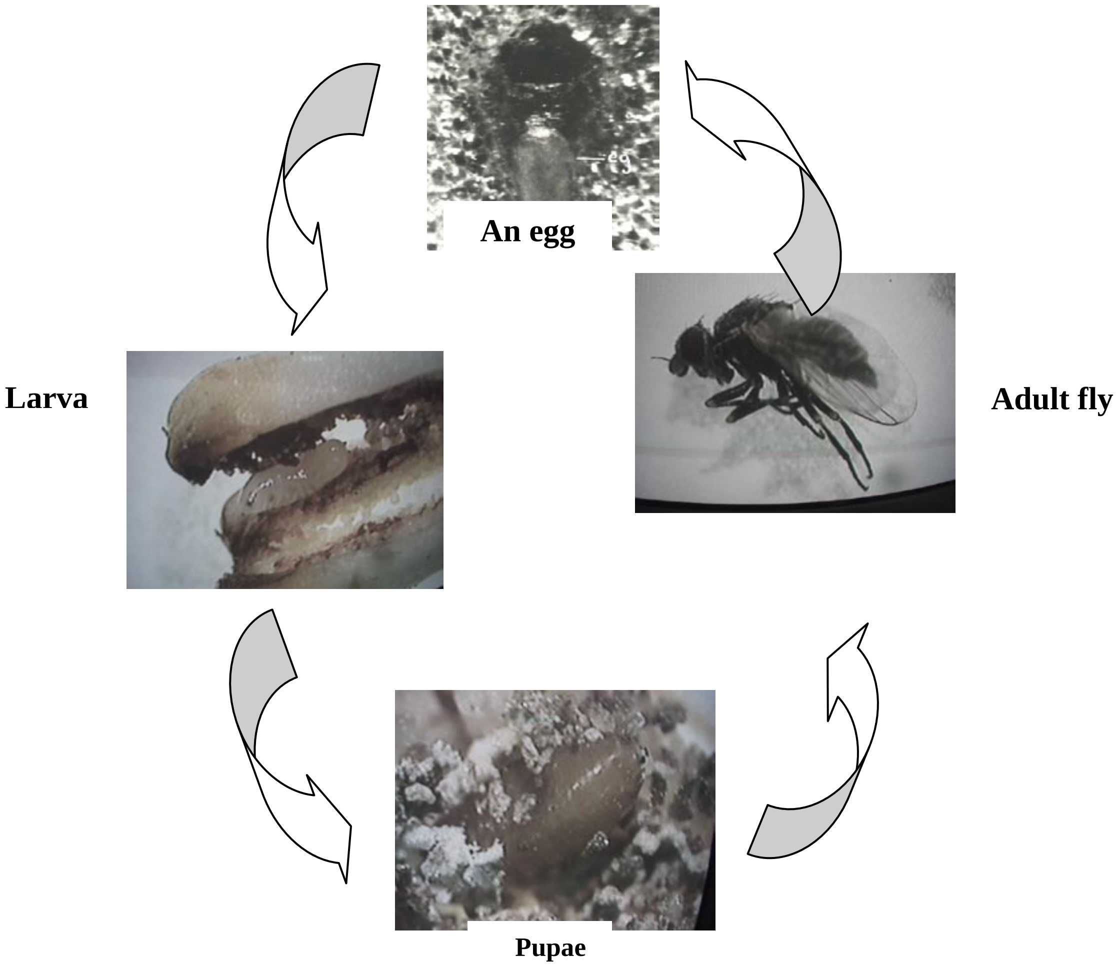
| Treatment | Rate/ha | Number of broomrape spikes per m² | Fresh weight of broomrape (g/ m²) | Faba bean seed yield |
|---|---|---|---|---|
| Orobane 1% SL | 476cc | 0 | 0 | 2.475 |
| Round up 48%WSC | 179cc | 0 | 0 | 2.037 |
| Hand pulling (twice) | | 2.8 | 12.5 | 1.775 |
| Untreated | | 29.5 | 172.5 | 1.735 |

## 10. Biological control

### 10.1. Natural biocontrolling activity of *Phytomyza orobanchia* against *Orobanche* spp.:

Throughout a period of 6 successive faba bean seasons, weekly visits covered 260 locations belonging to 11 Egyptian governorates to bring random samples of *Orobanche* spp. spikes from different crops to estimate the percentages of broomrape capsules infested by immature stages of *Phytomyza orobanchia* (Hassanein et al, 1997 and Shalaby et al 1998,1999,2000,2001 and 2002).

*Phytomyza orbanchia* stages



Data presented in Table (21) show the whole numbers of inspected *Orobanche* spp. capsules in different governorates and the percentages of those infested by *P. orobanchia*. It is clear that the seasonal mean percentage of infested capsules varied, greatly, between different governorates as well as between the successive seasons for the same governorate. Seasonal mean percentages of infestation varied from 11.56% in Fayoum governorate (1997/98 season) to 84.4% in Beheira governorate (1996/97 season). The total seasonal numbers of inspected capsules and percentages of those found infested by *P.orobanchia* in each of the six successive seasons of investigation (1996/97 – 2001/02). Season indicated that the mean highest natural role of this beneficial fly occurred in the first season as the percentage of infested *Orobanche* spp. capsules reached 73.8% (1741 infested from a total of 2360 inspected capsules). While, the lowest natural activity (30.54% infestation; 536 infested / 1755 inspected capsules) was detected in the subsequent season (1997/98). The remaining 4 seasons of study showed intermediate rates of natural activity of *P. orobanchia* against *Orobanche* spp.. The percentages of infested capsules during these 4 seasons could be arranged descendingly as 55.28% (season 1998/99) 48.71% (1999/00), 44.7% (2000/01) and 39.16 % (season 2001/02). It is thought that the increase or decrease in the natural activity of *P. orobanchia* may be correlated to the rate of intensity of using insecticides on plants susceptible to *Orobanche* infestation (mainly faba bean, peas and carrot), or to any other environmental and/or ecological factors.

Comparing the natural seasonal activity rates (means of 6 seasons) of *P. Orobanchia* against *Orobanche spp.* between 11 Egyptian governorates, Table (22) shows that the highest natural incidence of this beneficial fly occurred in Alexandria governorate (74.31% infested capsules), followed by Beheira (61.9%)and Kafr El-Sheikh (60.05). On the contrary, the lowest rate (25.35% infestation) was detected in Beni–Suef governorate, followed by Fayoum (31.32%)and Qalubiya (32.06%infested capsules). Gharbiyah, Minia, Sharkiya, Dakahliya and Menoufiya governorates manifested intermediate role of this fly (43.85, 45.86, 46.0, 46.11 and 51.22% as 6 seasons mean percentages of infested capsules, respectively).

These data seem to show, generally, increased activity of this fly by moving north towards the Mediterranean coast to reach its highest activity in Alexandria, followed by Beheira and Kafr El- Sheikh which are nearest to the coast, and decreased by moving to the south to reach its lowest activity in Beni-Suef and Fayoum. The intermediate activity (44 - 51%) was detected, generally, in the governorates which lie in the Nile- Delta.

During 2002/03 faba bean season, *O. crenata* spike samples were collected in weekly from Qalubiya (17 villages) and Menoufiya (15 villages) governorates. A total of 6000 capsules (2400 from Qalubiya and 3600 from Menoufiya were inspected for *P. orobanchia* infestations. Percentages of infestation ranged from 3-97% in Qalubiya and 18-96 in Menoufiya with seasonal means of 53.75 and 60.67%, respectively, confirming the natural active role of *P. orobanchia* in consuming seeds of *Orobanche* and consequently reducing its seed bank in soil.

**Table (21): Percentage of infested *O. crenata* capsules by *P. orobanchia* immatures in different Egyptian governorates and throughout six successive seasons.**

| Season | Governorate | Total inspected capsules | % infested capsules | Season | Governorate | Total inspected capsules | % infested capsules |
|---|---|---|---|---|---|---|---|
| 1996/97 | Fayoum | 308 | 25.32 | 1999/2000 | Dakahliyah | 352 | 52.56 |
| | Qalubiyah | 150 | 66.67 | | Behera | 411 | 26.50 |
| | Menoufiyah | 297 | 73.06 | | Kafr El-Sheikh | 366 | 31.97 |
| | Behera | 1499 | 84.39 | | Alexandria | 109 | 74.30 |
| 1997/98 | Fayom | 225 | 11.56 | 2000/01 | Minia | 471 | 45.86 |
| | Qalubiyah | 225 | 13.33 | | Beni – Suef | 666 | 24.77 |
| | Menoufiyah | 300 | 52.33 | | Fayoum | 462 | 27.06 |
| | Gharbiyah | 300 | 16.33 | | Qalubiyah | 935 | 42.99 |
| | Sharkiyah | 210 | 32.86 | | Menoufiyah | 858 | 50.47 |
| | Behera | 450 | 43.56 | | Gharbiyah | 198 | 34.85 |
| | Kafr El-Sheikh | 45 | 20.0 | | Sharkiyah | 335 | 41.19 |
| 1998/99 | Fayom | 350 | 49.14 | | Dakahliyah | 457 | 41.14 |
| | Qalubiyah | 350 | 23.43 | | Behera | 741 | 60.86 |
| | Menoufiyah | 300 | 60.00 | | Kafr El-Sheikh | 441 | 68.03 |
| | Gharbiyah | 200 | 80.50 | 2001/02 | Beni – Suef | 600 | 14.83 |
| | Sharkiyah | 150 | 71.33 | | Fayoum | 500 | 25.8 |
| | Behera | 155 | 83.87 | | Qalubiyah | 1470 | 21.29 |
| 1999/00 | Beni – Suef | 355 | 44.23 | | Menoufiyah | 1425 | 47.16 |
| | Fayoum | 253 | 64.43 | | Gharbiyah | 100 | 49.00 |
| | Qalubiyah | 410 | 50.73 | | Sharkiyah | 600 | 38.50 |
| | Menoufiyah | 313 | 41.53 | | Behera | 1300 | 51.46 |
| | Gharbiyah | 372 | 49.73 | | Kafr El-Sheikh | 700 | 72.29 |
| | Sharkiyah | 266 | 65.04 | Overall | | 20980 | 45.97 |

**Table (22): Rates of *P. orobanchia* infestation to *Orobanche* spp. capsules collected from different Egyptian governorates throughout 6 successive seasons (1996/97 – 2001/02).**

| Governorates | Total no. of capsules | | Mean% of infestation |
|---|---|---|---|
| | **inspected** | **Infested** | |
| **Minia** | **471** | **216** | **45.86** |
| **Beni – Suef** | **1621** | **411** | **25.35** |
| **Fayoum** | **2098** | **657** | **31.32** |
| **Qalubiyah** | **3540** | **1135** | **32.06** |
| **Menoufiyah** | **3493** | **1789** | **51.22** |
| **Gharbiyah** | **1170** | **513** | **43.85** |
| **Sharkiyah** | **1561** | **718** | **46.00** |
| **Dakahliyah** | **809** | **373** | **46.11** |
| **Beheira** | **4556** | **2820** | **61.90** |
| **Kafr El-Sheikh** | **1552** | **932** | **60.05** |
| **Alexandria** | **109** | **81** | **74.31** |
| **Overall** | **20980** | **9645** | **45.97** |

## 10.2. Applied biological control of *Orobanche* by *P. orobanchia*: A. Semi – field experiments:

Work was carried out by Shalaby et al (1999, 2000. 2001 and 2002) in which *P. orobanchia* adults (or pupae) or *O. crenata* spikes heavily infested by the immature stages of this fly were released in plastic screen cages placed in a faba bean field for 4 successive years (1999 – 2002). Data given in Table (23) demonstrate the percentages of infested *O. crenata* capsules by *P. orobanchia* 4 and 5 weeks after starting release at the rates recorded in Table (23), and also in the control cage and the open field surrounding the cages.

In all the 4 years, releasing *P. orobanchia* flies led to considerable increases in the role of fly than those recorded in the control cage and open field. Four weeks after starting release, the maximum percentages of infested *O. crenata* capsules reached 71.4 and 100% by releasing adults and heavily infested spikes, respectively in year 2000, compared to 21.4 and 31.1% in the control cage and open field, respectively. One week later, maximum percentages of infestation were 59.1 and 60% in cages received adults' release in years 1999 and 2000, respectively, while those recorded in the control were 31.1 and 40.3%, respectively (Table23).

**Table (23): Effect of releasing *P. orobancheia* in plastic screen cage placed in faba bean field on the rate of infestation of *O. crenata* capsules.**

| Releasing method | | % of infested capsules after releasing by: | |
|---|---|---|---|
| | | 4 weeks | 5 weeks |
| **Adults:** | | | |
| 1999 | | 43.5 | 60 |
| 2000 | | 71.4 | -- |
| 2001 | Normal elease | 75.6 | 51.5 |
| 2001 | Double elease | 54.5 | 59.1 |
| **Pupae:** | | | |
| 2002 | | 44 | 50.7 |
| **Spikes:** | 1991 | 45.9 | 39.4 |
| 2000 | | 100 | -- |
| 2002 | | 48 | 54.7 |
| **Control (mean of 4 years):** | | | |
| Control cages: | | 21.4 | 31.1 |
| Open field | | 23.8 | 40.3 |

## B. Field releases:
## B.1. Releasing diapaused pupae:

In this experiment at the time of emergence of the first *P. orobanchia* adult from the 1799 diapausing pupae which were obtained from *O. crenata* spikes collected at the end of the previous season (end of April 2001), the remaining 1798 pupae were distributed under the soil surface on November, 29th 2001 in about a feddan, cultivated with cabbage heavily infested by *O. ramosa*, at Zawiette El- Nagar village (Qalubiya governorate).

The first sample of *O. ramosa* spikes was collected on November, 29th just before release and microscopical inspection of *O. ramosa* capsules revealed the presence of immature stages of *P. orobanchia* in 33.3% of these capsules (25 infested out of 75 inspected capsules). While, by inspection of the third sample (December, 13th) of *O. ramosa* capsules (75 fruits), 46 were found infested by *P. orobanchia* larvae and/or pupae indicating a pronounced increase in the percentage of infestation reaching 61.3%; i.e., about twice that recorded at the day of release. By collecting a sample of *O. ramose* spikes (on December, 13th) from another field which lies in the same village in a place which was not so far from the field of release, but did not receive any release, the percentage of infested capsules by *P. orobanchia* was found to be 33.3% (25 infested out of the total of 75 inspected capsules). These data exhibited the great value of early release of the diapausing pupae at the time of broomrape emergence in order to increase the activity of *P.orobanchia* against *Orobanche* spp.

## B.2. Releasing active individuals:

Throughout the period from February, 22nd to March, 19th 2003, a total of 502 *P. Orobanchia* adults (freshly emerged from pupae obtained from *O.crenata* capsules collected from Qalubiya and Menoufiya governorates during 2002/2003 growing season of faba bean) were released in an area of about 200m$^2$ in a faba bean field of about 2 feddans cultivated in the Agricultural Research Center. A random sample of 100 capsules were, microscopically, dissected and inspected just before release, then weekly for 6 weeks. After 4, 5 and 6 weeks from starting release, the percentages of infested *O. crenata* capsules increased from 11, 24 and 27% in the control area to 52, 51 and 70% in the area of release. Thus confirming the great increase in the natural beneficial role of *P. orobanchia* in consuming *Orobanche* seeds by releasing the fly adults.

Irrespective of the host species, all fields, which were found invaded with broomrape showed some degree of natural biological control by the broomrape fly, although the percentages of infestation varied between different locations, on one hand, and throughout the six seasons, on the other hand.

From semi field and field experiments, the applied release of P. orobanchia among broomrape infestations led to increasing the natural role of this fly; i.e., increasing the percentages of infested Orobanche capsules by the fly larvae and consequently consumption of more seeds, leading to reduction of the Orobanche seed bank in soil which is normally the main source of next season infestation.

Field release of diapaused pupae (collected from the previous season) during November (at the time of adults’ emergence) confirmed the necessity of early release of this beneficial fly in the fields invaded by *O. ramosa* in order to increase the percentage of infestation to *O.ramosa* capsules, and consequently increasing the population of *P. orobanchia* first generation which play an important role in biological control of the emerging *O. crenata.* It is worth mentioning that infestation of *O. ramosa* capsules led to complete consumption of seeds in the infested capsules. Also, releasing active *P. orobanchia* flies was necessary to increase its active natural role against *Orobanche*.

In spite of the great value of *P. orobanchia* in reducing, naturally, the seed bank of *Orobanche* spp. in soil, no single measure is enough for *Orobanche* control. This is due to the immense number of seeds produced from capsules/spike. Consequently, it seems necessary for controlling this parasite to use other methods such as mechanical control, using resistant varieties, sowing date and chemical control in integration to biological control by early release of *P.orobanchia* in order to reach successful control of *Orobanche* spp. in Egypt.

**Demonstration fields for broomrape control in faba bean**

In this work about 42 demonstration fields of faba bean were conducted by El-Wekil and Hassanein (1996), Hassanein and Kholosy (1996, 1997), Ibrahim et al (1997), Abd El-Hamid et al (1998, 1999 and 2000), Salim et al (1998), Salim and Sherif (1999) at El-Fayoum and Qena (Middle and Upper Egypt) and Kafr El-Sheikh and Menoufia (Nile Delta) during 1995/96 – 1999/2000 winter seasons, to demonstrate to farmers and extension staff the potential of using glyphosate herbicide (Round Up 48% WSC) at the recommended rate 64.3g ai/ha at two or three times with three week intervals starting from the beginning of the flowering stage for the control of broomrape in faba bean, Table (24).

The herbicidal treatment reduced Orobanche spikes by 96.6% and increased faba bean seed yield by (33.5%) in Fayoum governorate; reduced Orobanche spikes by 80.3% and increased seed yield by in Qena governorate; reduced Orobanche spikes ($46/m^2$) by 93.8% and increased seed yield by 2.247 t/ha (386%) in Menoufia governorate; reduced Orobanche spikes ($57/m^2$) by 94.9% and increased seed yield by 2.195 t/ha (159%) in Kafer El-Sheikh governorate. These results average the 37 faba bean demonstration fields compared with farmers fields.

**Table (24): Effect of glyphosate on broomrape control in faba bean demonstration fields in four governorates during 1995/96 to 99 / 2000 seasons.**

| Site | No. Spike /m$^2$ | | L.S.D | Faba bean seed yield (t/ha) | | L.S.D |
|---|---|---|---|---|---|---|
| | In | Out | | In | Out | |
| *Fayoum* | | | *1995/96* | | | |
| **1** | **3.3** | **36.8** | **28.9** | **4.10** | **3.10** | **0.34** |
| **2** | **0.3** | **69.3** | **48.2** | **2.25** | **2.02** | **0.06** |
| **1996/97** | | | | | | |
| **3** | **0.5** | **14.3** | **6.7** | **1.42** | **0.70** | **0.63** |
| *Qena* | | | *1995/96* | | | |
| **1** | **3.3** | **12.0** | **1.5** | **2.70** | **1.67** | **0.81** |
| **2** | **2.8** | **14.0** | **0.2** | **2.97** | **1.66** | **0.08** |
| **3** | **2.3** | **16.0** | **1.7** | **2.65** | **1.54** | **0.13** |
| *Monoufia* | | | *1997/98* | | | |
| **1** | **3.5** | **48.3** | **15.8** | **2.53** | **0.79** | **NS** |
| **2** | **3.5** | **61.8** | **18.4** | **2.44** | **0.61** | **1.55** |
| **3** | **2.8** | **53.0** | **30.8** | **2.81** | **0.51** | **1.53** |
| **1998/99** | | | | | | |
| **1** | **3.0** | **39.5** | **19.2** | **2.68** | **0.39** | **0.75** |
| **2** | **2.5** | **50.5** | **19.0** | **2.97** | **0.59** | **0.14** |
| **3** | **3.0** | **36.5** | **7.4** | **2.96** | **0.49** | **0.11** |
| **4** | **2.3** | **36.0** | **9.4** | **3.22** | **0.47** | **1.08** |
| **5** | **3.5** | **37.5** | **6.9** | **3.76** | **0.66** | **0.43** |
| **6** | **1.3** | **28.8** | **8.0** | **3.16** | **0.55** | **0.65** |
| **7** | **2.8** | **38.0** | **6.9** | **3.04** | **0.67** | **0.25** |
| **8** | **1.5** | **37.8** | **12.3** | **2.96** | **0.55** | **1.01** |

**Table (24) cont.:**

| Site | No. of Spike /m$^2$ | | L.S.D | Faba bean seed yield (t/ha) | | L.S.D |
|---|---|---|---|---|---|---|
| | In | Out | | In | Out | |
| | | Kafer El-Sheikh | | 1995/96 | | |
| 1 | 6.0 | 58.0 | 28.2 | 3.15 | 0.52 | 0.98 |
| 2 | 8.0 | 84.0 | 25.6 | 2.42 | 0.64 | 0.64 |
| 3 | 7.0 | 93.0 | 22.2 | 2.22 | 0.66 | 0.22 |
| 4 | 0.0 | 32.0 | 8.9 | 2.90 | 0.71 | 0.60 |
| 5 | 0.0 | 26.0 | 15.4 | 2.50 | 0.29 | 0.33 |
| | | | 1996/97 | | | |
| 1 | 0.0 | 63.3 | 6.1 | 2.90 | 0.00 | - |
| 2 | 0.8 | 10.8 | 6.7 | 3.96 | 2.24 | - |
| 3 | 0.1 | 15.5 | 4.0 | 4.62 | 0.90 | - |
| 4 | 0.2 | 60.8 | 13.8 | 3.96 | 0.00 | - |
| 5 | 0.1 | 19.0 | 6.5 | 4.40 | 0.98 | - |
| | | | 1997/98 | | | |
| 1 | 0.0 | 41.0 | - | 4.77 | 2.70 | 1.81 |
| 2 | 0.0 | 34.0 | - | 5.63 | 3.20 | NS |
| 3 | 3.5 | 91.0 | 44.5 | 5.50 | 0.00 | - |
| 4 | 0.0 | 46.0 | - | 6.06 | 2.41 | 2.29 |
| 5 | 0.0 | 91.0 | - | 5.41 | 3.20 | NS |
| | | | 1998/99 | | | |
| 1 | 3.3 | 118.0 | 25.2 | 3.07 | 0.13 | 0.78 |
| 2 | 0.0 | 74.8 | 41.8 | 4.05 | 0.33 | 1.62 |
| 3 | 2.8 | 35.0 | 10.1 | 2.82 | 0.51 | 1.14 |
| 4 | 1.0 | 42.5 | 27.1 | 4.70 | 0.49 | 1.13 |
| | | | 1999/00 | | | |
| 1 | 0.0 | 7.0 | NS | 3.26 | 1.26 | 1.34 |
| 2 | 0.5 | 80.8 | 25.7 | 5.50 | 0.42 | 4.25 |
| 3 | 0.0 | 72.0 | 37.0 | 5.61 | 0.26 | 0.69 |
| 4 | 14.3 | 32.3 | NS | 2.36 | 1.08 | 0.61 |
| 5 | 0.0 | 10.5 | NS | 2.19 | 1.17 | NS |
| 6 | 1.5 | 21.3 | 13.6 | 3.03 | 0.84 | 1.54 |

**Faba bean infested field by *Orobache crenata***

**Faba bean demonstration field**

## 11. socioeconomic study of *Orobanche* in faba bean

Questionnaires were used to survey 240 faba bean grown fields by Ghonima et al (2000) in Dakahlia, Menoufia, Kafr El-Sheikh and Fayoum governorates to determine the rate of *Orobanche* infestation and available control methods in faba bean fields during the 2000 season. Results revealed that in the different governorates, 48-100% of the fields were infested with *Orobanche* spp and 0-23% were highly infested, while infestation in the other fields varied from low to medium. Farmers were aware of the injury symptoms in faba bean plants, such as wilting, the long lifespan of *Orobanche* seeds, the rapid dispersion of *Orobanche* and the severe seed yield reduction in heavily infested fields (Table 25, 26, 27) .

**Table (25): Injury resulting from *Orobanche* infestation of faba bean fields in different governorates, 1999/200 (number infested)**.

| Infestation rate | Governorate | | | |
|---|---|---|---|---|
| | Kafr El-Sheikh | Dakahlia | Menoufia | Fayoum |
| High | 14 | 1 | - | 5 |
| Medium | 16 | 30 | 14 | 13 |
| Low | 18 | 29 | 32 | 11 |
| Total | 48 | 60 | 46 | 29 |

**Table (26): Awareness % of farmers of the injury factors related to *Orobanche* infestation in faba bean in different governorates, 1999/2000 (by number of farmers).**

| Injury | Governorate | | | |
|---|---|---|---|---|
| | Kafr El-Sheikh | Dakahlia | Menoufia | Fayoum |
| Competition in nutrients and light | 58 | 60 | 60 | 60 |
| Wilting symptoms and thrust on faba bean plants | 48 | 60 | 60 | 60 |
| Weakness and dying of faba bean plants | 46 | 60 | 60 | 60 |
| Reduction in yield | 56 | 60 | 60 | 60 |

**Table (27): Adoption % of different Orobanche control recommendations in the studied governorates, 1999/2000.**

| Recommended practice | Governorate | | | |
|---|---|---|---|---|
| | Kafr El-Sheikh | Dakahlia | Menoufia | Fayoum |
| 1- Crop rotation that includes rice preceding faba bean. | 53 | 58 | | 45 |
| 2- Avoiding non-rotated faba bean after faba bean | 55 | 40 | 48 | 49 |
| 3- Sowing in November . | 46 | 39 | 54 | 41 |
| 4- Hand pulling of Orobanche spikes. | 60 | 60 | 48 | 27 |
| 5- Using non-infested manure with Orobanche seeds. | 42 | 30 | 59 | 4 |
| 6- Spraying Roundup at 75 cc/fed 3times at 21-day intervals. | 11 | | 15 | 16 |
| 7- Soil solarization | 2 | | | |
| 8- Using resistant cultivars | 46 | | 30 | |
| 9-Avoiding faba bean thrusting | 41 | | 59 | 50 |
| 10-Colarting and burning Orobanche spikes. | 56 | 42 | 5 | |

Growers in Kafr el-Sheikh, Dakahlia and Fayoum governorates adopted crop rotations, which include rice as the preceding summer crop, late sowing of faba bean in November, and hand – pulling as a common method for *Orobanche* control. Chemical control and tolerant varieties are rarely adopted. This was attributed to the lack of experience in using herbicides or to the unavailability of varieties (Table 21).

The sources of farmers' information about *Orobanche* biology and control are available through TV programs (such as Serr El-Ard), demonstration fields, extension bulletins and subject matter specialists. Farmers mentioned that the sources of *Orobanche* infestation were mainly contaminated soil, manure, and repeating growing of faba bean in the same fields. Training farmers and extension agents on the biology and appropriate use of herbicides and other control methods is needed to keep on overcoming such parasitic weed (Table 28).

**Table (28): source of information about *Orobanche* control in faba bean (by number of faemers).**

| Information source | Governorate | | | |
|---|---|---|---|---|
| | Kafr El-Sheikh | Dakahlia | Menoufia | Fayoum |
| 1- Training courses | 4 | | | 8 |
| 2- Extension bulleting | 17 | | 2 | 38 |
| 3- Demonstration fields | 33 | 10 | 5 | 19 |
| 4- TV programs | 53 | 60 | 57 | 45 |
| 5- Radio programs | 15 | 60 | 30 | 26 |
| 6- Posters | 5 | | 2 | 16 |
| 7- Weed scientists | 4 | | 12 | 34 |
| 8- Subject matter specialists | 37 | 32 | 58 | 15 |
| 9- Neighbors | 9 | 58 | 30 | |

## 2- Annual broadleaf and grassy weeds control in faba bean:

Eleven field trials were conducted in the period from 1992/93-2000 seasons where pre and post- emergence herbicides in four Research Stations (Sakha, Shandweel, Gimmeza and Nubaria) included 77 treatments to evaluate the performance of eight herbicides (Kerb 50% WP, Igran 80% WP, Arelon 50%FL, Stomp 500 EC, Gesagard 80% WP, Amex 48% EC and Fusilade super 12.5% EC) applied alone or in combination with hand hoeing in controlling annual weeds and their effects on faba bean yield.

This program started in 1992/93 by Salem et al (1993 & 1994) winter season at Sakha Research Station to evaluate the performance of Igran 80% WP at the rate of 2.38 and 2.98 kg/ha and completed in the second season (1993/94) to include Arelon 50% FL at 2.98 L/ha and Kerb 50% WP at 1.19 kg/ha. The results in table (29) led us to suggest to faba bean farmers, the use of Igran 80% WP at 2.98 or 2.38 kg/ha, respectively under the infested soil with both grassy and broad-leaved weeds, as it gave the best overall results.

In 1993/94-winter season two trials were carried out by Salem et al (1994) and El-Meshad and Sheriff (1994) to evaluate the performance of six treatments i.e. three herbicides at Sakha and two herbicides at Gimmeza Research Stations. The tested herbicides were Igran 80% WP at two rates (2.38 and 2.98 kg/ha) in addition to Arelon 50% FL at 2.98 L/ha and Stomp 500 EC at 4.046 L/ha at Sakha or Fusilade super 12.5% EC at 1.19 and 2.38 L/ha at Gimmeza Research station. Results in table (30) clearly indicate the value of using Igran 80% WP at 2.98 or 2.38 kg/ha, Stomp 500 EC at 4.046 L/ha and Arelon at 2.98 L/ha, these herbicides gave nearly the same effect as using hand hoeing twice under the infested soil with both grassy and broad-leaved weeds, being the best treatment used.

**Table (29): Fresh weight of weeds and faba bean seed yield as affected by different treatments at Sakha Research Station in 1992/93 and 1993/94 winter seasons.**

| No. | Treatments | Rate / ha | Weed fresh weight, g/m$^2$ | | | Seed yield t/ha |
|---|---|---|---|---|---|---|
| | | | Broad leaf | Narrow Leaf | Total weeds | |
| | | | 1992 / 1993 season | | | |
| 1 | Igran 80 % WP | 2.38 kg | 44 | 86 | 112 | 2.43 |
| 2 | Igran 80 % WP | 2.98 kg | 16 | 24 | 40 | 2.78 |
| 3 | Hand hoeing (twice | | 152 | 78 | 230 | 2.4 |
| 4 | Weedy check | | 553 | 379 | 932 | 2.0 |
| | L.S.D. at 5 % level for: | | 234 | NS | - | 0.515 |
| | | | 1993/ 1994 season | | | |
| 1 | Arelon 50% FL | 2.98 L | 259 | 122 | 381 | 4.0 |
| 2 | Kerb 50 % WP | 1.19 kg | 275 | 45 | 320 | 4.0 |
| 3 | Igran 80 % WP | 2.38 kg | 136 | 66 | 202 | 4.3 |
| 4 | Igran 80 % WP | 2.98 kg | 58 | 6 | 63 | 4.4 |
| 5 | Hand hoeing (twice) | | 66 | 297 | 363 | 4.2 |
| 6 | Weedy check | | 207 | 1086 | 1293 | 3.8 |
| | L.S.D. at 5 % level for: | | 77 | 277 | 299 | NS |

**Table (30): Fresh weight of weeds and faba bean seed yield as affected by different treatments in both Sakha and Gimmeza Research Station in 1993/94 winter seasons.**

| No. | Treatments | Rate / ha | Weed fresh weight, g/m$^2$ | | | Seed yield t/ha |
|---|---|---|---|---|---|---|
| | | | Broad leaf | Narrow Leaf | Total weeds | |
| Sakha Station | | | | | | |
| 1 | Arelon 50% FL | 2.98 L | 232 | 148 | 380 | 3.4 |
| 2 | Stomp 500 EC | 4.046 L | 102 | 64 | 166 | 3.6 |
| 3 | Igran 80 % WP | 2.38 kg | 81 | 35 | 116 | 3.6 |
| 4 | Igran 80 % WP | 2.98 kg | 47 | 19 | 66 | 3.8 |
| 5 | Hand hoeing (twice) | | 110 | 255 | 365 | 3.3 |
| 6 | Weedy check | | 175 | 1627 | 1802 | 3.1 |
| | L.S.D. at 5 % level: | | 72 | 306 | 329 | NS |
| Gimmeza Station | | | | | | |
| 1 | Fusilade super 12.5% EC | 1.19 L | 2274 | 201 | 2475 | 2.2 |
| 2 | Fusilade super 12.5% EC | 2.38 L | 1014 | 82 | 1096 | 2.5 |
| 3 | Igran 80 % WP | 2.38 kg | 290 | 817 | 1107 | 3.2 |
| 4 | Igran 80 % WP | 2.98 kg | 167 | 537 | 704 | 3.4 |
| 5 | Hand hoeing (twice) | | 363 | 517 | 880 | 2.6 |
| 6 | Weedy check | | 3117 | 2699 | 5816 | 0.6 |
| | L.S.D. at 5 % level: | | 372 | NS | NS | 0.5 |

In 1996/97-winter season, two trials were carried out by Kholosy et al (1997) to evaluate the effect of six treatments at Nubaria and four treatments at Gimmeza Research Station. The tested herbicides were Gesagard 80% WP at two rates (2.38 and 2.98 kg/ha) Amex 48% EC (4.76 L/ha) at Gimmeza in addition to one hand hoeing followed by Fusilade super 12.5% EC (2.38 L/ha) at Nubaria Research Station (Table 31).

The results in table (31) led us to suggest to faba bean farmers, the use of Gesagard 80 % WP at 2.38 or 2.98 kg/ha, hand hoeing twice at 30 and 50 DAS and Amex 48 % EC at 4.76 L/ha, respectively under the infested soil with both grassy and broad-leaved weeds, as it gave the best overall results.

**Table (31): Fresh weight of weeds and faba bean seed yield as affected by different treatments at both Nubaria and Gimmeza Research Stations in 1996/97 winter seasons.**

| No. | Treatments | Rate / ha | Weed fresh weight, $g/m^2$ | | | seed yield t/ha |
|---|---|---|---|---|---|---|
| | | | Broad leaf | Narrow Leaf | Total weeds | |
| **Nubaria station** | | | | | | |
| 1 | Gesagard 80% WP | 2.38 kg | 166 | 947 | 1113 | 0.7 |
| 2 | Gesagard 80% WP | 2.98 kg | 190 | 412 | 601 | 0.6 |
| 3 | Amex 48 % EC | 4.76 L | 729 | 992 | 1720 | 1.6 |
| 4 | H.H.* + Fusilade super 12.5% Ec | 2.38 L | 584 | 406 | 990 | 1.9 |
| 5 | Hand hoeing (twice) | | 348 | 872 | 1220 | 1.7 |
| 6 | Weedy check | | 627 | 1092 | 1719 | 1.3 |
| | L.S.D. at 5 % level for : | | 983 | 594 | NS | 0.6 |
| **Gimmeza station** | | | | | | |
| 1 | Gesagard 80% WP | 2.38 kg | 340 | 343 | 682 | 4.0 |
| 2 | Gesagard 80% WP | 2.98 kg | 239 | 315 | 553 | 4.2 |
| 3 | Amex 48 % EC | 4.76 L | 211 | 277 | 488 | 4.0 |
| 4 | Hand hoeing (twice) | | 187 | 146 | 333 | 4.1 |
| 5 | Weedy check | | 1462 | 824 | 2286 | 1.2 |
| | L.S.D. at 5 % level for : | | 90 | 70 | 107 | 0.4 |

*** H.H. = hand hoeing (once)**

Three trials were carried out at Sakha Research Station in 1997/98, 1998/99 and 1999/2000 seasons by Abd El-Hamid et al 1998, 1999& 2000 to evaluate the performance of the seven treatments including three herbicides applied alone i.e. Fusilade super 12.5% EC at 2.38 L/ha, Gesagard 80% WP at two rates (2.38 and 2.98 kg/ha) and Amex 48% EC at 4.76 L/ha in addition to Gesagard at 2.38 kg/ha followed by hand hoeing in both 1997/98 and 1998/99 seasons or Gesagard at 2.98 kg/ha followed by Fusilade super at 2.38 L/ha at 30 days after sowing in 1999/2000 season (Table 4). Results show that the most effective treatments in controlling weeds in 1997/98 season were Gesagard (2.38 kg/ha) + hand hoeing, hand hoeing twice, Gesagard (2.98 kg/ha) and Amex (4.76 L/ha) followed by Gesagard (2.38 kg/ha) which reduced the fresh weight of annual weeds by 95.9 , 92.4 , 89.2, 88.9 and 82.6 % and improved seed yield by 0.59, 0.65, 0.52, 0.53 and 0.44 t/ha, respectively compared to the untreated plots (1.278 t/ha). While in 1998/99 season, these treatments reduced the fresh weight of annual weeds by 85.8 , 75.8 , 85.0 , 64.5 and 71.0 % and improved seed yield by about 1.63, 1.77, 1.40, 1.55 and 2.76 t/ha, respectively compared to the untreated plots (2.293 t/ha). The results of 1999/2000 season indicate that the most effective treatments in controlling weeds in 1997/98 season were Gesagard (2.98 kg/ha) + Fusilade super (2.38 L/ha) and Gesagard (2.38 kg/ha) + hand hoeing, followed by Amex (4.76 L/ha), respectively. These treatments reduced the fresh weight of annual weeds by 97.2 , 95.2 and 67.6 % and this reduction positively reflected on seed yield and gave an increase of 1.63, 1.15 and 1.12 t/ha, respectively compared to the untreated plots.

From the results stated in table (32) it is recommended to faba bean farmers, the use of Gesagard (2.98 kg/ha) + Fusilade super (2.38 L/ha) and Gesagard (2.38 kg/ha) + hand hoeing, Gesagard (2.98 kg/ha) and Amex (4.76 L/ha) or using hand hoeing twice, respectively under the infested soil with both grassy and broad-leaved weeds, where it gave the best overall results.

Two trials were carried out at Shandweel Research Station by Al Marsafy et al (1998) & (2000) to evaluate the performance of eleven and twelve treatments in 1997/98 and 1999/2000 winter seasons, respectively. The studied herbicides and its applied methods are shown in Table (33). Results indicate that the most effective treatments in 1997/98 season were hand hoeing twice followed by Gesagard (2.98 kg/ha) + hand hoeing. These treatments improved seed yield by 0.559 and 0.524 t/ha, respectively compared to that of the untreated plots (2.286 t/ha). While the results of 1999/2000 season revealed that the use of hand hoeing twice, Amex (4.76 L/ha) + hand hoeing and Gesagard (2.98 kg/ha) + hand hoeing gave the best results, thus the fresh weight of annual weeds (14.98 ton weeds/ha) was reduced by 94.1, 89.2 and 84.2 % and improved seed yield by about 1.612, 1.392 and 2.291 t/ha, respectively compared to the untreated plots (1.212 t/ha). It can be recommended from results stated in table (32) to faba bean farmers, the use of Gesagard (2.98 kg/ha) + hand hoeing and Amex (4.76 L/ha) + hand hoeing or using hand hoeing twice at 30 and 50 DAS, respectively under the infested soil with both grassy and broad-leaved weeds, where it gave the best overall results.

**Table (32): Fresh weight of weeds (g/m$^2$) and faba bean seed yield as affected by different treatments at Sakha Research Station in1997/98, 1998/99 and 1999/2000 winter seasons.**

| No. | Treaments | Rate / ha | weed fresh weight, g/m$^2$ | | | seed yield t/ha |
|---|---|---|---|---|---|---|
| | | | Broad leaf | Narrow Leaf | Total weeds | |
| | | | **1997 / 1998 season** | | | |
| 1 | Fusilade super 12.5% EC | 2.38 kg | 1690 | 234.0 | 1924.0 | 1.5 |
| 2 | Gesagard 80% WP | 2.38 kg | 533 | 450.0 | 983.0 | 1.7 |
| 3 | Gesagard + Hand hoeing | 2.38 kg | 190 | 43.0 | 233.0 | 1.9 |
| 4 | Gesagard 80% WP | 2.98 kg | 307 | 303.0 | 610.0 | 1.8 |
| 5 | Amex 48 % EC | 4.76 L | 297 | 330.0 | 627.0 | 1.8 |
| 6 | Hand hoeing (twice) | | 141 | 291.0 | 432.0 | 1.9 |
| 7 | weedy check | | 2814 | 2850.0 | 5664.0 | 1.3 |
| | L.S.D. at 5 % level for : | | 495 | 550.0 | 550.0 | 0.3 |
| | | | **1998 / 1999 season** | | | |
| 1 | Fusilade super 12.5% EC | 2.38 kg | 550 | 375 | 925 | 2.4 |
| 2 | Gesagard 80% WP | 2.38 kg | 31 | 571 | 602 | 4.4 |
| 3 | Gesagard + Hand hoeing | 2.38 kg | 83 | 256 | 295 | 3.9 |
| 4 | Gesagard 80% WP | 2.98 kg | 12 | 300 | 312 | 3.7 |
| 5 | Amex 48 % EC | 4.76 L | 121 | 617 | 738 | 3.8 |
| 6 | Hand hoeing (twice) | | 19 | 484 | 502 | 4.1 |
| 7 | weedy check | | 138 | 1942 | 2080 | 2.3 |
| | L.S.D. at 5 % level for : | | 235 | 693 | 668 | 0.8 |
| | | | **1999 / 2000 season** | | | |
| 1 | Fusilade super 12.5% EC | 2.38 kg | 89 | 65 | 154 | 3.4 |
| 2 | Gesagard 80% WP | 2.38 kg | 72 | 139 | 211 | 3.7 |
| 3 | Gesagard + Hand hoeing | 2.38 kg | 22 | 47 | 69 | 4.1 |
| 4 | Gesagard 80% + Fusilade super | 2.98 kg + 2.38 L | 15 | 25 | 40 | 4.5 |
| 5 | Amex 48 % EC | 4.76 L | 138 | 324 | 461 | 4.0 |
| 6 | Hand hoeing (twice) | | 43 | 145 | 188 | 3.4 |
| 7 | weedy check | | 273 | 1150 | 1423 | 2.9 |
| L.S.D. at 5 % level for : | | | 76 | 201 | 214 | 0.6 |

**Table (33): Fresh weight of weeds and faba bean seed yield as affected by different treatments at Shandweel Research Station in 1997/98 and 1988/99 winter season.**

| No | Treatments | Rate / ha | Weed fresh weight, g/m² Broad leaf | Narrow Leaf | Total weeds | Seed yield t/ha |
|---|---|---|---|---|---|---|
| | | **1997 / 1998 season** | | | | |
| 1 | Gesagard 80% WP (post sowing) | 2.38 kg | 363 | 88 | 451 | 2.179 |
| 2 | Gesagard 80% WP (post sowing) | 2.98 kg | 600 | 79 | 680 | 1.988 |
| 3 | Amex 48% EC ( post sowing) | 4.76 L | 716 | 60 | 777 | 1.965 |
| 4 | Fusilade super ( post emergenc ) | 2.38 kg | 543 | 0 | 543 | 2.262 |
| 5 | Gesagard + (post sowing) H.H* | 2.38 kg | - | - | - | - |
| 6 | Gesagard 80% WP + H.H | 2.98 kg | 15 | 6 | 20 | 2.810 |
| 7 | Amex 48% EC (pre sowing) + H.H. | 4.76 L | - | - | - | - |
| 8 | Gesagard +(post sowing) + Fusilade super (post emergence) | 2.38 kg + 1.19 L | 200 | 0 | 200 | 1.833 |
| 9 | Gesagard +(post sowing) + Fusilade super ( post emergence) | 2.98 kg + 1.19 L | 167 | 8 | 176 | 2.071 |
| 10 | Gesagard +(post sowing ) + Fusilade super (post emergence) | 2.38kg + 2.38 L | 66 | 0 | 66 | 2.200 |
| 11 | Gesagard +( post sowing ) + Fusilade super ( post emergence) | 2.98 kg + 2.38 L | 48 | 1 | 50 | 2.000 |
| 12 | Amex 48% EC (post sowing) + Fusilade super (post emergence) | 4.76 L + 2.38 L | - | - | - | - |
| 13 | Hand hoeing (twice) | | 66 | 2 | 68 | 2.845 |
| 14 | Weedy check | | 1024 | 74 | 1098 | 2.286 |
| | L.S.D. at 5 % level for: | | | | | 0.421 |
| | | **1999 / 2000 season** | | | | |
| 1 | Gesagard 80% WP (post sowing) | 2.38 kg | 394 | 786 | 1180 | 1.486 |
| 2 | Gesagard 80% WP (post sowing) | 2.98 kg | 357 | 665 | 1022 | 1.591 |
| 3 | Amex 48% EC ( post sowing) | 4.76 L | 138 | 691 | 829 | 1.617 |
| 4 | Fusilade super ( post emergence) | 2.38 kg | 472 | 39 | 511 | 1.617 |
| 5 | Gesagard +( post sowing ) H.H* | 2.38 kg | 83 | 232 | 315 | 2.291 |
| 6 | Gesagard 80% WP + H.H | 2.98 kg | 91 | 146 | 237 | 2.604 |
| 7 | Amex 48% EC (pre sowing) + H.H. | 4.76 L | 26 | 134 | 161 | - |
| 8 | Gesagard +(post sowing) + Fusilade super (post emergence) | 2.98 kg + 1.19 L | - | - | - | 2.008 |
| 9 | Gesagard +(post sowing) + Fusilade super (post emergence) | 2.38kg + 2.38 L | 939 | 22 | 462 | 2.036 |
| 10 | Gesagard +(post sowing) + Fusilade super (post emergence) | 2.98 kg + 2.38 L | 370 | 17 | 387 | 2.036 |
| 11 | Amex 48% EC (post sowing) + Fusilade super (post emergence) | 4.76 L + 2.38 L | 468 | 1 | 469 | 2.03 |
| 12 | Hand hoeing (twice) | | 21 | 67 | 88 | 2.824 |
| 13 | Weedy check | | 491 | 1007 | 1498 | 1.212 |
| L.S.D. at 5 % level for: | | | 154 | 177 | 222 | 0.738 |

H.H* = hand hoeing

**Table (33) cont.**

| No | Treatments | Rate / ha | Weed fresh weight, g/m$^2$ | | | Seed yield t/ha |
|---|---|---|---|---|---|---|
| | | | Broad leaf | Narrow Leaf | Total weeds | |
| | | **1999 / 2000 season** | | | | |
| 1 | Gesagard 80% WP (post sowing) | 2.38 kg | 394 | 786 | 1180 | 1.486 |
| 2 | Gesagard 80% WP (post sowing) | 2.98 kg | 357 | 665 | 1022 | 1.591 |
| 3 | Amex 48% EC ( post sowing) | 4.76 L | 138 | 691 | 829 | 1.617 |
| 4 | Fusilade super ( post emergence) | 2.38 kg | 472 | 39 | 511 | 1.617 |
| 5 | Gesagard +( post sowing ) H.H* | 2.38 kg | 83 | 232 | 315 | 2.291 |
| 6 | Gesagard 80% WP + H.H | 2.98 kg | 91 | 146 | 237 | 2.604 |
| 7 | Amex 48% EC (pre sowing) + H.H. | 4.76 L | 26 | 134 | 161 | - |
| 8 | Gesagard +(post sowing) + Fusilade super (post emergence) | 2.98 kg + 1.19 L | - | - | - | 2.008 |
| 9 | Gesagard +(post sowing) + Fusilade super (post emergence) | 2.38kg + 2.38 L | 939 | 22 | 462 | 2.036 |
| 10 | Gesagard +(post sowing) + Fusilade super (post emergence) | 2.98 kg + 2.38 L | 370 | 17 | 387 | 2.036 |
| 11 | Amex 48% EC (post sowing) + Fusilade super (post emergence) | 4.76 L + 2.38 L | 468 | 1 | 469 | 2.03 |
| 12 | Hand hoeing (twice) | | 21 | 67 | 88 | 2.824 |
| 13 | Weedy check | | 491 | 1007 | 1498 | 1.212 |
| | L.S.D. at 5 % level for: | | 154 | 177 | 222 | 0.738 |

**H.H* = hand hoeing**

## 2- Grassy weed control:

Four field trials were conducted at Sakha research station by Salem et al (1993& 1994) Abd El Hamid et al (1995) and Abd El Hamid and Shebl (1996) to evaluate the efficacy of Fusilade super 12.5% EC as post emergence grass killer applied alone and other 5 treatments in controlling grassy weeds and their effects on faba bean seed yield.

Results show that the most effective treatments in controlling grassy weeds in 1992/93 season were both Fusilade super at 2.38 L/ha and hand hoeing twice. These treatments reduced the fresh weight of grassy weeds by 94.4 and 65.6 % and improved seed yield by 1.3 and 0.8 t/ha, respectively compared to the untreated plots (2.2 t/ha). While in 1993/94 season, the use of Fusilade super at 2.38 L/ha, 1.119 L/ha or using hand hoeing twice, respectively gave the best results and significantly reduced grassy weeds by

95.9, 88.9 and 75.2 % and improved seed yield by 1.2, 0.7 and 0.6 t/ha, respectively compared to the untreated plots (2.589 t/ha). The results of 1994/95 season indicate that the most effective treatments were Fusilade super at 2.38 L/ha, hand hoeing twice, Fusilade super at 1.119 L/ha and Grasp at 2.38 L/ha, respectively. These treatments reduced the fresh weight of grassy weeds by 98, 93.9, 92.6 and 75.8 %. The results of 1995/96 season indicate that the most effective treatments were Igran at 2.38 kg/ha followed by Fusilade super at 1.119 L/ha or hand hoeing twice, respectively.

The results in table (34) can be considered as recommendation faba bean farmers, to use of Fusilade super at 2.38 or 1.119 L/ha, at 30 day after sowing, respectively under the infested soil with grassy weeds.

**Table (34): Fresh weight of grassy weeds and faba bean seed yield as affected by different treatments at Sakha Station during the period from 1992 / 1993 to 1995/1996 winter seasons.**

| No. | Treatments | Rate / ha | Sakha Station | | | |
|---|---|---|---|---|---|---|
| | | | 1992/1993 | | 1993/1994 | |
| | | | Grassy weight g/m2 | Seed yield t/ha | Grassy weight g/m2 | Seed yield t/ha |
| 1 | Fusilade super 12.5 % EC | 1.19 L | - | - | 150 | 3.3 |
| 2 | Fusilade super 12.5 % EC | 2.38 L | 30 | 3.6 | 56.0 | 3.8 |
| 3 | Hand hoeing (twice | | 185 | 3.0 | 338 | 3.2 |
| 4 | weedy check | | 538 | 2.2 | 1361 | 2.6 |
| | L.S.D. at 5 % level for : | | 269 | 1.2 | 364 | 0.7 |
| | | | 1994/1995 | | 1995/1996 | |
| 1 | Igran 80% WP | 2.38kg | - | - | 938 | 2.5 |
| 2 | Grasp 10% EC | 2.38 L | 340 | 3.0 | 2500 | 2.6 |
| 3 | Fusilade super 12.5 % EC | 1.19 L | 104 | 2.9 | 1175 | 2.4 |
| 4 | Fusilade super 12.5 % EC | 2.38 L | 28 | 2.9 | - | - |
| 5 | Hand hoeing (twice | | 86 | 3.2 | 1350 | 2.4 |
| 6 | weedy check | | 1403 | 2.8 | 8563 | 1.7 |
| | L.S.D. at 5 % level for : | | 543 | NS | 231 | NS |

**Effect of Fusilade super on the grassy weeds in faba bean crop**

# Recommendations:

## 1-Orobanche management

Use tolerant varieties against *Orobanche* such as Giza 843.

For breeding resistant varieties use the developed scale for *Orobanche* / faba bean reaction which include *Orobanche* incidence, *Orobanche* severity (average of number of spikes / host plant and yield losses of host plant).

Soil solarization by covering soil with polyethylene plastic sheets for 45 days in August can decrease *Orobanche* and weed seed bank.

Sowing faba bean preceded with cotton decrease *Orobanche* infestation in faba bean fields.

The late sowing of faba bean (30 November) with the use of glyphosate 2.3 times at 0.174 l/ha can control *Orobanche* effectively in faba bean.

Shortening irrigation intervals/ to two weeks can decrease *Orobanche* infestation.

Hand pulling Orobanche spikes can work effectively against *Orobanche* almost similar to glyphosate application under medium infestation condition.

*Orobane* 1% application at 2 × 476 cc/ha sprays can be recommend against *Orobanche* in faba bean.

The activity of *Phytomyza orobanchia* fly is very beneficial in Egypt against *Orobanche* seed by (44-51%) and *Phytomyza orobanchia* fly release by adults, pupae or spikes enhances *Phytomyza* activities in faba bean fields.

## 2- Annual weeds management

Igran 80% WP application at 2.98 kg/ha Gesagard (2.98 kg/ha) + handhoeing and Amex (4.76 L/ha) + Handhoeing can be recommended for annual weeds control.

For grassy weeds control as wild oats Fusilade super 12.5% EC application at 1.19 L/ha post-emergence in faba bean can be recommended.

## التوصيات -:

مكافحة الهالوك
استخدام الأصناف المتحملة للإصابة بالهالوك مثل جيزة 843
لتربية الأصناف المتحملة /المقاومة للهالوك يوصى باستخدام مقاييس %للنباتات المصابة بالهالوك وشدة الاصابة )عدد الشماريخ /النباتات (والنقص فى المحصول نتيجة الاصابة بالهالوك .
يمكن استخدام التشميس بتغطية التربة بالبلاستيك الأبيض الشفاف لمدة 45 يوما خلال شهري يوليو وأغسطس لمكافحة الهالوك والحشائش الحولية فى الفول البلدي.
زراعة الفول عقب القطن يقلل من الإصابة للهالوك.
الزراعة المتأخرة )30 نوفمبر (مع استعمال الجليفوسيت 2-3 مرات بمعدل 0.179 لتر /هكتار يمكن استخدامها للمكافحة الفعالة للهالوك فى الفول البلدى.
تقصير الفترات الى اسبوعين يقلل إصابة الفول بالهالوك.
يمكن استعمال التقليع اليدوى للهالوك بعد 130,110,90 يوم كبديل للمكافحة الكيماوية.
التوصية بمركب جديد هو أوروبان 1 SL% رشا مرتين بمعدل 476 سم للهكتار ضد الهالوك فى الفول البلدى .
التوصية بإطلاق ذبابة الهالوك كأسلوب من أساليب المكافحة الحيوية ضد بذور الهالوك نتيجة لتغذية اليرقات على البذور بكبسولات الهالوك عن طريق إطلاق عذارى او ذباب الهالوك بالغ فى حقول الفول.

**2- مكافحة الحشائش الحولية**
- يمكن استخدام مبيدات الاجران 80 WP% بمعدل 2.98 كجم /هكتار أو جيسارجارد 80 WP% بمعدل 2.98 كجم /هكتار متبوعة بعزقة لمكافحة الحشائش الحولية في الفول البلدي .
- يمكن مكافحة الزمير والحشائش النجيلية الحولية الاخرى بمبيد فيوزيليد 12.5 EC% بمعدل 1.19 لتر /هكتار بعد شهر من الزراعةِ.

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# Chapter 4: Weed control in lentil

## Introduction:

Throughout the 19992/93 – 1999/2000 winter seasons, three main factors i.e. herbicides, hand weeding and method of sowing were tested in thirteen field experiments in five research stations i.e. Sakha, Gimmeza, Mallawi, Shandaweel and El-Nubaria for the control of annual weeds which represents major constraint facing lentil production.

In the 1st set of experiments single herbicides i.e. Fusilade super 12.5% EC at 1.19 L/ha or 2.38 L/ha, Gesagard 80% WP at 2.38 kg/ha, Furore at 1.19 l./ha and hand weeding (twice), were tested for the control of annual weeds under 2 different sowing mrthods i.e. the dry method (Afir) and the wet method (herati). The treatments were arranged in split plot design with sowing methods as the main plots and the weed control treatments as the sub- plots. These experiments were carried out at 3 different research stations i.e. Sakha, Mallawi (for 2 seasons; 1992- 1993 and 1995-1996) and shandaweel (for one season; 1995-1996). Another set of experiments were carried in 4 research stations at times i.e. Sakha (4 seasons; 1996-2000), Mallawi (2 seasons; 1998-2000), Gemmiza and Nubaria (one season; 1996-1997). In these experiments different weed control treatments were examined. Thus, Fusilade super at 2 rates (i.e. 1.19 l. & 2.38 l./ha) were used alone for the control of annual grasses; or used in combination with Gesagard (80% WP) at 2.38kg/ha or hand weeding (once) for the control of total annual weeds, These treatments were compared with the traditional hand weeding (twice) treatment carried out usually by the farmer, a weedy check was also included in all trials (tables 1 and 2).

## Results and Discussion

Data presented in table (1), by AL- Marsafy et al (1993) and Salem et al (1996) indicated that the herati sowing methods was more effective in reducing annual weeds population and increasing lentil seed yield at any given treatment including the check treatment. As for weed control treatments, the best significant reduction in annual weeds population and increase in lentil seed yield was obtained by the hand weeding (twice) treatment followed by the Gesagard treatment regardless of the sowing method used, (Abd El-Hamid et al (1998), (2000) and Hassanein et al (2000). As expected from the above results the most effective integration between weed control treatments and methods of sowing was the integration with the herati sowing method and hand weeding (twice) treatment followed by the herati method when integrated with Gesagard treatment. At Sakha station table (2) data show that the most effective treatments against annual weeds were hand weeding (twice); Gesagard 80% WP at 2.38 kg/ha plus Fusilade super 12.5% EC at 1.19 or 2.38 l./ha. Also, Fusilade super at 1.19 or 2.38 l./ha plus hand weeding once achieved the same effectiveness. These treatments reduced the fresh weight of annual weeds by 91-94% and increased lentil seed yield by 0.769-1.06 t/ha. (Abd El-Hamid et al (1997), (1998). (1999), Hassanien et al (1998), (1999), Abd El-Hamid et al (2000) and Hassanien et al (2000).

At Mallawi the data showed also the efficacy of hand weeding (twice); Gesagard 80% WP at 2.38 kg/ha plus Fusilade super 12.5% EC at 1.19 or 2.38 L/ha these treatments recorded 78 to 87% reduction of the annual weeds and increased lentil yield by 0.64- 0.84 t/ha . (Hassanien et al (2000))

At Gemmiza (table3) data indicated that the application of Gesagard 80% WP at 2.38 kg/ha plus Fusilade super 12.5% EC at 1.19 or 2.38 l./ha and Fusilade super at 1.19 or 2.38 l./ ha plus hand weeding once achieved 96-98% reduction in the fresh weight of total annual weeds and increased lentil seed yield by 1.38-1.80 t/ha. (Kholosy et al (1997))

At Nubaria (table3) data revealed that Gesagard 80% WP 1.87 or 2.38 kg/ha surpassed other weed control treatments and reduced the fresh weight of annual weeds by 86-89%. (Kholosy et al (1997))

In general, the data revealed the effectiveness of Gesagard 80% WP at 2.38 l/ha plus Fusilade super 12.5% EC at 1.19 or 2.38 l./ha as these treatments reduced the fresh weight of annual weeds by 91 and 91.7% and increased seed yield by 0.961 and 1.058 t/ha. Moreover, Gesagard 80% WP applied alone in Gemmiza and Nubaria only during 96-97 season at 1.87 or 2.38kg/ha achieved 82% reduction for annual weeds and increased lentil yield by 0.136 and 0.152 t/ha; respectively. Meanwhile, hand weeding (twice) achieved 74% reduction for annual weeds and increased lentil seed yield by 0.565 t/ha.

**Table(1): Effect of weed control treatments and sowing methods on fresh weight of annual weeds (g/m$^2$) and lentil seed yield (t/ha) at Sakha station during 1992-93, 1994/95 and 1995-96 season.**

| Treatment (rate/ha) | 1992/93 | | | | | | 1993/94 | | | | | | 1995/96 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Annual weeds | | Mean | Lentil yield | | Mean | Annual weeds | | Mean | Lentil yield | | Mean | Annual weeds | | Mean | Lentil yield | | Mean |
| | Afir | Herati | | Afir | Herati | | Afir | Herati | | Afir | Herati | | Afir | Herati | | Afir | Herati | |
| Fusilade super 12.5 % EC (1.19 L) | 1470 | 726 | 1098 | 0.8 | 1.6 | 1.2 | 95 | 37.5 | 66 | 0.429 | 0.929 | 0.6 | 275 | 131 | 231 | 0.9 | 1.5 | 1.2 |
| Fusilade super 12.5 % EC 2.28 L) | 1520 | 688 | 1104 | 1.3 | 1.8 | 1.6 | 5 | 0 | 2.5 | 1.509 | 1.708 | 1.609 | 73 | 44 | 59 | 1.2 | 1.9 | 1.55 |
| Gesagard 80% WP (2.38 kg) | 236 | 720 | 478 | 1.7 | 1.5 | 1.6 | 663 | 188 | 425 | 1.288 | 1.0 | 1.3 | 45 | 219 | 132 | 1.7 | 1.5 | 1.6 |
| Furore (1.19 L) | 865 | 1232 | 1048 | 0.8 | 1.5 | 1.15 | … | … | … | … | … | … | | | | | | |
| Hand weeding (twice) | 188 | 186 | 187 | 1.4 | 2 | 1.7 | 58 | 80 | 134 | 1.192 | 1.358 | 1.271 | 75 | 35 | 55 | 1.3 | 2.0 | 1.55 |
| Check | 2761 | 1674 | 2218 | 0.7 | 1.0 | 0.85 | 2580 | 837.9 | 1708 | 0.492 | 1.075 | 0.782 | 1425 | 425 | 925 | 0.7 | 0.9 | 0.8 |
| Mean | 1018 | 946 | | 1.15 | 1.6 | | | | | | | | 379 | 315 | 375 | 1.16 | 1.56 | |
| LSD5% | | | | | | | | | | | | | | | | | | |
| Sowing method | NS | | | | NS | | | 442 | | | 0.124 | | | 182 | | NS | | |
| Weed control | 274 | | | | 0.4 | | | 445 | | | 0.398 | | | 155 | | 0.4 | | |
| Sowing method x Weed control | 903 | | | | NS | | | 630 | | | NS | | | 262 | | NS | | |

**Table(2): Effect of weed control treatments on fresh weight of annual weeds (g/m$^2$) and lentil seed yield(t/ha) at Sakha and Mallawi research stations during 1996-2000 seasons.**

| Treatment (rate/ha) | Sakha | | | | | | | | Mallawi | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96/97 | | 97/98 | | 98/99 | | 99/2000 | | 98/99 | | 99/2000 | |
| | Annual weeds | yield | Annual weeds | yield | Annual weeds | yield | Annual weeds | yield | Annual weeds | yield | Annual weeds | yield |
| Fusilade super 12.5 % EC (1.19 L) | 1010 | 0.7 | 1836 | 0.2 | 2845 | 0.5 | 1636 | 0.5 | 1198 | 0.3 | 1268 | 0.2 |
| Fusilade super 12.5 % EC (2.38 L) | 226 | 0.9 | 821 | 0.2 | 2375 | 0.8 | 1273 | 0.8 | 1037 | 0.3 | 1166 | 0.3 |
| Fusilade super 12.5 % EC (1.19 L)+ H.W. | 224 | 1 | 374 | 0.4 | 345 | 1.1 | 525 | 1.5 | 432 | 0.6 | 761 | 0.5 |
| Fusilade super 12.5 % EC (2.38 L)+ H.W. | 65 | 1.8 | 214 | 0.6 | 547 | 1.3 | 454 | 1.4 | 405 | 0.6 | 602 | 0.6 |
| Fusilade super 12.5 % EC + Gesagard 80% WP (1.19 L + 2.38 kg) | 66 | 1.2 | 864 | 0.5 | 85 | 1.1 | 465 | 1.3 | 291 | 1.0 | 409 | 0.7 |
| Fusilade super 12.5 % EC + Gesagard 80% WP (2.38 L + 2.38 kg) | 59 | 1.5 | 925 | 0.4 | 55 | 1 | 399 | 1.1 | 168 | 1.2 | 578 | 0.7 |
| H.W. (twice) | 48 | 1.3 | 190 | 0.5 | 168 | 1.3 | 578 | 1.1 | 152 | 1.2 | 251 | 0.9 |
| Weed check | 2658 | 0.2 | 5122 | 0.2 | 3308 | 0.3 | 3856 | 0.3 | 1449 | 0.2 | 1679 | 0.2 |
| L.S.D. | 458 | 0.9 | 458 | 0.1 | 1260 | 0.6 | 142 | 0.3 | 40 | 0.3 | 26 | 0.1 |

**Table (3): Effect of some weed control treatments on annual weeds and lentil yield at Gemmiza and Nubaria during 1996-1997 season.**

| No. | Treatment | Rate/ha | Gemmiza | | Nubaria | |
|---|---|---|---|---|---|---|
| | | | Fresh wt. of annual weeds | Seed yield t/ha | Fresh wt. of annual weeds | Seed yield t/ha |
| 1 | Gesagard 80% WP | 1.87 kg | - | - | 502 | 0.379 |
| 2 | Gesagard 80% WP | 2.38 kg | - | - | 515 | 0.395 |
| 3 | Gesagard 80% WP + Fusilade 12.9%EC | 2.38 kg + 1.19 L | 63 | 1.75 | - | - |
| 4 | Gesagard 80% WP + Fusilade | 2.38 kg +2.38 L | 48 | 1.975 | - | - |
| 5 | Fusilade super 12.5 % EC | 1.19 L | 279 | 0.95 | 5063 | 0.331 |
| 6 | Fusilade super 12.5 % EC | 2.38 L | 149 | 1.375 | 3094 | 0.405 |
| 7 | Fusilade super 12.5 % EC + Handweeding. | 1.19 L | 47 | 1.575 | 2743 | 0.583 |
| 8 | Fusilade super 12.5 % EC + Handweeding | 2.38 L | 30 | 2 | 2150 | 0.436 |
| 9 | Handweeding (twice) | | 397 | 0.625 | 1825 | 0.524 |
| 10 | Weedy check | | 1551 | 0.2 | 4489 | 0.338 |
| L.S.D. | | | 99 | 0.295 | 1957 | N.S. |

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## Abstract

Thirteen field experiments were conducted at Sakha, Mallawi, Shandweel, Gemmeiza and Nubaria Agricultural Research stations, througout 1992/93 – 1999/2000 seasons. The aim of these experiments is to study the effect of some herbicides , hand weeding and sowing method for the control of annual weeds and improving lentil seed yield. The 1st set data indicateed that herati sowing methods was more effective in reducing annual weeds

population and increasing lentil seed yield at any given treatment. Also, the best significant reduction in annual weeds population and increase in lentil seed yield was obtained by the hand weeding (twice) treatment followed by the Gesagard treatment regardless of the sowing method used. The most effective was the integration between the herati sowing method with hand weeding (twice) treatment or Gesagard at 2.38 kg/ ha. Sakha data showed that the most effective treatments against annual weeds were hand weeding (twice), Gesagard at 2.38 kg/ ha. plus Fusilade super at 1.19 or 2.38 l / ha. and Fusilade super at 1.19 or 2.38 l / ha plus hand weeding once. At Mallawi, these treatments reduced annual weeds by 78 – 87 % and increased seed yield by 0.64 to 0.84 t/ha. At Gemmiza, Gesagard at 2.38 kg/ ha. plus Fusilade super at 1.19 or 2.38 l / ha. and Fusilade super at 1.19 or 2.38 l / ha. plus hand weeding once produced 96- 98 % reduction in the fresh weight of annual weeds and increased lentil seed yield by 1.38 - 1.80 t/ ha. At Nubaria the best weed control treatments from Gesagard at 1.87 or 2.38 kg/ ha. and reduced the fresh weight of annual weeds by 86 - 89%.

**مكافحة الحشائش الحولية فى العدس**

**الملخص العربى**

أقيمت ثلاث عشر تجربة فى مجموعتين بمحطات البحوث الزراعية وهى سخا ,ملوى ، شندويل ، جميزة و النوبارية خلال الفترة من سنة 1992– 2000 المشروع بهدف دراسة تأثير بعض مبيدات الحشائش و النقاوة اليدوية و طريقة ال زراعة لمكافحة الحشائش الكلية وزيادة انتاجية محصول العدس .

أظهرت نتائج المجموعة الأولى :أن طريقة الزراعة الحراتى كانت أكثر فاعلية فى تقليل عدد الحشائش و زيادة محصول العدس مع أى معاملة، و أنتجت اكبر نقص فى عدد الحشائش و زيادة محصول العدس عن معاملة النقاوة ا ليدوية مرتين تلتها معاملة الجيساجارد بغض النظر عن طريقة الزراعة المستخدمة ، وأعطت هذه المعاملات أحسن فاعلية بتفاعل طريقة الزراعة الحراتى مع النقاوة اليدوية مرتين او الجيساجارد بمعدل 2.38 كج /هكتار .

أظهرت نتائج المجموعة الثانية فى سخا أن معاملة النقاوة اليد وية مرتين تلتها معاملة الجيساجارد بمعدل 2.38 كج /هكتار مع معاملة الفيوزيليد سوبر بمعدل 1.19 أو 2.38 لتر /هكتار أو معاملة الفيوزيليد سوبر بمعدل 1.19 أو 2.38 لتر /هكتار مع النقاوة اليدوية مرة واحدة كانت أكثر فاعلية لمكافحة الحشائش الكلية فى العدس .فى ملوى حيث قدرت نسبة المكافحة لهذه المعاملات بمقدار 78 الى 87 %و زيادة محصول العدس بنسبة 0.64 الى 0.84 طن /هكتار و فى الجميزة أظهرت النتائج أن معاملة الجيساجارد بمعدل 2.38 كج /هكتار مع معاملة الفيوزيليد سوبر بمعدل 1.19 أو 2.38 لتر /هكتار أو معاملة الفيوزيليد سوبر بمعدل 1.19 أو 2.38 لتر /هكتار مع النقاوة اليدوية مرة واحدة نقص فى الوزن الغض للحشائش الكلية و زيادة محصول العدس بنسبة 1.38الى 1.80 طن /هكتار .فى النوبارية كانت أفضل معاملات مكافحة الحشائش هى معاملة الجيساجارد بمعدل 1.87 أو 2.38 كج /هكتار حيث نقص الوزن الغض للحشائش الكلية بنسبة تتراوح ما بين 86 الى 89 .%

# Unit III

# On farm activities

## I-Development of effective integrated weed management for wheat

## Introduction:

Wild oat is a troublesome grassy weed which dominates the wheat crop. This is mainly was attributed to the lack of information about the integrated wild oat management. Earlier, effective chemical control was not handled in the frame of effective weed management package. Results of basic studies were needed on ecology of the weed and the nature of the problem. Efforts were needed for on farm testing and dissemination of developed integrated wild oats technology along with adoption and impact studies. Therefore on farm activities were carried out to verify and demonstrate the improved technology in cooperation with subject matter specialists (SMS) extension staff and the farmers. This included the worthiness of integration of certain means for wild oat control especially by cultural practices i.e. crop rotation, sowing methods, preceding winter or summer crops, seeding rates, addition to the time of application recommended herbicides for weed control treatments.

On – farm trials were conducted for ten years i.e. from 1992 / 93 season to 2001/2002 season in 12 governorates on about 230 sites in different districts to demonstrate to farmers, extension agents and weed control specialists the benefits of the developed technology as recommended on wild oat control.

## 1-Effect of preceding crops

Trials in table (1) about the effect of the preceding winter crops i.e. clover, faba bean and wheat in Assuit governorate 1992 / 1993 season were carried out by Hassanein *et al* (1993) indicated that clover as preceding winter crop gave the highest effect on decreasing wild oat fresh weight followed by faba bean and wheat at all treatments, and surpassed significantly faba bean or wheat in grain yield. Reduction percentage of fresh wild oat weight by using Grasp was 93% after clover, 91% after faba bean and 83% after wheat as compared to wheat preceded with wheat under unweeded treatment. In general, Grasp showed to be superior than hand weeding in wild oat control and wheat grain yield .

**Table (1): Effect of preceding winter crops and weed control treatments on wild oat and wheat grain yield (t/ha) in Assiut governorate during 1992 / 1993 season.**

| *Treatments* | Fresh weight of wild oat ( g/m$^2$) | | | Grain yield (t/ha) | | |
|---|---|---|---|---|---|---|
| | Preceding crop | | | | | |
| | **Clover** | **Faba bean** | **Wheat** | **Clover** | **Faba bean** | **Wheat** |
| **Grasp at 2.38 L/ha** | **74(1.9)** | **98.0(2.0)** | **176.0(2.2)** | **7.7** | **7.3** | **3.3** |
| **Hand weeding twice** | **174(2.2)** | **229(2.4)** | **306 (2.5 )** | **5.5** | **5.4** | **2.7** |
| **Unweeded** | **794(2.3)** | **819(2.9)** | **1047(3.0)** | **3.3** | **3.5** | **1.6** |
| **Mean** | **347(2.3)** | **381.7(2.4)** | **504(2.6)** | **5.5** | **5.4** | **2.6** |
| **L.S.D for preceding crop** | | **(N.S)** | | | **1.5** | |
| **L.S.D for treatments** | | **(0.07)** | | | **1.6** | |
| **L.S.D for Interaction** | | **(N.S)** | | | **1.1** | |

Hassanein *et al* (1995), Hassanein and Kholosy 1996 and Yehia *et al* 1995 and 1996 in table (2) revealed that generally clover as preceding winter crop was effective in controlling wild oat than wheat. Grasp plus Handweeding once gave the best results being higher than handweeding only.

Results in table (3) indicated that generally, the wild oat control and wheat grain yield were better in the sites preceded by clover than that preceded by wheat. Puma super gave the best control of wild oat and the highest grain yield but was not significantly higher than that obtained by other herbicides as reported by Hassanein *et al* (1996), Yehia *et al* (1996) and Elian and Abd El-Rahman (1996).

An experiment was conducted by Abd El-Hamid *et al* 1997 in Kafr El Sheikh governorate included six sites, three of them were preceded by rice and the other three sites were preceded by cotton. Results in table (4) show clearly that cotton as preceding summer crop was better than rice in controlling grassy weeds, however, the opposite for broadleaved weeds was observed. No differences for wheat grain yield in both preceding summer crops were obtained. On the other hand, Arelon herbicide plus hand weeding gave the best results on reducing the fresh weight of both grasses and broadleaved weeds and increasing wheat grain yield whether preceded by rice or cotton as summer crops.

Table (2): Effect of preceding winter crop and weed control treatment on wild oat fresh weight g/m$^2$ and wheat grain yield t/ha in different governorates in 1994/95 & 1995/96 seasons.

| Governorate | | Assuit | | | | | Minia | | | Fayoum | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Season | | 1994/95 | | | 1995/96 | | 1994/95 | | | 1994/95 | | | 1995/96 | |
| | | Av. 2 sites | | | Av. 3 sites | | Av. 2 sites | | | Av. 2 sites | | | Av. 3 sites | |
| Preceding crop | Weed control treatment | F.w. of wild oats (g/m$^2$) | | Grain yield (t/ha) | F.w. of wild oats (g/m$^2$) | Grain yield (t/ha) | F.w. of wild oats (g/m$^2$) | | Grain yield (t/ha) | F.w. of wild oats (g/m$^2$) | | Grain yield (t/ha) | F.w. of wild oats (g/m$^2$) | Grain yield (t/ha) |
| | | O | T | | | | O | T | | O | T | | | |
| Wheat | Grasp at 2.38 L/ha | 29.0 | 1.40 | 6.41 | 29 | 6.01 | 37 | 1.57 | 5.22 | 342 | 2.19 | 4.41 | 21 | 6.49 |
| | Grasp at 2.38 L/ha+ Handweeding once | 16.0 | 1.21 | 6.90 | 18 | 6.56 | 18 | 1.27 | 5.43 | 175 | 1.98 | 4.56 | 4 | 6.42 |
| | Handweeding twice | 91.0 | 1.96 | 5.26 | 102 | 4.84 | 59 | 1.77 | 4.73 | 916 | 2.05 | 3.61 | 27.9 | 5.66 |
| | Farmer's treatment | 33.0 | 1.52 | 5.75 | 38 | 5.65 | 219 | 2.34 | 2.5 | 1294 | 2.99 | 3.47 | 264.2 | 5.66 |
| | Unweeded check | 1021.0 | 3.00 | 3.11 | 725 | 2.91 | 216 | 2.33 | 3.1 | 2034 | 3.25 | 2.26 | 545.7 | 5.51 |
| | L.S.D. | | 0.15 | 0.27 | 31 | 0.52 | | 0.08 | 0.16 | | 0.49 | NS | 165.1 | 0.67 |
| Clover | Grasp at 2.38 L/ha | 19.6 | 1.30 | 7.08 | 27 | 6.74 | 10.7 | 1.02 | 5.75 | 65 | 1.28 | 7.62 | 20.2 | 6.35 |
| | Grasp at 2.38 L/ha+ Handweeding once | 9.3 | 0.98 | 7.66 | 12 | 7.36 | 5.9 | 0.8 | 6.12 | 52.4 | 1.29 | 7 | 7.58 | 6.37 |
| | Handweeding twice | 64.1 | 1.61 | 5.91 | 87 | 5.73 | 18.9 | 1.28 | 5.4 | 770 | 2.29 | 5.29 | 258.8 | 5.94 |
| | Farmer's treatment | 24.4 | 1.38 | 6.42 | 35 | 9.29 | 65.5 | 1.74 | 3.9 | 7.23 | 2.28 | 5.81 | 293.3 | 5.76 |
| | Unweeded check | 208.7 | 2.85 | 3.72 | 645 | 3.32 | 44 | 1.92 | 3.3 | 876 | 2.43 | 5.17 | 532.4 | 5.47 |
| | L.S.D. | | 0.12 | 0.10 | 58 | 0.37 | | 0.43 | 1.05 | | 0.35 | 1.53 | 152 | 0.65 |

**Table (3): Effect of preceding winter crops and weed control treatments on wild oat control and wheat grain yield in farmer's fields in different governorates in 1995/96 season.**

| *Governorate* | Fayoum | | Assuit | | | | Sharkia | |
|---|---|---|---|---|---|---|---|---|
| | site (1) | | site (1) | | site (1) | | site (2) | |
| Weed control treatments | Fresh weight (g/m²( | Yield (t/ha) | Fresh weight (g/m²( | Yield (t/ha) | Fresh weigh t (g/m²( | Yield (t/ha) | Fresh weigh t (g/m²( | Yield (t/ha) |
| **Wheat** | | | | | | | | |
| Topik at 0.24 L/ha | 34 | 5.86 | 156 | 1.68 | 2.3 | 9.00 | 2.8 | 7.38 |
| Illoxan at 2.38 L/ha | 31 | 6.23 | 0 | 2.09 | 2.5 | 7.25 | 24.3 | 6.88 |
| Puma Super at 1.19 L/ha | 21 | 6.73 | 17.6 | 2.00 | 2.08 | 8.63 | 11.0 | 6.88 |
| Grasp at 2.38 L/ha | 26 | 6.44 | 22.3 | 2.02 | 15.5 | 8.81 | 9.4 | 7.38 |
| Hand weeding twice | 112 | 4.16 | 55.5 | 1.57 | 30.8 | 8.10 | 36.0 | 6.33 |
| Unweeded check | 676 | 3.12 | 542.3 | 1.39 | 860 | 2.95 | 123.5 | 3.38 |
| LSD | 49 | 1.06 | 64.2 | NS | 170.3 | 0.68 | 60.1 | 0.83 |
| Clover | | | | | | | | |
| Topik at 0.24 L/ha | 32 | 6.65 | 27.5 | 5.42 | | | | |
| Illoxan at 2.38 L/ha | 28 | 6.68 | 443.6 | 4.59 | | | | |
| Puma Super at 1.19 L/ha | 18 | 7.08 | 20.5 | 5.34 | | | | |
| Grasp at 2.38 L/ha | 21 | 6.85 | 6.1 | 4.90 | | | | |
| Hand weeding twice | 104 | 4.66 | 181.3 | 4.94 | | | | |
| Unweeded check | 628 | 3.35 | 991.1 | 3.71 | | | | |
| LSD | 46 | 0.53 | 300.4 | 0.71 | | | | |

Results obtained by Abd El-Hamid *et al* (2002) and Elian *et al* (2002) and Tewfik el al (2002) shown in table (5) indicate clearly that clover as preceding winter crop whether followed by cotton or maize decreased fresh weight of weeds and produced higher grain yield compared to that obtained when wheat was used as winter preceding crop in Behera, Sharkia and Kalubiah governorates. Cotton as summer preceding crop also was better than maize. Treated sites (Sinal + Topik in Sharkia or Brominal + Topik in Behera) controlled weeds by clover/ cotton, clover/ maize, what/ maize and excellent wheat respectively.

**Table (4): Effect of the preceding summer crop and weed control method on annual weeds and wheat grain yield in Kafr El-Sheikh governorate in 1996/1997 season.**

| Treatments | Preceding summer crop | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Rice | | | Mean | Cotton | | | Mean |
| | Sites | | | | Sites | | | |
| | 1 | 2 | 3 | | 1 | 2 | 3 | |
| | Fresh weight of annual grassy weeds (g/m$^2$) | | | | | | | |
| Arelon at 2.98 L/ha | 28 | 44.1 | 14 | 29 | 0 | 1.1 | 0.9 | 0.7 |
| Arelon + H.W | 8 | 29.6 | 11 | 16 | 0 | 0.0 | 0.9 | 0.3 |
| H. Weeding | 45 | 132.1 | 142 | 107 | 1 | 26.0 | 14.9 | 0.4 |
| Unweeded | 218 | 964.0 | 295 | 492 | 18 | 148.0 | 42.0 | 70 |
| LSD | 84 | 539.0 | 44 | | 3.4 | 50.0 | 5.2 | |
| | Fresh weight of annual broad-leaf weeds (g/m$^2$) | | | | | | | |
| Arelon at 2.98 L/ha | 2.4 | 26.5 | 24.5 | 18.8 | 8.0 | 111.0 | 31.5 | 50.0 |
| Arelon + H.W | 1.9 | 7.9 | 15.9 | 8.5 | 4.5 | 59.9 | 23.0 | 29.0 |
| H. Weeding | 5.8 | 245.0 | 55.3 | 28.5 | 56.3 | 209.0 | 76.0 | 114.0 |
| Unweeded | 15.3 | 267.0 | 244.0 | 175.0 | 27.5 | 696.0 | 241.0 | 403.0 |
| LSD | 3.6 | 200.0 | 19.2 | | 22.0 | 299.0 | 42.0 | |
| | Fresh weight of annual weeds (g/m$^2$) | | | | | | | |
| Arelon at 2.98 L/ha | 30.4 | 70.6 | 38.5 | 46.5 | 8.0 | 111.5 | 32.0 | 50.6 |
| Arelon + H.W | 10.3 | 37.5 | 264.0 | 24.7 | 4.5 | 59.8 | 23.9 | 29.3 |
| H. Weeding | 50.8 | 156.6 | 197.0 | 135.0 | 57.3 | 236.0 | 90.9 | 128.0 |
| Unweeded | 232.5 | 1232.0 | 538.0 | 667.0 | 240.0 | 844.0 | 28.4 | 472.0 |
| LSD | 84.4 | 431.0 | 53.0 | | 23.3 | 333.0 | 45.9 | |
| | Wheat grain yield (t/ha) | | | | | | | |
| Arelon at 2.98 L/ha | 5.50 | 5.56 | 4.50 | 5.19 | 5.32 | 4.34 | 4.95 | 4.87 |
| Arelon + H.W | 5.89 | 5.73 | 4.00 | 5.21 | 6.25 | 4.77 | 5.43 | 5.48 |
| H. Weeding | 5.05 | 4.69 | 3.46 | 4.40 | 4.44 | 3.14 | 510.00 | 4.39 |
| Unweeded | 4.32 | 3.62 | 3.39 | 3.78 | 4.48 | 2.50 | 4.25 | 3.74 |
| LSD | 0.65 | 0.88 | NS | | 0.88 | 1.44 | NS | |

Data in table (6) reported by Al- Marsafy *et al* 1995, El- Wekil *et al* 1994, Kholosy *et al* 1994 and Yehia *et al* 1994 showed that clover as preceding winter crop decreased fresh weight of wild oat more than wheat used as a preceding winter crop. Grasp decreased significantly wild oat fresh weight compared to handweeding in both Afir and Herati sowing methods. Herati method exceeded Afir in either controlling wild oat or increasing wheat grain yield.

**Table (5): Effect of crops sequence and weed control treatments on fresh weight of weeds and wheat grain yield in Beheira, Sharkia and Kalubiah governorates in 2001/2002 season.**

| Crop sequence | Clover/cotton | | Clover/maize | | Wheat/maize | |
|---|---|---|---|---|---|---|
| Treatment | Weeds ($g/m^2$) | Yield (t/ha) | Weeds ($g/m^2$) | Yield (t/ha) | Weeds ($g/m^2$) | Yield (t/ha) |
| **Beheira** | | | | | | |
| Treated | 20.5 | 5.6 | 29.3 | 6.7 | 65.5 | 5.3 |
| Untreated | 139.2 | 5.3 | 96.3 | 4.8 | 290.8 | 2.6 |
| L.S.D. | S | NS | NS | S | NS | NS |
| **Sharkia** | | | | | | |
| Treated | 16.3 | 7.1 | 22.5 | 6.5 | 145 | 6.4 |
| Untreated | 195 | 5 | 233.8 | 4 | 702.5 | 2.9 |
| L.S.D. | S | S | S | S | S | S |
| **Kalubiah** | | | | | | |
| Treated | 0 | 8.3 | 12.5 | 7.3 | 226 | 7.3 |
| Untreated | 75.5 | 7.6 | 709 | 6.4 | 1725 | 5.6 |
| L.S.D. | S | NS | S | NS | S | S |

S = Significant at 5%

**Table (6): Effect of preceding winter crop, sowing method and weed control treatment on fresh weight of wild oat control and wheat grain yield 1993/94 season**

| Preceding winter crop | Sowing method | Weed control treatments | Qena (2 sites) | | Sohag (7 sites) | | Assiut (4 sites) | | Fayoum (8 sites) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Fresh weight ($g/m^2$) | Yield (t/ha) | F.W. ($g/m^2$) | Yield (t/ha) | F.W. ($g/m^2$) | Yield (t/ha) | F.W. ($g/m^2$) | Yield (t/ha) |
| Clover | Afir | Grasp at 2.38 L/ha. | 9.5 | 6.4 | 33a | 7.3 | 10 | 6.9 | 14.1 | 5.3 |
| | | Handweeding twice | 96 | 5.4 | 29 a | 4.9 | 80 | 5.4 | 111.4 | 5.6 |
| | | Unweeded | 428.8 | 4.6 | 1718 b | 2.5 | 312.5 | 3.1 | 74 | 4.6 |
| | | LSD | 55.2 | 0.64 | | 2.56 | 58.4 | 0.85 | 50.6 | N.S |
| | Heratti | Grasp at 2.38 L/ha. | 4.8 | 7.7 | 12.5 a | 7.1 | 6.3 | 6.5 | 11.0 | 5.6 |
| | | Handweeding twice | 55 | 6.8 | 966 b | 5.6 | 61.3 | 4.6 | 7.8 | 5.7 |
| | | Unweeded | 235 | 6.1 | 1000 b | 3.9 | 2125 | 2.9 | 30.0 | 4.4 |
| | | LSD | 72.5 | 0.97 | | 1.77 | 34.5 | 0.60 | N.S | N.S |
| Wheat | Afir | Grasp at 2.38 L/ha. | 29.5 | 5.8 | 25 a | 3.7 | 28.5 | 5.3 | 112.1 | 4.2 |
| | | Handweeding twice | 245 | 3.6 | 99 b | 3.9 | 221 | 4.0 | 474.5 | 2.8 |
| | | unweeded | 994 | 2.7 | 1275 c | 0.4 | 905 | 2.5 | 807 | 1.8 |
| | | LSD | 83.3 | 0.61 | | 0.86 | 52.41 | 0.4 | 280.2 | 1.4 |
| | Heratti | Grasp at 2.38 L/ha. | 17.5 | 6.7 | 58 a | 3.4 | 14.5 | 4.8 | 2.0 | 5.1 |
| | | Handweeding twice | 141.2 | 5.4 | 65 a | 2.9 | 102.5 | 3.7 | 320.9 | 4.5 |
| | | unweeded | 713.8 | 3.4 | 1613 b | 2.4 | 459 | 2.1 | 334 | 3.9 |
| | | LSD | 107.7 | 0.68 | | N.S | 54.9 | 0.8 | 141.4 | N.S |

## 2. Effect of sowing methods:

Studies by Salim *et al* 1993 presented in table (7) showed that *Herati* method significantly decreased fresh weight of wild oat than *Afir* drill or broadcast. *Afir* drill gave the highest wheat grain yield. Results revealed the benefits of integration between Grasp and sowing methods for successful wild oat control and wheat production.

**Table (7): Effect of sowing method and chemical weed control of wild oat in Assiut governorate during 1993 winter season**.

| District | | Manflout | | Abu Teig | |
|---|---|---|---|---|---|
| Sowing method | Treatments | Fresh weight ($g/m^2$) | Yield (t/ha ) | Fresh weight ($g/m^2$) | Yield (t/ha ) |
| | | O (T) | | O (T) | |
| Afir drill | Unweeded | 648(2.8) | 5.0 | 533(2.7) | 4.5 |
| | Grasp at 2.38 L/ha | 55(1.7) | 6.9 | 43(1.6) | 6.3 |
| | Hand weeding | 166(2.2) | 6.0 | 133(2.2) | 5.4 |
| Afir broadcast | Unweeded | 770(2.9) | 4.5 | 571(2.8) | 4.0 |
| | Grasp at 2.38 L/ha | 65(1.8) | 6.1 | 51(1.7) | 5.5 |
| | Hand weeding | 230(2.4) | 5.3 | 180(2.3) | 4.8 |
| Herati | Unweeded | 193(2.3) | 5.3 | 170(2.2) | 4.9 |
| | Grasp at 2.38 L/ha | 10(1.0) | 5.8 | 11.5(1.1) | 5.3 |
| | Hand weeding | 44(1.6) | 5.3 | 53(1.7) | 5.0 |
| Afir drill | | 289(2.3 | 6.0 | 235.9(2.2) | 5.4 |
| Afir broadcast | | 338(2.3) | 5.3 | 267.5(2.2) | 4.8 |
| Herati | | 82.2(1.6) | 5.5 | 78.0(1.7) | 5.0 |
| Unweeded | | 520(2.7) | 4.9 | 424.6(2.6) | 4.5 |
| Grasp at 2.38 L/ha | | 43.3(1.5) | 6.3 | 35.2(1.5) | 5.7 |
| Hand weeding | | 146.7(2.1) | 5.5 | 121.7(2.0) | 5.0 |
| L.S.D. at 5% for | | | | | |
| Sowing method | | (2.1) | N.S. | 0.05 | 0.24 |
| Weed control treatments | | (0.08) | 0.12 | 0.08 | 0.45 |
| Interaction | | (0.58) | N.S. | N.S | N.S |

(T) = transformed data

As shown in Table (8) results indicated that clover as preceding winter crop decreased fresh weight of wild oat and gave higher wheat grain yield compared to wheat as preceding winter crop. As for row spacing 20 cm apart gave higher wheat grain yield than 15 cm apart; also Sinal plus Grasp controlled grassy weeds better than hand weeding (Shebl *et al*, 2000; Elian *et al*, 2000; Ibrahim *et al*, 2000 and Shrief, 2000).

**Table (8): Effect of crop sequence, row spacing and weed control treatments on fresh grassy weeds and grain yield in West Nubaria, Sharkia, Menofia and Fayoum governorates in 1999/2000 season.**

| Preceding winter crop | Clover | | | | | | | | Wheat | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Governorates | Minofia | | Nubaria | | Sharkia | | Fayoum | | Nubaria | | Sharkia | |
| Treatments | Fresh weight ($g/m^2$) | Yield (t/ha) | F. w. ($g/m^2$) | Yield (t/ha) | F. w. ($g/m^2$) | Yield (t/ha) | F. w. ($g/m^2$) | Yield (t/ha) | F. w. ($g/m^2$) | Yield (t/ha) | F. w. ($g/m^2$)) | Yield (t/ha) |
| Drilling (15 cm)+ Sinal+ Grasp | 113 c | 8.5 a | 87 | 5.0 | 18.8 | 6.3 | 170 | 5.8 | 41 | 4.2 | 19.5 | 5.8 |
| Drilling ( 20 cm)+ Sinal+ Grasp | 24 c | 8.3 a | 150 | 3.9 | 22.8 | 6.7 | 195 | 6.6 | 66 | 3.8 | 27.6 | 6.4 |
| Handweeding | 285 b | 6.8 b | 175 | 3.5 | 156.9 | 4.9 | 87 | 5.2 | 78 | 3.4 | 214.4 | 4.9 |
| Untreated | 1124 a | 3.9 c | 548 | 2.7 | 521.4 | 3.3 | 893 | 4.12 | 1025 | 2.5 | 560 | 3.5 |
| LSD | | | 94.9 | 0.4 | 49 | 0.2 | 138 | 0.39 | 159.1 | 0.6 | | |

Table (9) indicated that clover as preceding winter crop decreased fresh weight of wild oat than wheat and gave higher grain yield in both EL-Banger zone and Menoufia. Improved dry method + Sinal + Topik gave the lowest fresh weight of wild oat and the highest grain yield followed by both Afir dry method + Sinal + Topik and improved dry method + Handweeding in EL-Banger zone. Improved dry method + Sinal + Topik was superior in Menoufia governorate followed by improved dry method + handweeding in controlling wild oat and increasing wheat grain yield as reported by Salim and Shrief 2001, and Yehia and El-Wekil 2001.

**Table (9): Effect of crop sequence, sowing methods and weed control treatments on wild oat and wheat grain yield in farmer fields in 2000/2001 season.**

| Crop sequence / Treatments | Clover/wheat | | Wheat/wheat | | Clover/wheat | | Wheat/wheat | | Clover/wheat | | Wheat/wheat | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | El-Banger zone (av.4 sites) | | | | Menoufia (av.4 sites) | | | | Beheira (av.4 sites) | | | |
| | Fresh weight ($g/m^2$) | Yield (t/ha) | Fresh weight ($g/m^2$) | Yield (t/ha) | Fresh weight ($g/m^2$) | Yield (t/ha) | Fresh weight ($g/m^2$) | Yield (t/ha) | Fresh weight ($g/m^2$) | Yield (t/ha) | Fresh weight ($g/m^2$) | Yield (t/ha) |
| Improved dry method+Sinal+Topik | 7.13 | 7.5 | 13.1 | 6.5 | 1.25a | 7.1b | 5.0a | 6.7 a | 70 | 5.3 | 170 | 5.32 |
| Improved dry method+handweeding | 140.6 | 5.8 | 206.3 | 4.6 | 8.38a | 6.6ab | 24.0ab | 6.2 a | 138 | 5.2 | 295 | 5.2 |
| Dry method+Sinal+Topik | 29.9 | 6.8 | 35.9 | 5.8 | 11.88a | 6.4a | 72.5b | 5.7 a | 225 | 4.8 | 361 | 4.7 |
| Dry method+handweeding | 195 | 6.3 | 251.3 | 4.3 | 51.25b | 6.1a | 102.2b | 5.5 a | 415 | 4.4 | 1601 | 4.4 |
| L.S.D. | 21.9 | 0.59 | 22.5 | 0.68 | | | | | 102 | 0.4 | 1037 | 0.6 |
| | Kalubia (av. 4 sites) | | | | Sharkia (av. 4 sites) | | | | Fayom (av. 4 sites) | | | |
| Improved dry method+Sinal+Topik | 28 | 6.0 | 173 | 5.5 | 25 | 5.3 | 29 | 4.2 | | | 119 | 9.9 |
| Improved dry method+handweeding | 0 | 6.3 | 15 | 6.0 | 61 | 3.9 | 172 | 3.3 | | | 283 | 6.8 |
| Dry method+handweeding | 1471 | 4.6 | 2540 | 3.9 | 334 | 1.9 | 566 | 2.1 | | | 1394 | 3.5 |
| L.S.D. | 191 | 0.8 | 432 | 0.7 | 113 | 1.1 | 189 | 0.6 | | | 349 | 0.3 |

## 3- Effect of tillage system on weed control and wheat productivity

Results from tillage systems conducted in Kafr El-Shiekh governorate by El-Maghraby *et al* 1994 showed that tillage system was superior in controlling weeds and gave highest wheat grain yield than no tillage system.

Table (10): Effect of tillage system on weed control and wheat productivity in Kafr El-Sheikh governorate in 1993/1994 season.

| Tillage system | Site (1) Fresh weight of total weeds (g/m$^2$) | Site (1) Grain yield t/ha | Site (2) Fresh weight of total weeds (g/m$^2$) | Site (2) Grain yield t/ha |
|---|---|---|---|---|
| Tillage | **475 a** | **6.1 a** | **104 b** | **6.5 a** |
| **No tillage** | **756 a** | **4.8 b** | **329 b** | **5.2 b** |

## 4- Effect of seed rate:

Data in table (11) indicated that increasing seeding rates at 154, 178 and 214 kg/ha decreased significantly the fresh weight of wild oat by 23.5,35.3 and 54.1%, respectively, as compared to 119kg/ha. Grasp gave the best control of wild oat under the highest seeding rate at 214 kg/ha. (Yehia *et al*, 1993) .

## 5- Effect of herbicides

Yehia *et al* (1993) found that Grasp at 2.381 L/ha followed by hand weeding reduced the fresh weight of weeds by 98 % and increased wheat grain yield by 81.5 % as compared to the unweeded check (Table 12).

Table (13) indicated that Grasp 10% EC at 2.38 L/ha gave the best weed control of wild oat than handweeding twice when preceded by either clover or wheat and increased wheat grain yield (Kholosy *et al*, 1997).

Thirteen trials in new land and Nile Delta were conducted, as verification trials during 97/98 season in farmer's fields in 5 governorates or locations naturally infested by wild oats to investigate the performance of some new selective herbicides i.e. (Topik, Grasp and Puma super) in an attempt to produce better wild oat control. Table (14) indicate that the previous herbicides and hand weeding twice reduced the fresh weight of wild oat. However, Grasp and Topik, exceeded Puma-super. All herbicides gave higher control than hand weeding and Topik 15% gave the highest grain yield followed by Grasp.

**Table (11): Effect of some weed control treatments under seeding rates on fresh weight of wild oat ($g/m^2$) and wheat grain yield (t/ha)in Assuit governorate,1992/1993 season .**

| Weed control treatments | Seeding rate (kg/ha) | Fresh weight of wild oat ($g/m^2$) | Wheat grain yield ( t/ha ) |
|---|---|---|---|
| **Unweeded** | 119 | 990 | 3.13 |
| | 154 | 717 | 3.63 |
| | 178 | 610 | 4.25 |
| | 214 | 452 | 4.81 |
| Mean | | 693 | 3.85 |
| **Grasp 10% EC. at 2.38 L / ha** | 119 | 62 | 4.25 |
| | 154 | 57 | 5.00 |
| | 178 | 57 | 5.81 |
| | 214 | 40 | 6.56 |
| Mean | | 54 | 5.41 |
| **Hand weeding twice** | 119 | 287 | 3.63 |
| | 154 | 250 | 4.38 |
| | 178 | 200 | 5.00 |
| | 214 | 122 | 5.56 |
| Mean | | 215 | 4.64 |
| **Mean of seeding rates** | 119 | 446 | 3.67 |
| | 154 | 341 | 4.33 |
| | 178 | 289 | 5.00 |
| | 214 | 205 | 5.65 |
| **L.S.D. at 5% for:** | | | |
| **Seeding rate** | | 57.31 | 0.595 |
| **Weed control treatments** | | 69.8 | 0.706 |
| **Interaction** | | 139.6 | N.S |

**Table (12): Effect of weed control treatments on fresh weight of weeds ($g/m^2$) and wheat grain yield (t/ha) in Assiut governorate at 1992/1993 season (Average 2 sites) .**

| Treatments | Fresh weight of weeds ($g/m^2$) | Grain yield (t/ha) |
|---|---|---|
| Grasp at 2.38L/ha | 47 | 6.1 |
| Suffix at 2.98 L/ha | 125 | 5.4 |
| Grasp + Hand weeding | 18 | 6.9 |
| Suffix + Hand weeding | 69 | 6.1 |
| Hand weeding | 208 | 4.5 |
| Untreated | 862 | 3.8 |
| L.S.D | 52 | 0.7 |

**Table (13): Effect of the preceding winter crop and weed control treatments on the fresh weight of wild oat (g/m$^2$) and grain yield of wheat (t/ha) in El-Fayoum governorate during 1996/97 season**

| Preceding crop | Wheat (5 sites) | | Clover (3sites) | |
|---|---|---|---|---|
| Weed control treatments | Fresh weight of wild oat (g/m$^2$) | yield (t/ha) | Fresh weight of wild oat (g/m$^2$) | yield (t/ha) |
| Grasp at 2.38 L/ha | 105 | 7.4 | 27 | 7.8 |
| Hand weeding twice | 192 | 7.6 | 221 | 7.5 |
| Unweeded | 461 | 7.0 | 458 | 7.2 |
| LSD | 79 | 0.33 | 258 | NS |

**Table (14): Effect of some weed control treatments on controlling wild oats in wheat fields during 1997/1998 season.**

| Sites | Banger El-Sukker (2 sites) | | Nubariah (4 sites) | | Minofia (3 sites) | | Kalubia (3 sites) | | Sharkia (one sites) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Treatments | Wild oat weight (g/m$^2$) | yield (t/ha) | Wild oat weight (g/m$^2$) | yield (t/ha) | Wild oat weight (g/m$^2$) | yield (t/ha) | Wild oat weight (g/m$^2$) | yield (t/ha) | Wild oat weight (g/m$^2$) | yield (t/ha) |
| Grasp | 27 | 5.56 | 214 | 3.3 | 75 | 8.06 | 10 | 6.88 | 25 | 5.55 |
| Topik | 25 | 5.74 | 380 | 3.36 | 48 | 8.31 | 15 | 7.21 | 0 | 6.39 |
| Puma super | | | 570 | 3.30 | 81 | 7.5 | | | | |
| Hand weeding | | | 877 | 3.11 | 138 | 7.1 | | | 037 | 4.23 |
| Unweeded | 605 | 2.70 | 2107 | 2.54 | 534 | 4.59 | 113 | 4.13 | 1225 | 2.45 |
| LSD | 44 | 0.64 | | | 47 | 0.73 | | 0.48 | | |

Data in table (15) show that the fresh weight of grassy weeds was decreased by 95%, 61%, 96%, and 97% for El-Banger, Kalubia, Sharkia and Sohag, respectively, while broadleaved weeds decreased by 79%, 70%, 93%, and 98% for the previous sites, respectively, as compared to farmer practice. The wheat grain yield was increased by 3.2, 1.1, 2.4, and 4.7 t/ha in these sites, respectively, by using Grasp herbicides; while it was increased by 3.1, 1.0, 2.5 and 2.6 t/ha by using Sinal herbicide (Salim *et al*, 1998; El-Marsafy *et al*, 1998; Ibrahim *et al*, 1998; Elian *et al*, 1998; Tewfik *et al*, 1998; Yehia *et al*, 1998 and Abd-El-Hamid *et al*, 1998).

**Table (15): Effect of some weed control treatments on fresh weight of weed (g/m$^2$) and grain yield of wheat in some governorates in 1998/99 season.**

| Governorate | No. of sites | Weed control treatments | | | | | |
|---|---|---|---|---|---|---|---|
| | | Fresh weight of Grasses weeds (g/m$^2$) | | | Yield | | |
| | | Grasp | Farmer treatments | L.S.D | Grasp | Farmer treatments | L.S.D |
| Menofia | 9 | 11.7 | 43 | | 9.5 | 6.7 | 101 |
| Sohag | 5 | 37 | 1142 | 0.52 | 8.9 | 4.2 | 2.9 |
| Fayoum | 5 | 18.5 | 281 | 0.24 | 6.4 | 3.9 | 0.42 |
| West El-Nubaria | 5 | 192.6 | 754 | N.S | 4.6 | 3.2 | |
| Kalubia | 5 | 71 | 182 | | 7.6 | 6.5 | 0.37 |
| Sharkia | 5 | 21 | 540 | N.S | 5.2 | 2.8 | 0.7 |
| El-Banger Zone | 5 | 30 | 649 | 90.9 | 6.6 | 3.4 | 0.46 |
| Fresh weight of broad leaved weeds (g/m$^2$) | | | | | | | |
| | | Sinal | Farmer treatment | L.S.D | Sinal | Farmer treatment | L.S.D |
| Menofia | 9 | 94 | 479 | | 9.5 | 6.7 | 0.4 |
| Sohag | 5 | 6.4 | 553 | 0.23 | 8 | 5.4 | 0.63 |
| Fayoum | 5 | 23 | 283 | 0.30 | 6.4 | 4.3 | 0.36 |
| West El-Nubariah | 5 | 19.5 | 139 | 55.7 | 4.5 | 2.8 | 0.3 |
| Kalubia | 5 | 45 | 152 | | 7.5 | 6.5 | N.S |
| Sharkia | 5 | 40 | 572 | 103 | 5 | 3 | 0.4 |
| El-Banger Zone | 5 | 26 | 901 | 43.8 | 6.5 | 3.3 | 0.38 |

## II- Demonstration plots for integrated wild oat control in wheat.

## Introduction

950 demonstration trials during 1992 to 2002 winter seasons included the main items of the package for wild oat control were conducted in six governorates in upper Egypt, six governorates in lower Egypt in addition to 2 areas in the new lands. The efficacy of the package in decreasing wild oat infestation and increasing the wheat yield was followed up throughout the work where socio-economic and adoption studies were carried out.

## 1- Trials in Upper Egypt:

410 demonstration trials from 1992/93 up to 2001/2002 season conducted in six governorates in upper Egypt namely Fayoum, Beni suef, Minia, Assuit, Sohag and Qena are presented in table (16). The trials were carried out in Fayum, by Ibrahim, 1993, Hassanien et al (1994, 1995, 1997, 1998, 2000 and 2002) in Assuit by Salim and Yehia 1993, Hassanein and Yehia 1994 and Hassanein et al (1995, 1996, 1997, 1998), in Sohag byAl Marsafy and Micheal (1993), 1999, 2000 and 2001, Al Marsafy et al 1996, 1997, 1999 and Hassanein et al (1994, 1995, 1998 2001); in Beni suif by Kholousy (1993); in Qena El-Wekil et al (1993), Hassanein et al (1994, 1995 and Hassanein and El-Wekil (1996) and Minia by Hassanein et al (1996, 1998, 1999, 2000 and 2001).

It is clear from table 16 that certain governorates were heavily infested by wild oats especially in the early seasons of the work. The pressure of this weed decreased gradually through out the seasons to reach a low or moderate infestation as the work progressed. This was clear in Sohag and Qena. Other governorates e.g. Assuit, the infestation was moderate by wild oat and fluctuated throughout the wheat yield seasons according to the area chosen for the trials.

**Table (16): Wild oat infestation (g/m$^2$) and wheat grain yield (t/ha) in demonstration plots in Middle and Upper Egypt during 1992/93 - 2001/2002 seasons.**

| Season | No. of sites | Wild oat (g/m$^2$) O | | Wild oat (g/m$^2$) T | | | Wheat grain yield (t/ha) | | |
|---|---|---|---|---|---|---|---|---|---|
| | | In | Out | In | Out | L.S.D | In | Out | L.S.D |
| *Fayoum* | | | | | | | | | |
| **1992/93** | **10** | **55** | **872** | **1.1** | **2.7** | **0.7** | **5.8** | **2.9** | **0.2** |
| **1993/94** | **10** | **85** | **617** | **1.4** | **2.4** | **0.4** | **2.4** | **2.9** | **0.5** |
| **1994/95** | **10** | **116** | **534** | **1.7** | **2.7** | **0.4** | **5.5** | **2.2** | **1.2** |
| **1995/96** | **10** | **68** | **142** | **1.7** | **2.1** | **0.1** | **7.3** | **5.2** | **0.8** |
| **1996/97** | **10** | **38** | **184** | **1.2** | **2.2** | **0.3** | **8.5** | **5.3** | **0.9** |
| **1997/98** | **10** | **66** | **1189** | **1.6** | **2.9** | **0.2** | **5.8** | **3.5** | **1** |
| **1998/99** | **10** | **23** | **270** | **1.2** | **2.4** | **0.5** | **6.5** | **3.9** | **0.6** |
| **1999/00** | **10** | **237** | **1054** | **2.3** | **3** | **0.2** | **8.1** | **5.3** | **0.5** |
| **2000/01** | **10** | **138** | **860** | **1.7** | **2.1** | **0.1** | **10** | **5.2** | **1.2** |
| **2001/02** | **10** | **92** | **615** | **2** | **2.8** | **0.1** | **8** | **6.4** | **0.5** |
| **Beni Suef** | | | | | | | | | |
| **1992/93** | **10** | **117** | **3586** | **2.1** | **3.5** | **0.2** | **1.4** | **0.8** | **0.3** |
| **Minia** | | | | | | | | | |
| **1994/95** | **10** | **80** | **186** | **1.4** | **2.2** | **0.04** | **6.1** | **5.7** | **0.1** |
| **1995/96** | **10** | **63** | **156** | | | **12.9** | **5.7** | **5.1** | **0.2** |
| **1997/98** | **10** | **51** | **161** | **1.7** | **2.2** | **0.3** | **5.4** | **5.9** | **0.2** |
| **1998/99** | **10** | **75** | **375** | | | **24.9** | **7.5** | **5.8** | **0.2** |
| **1999/00** | **10** | **83** | **414** | **1.9** | **2.6** | **0.02** | **7.0** | **5.7** | **0.3** |
| **2000/01** | **10** | **5** | **457** | **0.3** | **2.7** | **0.1** | **7.7** | **5.1** | **0.1** |
| **2001/02** | **10** | **5** | **482** | | | **20.0** | **7.7** | **5.0** | **0.1** |

**Table (16) cont.:**

| Seasons | No. of sites | O | | T | | | Wheat grain yield (t/ha) | | |
|---|---|---|---|---|---|---|---|---|---|
| | | In | Out | In | Out | LSD | In | Out | LSD |
| **Assuit** | | | | | | | | | |
| **1992 / 93** | **10** | **44** | **890** | **1.6** | **2.9** | **0.1** | **7.5** | **2.7** | **0.5** |
| **1993 / 94** | **10** | **18** | **908** | **1.3** | **2.9** | **0.1** | **5.9** | **1.5** | **1.4** |
| **1994 / 95** | **10** | **21** | **796** | **1.3** | **2.9** | **0.2** | **6.7** | **2.8** | **0.5** |
| **1995 / 96** | **10** | **20** | **125** | **1.3** | **2.0** | **0.2** | **6.7** | **5.6** | **0.3** |
| **1997 / 98** | **10** | **22** | **143** | **1.4** | **2.2** | **0.1** | **7.0** | **4.0** | **0.3** |
| **1998 / 99** | **10** | **26** | **436** | **1.4** | **2.6** | **0.1** | **7.2** | **3.8** | **0.3** |
| **1999 / 00** | **10** | **23** | **429** | **1.4** | **2.7** | **0.1** | **6.8** | **4.7** | **0.3** |
| 2000 / 01 | **10** | **13** | **628** | **1.1** | **2.8** | **0.1** | **7.6** | **4.6** | **0.3** |
| **2001 / 02** | **10** | **8** | **710** | **0.9** | **2.9** | **0.1** | **8.4** | **4.7** | **0.3** |
| **Sohag** | | | | | | | | | |
| **1992 / 93** | **10** | **50** | 1137 | **1.7** | **3** | **0.3** | **5.8** | **3.9** | **1.3** |
| **1993 / 94** | **10** | **83** | **2135** | **1.4** | **3.3** | **1.5** | **5.1** | **2.2** | **1.2** |
| **1994 / 95** | **10** | **49** | **339** | **1.6** | **2.5** | **0.2** | **4.9** | **3.9** | **0.9** |
| **1995 / 96** | **10** | **54** | **569** | **1.1** | **2.2** | **0.9** | **6.5** | **4.5** | **0.9** |
| **1997 / 98** | **10** | **28** | **332** | **0.5** | **2.0** | **0.5** | **6.1** | **5.1** | **0.7** |
| **1998 / 99** | **10** | **175** | **1105** | **1.2** | **2.4** | **0.7** | **5.7** | **4.4** | **0.3** |
| **1999 / 00** | **10** | **42** | **1128** | **1.1** | **3.0** | **0.3** | **8.4** | **4.5** | **0.8** |
| **2000 / 01** | **10** | **15** | **416** | **0.4** | **2.5** | **0.3** | **7.1** | **4.8** | **0.4** |
| **2001 / 02** | **10** | **20** | **974** | **0.6** | **2.9** | **0.2** | **6.5** | **4.7** | **0.5** |
| **1992 / 93** | **10** | **10** | **267** | **0.4** | **2.4** | **0.4** | **7.9** | **6.1** | **0.3** |
| Qena | | | | | | | | | |
| **1992 / 93** | 10 | **46** | **1399** | **1.6** | **3.1** | **0.3** | **4.7** | **1.6** | **0.9** |
| **1993 / 94** | **10** | **225** | **1902** | **2.4** | **3.3** | **0.2** | **5.0** | **0.7** | **0.8** |
| **1994 / 95** | **10** | **35** | **912** | **1.5** | **2.9** | **0.1** | **5.7** | **1.7** | **0.4** |
| **1995 / 96** | **10** | **87** | **576** | **1.9** | **2.7** | **0.1** | **4.8** | **2.0** | **0.2** |
| *Total* | **410** | | | | | | | | |

The demonstration trials included several factors of the package for wild oat control included preceding crop, sowing method, hand weeding and grassy herbicides.

In the first season of the work, the major item used was herbicides (Grasp and Suffix). In the following seasons more than one item of the package was used focusing on the most effective item i.e. clover as a preceding winter crop together with the use of herbicides and/or the supplementary handweeding. The method of sowing i.e. wet method (Herati) or dry method (Afir drill) was practiced according to the rate of infestation by wild oat i.e. Herati method for heavily infested and Afir drill for the moderately infested areas.

The herbicides used for wild oat control changed throughout the years and according to the new recommendation of Ministry of Agricultural. In the early seasons the major herbicides used were Grasp and Suffix and in latter season using Topik and Puma-S for more effective results in controlling wild oat. The yield in the demonstration trials throughout the work showed a great increase which varied between 20 to over 230%. The great differences in the yield of different governorates were due to many factors. The main factor was the rate of wild oat infestation in farmer fields which was very high in certain governorates. Thus in Qena where the infestation was very high, the yield in the out of demonstration was very low and varied between 0.7 to 2.0 t/ha in the demonstration trials in this governorate wheat yield increased greatly and varied from 4.7 to 5.7 t/ha and giving the high percentage increase of over 230%.

## 2- Trials in Lower Egypt:

In this work six governorates from lower Egypt were included in the demonstration trials. Tables (17,18 & 19).
The trials were carried out in Minofia by Elian et al (1994), Salim and Attalla (1995), Salim and Fadllala (1996), Salim (1997, 1998 and 1999), Salim and Sherif (2000,and 2001) and Salim (2002). In Sharkia Elian et al (1994, 1995, 1996, 1997,and 1998), Elian and Shatla (1999/ 2000 and 2001) and Nassar and Shatla (2002). In Kalubia by Al Marsafy et al (1998, 1999), Al Marsafy and Barhoma (2000, 2001 and 2002) Elian and Barhoma (1994) and Tewfik et al (1996 and 1997). In Kafr El-Sheikh by EL-Maghraby et al (1993 and 1994), Salem et al (1995, 1996 and 1997) and in Ismailiah by Moshtohry and Die (2000, 2001 and 2002).

It was noticed from tables 17, 18 and 19 that certain governorates were heavily infested by wild oats especially in Menofia and Behera. Other governorates e.g. Sharkia, Kalubia and Ismailia, the infestation was moderate. On the other hand in Kafr El- Sheikh governorate, the dominant weeds were *Phalaris* spp. and the rate of infestation fluctuated from heavy to moderate (table 19) .As in upper Egypt the demonstration trials included several items as a package for wild oat control i.e. preceding crop, sowing method, hand weeding and grassy herbicides. The herbicides used for wild oat control were Grasp and Suffix and latter on Topik and Puma–S use. While in Kafr El-Shakh governorate, Arelon and IPFLO. (isoproturon) were used.

It was clear from all sites of experimentations that the most effective item in the package of wild oat control after herbicides was the use of clover as a preceding winter crop. This may be due to the fact that clover during the growing season is cut 4 – 5 times and this practice decreased the population of wild oat drastically as when every flush of wild oat grows, it is removed in the next cut. This practice also reduces the wild oat seed bank by over 90% as reported by Yehia et al (Unit 2).

Also, the sowing method as a major item in the package of wild oat control had also good effect in reducing wild oat infestation. In sites where the infestation by wild oat was moderate, the drill dry method (Afir) was preferred. This method allowed better using hand weeding than, broadcasting method as weeds grow mainly between the rows. While the competition of wheat within the rows does not usually allow wild oat or other weeds to grow. The advantage of the drill method is to facilitate hand weeding of wild oat in wheat fields by farmers.

**Table (17): Wild oat infestation (g/m²) and wheat grain yield (t/ha) in demonstration fields in Nile Delta during 1993/94-2001/2002 seasons**

| Seasons | No. of sites | Wild oat (g/m²) | | | | | Wheat grain yield (t/ha) | | |
|---|---|---|---|---|---|---|---|---|---|
| | | O | | T | | | | | |
| | | In | Out | In | Out | *LSD* | *In* | Out | *L.S.D* |
| **Kaliubia** | | | | | | | | | |
| 1993/94 | 10 | 26 | 70 | 1.04 | 1.5 | 0.1 | 7.6 | 6.3 | 0.9 |
| 1995/96 | 10 | 4 | 193 | 0.6 | 202 | 0.3 | 6.6 | 4.1 | 0.8 |
| 1996/97 | 10 | 37 | 129 | 1.5 | 2.1 | 0.1 | 7.8 | 4.7 | 0.8 |
| 1997/98 | 10 | 66 | 397 | 1.7 | 2.5 | 0.2 | 5.9 | 4.2 | 1.1 |
| 1998/99 | 10 | 69 | 252 | 1.8 | 2.4 | 0.1 | 7.6 | 6.1 | 0.2 |
| 1999/2000 | 10 | 10 | 300 | 0.4 | 2.2 | 0.3 | 8.1 | 5.9 | 0.4 |
| 2000/2001 | 10 | 15 | 725 | 0.4 | 2.7 | 0.5 | 6.2 | 5 | 0.3 |
| 2001/2002 | 10 | 84 | 678 | 1.2 | 2.5 | 0.4 | 7.6 | 6.1 | 0.3 |
| **Minofia** | | | | | | | | | |
| 1993/94 | 10 | 25 | 167 | 1.7 | 2.1 | 0.3 | 7.8 | 3.7 | 0.8 |
| 1994/95 | 10 | 393 | 1058 | 2.6 | 3 | 0.2 | 8.7 | 4.7 | 1.2 |
| 1995/96 | 10 | 428 | 1064 | 2.6 | 3 | 0.1 | 7.8 | 4.9 | 2 |
| 1996/97 | 10 | 46 | 192 | 1.6 | 2.2 | 0.1 | 4.9 | 3.5 | 1 |
| 1997/98 | 10 | 356 | 1891 | 2.5 | 3.2 | 0.4 | 8.7 | 5.4 | 0.7 |
| 1998/99 | 10 | 135 | 2724 | 2 | 3.3 | 0.4 | 10.2 | 7.3 | 1.3 |
| 1999/2000 | 10 | 137 | 1735 | 2.1 | 3.2 | 0.3 | 8.9 | 6 | 0.9 |
| 2000/2001 | 10 | 50 | 2143 | 1.6 | 3.3 | 0.1 | 6.5 | 2.9 | 0.4 |
| 2001/2002 | 10 | 3.8 | 867 | 1.5 | 2.9 | 0.2 | 8.8 | 4.1 | 2.6 |
| **Sharkia** | | | | | | | | | |
| 1993/94 | 10 | 25 | 36 | 1.4 | 1.6 | 0.2 | 3.5 | 2.5 | 0.6 |
| 1994/95 | 10 | 106 | 756 | 2 | 2.9 | 0.2 | 4.9 | 3.8 | 0.5 |
| 1995/96 | 10 | 48 | 800 | 1.6 | 2.9 | 0.5 | 6.5 | 3.7 | 1.8 |
| 1996/97 | 10 | 22 | 826 | 1.3 | 2.9 | 0.4 | 7.1 | 3.9 | 3 |
| 1997/98 | 10 | 35 | 405 | 1.5 | 2.6 | 0.2 | 6.2 | 3.7 | 1.6 |
| 1998/99 | 10 | 15 | 330 | 1.2 | 2.6 | 0.2 | 3.7 | 2.2 | 0.9 |
| 1999/2000 | 10 | 28 | 427 | 1.5 | 2.6 | 0.1 | 6.1 | 4.1 | 0.9 |
| 2000/2001 | 10 | 20 | 238 | 1.2 | 2.3 | 0.7 | 5.2 | 1.7 | 2.2 |
| 2001/2002 | 10 | 116 | 840 | 1.9 | 2.8 | 0.3 | 6.8 | 3.7 | 0.4 |
| Total | 260 | | | | | | | | |

**Table (18): wild oat infestation (g/m²) and wheat grain yield (t/ha) in demonstration fields in Behera and Ismailiah governorate during 1992/93 -2001/2002 seasons**

| Seasons | No. of sites | Wild oat weight ($g/m^2$) | | | | | Wheat grain yield (t/ha) | | |
|---|---|---|---|---|---|---|---|---|---|
| | | O | | T | | | | | |
| | | In | Out | In | Out | *L.S.D* | In | Out | L.S.D |
| **Behera** | | | | | | | | | |
| **1993/94** | **10** | **65** | **1277** | **1.5** | **3.1** | **0.5** | **5.3** | **3.6** | **0.9** |
| **1994/95** | **10** | **116** | **1725** | **2.1** | **3.2** | **0.4** | **4.1** | **2.1** | **0.7** |
| **1995/96** | **10** | **10** | 259 | **0.3** | **1.7** | **0.2** | **6.8** | **3.1** | **1** |
| **2000/01** | **10** | **89** | **1401** | **1.2** | **3** | **0.3** | **4.3** | **2.4** | **1.1** |
| **2001/02** | **10** | **44** | **371** | **0.8** | **2.2** | **0.5** | **5.3** | **3.7** | **1** |
| Ismailiah | | | | | | | | | |
| **1999/2000** | **10** | **104** | **616** | **1.4** | **2.7** | **0.5** | **4.3** | **1.7** | **0.3** |
| **2000/01** | **10** | **35** | **60** | **1.1** | **2.7** | **0.5** | **6** | **2.5** | **0.9** |
| **2001/02** | **10** | **18** | **486** | **1** | **2.7** | **0.2** | **6.4** | **2.8** | **0.7** |
| Total | **80** | | | | | | | | |

**Table (19): Grassy weed infestation (g/m²) and wheat grain yield (t/ha), 1992/1997 seasons in Kafr El-Sheikh governorate.**

| Seasons | No. of sites | Grassy weed ($g/m^2$) | | | | | Wheat grain yield (t/ha) | | |
|---|---|---|---|---|---|---|---|---|---|
| | | O | | T | | | | | |
| | | In | Out | In | Out | *LSD* | In | Out | LSD |
| 1992/93 | **10** | 2.0 | 382 | **0.2** | **2.5** | **0.5** | **6.2** | **4.9** | **0.5** |
| **1993/94** | **10** | **27** | **1132** | **0.8** | **3.0** | **0.9** | **4.9** | **3.2** | **1.4** |
| **1994/95** | **10** | **38** | **848** | **1.4** | **2.9** | **0.5** | **4.7** | **1.9** | **1.7** |
| **1995/96** | **10** | **33** | **745** | 1.3 | **2.5** | **0.3** | **4.5** | **2.8** | **1.0** |
| 1996/97 | **10** | 40 | **558** | **1.1** | **2.4** | **0.2** | **6.1** | **2.7** | **1.2** |
| *Total* | **50** | | | | | | | | |

The yield of wheat in the demonstration trials throughout this period showed a great increase which varied from over 35 to about 140%. This great increase in the yield was due to the application of the package of wild oat control (i.e. clover as preceding winter crop, sowing methods and complementary hand – weeding after the use of grassy herbicides) .

## 3- Trials in new lands:

In the new lands, 150 demonstration trials were carried out in El-Banger zone for six years starting from 1996/97 seasons by El-Wekil and Yehia (1997) and Hassanein et al (1999, 2000, 20001and 2002 seasons) while in El-Bustan area the demonstration trials were carried out for three seasons only starting from 1997/98-1999/2000 season, by Hassanein et al (1998, 1999 and 2000) table (20). It will be noticed that Bustan area was heavily infested by wild oats especially in the early seasons of the work. Weeds decreased gradually throughout the seasons to reach a low or moderate infestation as the work progressed. In the Bangar zone the infestation was moderate by wild oat and fluctuated throughout the seasons according to the area chosen for the trials.

The method of sowing i.e. wet method (Herati) was practiced for heavily infested and Afir drill for the moderately infested areas .The herbicides used were Grasp and Suffix and latter on Topik and Puma-S were recommend. The most effective item in the package of wild oat control after herbicides was the use of clover as preceding winter crop.

The increase in yield of wheat in the demonstration trials varied from 56 to 68%. This increase was due to the application of the package of wild oat control (i.e. clover as preceding winter crop, sowing methods and complementary hand – weeding after the use of grassy herbicides).

**Table (20): Wild oat infestation (g/m$^2$) and wheat grain yield (t/ha) in demonstration fields in new lands during 1996/97-2001/002 season.**

| Seasons | No | Wild oat (g/m$^2$) | | | | | Wheat grain yield (t/ha) | | |
|---|---|---|---|---|---|---|---|---|---|
| | | O | | T | | | | | |
| | | In | Out | In | Out | *LSD* | In | Out | LSD |
| **Banger EL Soker** | | | | | | | | | |
| 1996/97 | 20 | 26 | 132 | 1.4 | 2.1 | 0.1 | 6.4 | 3.3 | 0.4 |
| 1997/98 | 20 | 24 | 133 | 1.4 | 2.1 | 0.1 | 5.8 | 3.1 | 0.2 |
| 1998/99 | 20 | 22 | 492 | 1.4 | 2.7 | 0.1 | 6.6 | 3.2 | 0.2 |
| 1999/000 | 20 | 19 | 432 | 1.3 | 2.6 | 0.2 | 6.3 | 4.5 | 0.3 |
| 2000/001 | 20 | 20 | 601 | 1.1 | 2.8 | 0.1 | 6.7 | 4.3 | 0.2 |
| 2001/002 | 20 | 11 | 569 | 1.0 | 2.6 | 0.1 | 6.9 | 4.6 | 0.4 |
| **El Bustan** | | | | | | | | | |
| 1997/98 | 10 | 150 | 2046 | 1.8 | 3.1 | 0.4 | 4.1 | 3.3 | 0.6 |
| 1998/99 | 10 | 165 | 1709 | 2.3 | 3.2 | 0.1 | 4.8 | 2.8 | 0.5 |
| 1999/2000 | 10 | 70 | 1294 | 1.4 | 3.0 | 0.4 | 4.2 | 2.3 | 0.9 |
| *Total* | 150 | | | | | | | | |

## Summary

## Verification trials:

Results of verification trials in 12 governorates which include 53 field experiments were carried out which included 230 site in various districts, dealing week new packages of controlling broadleaved and grassy weeds especially wild oat and to demonstrate to farmers, extension agencies and weed control specialists the benefit of applying the technology of weed control, the main findings are as follow:

**-Clover as preceding winter crop gave the highest effect on decreasing fresh weight of wild oat and increasing wheat grain yield.**

-Cotton as preceding summer crop was better than rice in controlling grassy weeds but rice was better in controlling broadleaved weeds .

-Herati method significantly decreased fresh weight of wild oat than Afir broadcast or drill.

-Increasing seeding rates of wheat decreased fresh weight of wild oat.

-Tillage system decreased fresh weight of wild oat and gave higher wheat grain yield compared to no tillage .
-Brominal or Sinal was more effective in controlling broadleaved weeds and Topik, Grasp or Puma Super were effective in controlling grassy weeds especially wild oat .
- Integration of clover as preceding winter crop with Sinal + Topik under herati method gave the best treatment for controlling broadleaved and grassy weeds.
-Clover as preceding winter crop with drilling method (15cm apart) + Sinal + Grasp gave the best integrated treatment for controlling grassy and broadleaved weeds.
-Improved dry method Sinal + Topic with clover as preceding winter crop gave the best integrated treatment for controlling weeds in wheat fields.
-Integrated weed control treatment of crop sequence clover/cotton with Sinal + Topik herbicides gave the best results in decreasing the fresh weight of broadleaved and grassy weeds as well as the highest increas in wheat grain yield.

## Demonstration plots for wild oat control in wheat:

- Results of 950 demonstration plots conducted in heavy infested wheat fields with wild oat and other weeds during 1992-2002 seasons in 14 governorates in Nile Delta using wild oat control package including 4 items generated during this work (preceding crop clover, herati sowing methods, proper herbicides and handweeding), were compared with 950 neighboring infested farmers. Applying the package resulted in decreasing wild oats and improving wheat yield by 56-68% than out of demonstration plots fields. Thus the application of this package annually is important to sustain wheat production in Egypt.

## Conclusion

The main conclusion from the study are :

The elements of the developed integrated wild oat control packages are the use of clean seeds, herati sowing method, sowing wheat after preceding clover and the use of herbicides and/or handweeding.

In case of medium infestation cultural practices plus handweeding proved to be effective.

Socio – economic data showed that national income was increased by 425 million pounds due to the adoption of wild oat control technology during the period from 1992/93 – 2000/01.
Continuous efforts must be undertaken to keep the infestation of wild oat under control.

The technology transfer efforts carried out by scientists of Weed Research Central Laboratory and the exclusive agents were the main reason for the adoption of the package by many farmers. This was very clear in the later seasons of the activities as the difference in the yield between in and out of the demonstration trials in the areas was decreased as the work progressed. Hence the informer was beneficial by adopting the package or part of the package to increase the yield of wheat by reducing the wild oat infestation and other weeds.

## الملخص العربي

أقيمت عديد من التجارب الحقلية لدى المزارعين في مختلف محافظات جم هورية مصر العربية بغرض معرفة أنسب حزمة متكاملة لمقاومة الحشائش عريضة وضيقة الأوراق خاصة حشيشة الزميرفى القمح .كما تم نقل أحدث التوصيات الفنية لمقاومة الحشائش في محصول القمح من قبل الباحثين إلى المرشدين الزراعيين ثم إلى المزارعين .

وقد نفذت حوالي 53 تجربة تأكيدية لدى المزارعين في عدد 230 موقع كما تم إقامة عدد 950 حقل إيضاح لمكافحة الزمير في القمح في عدد 14 محافظة من محافظات جمهورية مصر العربية في الفترة من عام 1992-2002 وتتلخص أهم النتائج فيما يلي:
عند استخدام البرسيم كمحصول شتوي سابق في الدورة الزراعية فقد أعطى أقل وزن لحشيشة الزمير وبالتالي أعطى أعلى محصول حبوب للقمح .
استخدام الطريقة الحراتي في زراعة القمح أعطت كفاءة في مقاومة حشيشة الزمير عن طريقتي البدار والتسطير.
زيادة معدلات تقاوي القمح يقلل الوزن الغض لحشيشة الزمير.
نظام خدمة الأرض )Tillage (يزيد من كفـاءة مكافحة حشيشة الزمير وأظهرت النتائج أنه يعطي محصول أعلى إذا ما قورن بعدم الخدمة.
عندما يكون المحصول الصيفي السابق للقمح أرزا تقل أعداد وأوزان الحشائش عريضة الأوراق وعندما يكون المحصول الصيفي السابق قطناً تقل أعداد وأوزان الحشائش النجيلية.
أعطى مبيدى برومينال وسينال كفاءة عالية في مكافحة الحشائش العريضة الأوراق في القمح ومن جهة أخرى فإن مبيدات التوبيك والجراسب والبوما سوبر أعطت أفضل نتيجة في مقاومة الحشائش النجيلية خاصة الزمير.
المكافحة المتكاملة لحشائش القمح بإتباع الدورة الزراعية حيث المحصول السابق برسي م مع استخدام السينال والتوبيك أعطت أعلى نتيجة لمقاومة الحشائش العريضة والنجيلية.

استخدام طريقة التسطير )15سم بين السطور (مع السينال والجراسب أعطى أعلى مكافحة للحشائش العريضة والنجيلية.

كان للمكافحة المتكاملة للحشائش باستخدام السينال والتوبيك مع المحصول السابق برسيم أعلى كفاءة في مقاومة الحشائش في القمح وأعلى محصول.

كان لطريقة العفير المحسن مع السينال والتوبيك والمحصول السابق برسيم أعلى كفاءة في مقاومة الحشائش في القمح كأفضل مكافحة متكاملة للحشائش وتفوقت على طريقة العفير فقط مع نفس المبيدات.

أوضحت نتائج إقامة 950 حقل ايضاح عملي في حقول القمح التى ينتشر بها الزمير بغزارة خلال عشرة أعوام في الفترة من 1992-2002 في عدد 14 محافظة بمختلف محافظات مصر أن تطبيق حزمة التوصيات والتى تشتمل على أربع مكونات المتحصل عليها من بحوث مكافحة الزمير في القمح وهى )الزراعة عقب برسيم في الموسم الشتوى السابق والزراعة حراتى واستخدام المبيدات الموصى بها والنقاوة اليدوية (مقارنة بــ 950 حقل غير منتشر بها الزمير مجاورة لهذه الحقول حيث خفضت الإصابة بالزمير بدرجة كبيرة أكثر من 90 %وزيادة في إنتاجية القمح ما بين 56-68 %عن الحقول المصابة المجاورة .ومن ذلك يوصى باستخدام حزمة التوصيات السابقة سنوياً للمحافظة على إنتاجية القمح بمصر .

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# Unit IV

# Socio – economic studies on the impact and adoption of weed management in wheat fields

## Socio – economic studies on technology Transfer of integrated Wild Oat control in wheat

## Introduction

Wild oat is one of the most troublesome grassy weeds, it spreads quickly in wheat fields. Great losses in wheat yield have been attributed to wild oat competition. Weed scientists from weed research central laboratory developed and transferred to the extension agents and farmers the recommended technological package of wild oat control. Socio-economic studies have been made to investigate the effect of using the recommended technological package of wild oat control on wheat production and returns, at the level of farm trials, demonstration fields, and adoption fields, by farmers in some wheat infested fields with wild oat through 1992/93 – 2000/01 seasons.

## Materials and Methods

Studies were carried out by Ghonima et al (1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002) and Ahmed et al (1996) using verification trials and demonstration fields which were conducted using the technological options in the selected governorates. Special questionnaires has been designed for verification trials to cover several aspects including general information, extension services, technical coefficients of the inputs, costs of production, and the yield for the treated and untreated fields, some economic criteria had been applied for the economic evaluation for each substudy, which included productivity, total costs, net benefits, and profitability.

The developed recommended technological package included clover as preceding winter crop, sowing method, herbicides and handweeding for controlling wild oat and maintaining wheat productivity where 663 verification trials were conducted to verify the effect of the recommended technological package of wild oat control in wheat fields.

Also the effects of using the recommended technological package of wild oat control on the grain yield and other economic criteria in the demonstration fields of wheat were studied using 208, 194, 164, 200, 124, 188, 200, 220, 200 and 76 demonstration fields being 1774 demonstration fields through 1992/93 – 2001/02. According to the encouraging results of the yield and returns in wheat fields, it was important to study the economic impact of farmers adoption for wild oat control package in the same governorates by selecting random samples of the farmers who adopted the recommended technological package through 1992/93 – 2001-02 seasons. Thus 200, 270, 321, 210, 230, 180, 180, 220, 180 and 80 fields totally 2071 wheat fields, were used to investigate the impact of the recommended technological package of wild oat control on the grain yield and other economic criteria in the selected governorates. Table (1).

**Table (1): Verification trials, demonstration and generalization fields of wheat through 1992/93 - 2001/2002 seasons.**

| Governorates | Type of fields | 92/93 | 93/94 | 94/95 | 95/96 | 96/97 | 97/98 | 98/99 | 99/00 | 00/01 | 01/02 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | V | | 20 | | | | | | | | | 20 |
| Qena | D | 82 | 32 | 18 | 20 | | | | | | | 152 |
| | A | 50 | 50 | 45 | 20 | | | | | | | 165 |
| | V | | 40 | | | | | 13 | | | | 53 |
| Sohag | D | 56 | 40 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | | 236 |
| | A | 60 | 40 | 45 | 20 | 50 | 20 | 20 | 20 | 20 | | 295 |
| | V | 36 | 20 | 16 | 42 | | | | | | | 114 |
| Assiut | D | 28 | 32 | 20 | 20 | | 20 | 20 | 20 | 20 | | 180 |
| | A | 50 | 40 | 45 | 20 | | 20 | 20 | 20 | 20 | 20 | 255 |
| | V | | | 24 | | | | | | | | 23 |
| Minia | D | | | 20 | 10 | | 12 | 20 | 20 | 20 | | 102 |
| | A | | | 31 | 20 | | 20 | 20 | 20 | 20 | | 131 |
| | V | | 40 | 28 | 42 | 6 | - | 20 | 20 | 12 | 4 | 172 |
| Fayoum | D | 15 | 26 | 16 | 26 | 20 | 20 | 20 | 20 | 20 | 20 | 203 |
| | A | 40 | 40 | 45 | 30 | 20 | 20 | 20 | 20 | 20 | 20 | 275 |
| Bani swef | D | 9 | | | | | | | | | | 9 |

## Con table (1):

| Governorates | Type of fields | 92/93 | 93/94 | 94/95 | 95/96 | 96/97 | 97/98 | 98/99 | 99/00 | 00/01 | 01/02 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | V | | | | | | 6 | 20 | 16 | 12 | | 54 |
| Kalubia | D | | 12 | | 26 | 10 | 18 | 20 | 20 | 20 | | 126 |
| | A | | 20 | | 20 | 20 | 20 | 20 | 20 | 20 | | 140 |
| | V | | | | | | 8 | | 12 | 16 | | 36 |
| Menofia | D | | 28 | 22 | 20 | 18 | 20 | 20 | 20 | 20 | | 168 |
| | A | | 20 | 30 | 20 | 50 | 20 | 20 | 20 | 20 | | 200 |
| | V | | | | 12 | | 5 | | 16 | 24 | 3 | 60 |
| Sharkia | D | | 6 | 28 | 18 | 20 | 18 | 20 | 20 | 20 | 16 | 166 |
| | A | | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 180 |
| | V | | | | | | | | | 16 | | 16 |
| Behera | D | | 6 | 6 | 20 | | | | | 20 | | 52 |
| | A | | 20 | 30 | 20 | | | | 20 | 20 | | 110 |
| | V | | | | | 4 | | | | | | 4 |
| Kafr-Elsheikh | D | 18 | 12 | 14 | 20 | 16 | | | | | | 20 |
| | A | | 20 | 30 | 20 | 50 | | | | | | 120 |
| Ismailiah | D | | | | | | | | 20 | | | 20 |
| | A | | | | | | | | 20 | | | 20 |
| | V | | | | | | 5 | 20 | - | | | 25 |
| West Nubaria | D | | | | | | 20 | 20 | 20 | | | 60 |
| | A | | | | | | 20 | 20 | 20 | | | 60 |
| | V | | | | | | 5 | 18 | 16 | 16 | | 55 |
| Banger zone | D | | | | | 20 | 40 | 40 | 40 | 40 | 40 | 220 |
| | A | | | | | 20 | 20 | 20 | 20 | 20 | 20 | 120 |
| | V | 36 | 120 | 68 | 96 | 10 | 29 | 91 | 80 | 96 | 7 | 633 |
| Total Selected governorates | D | 208 | 194 | 164 | 200 | 124 | 188 | 200 | 220 | 200 | 76 | 1774 |
| | A | 200 | 270 | 321 | 210 | 230 | 180 | 180 | 220 | 180 | 80 | 2071 |
| Total | | 444 | 584 | 553 | 506 | 364 | 697 | 471 | 520 | 476 | 163 | 4478 |

V = verification trials, D = demonstration field, A = adopted fields

## 1- Verification trials

Table (2) and fig (1) indicated that grain yield of the verification trials for the treated and untreated plots during 1992/93 –2000/01 seasons yielding about 5.97, 4.31 t/ha, being 38.5% or LE 1009 increased for net benefit as compared to untreated plots and the total cost reached about LE 3026, LE 2775, for the gross margin LE 2772, LE 1764, for the net benefits LE 1522, LE 513 and 56%, 23% for the profitability respectively. These results indicated that the averages grain yield and other economic criteria increased significantly in the treated plots of the verification trials of wheat fields relative to the untreated plots.

**Table (2): Economic impact for wild oat and control in wheat fields under verification experiments during 1992/93 - 2001/02 seasons in Egypt.**

| Seasons | Grain yield t/ha | | Total cost LE | | Gross margin LE | | Net benefit LE | | Profitability% | |
|---|---|---|---|---|---|---|---|---|---|---|
| | In | Out | In | Out | In | Out | In | Out | In | Out |
| 1992/93 | 5.900 | 4.56 | 2294 | 2173 | 2228 | 1528 | 1348 | 648 | 59 | 30 |
| 1993/94 | 5.054 | 3.382 | 2854 | 2377 | 1483 | 878 | 576 | -29 | 20 | -3 |
| 1994/95 | 5.795 | 3.495 | 2.596 | 2296 | 2240 | 985 | 1339 | 83 | 52 | 4 |
| 1995/96 | 5.262 | 3.855 | 2.509 | 2206 | 3592 | 1904 | 2689 | 1012 | 112 | 50 |
| 1996/97 | 6.21 | 5.4 | 2275 | 2133 | 3538 | 304 | 2789 | 2264 | 125 | 108 |
| 1997/98 | 5.564 | 4.517 | 3208 | 2847 | 2656 | 2076 | 1315 | 732 | 46 | 25 |
| 1998/99 | 6.386 | 4.053 | 3466 | 3327 | 3193 | 147 | 1571 | -152 | 45 | -6 |
| 1999/2000 | 6.086 | 4.058 | 3513 | 3154 | 2710 | 1468 | 1088 | -174 | 30 | -7 |
| 2000/01 | 6.303 | 4.653 | 3474 | 3324 | 2849 | 1828 | 1166 | 145 | 40 | 8 |
| 2001/02 | 6.176 | 5.102 | 4068 | 3916 | 3230 | 2485 | 1349 | 604 | 33 | 20 |
| Average | 5.974 | 4.308 | 3026 | 2775 | 2772 | 1764 | 1522 | 513 | 56 | 23 |

Fig. (1): The impact of wild oat control on some economic criteria in on-farm fields of wheat in Egypt through 1992/93 - 2001/02 seasons.

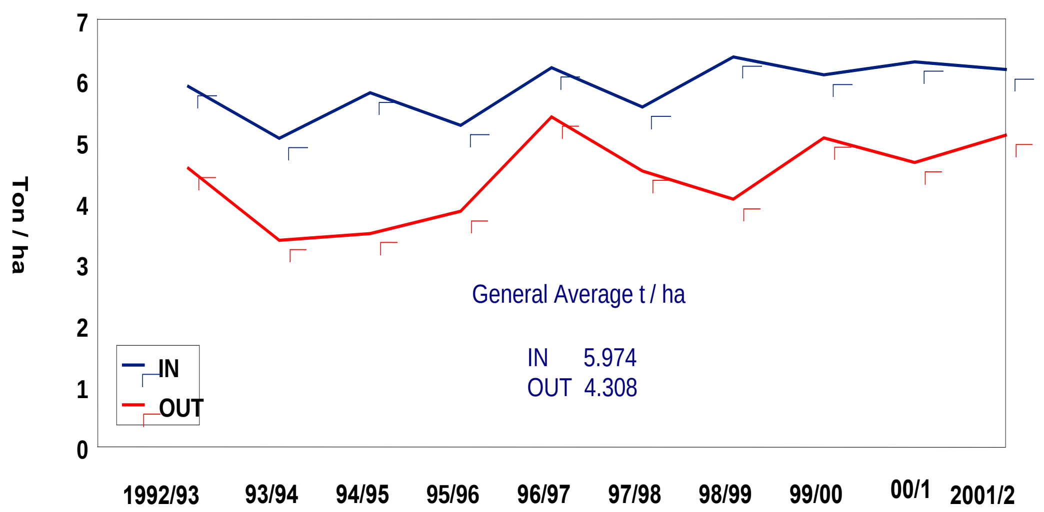

Table (3) showed the grain yield and some other economic criteria for 16 options of the recommended technological package using four cases of preceding winter crop, handweeding, herbicides and sowing method. The grain yield reached about 6.11 t/ha in the wheat fields where the package included the four treatments, while it reached about 6.68 t/ha, 5.23 t/ha, 7.01 t/ha, and 5.25 t/ha for the packages which included three treatments, it decreased for the next options which included less number of treatments until it reached about 3.39 t/ha and 3.45 t/ha for the last two options which included one treatment only or untreated fields (check) respectively . Gross margin decreased from about LE 4096 to about LE 1141, while the net benefits decreased from about LE 2896 to about LE 41, and the profitability decreased from about 70% to about 1% as averages through the period 1992/93 – 2001/02 with the previous sequences.

Results proved that the values of the economic criteria decreased with the decreasing of the used number of the items of the recommended technological package of wild oat control. Also, the data showed that there were significant differences between the groups of the on-farm verification trials which have different number of treatments of the package and each of the groups which have the same number of treatments and differ in the herbicide presence in the package. The groups which included herbicide and differ in the number of treatments.

**Table (3): The effects of integrated wild oat control treatments on some economic criteria in the verification fields of wheat under various technological packages in Egypt through 1992/93 - 2001/02.**

| The Technological Packages | Grain yield t/ha | Gross margin LE | Net Benefits LE | Profita - bility % |
|---|---|---|---|---|
| Clover, herati, handweeding, herbicide | 6.114 | 3405 | 2205 | 56 |
| Clover, handweeding, herbicide | 6.683 | 3874 | 2674 | 67 |
| Herati, handweeding, herbicide | 5.23 | 2621 | 1421 | 37 |
| Clover, herati, herbicide | 7.005 | 4096 | 2896 | 70 |
| Clover, herati, handweeding | 5.251 | 2742 | 1542 | 39 |
| Mean | 6.05 | 3333 | 2133 | 53 |
| Herbicide, handweeding | 5.927 | 3218 | 2020 | 52 |
| Clover, herbicide | 6.569 | 3660 | 2460 | 60 |
| Herati, herbicide | 6.199 | 3290 | 2090 | 51 |
| Clover, handweeding | 5.607 | 2998 | 1798 | 47 |
| Herati, handweeding | 4.246 | 1837 | 637 | 18 |
| Clover, herati | 3.859 | 1550 | 350 | 7 |
| Mean | 5.04 | 2759 | 1599 | 39 |
| Herbicide | 5.618 | 2148 | 1709 | 44 |
| Handweeding | 4.413 | 1804 | 604 | 16 |
| Clover | 4.513 | 2304 | 1204 | 36 |
| Herati | 3.392 | 1183 | 83 | 3 |
| Mean | 4.49 | 1860 | 900 | 25 |
| Wheat check | 3.45 | 1141 | 41 | 1 |

**2- The demonstration fields**

Table (4) show the averages grain yield for demonstration and out-demonstration wheat fields was about 6.317, 4.158 t/ha respectively, while total costs of the other economic criteria reached about LE 3068, LE 2783 for the total costs, LE 3029, LE 1739 for the gross margin, LE 1785, LE 551 for the net benefits and 60%, 20% for the profitability respectively.

**Table (4): Economic analysis of wheat production in demonstration fields for wild oat control of wheat in Egypt during 1992/93 - 2001/2002 seasons.**

| Seasons | Grain yield t/ha | | Total cost LE | | Gross margin LE | | Net benefit LE | | Profitability% | |
|---|---|---|---|---|---|---|---|---|---|---|
| | In | Out | In | Out | In | Out | In | Out | In | Out |
| 1992/93 | 5.408 | 3.866 | 2376 | 2184 | 1665 | 1035 | 779 | 149 | 33 | 7 |
| 1993/94 | 5.283 | 3.125 | 2571 | 1951 | 1459 | 750 | 583 | -126 | 23 | -8 |
| 1994/95 | 5.871 | 3.258 | 2528 | 2272 | 2151 | 854 | 1276 | -24 | 52 | -0.4 |
| 1995/96 | 6.500 | 5.010 | 2796 | 2518 | 3843 | 2793 | 2959 | 1910 | 106 | 77 |
| 1996/97 | 6.419 | 4.363 | 2680 | 2477 | 3720 | 2199 | 3018 | 1626 | 113 | 67 |
| 1997/98 | 6.006 | 4.124 | 3399 | 3149 | 2939 | 1890 | 1445 | 388 | 41 | 12 |
| 1998/99 | 7.018 | 4.439 | 3761 | 3346 | 3658 | 1860 | 1982 | 184 | 53 | 4 |
| 1999/2000 | 6.677 | 4.478 | 3494 | 3340 | 3210 | 1732 | 1539 | 58 | 43 | 0.3 |
| 2000/01 | 6.741 | 4.060 | 3592 | 3415 | 3259 | 1515 | 1408 | 112 | 42 | -7 |
| 2001/02 | 7.247 | 4.859 | 3485 | 3181 | 4383 | 2758 | 2856 | 1231 | 91 | 45 |
| Average | 6.317 | 4.158 | 3068 | 2783 | 3029 | 1739 | 1785 | 551 | 60 | 20 |

Table (5) presented the grain yield and some other economic criteria for 16 options of the recommended technological package in the demonstration fields of wheat. Results indicated that the grain yield reached about 6.8 t/ha when the four treatments (the full package) were applied, while it decreased with the reducing of the number of treatments used until it reached about 3.45 t/ha and 3.52 t/ha for the last two options (using one treatment and the control), respectively. The gross margin reached about LE 3972 for the full package and was about LE 1445 and LE 1512 for the last two options, while the net benefits decreased from about LE 2791 for the full package's option to about LE 241 and LE 308 for the last two options, also, the profitability decreased from about 70% to about 8% and 10% for the first and two last options respectively.

**Table (5): Economic analysis for the effect of integrated wild oat control technologies applied in demonstration fields of wheat in Egypt during 1992/93 - 2001/02.**

| The Technological Packages | Grain yield Ton/ha | Gross Margin LE | Net Benefits LE | Profitability % |
|---|---|---|---|---|
| **Clover, herati, handweeding, herbicide** | **6.8** | **3972** | **2791** | 70 |
| **Clover, handweeding, herbicide** | **6.274** | **3469** | **2265** | **56** |
| **Herati, handweeding, herbicide** | **5.597** | **2792** | **1588** | **40** |
| **Clover, herati, herbicide** | **6.193** | **3488** | **2284** | **58** |
| **Clover, herati, handweeding** | **3.939** | **1434** | **230** | **6** |
| **Mean** | 5.5 | **2796** | **1592** | **40** |
| **Herbicide, handweeding** | **6.441** | **3636** | **2432** | **61** |
| **Clover, herbicide** | **6.357** | **3598** | **2398** | **61** |
| **Herati, herbicide** | **4.042** | **1437** | **233** | **6** |
| **Clover, handweeding** | **4.703** | **2198** | **994** | **27** |
| **Herati, handweeding** | **3.246** | **1441** | **237** | **6** |
| **Clover, herati** | **4.292** | **2287** | **1083** | **34** |
| **Mean** | **4.96** | **2433** | **1688** | **33** |
| **Herbicide** | **5.918** | **3213** | **2009** | **51** |
| **Handweeding** | **4.58** | **2075** | **871** | **23** |
| **Clover** | **4.116** | **2111** | **207** | **28** |
| **Herati** | **3.45** | **1445** | **241** | **8** |
| **Mean** | **4.52** | **2211** | **2009** | **28** |
| **Wheat check** | **3.517** | **1512** | **308** | **10** |

In general results indicated that there are generally significant differences between: The groups of demonstration fields which have different number of treatments of the package, the groups which have the same number of treatments and differ in the herbicide presence in the package and the groups which included herbicides and differ in the number of treatments.

Also, the results proved that the values of the economic criteria decreased with decreasing the number of the elements of the recommended technological package of wild oat control in wheat fields.

## 3- Extension villages for wild oat control management in the new and old lands.

Seven extension villages, heavily infested with wild oats, were chosen by Hassanein et al (2000, 2001) in Arab El Raml, Gafaria and El Ola villages in Menoufia and Sharkia governorates and Banger El-Sukkar area in Beheira governorate and in Fayoum governorate, respectively to apply wild oat control management in wheat in seven aggregates, in 1999/2000 and 2000/01season each 21 hectares (147 ha total). The infestation rate varied from 21 to 83 wild oat plants/$m^2$. Results indicated that wheat yield production increased and was economically beneficial compared to neighboring farmers Table (6).

## 4- Adoption technology package by farmers

Table (7) indicated that the increase in the grain yield for the treated fields relative to the untreated fields of wheat which reached about 19.7, 37, 69.8, 25.7, 17.6, 28.9, 33.5, 18.6, 20.5, 18.0% 2001/02 respectively with an average of about (24.9)%, while the gross margin and net benefit increased for the treated fields relatively the untreated fields of wheat.

Table (8) shows the main results of the adopted fields for the selected governorates and zones as averages of the study period, it indicated that the averages grain yield for the treated and untreated fields of wheat reached about 5.714, 4.575 t/ha respectively, while the averages of the other economic criteria reached about LE 2981, LE2748 for the total costs, LE2669, LE 2041 for the gross margin, LE 1445, LE799 for the net benefits and 51%,31%, for the profitability respectively. The results indicated that the averages grain yield and other economic criteria increased significantly in the treated fields using the recommended technological package of wild oat control relative to the untreated fields of wheat

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**Table (6): Effect of wild oat control management in wheat fields of extension aggregates in Menoufia, Sharkia,Beheira and Fayoum governorates, 1999/2000 and 2000/2001 winter seasons.**

| Governorate | Village | Treatment | Grain yield (t/ha) | Total variable cost (LE/ha) | Gross income (LE/ha) | Net income (LE/ha) | Grain yield (t/ha) | Total variable cost (LE/ha) | Gross income (LE/ha) | Net income (LE/ha) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1999 / 2000 season | | | | | | | 2000/2001 season | | | |
| Menoufia | Arab El Raml | Extensioin aggregates | 7.74 | 1900 | 5650 | 1450 | 5.89 | 1428 | 4302 | 881 |
| | | Neighbors | 4.71 | 1700 | 3100 | -900 | 3.61 | 1093 | 2741 | -352 |
| Sharkia | Gafaria | Extensioin aggregates | 6.22 | 1770 | 4700 | 1220 | 4.78 | 1507 | 3569 | 347 |
| | | Neighbors | 3.87 | 1670 | 3010 | -430 | 1.95 | 1035 | 1729 | -1021 |
| Nubaria | El-Markazia | Extensioin aggregates | 6.72 | 1833 | 4680 | 1895 | 6.63 | 1373 | 4761 | 2437 |
| | | Neighbors | 4.77 | 1517 | 3261 | 792 | 4.46 | 1195 | 3202 | 1055 |
| Fayoum | Taton | Extensioin aggregates | 9.56 | 1785 | 6702 | 3013 | 9.56 | 1785 | 6702 | 3013 |
| | | Neighbors | 7.62 | 1607 | 5342 | 1831 | 7.62 | 1607 | 5342 | 1831 |

**Table (7): The impact of wild oat control on some economic criteria in under farmer fields of wheat in Egypt through 1992/93 - 2001/2002 seasaons.**

| Seasons | Grain yield t/ha | | Total cost LE | | Gross margin LE | | Net benefit LE | | Profitabilit y% | |
|---|---|---|---|---|---|---|---|---|---|---|
| | In | Out | In | Out | In | Out | In | Out | In | Out |
| 1992/93 | 4.833 | 4.036 | 2273 | 2074 | 1676 | 1336 | 772 | 435 | 34 | 21 |
| 1993/94 | 5.311 | 3.127 | 2413 | 1953 | 1628 | 750 | 752 | -126 | 31 | -8 |
| 1994/95 | 5.428 | 4.317 | 2417 | 2224 | 2120 | 1342 | 1244 | 467 | 54 | 22 |
| 1995/96 | 6.005 | 5.108 | 2680 | 2436 | 3414 | 2856 | 2531 | 1973 | 94 | 81 |
| 1996/97 | 5.231 | 4.549 | 2660 | 2530 | 2723 | 2336 | 2112 | 1634 | 82 | 67 |
| 1997/98 | 5.268 | 4.087 | 3308 | 3094 | 2387 | 1734 | 994 | 321 | 31 | 10 |
| 1998/99 | 6.211 | 4.653 | 3522 | 3232 | 2996 | 2116 | 1383 | 453 | 42 | 16 |
| 1999/2000 | 6.169 | 5.202 | 3429 | 3283 | 2945 | 2314 | 1285 | 628 | 39 | 20 |
| 2000/01 | 6.431 | 5.337 | 3534 | 3363 | 3063 | 2449 | 1240 | 625 | 38 | 20 |
| 2001/02 | 6.249 | 5.294 | 3569 | 3291 | 3737 | 3178 | 2136 | 1579 | 68 | 56 |
| Average | 5.714 | 4.575 | 2981 | 2748 | 2669 | 2041 | 1445 | 799 | 51 | 31 |

**Source: Collected and calculated from the sample data for wild oat control of wheat, through 1992/93-2001/02.**

**Table (8): The impact of the wild oat control on some economic criteria in adopted fields of wheat through 1992/93 - 2001/2002 seasons.**

| Seasons | Grain yield t/ha | | Total cost LE | | Gross margin LE | | Net benefit LE | | Profitability% | |
|---|---|---|---|---|---|---|---|---|---|---|
| | In | Out | In | Out | In | Out | In | Out | In | Out |
| 1992/93 | 4.833 | 4.036 | 2273 | 2074 | 1676 | 1336 | 772 | 435 | 34 | 21 |
| 1993/94 | 5.311 | 3.127 | 2413 | 1953 | 1628 | 750 | 752 | -126 | 31 | -8 |
| 1994/95 | 5.428 | 4.317 | 2417 | 2224 | 2120 | 1342 | 1244 | 467 | 54 | 22 |
| 1995/96 | 6.005 | 5.108 | 2680 | 2436 | 3414 | 2856 | 2531 | 1973 | 94 | 81 |
| 1996/97 | 5.231 | 4.549 | 2660 | 2530 | 2723 | 2336 | 2112 | 1634 | 82 | 67 |
| 1997/98 | 5.268 | 4.087 | 3308 | 3094 | 2387 | 1734 | 994 | 321 | 31 | 10 |
| 1998/99 | 6.211 | 4.653 | 3522 | 3232 | 2996 | 2116 | 1383 | 453 | 42 | 16 |
| 1999/2000 | 6.169 | 5.202 | 3429 | 3283 | 2945 | 2314 | 1285 | 628 | 39 | 20 |
| 2000/01 | 6.431 | 5.337 | 3534 | 3363 | 3063 | 2449 | 1240 | 625 | 38 | 20 |
| 2001/02 | 6.249 | 5.294 | 3569 | 3291 | 3737 | 3178 | 2136 | 1579 | 68 | 56 |
| Average | 5.714 | 4.575 | 2981 | 2748 | 2669 | 2041 | 1445 | 799 | 51 | 31 |

**Source: Collected and calculated from the sample data for wild oat control of wheat, 1992/93-2001/02.**

Table (9) shows the grain yield and some economic criteria for 16 options of the recommended technological packages in adopted farmer fields of wheat. The main results indicated that the grain yield reached about 6.75 t/ha for the option of the four treatments (the full package), it decreased with decreasing the number of treatments until it reached about 4.15 t/ha for the last option (control). Also, the gross margin reached about LE 3924 for the last option of full package and decreased until it reached about LE 2147 for last option, while the net benefits decreased from about LE 2743 when using the full packages, to about LE 943 for the non–treatment's option, then the profitability decreased from about 68% to about 29% for the first and last options respectively. Results proved that the averages grain yield and other economic criteria in the treated fields generally decreased significantly with the association of the absence of herbicides and decreasing of the number of the treatments of the recommended technological package of wild oat control in wheat fields.

## The economic impact of using wild oat control package on the national income

The total area cultivated with wheat in Egypt reached about 0.894, 0.768, 0.887, 1.055, 1.017, 1.017, 1.0, 1.035, 0.984, and 1.029 million hectares through 1992/93 – 2001/02 respectively with a total of about 9.685 million hectares, while the total production of wheat reached about 4.876, 4.452, 4.437, 5.722, 5.735, 6.091, 6.347, 6.564,6.255 and 6.625 with a total of about 57.014 million tons with an average yield of about 5.89 t/ha through the study period (table 10). The total sample size in three parts of study through the period 1992/93–2001/02 reached 4478 fields of wheat in 14 selected governorates and zones, which were distributed in the lower Egypt, upper Egypt, middle Egypt and the new lands with about 35%, 33%, 20% and 12% of the total sample size respectively, the area cultivated with wheat in the selected govenorates and zones reached about 51% of the total area cultivated with wheat in Egypt through the study period .

Intensive efforts had been made by the agricultural administration in the governorates to carry out the integrated control for wild oat, where in table (11) that the total area of wheat which was covered with wild oat control integrated measures through the study period reached about 681632 hectare equal to about 7% of the total area cultivated with wheat in Egypt in 1992-2002 period. The study estimated that the average grain yield in the fields adopted wild oat control increased with about 1.18 t/ha as an average of the study period by using the recommended technological package (table 12), therefore, the total quantity of added wheat production reached about 804326 ton, with total value of added national income of about 119 million dollars equal to about 425 million Egyptian pounds.

**Table (9): The effect of integrated wild oat control treatments on some economic criteria in the adoption studies under farmer fields of wheat using various technological packages in Egypt during 1992/93 - 2001/02.**

| The Technological Packages | Grain yield t/ha | Gross Margin LE | Net Benefits LE | Profita-bility % |
|---|---|---|---|---|
| Clover, herati, handweeding, herbicide | 6.752 | 3924 | 2743 | 68 |
| Clover, handweeding, herbicide | 6.445 | 3640 | 2436 | 61 |
| Herati, handweeding, herbicide | 6.099 | 3294 | 2090 | 52 |
| Clover, herati, herbicide | 5.949 | 3244 | 2040 | 52 |
| Clover, herati, handweeding | 5.554 | 3049 | 1845 | 50 |
| Mean | 6.01 | 3307 | 2103 | 54 |
| Herbicide, handweeding | 5.921 | 3116 | 1912 | 48 |
| Clover, herbicide | 5.97 | 3211 | 2011 | 51 |
| Herati, herbicide | 5.241 | 2636 | 1432 | 38 |
| Clover, handweeding | 5.449 | 2944 | 1740 | 47 |
| Herati, handweeding | 5.015 | 251 | 1306 | 35 |
| Clover, herati | 4.848 | 2843 | 1639 | 51 |
| Mean | 5.41 | 2877 | 1673 | 45 |
| Herbicide | 5.474 | 2769 | 1565 | 40 |
| Handweeding | 4.908 | 2403 | 1199 | 32 |
| Clover | 4.886 | 2881 | 1677 | 52 |
| Herati | 4.448 | 2443 | 1239 | 39 |
| Mean | 4.93 | 2624 | 1420 | 41 |
| Wheat check | 4.152 | 2147 | 943 | 29 |

**Source : Collected and calculated from the sample data for the weed control of wheat through 1992/93 - 2001/02.**

**Table (10): The area cultivated, yield and total production of wheat in the selected governorates through 1992/93 - 2001/2002 seasaons.**

| Governorates | | | 1992/93 | 93/94 | 94/95 | 95/96 | 96/97 | 97/98 | 98/99 | 99/00 | 00/01 | 01/02 | Total or average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Qena** | *Area yield production* | *ha* | 44246 | 44327 | 40583 | 62873 | - | - | - | - | - | - | 192029 |
| | | *t/ha* | 5.32 | 5.33 | 4.83 | 5.2 | - | - | - | - | - | - | 5.176 |
| | | *t* | 235437 | 235637 | 195849 | 327066 | - | - | - | - | - | - | 993989 |
| **Sohag** | *Area yield production* | *ha* | 62728 | 62702 | 56740 | 65441 | 65436 | 61418 | 65964 | 57714 | 65759 | - | 563902 |
| | | *t/ha* | 5.19 | 5.19 | 5.3 | 5.95 | 6.2 | 6.53 | 6.73 | 6.61 | 6.714 | - | 6.056 |
| | | *t* | 325367 | 325367 | 300921 | 389372 | 405986 | 401060 | 443931 | 381739 | 441522 | - | 3415265 |
| **Assuit** | *Area yield production* | *ha* | 49507 | 49486 | 44932 | 57355 | - | 54832 | 56641 | 56140 | 56291 | 59947 | 485131 |
| | | *t/ha* | 6 | 6.03 | 5.61 | 5.83 | - | 6.3 | 7 | 6.52 | 6.821 | 6.857 | 6.358 |
| | | *t* | 297043 | 298397 | 252079 | 334184 | - | 345442 | 396488 | 365908 | 383987 | 411065 | 3084593 |
| **Menia** | *Area yield production* | *ha* | - | - | 57547 | 60819 | - | 66856 | 72244 | 69208 | 78547 | - | 405221 |
| | | *t/ha* | - | - | 5.91 | 6.45 | - | 7.15 | 7.04 | 7.39 | 7.214 | - | 6.903 |
| | | *t* | - | - | 340167 | 392251 | - | 478020 | 508449 | 511642 | 5.66661 | - | 2797190 |
| **Fayoum** | *Area yield production* | *ha* | 54392 | 14533 | 53843 | 58665 | 59815 | 61420 | 61522 | 62538 | 61450 | 65268 | 553446 |
| | | *t/ha* | 5.49 | 6.09 | 5.5 | 5.73 | 6.02 | 6.05 | 5.8 | 6.27 | 6.25 | 6.339 | 5.989 |
| | | *t* | 298397 | 88522 | 295882 | 335830 | 360008 | 371591 | 374510 | 392200 | 384061 | 413750 | 3314751 |
| **Kalubia** | *Area yield production* | *ha* | - | 35447 | - | 22987 | 19727 | 19197 | 17460 | 19244 | 17062 | - | 151124 |
| | | *t/ha* | - | 6.19 | - | 5.87 | 4.27 | 5.53 | 7.86 | 6.78 | 6.964 | - | 6.162 |
| | | *t* | - | 219243 | - | 135035 | 84248 | 106159 | 137184 | 130585 | 118825 | - | 931278 |

**Source: Collected and calculated from the samples data for wild oat control of wheat through 1992/93-2001/02**

**Cont. (10): The area cultivated, yield and total production of wheat in the selected governorates through 1992/93 - 2001/2002 seasaons.**

| Governorates | | | 1992/93 | 93/94 | 94/95 | 95/96 | 96/97 | 97/98 | 98/99 | 99/00 | 00/01 | 01/02 | Total or average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Monofia** | *Area yield production* | *ha* | - | 54370 | 33320 | 37583 | 38712 | 39348 | 37800 | 37213 | 36211 | - | 314557 |
| | | *t/ha* | - | 5.46 | 5.85 | 6.39 | 5.67 | 6.06 | 6.5 | 6.99 | 6.857 | .- | 6.171 |
| | | *t* | - | 296843 | 195013 | 240244 | 219314 | 238449 | 242835 | 260091 | 248302 | - | 1941091 |
| **Sharkia** | *Area yield production* | *ha* | - | 95754 | 85612 | 122576 | 111241 | 101278 | 118385 | 99205 | 113846 | 118440 | 966337 |
| | | *t/ha* | - | 5.94 | 5.33 | 5.85 | 5.37 | 6.07 | 6.24 | 6.53 | 6.286 | 6.393 | 6.017 |
| | | *t* | - | 568592 | 456147 | 717201 | 597253 | 614757 | 739290 | 648377 | 715601 | 757170 | 5814388 |
| **Behera** | *Area yield production* | *ha* | - | 78208 | 80483 | 84043 | - | - | - | 93375 | 91613 | - | 427722 |
| | | *t/ha* | - | 5.75 | 5.79 | 5.97 | - | - | - | 6.6 | 6.607 | - | 6.169 |
| | | *t* | - | 449581 | 465593 | 501842 | - | - | - | 616277 | 605300 | - | 2638593 |
| **Kafr-Elsheikh** | *Area yield production* | *ha* | - | 55629 | 55.57 | 70082 | 77092 | - | - | - | - | - | 257860 |
| | | *t/ha* | - | 6.11 | 6.17 | 5.91 | 5.79 | - | - | - | - | - | 5.973 |
| | | *t* | - | 339954 | 339679 | 414075 | 446380 | - | - | - | - | - | 1540088 |
| **Ismaealia** | *Area yield production* | *ha* | - | - | - | - | - | - | - | 10633 | - | - | 10633 |
| | | *t/ha* | - | - | - | - | - | - | - | 5.86 | - | - | 5.86 |
| | | *t* | - | - | - | - | - | - | - | 62280 | - | - | 62280 |
| **New Land** | *Area yield production* | *ha* | - | - | - | - | 135164 | 114260 | 58533 | 181624 | 66700 | 68172 | 624453 |
| | | *t/ha* | - | - | - | - | 4.06 | 4.32 | 5.13 | 4.88 | 5.679 | 6.25 | 4.857 |
| | | *t* | - | - | - | - | 548132 | 493603 | 300264 | 885885 | 378759 | 426074 | 3032717 |

**Cont. Table (10): The area cultivated, yield and total production of wheat in the selected governorates through1992/93 - 2001/2002 seasaons.**

| Governorates | | | 1992/93 | 93/94 | 94/95 | 95/96 | 96/97 | 97/98 | 98/99 | 99/00 | 00/01 | 01/02 | Total o averag |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Upper Egypt** | *Area yield production* | *ha* | 156481 | 156515 | 142255 | 185669 | 65436 | 116250 | 122605 | 113854 | 122050 | 59947 | 124106 |
| | | *t/ha* | 5.482 | 5.491 | 5.264 | 5.659 | 6.204 | 6.422 | 6.855 | 6.567 | 6.764 | 6.857 | 6.038 |
| | | *t* | 857847 | 859401 | 748849 | 1050622 | 405986 | 746502 | 840419 | 747647 | 825509 | 411065 | 749384 |
| **Middle Egypt** | *Area yield production* | *ha* | 54392 | 14533 | 111390 | 119484 | 59815 | 128276 | 133766 | 131746 | 139997 | 65268 | 958667 |
| | | *t/ha* | 5.486 | 6.091 | 5.71 | 6.094 | 6.019 | 6.623 | 6.601 | 6.86 | 6.791 | 6.339 | 6.375 |
| | | *t* | 298397 | 88522 | 636049 | 728081 | 360008 | 849611 | 882959 | 903842 | 950722 | 413750 | 611194 |
| **Lower Egypt** | *Area yield production* | *ha* | - | 319408 | 254472 | 337271 | 246772 | 159823 | 173645 | 25967 | 258732 | 118440 | 212823 |
| | | *t/ha* | - | 5.868 | 5.723 | 5.955 | 5.459 | 6.003 | 6.446 | 6.615 | 6.524 | 5.393 | 6.074 |
| | | *t* | - | 1874213 | 1456432 | 2008397 | 1347195 | 959365 | 1119309 | 1717609 | 1688028 | 757170 | 1292771 |
| **New Land** | *Area yield production* | *ha* | - | - | - | - | 135164 | 114260 | 58533 | 181624 | 66700 | 68172 | 624453 |
| | | *t/ha* | - | - | - | - | 4.055 | 4.32 | 5.13 | 4.878 | 5.679 | 6.25 | 4.857 |
| | | *t* | - | - | - | - | 548132 | 493603 | 300264 | 885885 | 378759 | 426074 | 303271 |
| **Total selectd governorates** | *Area yield production* | *ha* | 210873 | 490456 | 508117 | 642424 | 507187 | 518609 | 488549 | 686894 | 587479 | 311827 | 495241 |
| | | *t/ha* | 5.483 | 5.754 | 5.592 | 5.895 | 5.247 | 5.879 | 6.433 | 6.195 | 6.542 | 6.44 | 5.97 |
| | | *t* | 1156244 | 2822136 | 2841330 | 3787100 | 2661321 | 3049081 | 3142951 | 4254983 | 3843018 | 2008062 | 2956622 |
| **Total Egypt** | *Area yield production* | *ha* | 894333 | 768254 | 886596 | 1054962 | 1016786 | 1016875 | 999598 | 1034571 | 983554 | 1029180 | 968470 |
| | | *t/ha* | 5.351 | 5.795 | 5.005 | 5.424 | 5.641 | 5.99 | 6.349 | 6.345 | 6.359 | 6.437 | 5.887 |
| | | *t* | 4785625 | 4451951 | 4437055 | 5722441 | 5735367 | 6091081 | 6346642 | 6564164 | 6254582 | 6624867 | 5701377 |
| **% of Total Egypt** | *Area yield production* | *ha* | 24 | 64 | 57 | 61 | 50 | 51 | 49 | 66 | 60 | 30 | 51 |
| | | *t/ha* | 102 | 99 | 112 | 109 | 93 | 98 | 101 | 98 | 103 | 100 | 102 |
| | | *t* | 24 | 63 | 64 | 66 | 46 | 50 | 50 | 65 | 61 | 30 | 52 |

**Source: Collected and calculated from the samples data for wild oat control of wheat through 1992/93-2001/02**

**Table (11): The area of wheat which infested with wild oat and controlled with handweeding and herbicides through 1992/93-2001/02 seasons.**

| Seasons | Handweeding | | Herbicides | | Total |
|---|---|---|---|---|---|
| | Hec | % | Hec | % | |
| *1992/93* | 0 | 0 | 8796 | 100 | 8796 |
| 1993/94 | 32031 | 90 | 3708 | 10 | 35739 |
| 1994/95 | 81838 | 91 | 8478 | 9 | 90316 |
| 1995/96 | 99133 | 99 | 1558 | 1 | 100691 |
| 1996/97 | 103072 | 97 | 3069 | 3 | 106141 |
| 1997/98 | 80294 | 96 | 3415 | 4 | 83709 |
| 1998/99 | 51586 | 94 | 3533 | 6 | 55119 |
| 1999/2000 | 49351 | 65 | 26837 | 35 | 76188 |
| 2000/01 | 54093 | 69 | 24771 | 31 | 78864 |
| 2001/02 | 14944 | 32 | 31125 | 68 | 46069 |
| Total | 566342 | 83 | 115290 | 17 | 681632 |

Source: **Collected and calculated from Agr. Ext. Dep., Ministry of Agricultural.**

**Table (12): The impact of wild oat control on the production and returns of wheat in Egypt through1992/ 93 -2001/ 02 seasons.**

| season | sample size | cultivated area ha | treated area ha | added yield t/ha | quantity of added production | world wheat price dollars | value of added production | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | million dollors | million Egyptain pounds |
| 1992/93 | 444 | 894333 | 8796 | 0.68 | 5981 | 100 | 0.595 | 1.986 |
| 1993/94 | 584 | 768254 | 35739 | 2.29 | 81842 | 140 | 11.458 | 38.453 |
| 1994/95 | 553 | 886596 | 90316 | 1.24 | 111992 | 150 | 16.799 | 56.981 |
| 1995/96 | 506 | 1054462 | 100691 | 0.85 | 85587 | 182 | 15.577 | 52.884 |
| 1996/97 | 364 | 1016786 | 106141 | 0.73 | 77483 | 196 | 15.187 | 51.633 |
| 1997/98 | 397 | 1016875 | 83709 | 1.22 | 102125 | 161 | 16.442 | 55.903 |
| 1998/99 | 471 | 999598 | 55094 | 1.56 | 85447 | 150 | 12.89 | 43.83 |
| 1999/2000 | 520 | 1034571 | 76188 | 0.97 | 73902 | 150 | 11 | 39 |
| 2000/2001 | 476 | 983554 | 78864 | 1.054 | 83123 | 100 | 8.3 | 33.23 |
| 2001/2002 | 163 | 1029180 | 46069 | 2.39 | 110105 | 100 | 11 | 51 |
| Total | 4478 | 9684709 | 681607 | 1.18 | 818087 | | 119 | 424.9 |

## Dissemination and technology adoption of wild oat control in wheat :

This study was designed to evaluate the impact of wild oat control activities in wheat in Egypt. A total of 131 Wheat participant farmers and a similar number of non-participants were interviewed in Delta governorates and Upper Egypt ( Sharkia, Menoufia, Beherira, Qena, Sohag, Assuit and Fayoum ). The main findings were that exposed to 10 sources of wild oat control information mainly TV programs, extension field agents, weed scientists' visits, extension demonstrations and demonstration plots under the supervision of weed scientists Table (13) .

**Table (13): Farmer sources of information on wild oat management in wheat Egypt.**

| No. | Sources of information | Participants % | Non- participants % |
|---|---|---|---|
| **1-** | **TV programs** | **94** | **80.2** |
| **2-** | **Extension field agents and subject matter specialists (SMS) field visits** | 100.0 | 59.5 |
| **3-** | **Extension demo and demo plots under the supervision of weed scientists** | 71.0 | 63.4 |
| **4-** | **Panel and extension group discussions** | **80.2** | **45.8** |
| **5-** | **Cooperative societies** | **59.5** | **60.3** |
| **6-** | **Radio programs** | **63.4** | **55.0** |
| **7-** | **A.R.C. researchers' field visits** | **100.0** | **9.2** |
| **8-** | **Demonstrations under the supervision of weed scientists in farmers' fields** | 100.0 | .. |
| **9-** | **Printed material** | **44.3** | **29.8** |
| **10-** | **Relatives and neighbors** | **13.0** | **45.8** |

Table (14) shows that the total number of participants in the Delta and Upper Egypt who had adopted the full package of wild oat control was higher than non-participants in the same areas, These results suggest that such programs of integrated control of wild oats should continue yearly to sustain wheat productivity in Egypt .

**Table (14): Adoption % of different wild oat control package components in wheat fields in the Nile Delta and Upper Egypt in the 1995/96 season.**

| Package components | Delta | | Upper Egypt | |
|---|---|---|---|---|
| | Participants | Non-participant | Participants | Non-participant |
| **Full package** | | | | |
| Rotation + herati method + herbicide + hand weeding | 51.10 | 17.00 | 45.24 | 23.80 |
| **3 Components** | 4.30 | | | |
| Rotation + herbicide + hand weeding | - | - | 1.20 | - |
| Herati + herbicide + hand weeding | 8.50 | - | 6.30 | 5.30 |
| Rotation + herati herbicide | 4.30 | 2.00 | 13.10 | 9.50 |
| Rotation + herati + hand weeding | | 42.60 | - | 34.50 |
| **2 Components** | 4.30 | | | |
| Herbicide + hand weeding | - | - | - | - |
| Rotation + herbicide | - | 6.34 | 10.70 | 5.950 |
| Herati + herbicide | - | 4.36 | 2.40 | 1.20 |
| Rotation + hand weeding | 14.90 | 6.34 | - | - |
| Herati + hand weeding | - | 10.60 | 4.30 | 4.30 |
| Rotation + herati | 6.34 | - | 2.34 | - |
| **One component** | | | | |
| Herbicide | 6.34 | - | - | - |
| Hand weeding | 6.30 | 2.10 | 3.57 | - |
| Rotation | - | - | 3.60 | - |
| Herati | - | 6.50 | - | - |
| No technological package | - | - | 2.40 | - |

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## Conclusion

**The main conclusions from the study are:**

`The elements of the developed integrated wild oat control packages are sowing wheat after preceding clover, the use of clean seeds, herati-sowing method and the use of herbicides and/or handweeding.

In case of medium infestation cultural practices plus handweeding proved to be effective.

Socio – economic data showed that national income increased by 425 million pounds due the adoption of wild oat control technology during the period from 1992/93 – 2000/01.

Continuous efforts must be undertaken to keep the infestation of wild oat under control.

## Abstract

This study dealt with the impact of using the recommended technological package of wild oat control on wheat production and net returns in Egypt through the period 1992/93 – 2001/02 seasons under verification trials, demonstration fields and adoption fields. For this purpose 4478 wheat fields were randomly selected in some governorates of wheat where the recommended technological package was adopted. Results indicated that there

were significant increases in wheat yield t/ha, total cost, gross margin, net benefit, and profitability for the treated fields relative to the untreated fields of wheat. The main elements of the developed technological package were sowing wheat in fields preceded with clover, herati sowing method, herbicides, handweeding and certified wheat seeds. The added income due to using the recommended technological package was about 425 million Egyptian pounds in the treated infested wheat areas.

## الملخص العربي

## نقل تكنولوجيا المكافحة المتكاملة للزمير في القمح

تم دراسة أثر استخدام حزمة التوصيات لمكافحة الزمير على انتاجية القمح وعوائده في مصر وذلك في الفترة 1993/1992– 2001 /2002 وذلك داخل 4478 حقل أجريت فيها التجارب التأكيدية أو حقول الإيضاح العملى أو الحقول التى قام المزارعين بتطبيق حزم التوصيات بأنفسهم فيها مقارنة بالحقول الغير معاملة ، حيث طبقت بعض المعايير الاقتصادية والاجتماعية .

أوضحت النتائج زيادة في المقاييس المستخدمة مثل المحصول والتكاليف والعائد الإجمالى والعائد الصافى في الحقول المعاملة عن الحقول غير المعاملة كما اتجهت هذه المقاييس بزيادة عدد العوامل المطبقة من حزمة التوصيات والتي تحتوى على المبيدات عن التى لا تحتوى على مبيدات .

بلغت الزيادة في الدخل القومي نتيجة لتطبيق حزم توصيات مكافحة الزمير مقدار 425 مليون جنيه مصرى أو 119 مليون دولار في الفترة من 1992/93– 2002/2001 كما أدى استخدام النقاوة اليدوية للزمير لتقليل استعمال ا لمبيدات وحماية البيئة وإنتاج نظيف وتقليل التكاليف كما يوصى باستمرار الجهود لسيطرة على انتشار الزمير في القمح.

# Unit V

# Expert systems

## A- Neper-Weed

## B- Es-Parasitic Weeds

**SOFTWARE**

# A- NEPER-Weed: A Picture-Based Expert System for Weed Identification

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## ABSTRACT

Most current expert systems for weed identification are ruled- based. They use text only and rely on a large number of botanical terms. In rule-based expert systems, knowledge is not organized in a structured manner. Hence, they are difficult to create and use. This article describes the advantages of the generic task approach to building expert systems. The generic task approach is based on the assumption that certain knowledge and control structures may be common to a particular task across domains. Hence, reusable control structures, or tools, have been developed to solve problems. We developed an expert system that uses a hierarchical classification tool. Text descriptions are replaced with pictures, to minimize the use of technical terms. Hypotheses are established or ruled out on the basis of the user's choices among options presented as pictures . this approach reduces the number of characters required for weed identification and the user does not need to know technical terms. In our system, the classification of grasses is based on the morphologies of the leaf base and leaf surface. Broadleaf weed classification is based on the shapes of the cotyledon and true leaf. The system contains 51 Egyptian weeds. The hierarchical classification tool allowed for a clear separation of the knowledge from the structure in which the knowledge is organized. The object-oriented nature of this approach simplifies adding or removing weeds. This approach can be readily applied to other domains, such as disease identification, fertilizer recommendation, or cultivar selection.

NPER- Weed. The weed identification system described here, is part of

NEPER-Wheat (Kamel et al., 1995), an expert system that cover most planning and management problems of irrigated wheat (*Triricum aestivum* L.) in Egypt. Weeds are major pests in wheat, and their efficient control is difficult. The first step in integrated pest control is the correct identification of the pest, in the case of weeds, the species, density, distribution in the field, and size.

Traditional taxonomy is based mainly on reproductive structures and uses an exhaustive set of technical terms (Jones and Luchsinger,1986). In wheat, effective chemical and mechanical weed control are possible until wheat has reached the stem elongation stage (Koch and Hess, 1980). Hence, weeds need to be identified at the seeding stage when their reproductive structure are not visible. Most biological classifications are hierarchical, consisting of groups of taxa at different levels (Pankhurst, 1991). Taxonomic keys are mostly dichotomous. They represent mainly two contrasting choices at each step, which are indented or yoked. This helps the user to grasp the differences faster. A big difficulty in constructing these keys is that of characterization. The manner in which a character is described will substantially affect the resulting classification (Pankhurst, 1991). Furthermore, these keys force the use of certain characters regardless of whether they convenient or can be identified (Mores, 1971). Therefore, the classical taxonomic approach has several disadvantages as a tool for weed identification.

Identification keys for weed seedlings based on shapes and morphology have been developed by Chancellor (1966), Behrendt and Hanf (1979), and Hanf (1983, 1990). Some expert systems, such as those of Fermanian and Michalski (1989) and Pasqual (1994) , enable the user to identify grasses based on several vegetative characters, whereas the system of Longchamp et al. (1991) can be used for flowering weeds only. All these systems are text-based, which as-sums the user has an in-depth knowledge of the characters. As pointed out by Fermanian and Michalski(1989), poor recognition skill in the user can severely limit the effectiveness of that type of weed identification system. The knowledge contained in rule-based weed identification systems is represented by rules (so-called condition action pairs) with the general from of

If *condition* THEN *conclusion*

If a set of condition is satisfied. Then a particular conclusion is acted upon. Several rules are used to characterize a weed. To account for uncertainty and the expert's confidence limit in the importance of a rule, a value between 0 and 100 is assigned to each rule in the system of Fermanian et al . (1989). These values are added up and the rules are concluded (i.e., a solution is achieved) when a give threshold is reached. A similar approach is used in EXPERTKEY (Atkinson and Gammerman, 1987). This plant identification system asks the user to enter the degree of uncertainty about a statement. In some of the systems (Fermanian and Michalski, 1989; Longchamp et al.,1991), the user can , to an extent, choose the characters for identification. Thus, if the user does not know a character or is unsure about its value, that character can be omitted. The system then tries to arrive at a conclusion with the remaining characters, for which a value has been entered by the user.

A disadvantage of a rule-based system is that the knowledge is not organized in a real structure (Chandrasekaran, 1986). A rule-based system basically consists of an aggregated number of rules. This makes creation of the system and validation of the embedded knowledge difficult. Rules need to be formulated cleverly, and it becomes unclear which portion of the system represent domain knowledge and which are programming devices (Chandrasekaran, 1986).

Our objective was to develop a weed identification system that overcomes several constraints of existing identification system and is easy to use, and relies on few botanical terms. Furthermore, we wanted to build a system that can easily be modified and adapted for different environments.

## Theory

## Generic Task Approach for a Weed Identification system

Based on the experience with the first –generation expert systems, Chandrasekaran (1986) postulated that certain knowledge and control structures may be common to a particular task across domains (e.g., a task may be identification and the domains either plants or diseases). Thus, the assumption is that problem solving by experts can be classified into different categories, whereby each category shares common methodology. Only the knowledge needed for solving individual problems within each category is generics. Chandrasekaran (1986) also postulated that knowledge should be directly encoded at the appropriate level by using terms that naturally describe the domain knowledge for a given task. These assumption led to the creation of second-generation expert systems, using a task-specific approach. For solving problems in the field of identification, this means that similar programming structures or underlying mechanisms can be use to identify weeds or plant diseases, or to select wheat cultivars for a given circumstance. These programming structures are generally referred to as tools. Several types of tools have been developed: hierarchical classification and structured matching (Sticklen and Chandrasekaran, 1989a), routine design (Kamel et al., 1994), abdicative assembly, and functional reasoning (Sticklen and

Chandrasekaran, 1989b). As indicated by the name, hierarchical classification was developed for solving classification problems. The hierarchical classification tool was used in developing the NEPER-Weed identification system.

## Knowledge Organization

In hierarchical classification, knowledge is organized a decision tree, with nodes at different levels. This implies that knowledge is distributed among many nodes, or so-called specialists (Fig. 1). The general hypotheses are found higher in the hierarchy, while the more specific hypotheses are found lower in the hierarchy. Each specialist at a level $i$ represent a complete $i$th-level solution. The children (level $i + 1$) of a node (parent) represent a more refined solution.

In the case of weed identification, the structure of hierarchical classification can be similar to the different level of a classical key. The most general hypothesis is whether the weed is a grass or a broadleaf weed, while at the lowest-level node in the hierarchy the weed species are represented. The lowest-level node is complete solution of the input data. Thus, the box *Euphorbia peblus* in Fig. 1 represents that this weed is broad-leaved and has the cotyledon shape VI and true leaf shape E. Abbreviations used for the shapes of cotyledon and true leaves are based on the nomenclature of Hanf (1983, 1990).

Hypotheses at each level are established or rejected by specialists. These specialists interact in a hierarchical, structured manner. Each specialist contains the knowledge of a given level of the key. Each specialist in this hierarchy is responsible for accepting or rejecting one hypothesis only.

The knowledge within a specialist is embedded in so-called decision tables. These decision tables consist of one or more variables (columns). In the case of the weed identification system, the variables stand for the characters of the plants: shapes of the leaf base, cotyledon, true leaf, and the like. The establishment of a hypothesis at the specialist level is accomplished by a set of table matchers that correspond to the result of the comparison between values of the variables of the decision table and the user's input.

Hence, the rules used in first-generation expert systems are grouped into decision tables at each specialist. The hierarchical classification tool provides a framework to formulate the rules and to declare how the specialists which contain the rules, interact with each other. Rules are thus encapsulated into mutually exclusive small sets of rules, making them easier to modify and update.

To minimize the use of technical terms. We made some alteration to the standard version of the classification tool, which used to be text-based. Assuming that pictures are easier to understand, we replaced the text-based variables with pictures. The hypotheses are established or ruled out on the basis of user made selections among a series of pictures. Hence, in our weed identification system a table consists of one variable only, which is represented by the picture. An example of a specialist is shown in Fig.2. It depicts level 3 of the hierarchy. The three pictures of true leaf shape types E, G, and O are shown if the user has previously selected Broadleaf weeds and VI for shape of cotyledon. The shapes of E,G, and O are unique to the VI of level 2. Other shapes of level 2 may have the same shapes of true leaves on level 3. This however would cause the system to show pictures of different seedlings at level 4.

## Control Strategy

The control strategy used by hierarchical classification is *established* and *refine*. In this strategy, the hierarchy of hypotheses is explored in a top-down manner by first establishing the top-level hypothesis, then refining this hypothesis by asking the immediate sub-specialists in the hierarchy to establish their hypotheses. The establish and refine process is repeated at reach level until a list of specific hypotheses is established. If a hypothesis is rules out, then the hypotheses below it in the hierarchy are also ruled out. This allows a large section of hierarchy (i.e., hypothesis space) to be pruned, providing a significant computational advantage over searching the entire hypotheses space. Pruning of the hierarchy also implies that the user is confronted with a minimal set of questions (pictures).

### Knowledge Acquisition

The task of building a hierarchical classification system consists of determining the hierarchy and defining the specialists. The generic task approach explicitly presents a structure for knowledge organization. The knowledge can be entered directly at the level appropriate to the input and output relationship of the system. Thus. It overcomes the biggest obstacles in Knowledge-based systems development. knowledge acquisition and representation. The tool distributed here can be used directly for entering knowledge. Thus, the domain expert , after a short training period, can enter and modify the knowledge directly without knowing a programming language. Introduction with a computer scientist is necessary only to choose the right type of tool and for occasional trouble shooting. Thus, the computer scientists does not need to acquire the entire knowledge, but needs to understand only the basic mechanism of reasoning; the domain expert has control over the information that goes into the system.

## The weed identification system

Two different sets of criteria are used for the identification of grass and broadleaf weeds. The identification of broadleaf weeds is based on two phonetic characters of the weed seedling as outlined by Hanf (1983,1990): shape of the cotyledon and shape of the true leaf. For each, cotyledons and true leaves, the system uses 12 different shapes. For grass weeds, we followed an approach described by Behrendt and Hanf (1979). For consistency, we also used their terminology. Their system for the identification of grasses is based on five characters were sufficient to distinguish the nine grasses. The characters are shape of the leaf base and morphology of the leaf surface. The leaf based are distinguished by the presence or absence of aueicles, ligules, and bristles, as well as by their different shapes. There are two types of leaf surfaces: distinct midrib, or numerous veins.

*Process of Weed Identification*

The identification process begins with two pictures showing a grass and a broadleaf weed. The user selects one of them by clicking on the picture with the mouse. Depending on the selection, a new set of picture representing the classification criteria of the grasses or broadleaf weeds is displayed to the right side of the first level. If the user selects grasses, the system will show drawings of three different leaf-bases. Next, the user has to decide whether the leaf has a distinct midrib or if it has numerous veins. Finally, at the last level, the system shows all grasses matching the selected criteria. At a maximum, there are three grasses at the last node. The user is responsible for comparing the picture with the current case and selecting the appropriate match.

If the user selects broadleaf weeds, the system shows 12 different shapes of cotyledons from which to choose. The selected cotyledon then generates a set of true leaves, which is shown at the third level. Finally, at the fourth level, the user is shown the set of weed seedlings that mach with the selected criteria of the previous levels. At a maximum, there are three broadleaf seedlings from which the user has to select one.

The system records the decision made at each node and it also allows for jumping back to any previous decision level. Thus, revising decisions and exploring different paths is simple. Because pictures represent an idealized form of the plant that does not always correspond to the forms found in nature, we added the option of selecting any two criteria within one level at the same time. At the next deeper level, the system presents the user with the combined selection of both criteria.

The hierarchical classification tool allows a node to have one, two, or more parents. This could be useful in cases where the particular shapes of a weed resemble two or more shapes that are used as classification criteria. We have not used that feature yet, but testing in the field may reveal such situation where weeds do not fit well into one class.

Theoretically, the logic of the hierarchical classification tool allows for incorporating *Don't-know* answers as well. We decided to omit that option, since it would bring up too many options at the next lower level. Thus, the user must decide which shapes correspond best to the plant being identified.

The user answers all questions by selecting the appropriate picture. Ideally, a good picture represents all the information needed to make a decision. However, we added a help box that describes the picture and point out potential pitfalls. Each picture of a weed seedling contains an information button that gives a description of the weed, point to other weeds that look similar, and offers information on its ecology, its damage potential, and how it can controlled.

## Updating the Weed Identification System

A weed identification system that is crop and region specific has, by definition, a very limited scope. Therefore, it is essential that the system be easily modified, as when weed must be added or removed according to the specific flora of a given environment. The weed identification system uses pictures stored in its own file format. A screen-capture module is included to capture and save any image or drawing displayed in any other program. Each picture in the identification system is saved in a separate file.

To facilitate building and updating the weed identification system, the hierarchical classification tool control a set menus that id usually not immediately shown to the user who wants to identify a weed. A command called Browse picture Hierarchy prompts the tool to show a new window that displays the hierarchical classification tree (Fig. 3). In that window, holding down a modifier key while pressing the mouse button brings up a floating menu. That menu lest the user add, rename, or remove node. A node can also be moved to a different parent. Figure 3 shows the first steps of adding a new weed, *Bunias orientalis* L., to the system. The user has selected node E. From the floating menu, the user selects Create Sub. The menu then asks for the name of new weed (in our case, *Bunias orientalis*) and for the filename of the picture. At the end, the tool will show an updated window that includes *Bunias orientalis* along with the other weeds.

## DISCUSSION

The use of a hierarchical classification system within the generic task approach permitted us to develop a system that has several advantages over the text and ruled based identification system.

## Advantages of Using a Hierarchical

A pointed out by Edwards-Jones (1992), the process of knowledge acquisition, or extraction of rules, is critical in developing an expert system. Since the hierarchical classification tool provides a natural structure for the knowledge, the domain expert can enter and modify the knowledge. This allows for fast development and adaptation of the system to various conditions.

The computational advantages of hierarchical classification arises from the distribution of domain knowledge throughout the hierarchy and the concentration of specific decision knowledge for each hypothesis at a specialist (Chandrasekaran, 1986). By distributing the domain knowledge across the hierarchy, only the relevant portions of the domain knowledge are examined during the establish and refine process. Figure 1 shows the result of a specialist ruling out its associated hypothesis; for example, with the exception of cotyledon shape VI, all the subtrees of shapes 1 to XII are ruled out at Level 2 and are therefore not explored. Additionally, the knowledge a specialist needs to establish or rule out its hypothesis is located at the specialist. When a specialist is called upon to establish itself it needs to only examine its own knowledge to gather sufficient evidence to confirm or deny its associated hypothesis. Thus, by concentrating knowledge at each specialist, only a small portion of the knowledge base must be examined.

Pruning of subtrees considerably speeds up the identification process and makes using the system easier. The user is only confronted with potentially true hypotheses.

As pointed out by Hanf (1983, 1990), the occurrence of weed species in field crops depends upon factors such as cropping sequence and previous control methods as well as the region and crop. The nature of the hierarchical classification system allows for a modification and adaptation of the system to the requirements of the user. This provides the opportunity to create a customized weed identification system for different crops, regions or soil types. By creating a crop- and region-specific weed identification system for wheat grown in Egypt, we limited the number of weeds in our system to 51. A small but specific database of weeds has the advantage that fewer characters or variables for identification are required to distinguish the weeds. Additionally, identification of the weeds is easier, faster, and more accurate, since the user's choice is limited to the relevant weeds that occur in a given environment.

## Advantage of Picture-Based Approach

The picture-based approach permitted us to limit the number of technical terms required to identify a weed seedling to the following : grassy weed, broadleaf weed, cotyledon , true leaf, and leaf base. Thanks to their representation through pictures, most are self-explanatory even to a novice. This is an improvement over text-based weed identification keys, which use up to 70 technical terms (Stucky, 1980). Another advantage of using pictures if that it circumvents the problem of describing the weed characters in words, thus sidestepping the problems of ambiguity that make construction of good keys such a difficult task (Pankhurst, 1991).

Good keys are constructed in such a manner that they allow for an easy distinction among the dichotomous characters. However, descriptions even pictures represent an idealized form of the characters. To accommodate the possibility of uncertainty, some expert systems, such as RXPERTKEY (Atkinson and Gammerman, 1987), allow the user to enter a value for the level of consuming of the choice made. However, this is time consuming and the user has to make two decisions at each step instead of one, even when certain of decision. It also complicates use of the system. We preferred to give the user the pos- Sibility of choosing two criteria at the same time at each decision node. Thus NEPER-weed uses a polychotomous approach that additionally allows expiring tow paths at the same time. As pointed out before, the hierarchical classification tool can be used for various tasks. Within NEPER-wheat, it is also being used for identification of diseases, nutrient deficiencies, and insects. The cultivar-selection module that assists farmers in choosing a suitable cultivar is also based on the hierarchical classification approach. In conjunction with NEPER-wheat, NEPER-weed is being tested in the field in Egypt by extension agent and farmers.

Hardware and software

The hierarchical classification tool is written in small talk. However, no knowledge of Smalltalk is required to use the tool. The weed identification system requires 8to 10Mb of RAM. Approximately 8to 10 Mb of hard disk space is required, but the size of the program depends on the number of weeds included in the system. Each picture occupies about 25 kb of hard disk space.

The program is fully portable and compatible with Macintosh, DOS, and UNIX operating system. A colour monitor is recommended, with a minimum resolution of 640 by480 pixels. To customize the system for a specific weed population, a scanner is required to put the appropriate weed pictures into an electronic format.

## Availability and documentation

A trial version of NEPER-weed, as well as the hierarchical classification tool are available without charge from the corresponding author. The program may be used for three calendar months. After that period, a license for the right to use Smalltalk must be purchased from park- place system (999 E. Arques Ave., Sunnyvale, CA, 94086-4593). Detailed information for the use of the classification tool is given in an ASII text file distributed with the program.


## Acknowledgement

The pictures of true leaves shown in fig. 2 have been reproduced with the permission of the publisher from ackerunkrauter europas- the arable weed of Europe with their seedling and seeds, by M. Hanf, published in German in 1990 by BLV- verlagagesellschatft of Munich, Germany. This research was sup-ported by joint USDA (OICD)/NARP funding. The intelligent system Laboratory, MUS, receives substantial equipment sup-port from Apple computer.


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## B- ES – Parasitic Weeds: A computerized Expert System for Parasitic Weed Identification and Management with special reference to *Orobanche* spp

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### Abstract

An expert system based on the degree of parasitism either completely or partially, was prepared. The identification of *Orobanche spp.* was dependent on site of attachment with the host, stem branching as well as corolla shape and colour. *Cuscuta* spp. identification was depending on stem thickness, flowers and its host range. Method of control and management for each parasite were included i.e. crop rotation, clean seeds, sowing dates, biological control, solarization, herbicides and hand pulling for each parasite for different host species.

Version 1.2, editing by Arabic and English languages.

### Introduction

The use of an expert system for parasitic weed identification is a very important tool for training extension agents, farmers, and education purpose. Lots of weed expert systems depend on botanical term rules, but it is very difficult to be used. Schulthess *et al* (1996) recommended to use a picture-based expert system for weed identification in wheat, which is very useful for minimizing botanical terms. Parasitic weed identification in adult stages will be useful for controlling it in long and short terms using on the taxonomy of parasitic weeds in Egypt which had been used by Tackholm (1974) and parasitic weed control by Zahran (19973), and method of control Hassanein (1997).

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The objective of this study is to discuss an expert system for identifying and controling *Orobanche, Cuscuta* and *Striga* in their host crops.

## Knowledge Organization:

Knowledge organization depends on the system, which follows Schulthess *et al* (1996) as shown in diagrammatic figure (1).

## Parasitic Weeds Identification System:

Three different sets of criteria are used for the identification of parasitic weeds. The first set belongs to the habit of the parasitic weeds in attachment to the host plant as holo and partially parasitic weeds. The second set belongs to the site of attachment on the host plant on roots or shoots. The third set belongs to the morphological characteristic of the flowering stalks depending on difference in the shape, size, colour, component of the stems and flowers, which described by Long (1910), Georgia (1925), Tackholm (1974), Chaudhary and Akram (1987); Koch *et al* (1988); and Robson *et al* (1991).

### Process of Parasitic Weed Identification

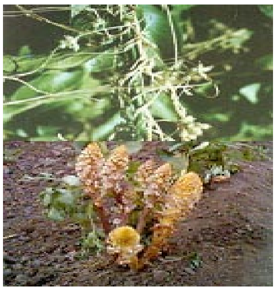
The identification process starts on level 1 with two pictures (1 & 2) to show the parasitic habitat as holo (1) and partially parasite (2). The user selects picture (1) by clicking on the mouse to go to level 2. The system shows the pictures of the parasite attachment site on the roots or shoots of the host plant "pictures 3 & 4". Next, the user selects the parasite on roots at level 3. The system will show *Orobanche* spp. (broomrape or halouk) stem brown or yellowish squamose parasite, leaves reduced to scales, flowers in spikes, each flower supported at its base by a broad colorless bract, calyx tube has usually 4- acute teeth and split up in one or two places, fruit is a capsule as bluntly ovoid, one celled, two valves with containing many minute seeds. This level dependent stem either branched or unbranched in pictures (5&6). Then the user selects picture 5 which describes the stem as branched, slender, thin, glandular hairy, with bracteoles present, the flower elongated and constricted at middle.

## ES – PARASITIC WEEDS

**Levels**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | Show Room | Ar.Control Method Room | En.Control Method Room | Print | Exit |
|---|---|---|---|---|---|---|---|---|---|---|---|

Holo parasite



**Click any picture to go to the next level**

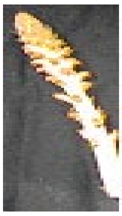
Partially parasite

Next, the user selects picture 5 to go to pictures (7&8) in level 4. Picture 7 shows the flower has calyx tube like bell shaped, blue or sometimes yellow, with 4- acuminate lobes longer than the calyx tube and reaching the constriction of the corolla, corolla tube distinctly funnel shaped, white, curved with 2 ovate lobes, constricted above the ovary with pale violet to blue, anthers has crispy, densely hairs at the base (Shaggy) and the main host plants are legume, solanaceous and crucifer crops.

**Pic. (3 )**

**Pic. (4)**

**Pic. (5)**



**Pic. (6)**

**Pic. (7)**

**Pic. (8)**

**Pic. (9)**

**Pic. (10)**

**Pic. (11)**

## 1- الهالوك

نظرا لطبيعة تطفل الهالوك على جذور عوائله ولتمييز أنواع الهالوك للتعرف عليها فيلزم فحص ساقه وما تحمله من أزهار عندما تظهر فوق سطح التربة "مرحلة التزهير والإثمار "

**وعموما يتميز نبات الهالوك بـ**
**الساق :**بنية أو مصفرة عصيرية .
**الأوراق :**تختزل إلى حراشيف وغالبا غير ملونة
**الأزهار :**تتجمع فى نورات سنبلية وكل زهرة يحيطها من أسفل قنابة عريضة غير ملونة **.**
**الثمرة :**كبسولة وتحتوى على عديد من البذور دقيقة الحجم.

أنواع الهالوك المنتشرة بمصر
يتم التعرف عليها من الساق وما تحمله من أزهار :

**أولا-: الساق :**مفوعة وأسطوانية الشكل بها شعيرات غدية.
الأزهار :**تتجمع فى نورات سنبلية مفككة "غير مندمجة أو غير كثيفة "**
**الزهرة :**تشبه القمع نظرا لأن بتلات التويج متحدة فى صورة أنبوب يختنق "يضيق "فوق مستوى المبيض .

**وللساق المتفرعة نوعان -:**
**<u>الأول</u> -:** ***O. aegyptiaca***

وأهم ما يميزه بعض صفات مكونات الزهرة :
**الكأس :**من 4 سبلات متحدة من أسفل مكونة أنبوب حوافه الأربعة أطول من الأنبوب نفسه وطول الكأس يصل إلى منطقة إختناق أنبوبة التويج فوق مستوى المبيض – ولون الكأس أزرق وأحيانا أصفر اللون .
**التويج :**من 4 بتلات تلتحم من أسفل مكونة ما يشبه القمع لوجود اختناق له فوق مستوى المبيض وبالبتلات شعيرات دقيقة الحجم وأنبوبة التويج بيضاء اللون ولون حوافها الأربعة ما بين الأزرق إلى البنفسجى .
**المتك :**الأسدية فى قاعدتها شعيرات.

***O. aegyptiaca***

Next, the user selects picture 8, the stem has a swollen base, flower shorter than O. aegyptiaca, in loose spikes, calyx tube as long as the corolla tube, calyx lobes shorter than the calyx tube, corolla tube as tubular to funnel – shaped, yellow to violet with a white base, anthers glabrous or sparsely white hairy at the base or glandular, and the main host plants are legumes, solanaceous and crucifer crops.

***O. ramosa*** **الثانى -:**

[illegible]

**الزهرة :**أصغر فى الحجم من النوع الأول.
الكأس :**من 4 سبلات تلتحم من أسفل مكونه أنبوب وحوافه العليا الأر بعة أطول من الأنبوب نفسه والكأس طوله يصل إلى طول التويج**
**التويج :**من 4 بتلات تلتحم من أسفل مكونة أنبوب أبيض اللون وقمعى الشكل لوجود الاختناق فوق مستوى المبيض مع لون حوافه الأربع ما بين الأصفر والبنفسجى .
**المتك :**الأسدية خالية من الشعر أو بها عدة شعيرات بيضاء متفرقة.

***O. ramosa***

If the user returns to picture 6, in level 3 with stem erect, unbranched, thick, tall with large size without bracteoles, the flower has long corolla tube usually not constricted it will show pictures (9, 10 and 11) in level 4. In picture 9, calyx is about half as long as the corolla, corolla tube as tubular, white, curved, constricted above the ovary and the main host plants are legumes and solanaceous.

**ثانيا-: الساق قائمة غير متفرعة :**
وتتضمن عدة أنواع منتشرة يجمعها ما يلى:
**الساق :**سميكة وطويلة .
**القنابة :**يصل طولها إلى طول أنبوبة الكأس .
**الأزهار :**تتجمع فى نورات سنبلية كثيفة وتختلف درجة كثافتها حسب النوع ومكانها على الساق.

***O. crenata*** **الأول -:**

**أهم ما يميزه :**

**الساق :**أطول وأكثر سمكا من الأنواع الأخرى .
**الكأس :**من 2 سبلة ملتحمة من أسفل مكونة أنبوب مستدق وبطول أنبوبة التويج.
**التويج :**من 5 بتلات تشبه شكل الجرس حيث لا يوجد اختناق فى أنبوب التويج وحوافه من شفتين علويتين وثلاث شفات سفلية وتلك الحواف مسننة ولون الأنبوب أبيض مع احمرار أو اصفرار مع لون بنفسجى فى عروق البتلات .
**المتك :**الأسدية خالية من الشعر أو بها بعض الشعيرات فى أسفلها .

***O. cernua***

Next, in picture 10, stem is largest of all other species, flower is large and in fleshy dense spike, subtended by glandular, hairy, acuminate bract; calyx has 2 sepals bifid as long as corolla tube, corolla tube like bell – shaped, not constricted, dull with white, yellowish or reddish, its limbs are pink or violet, margin of petals crenate, anthers glabrous but the base, and the filaments are woolly at the base, and the main host plants are *Vicia faba* and other legumes and *Daucus carota*.

***O. cernua / cumana*** **<u>الثانى</u> -:**

**أهم ما يميزه :**

**الكأس :**طوله يصل إلى نصف طول التويج .
**التويج :**تلتحم بتلاته الخمسة من أسفل مكونة أن بوب أبيض اللون بشكل القمع لوجود اختناق فوق مستوى المبيض وبه انحناء وحوافه الخمسة من شفتان صغيرتان علويتان و ثلاثة سفلية زرقاء اللون .

**O. crenata**

Next, in picture 11, the stem is more slender than the previous two species, flowers are small, blue to violet with narrow spikes, calyx tube cleft to the base above and below, corolla tube bell like shaped, pale brownish yellow, not constricted, lips are purple – tinged, the upper limb out side is glabrous or minutely, in curved and notched, the lower limb with three spreading and rounded lobes and the main host plant is *Trifolium* spp.

***O. minor*** **<u>الثالث</u> -:**

**الساق :**تميل للاستدارة أكثر من الأنواع الأخرى.
**الكأس :**من خمس سبلات متحدة فى أنبوبة مشقوقة الى قاعدتة فى جزئيين مع حواف طويلة ومستدقة .
**التويج :**من خمس بتلات تلتحم من أسفل مكونه أنبوب ليس به اختناق وعلى شكل الجرس ولون الأنبوب بنى مصفر أو أرجوانى وحوافه "الشفة "أرجوانية اللون إما خالية من الشعر أو بها بعض الشعيرات الدقيقة.

**O. minor**

If the user returns to level 2 and selects the completely parasitic on shoots in picture 4 the system will show *Cuscuta* spp. (dodder or hamool), with a stem as a filiform, yellowish delicate, twining round the host plants above ground the soil, leaves absent or minute scale – like, flowers are clustered in groups, calyx tube is bell – shaped of 4 or 5 united sepals with 4 or 5 teeth, Corolla tube is tubular or bell – shaped, is covered by the calyx has 4 or 5 lobes pointed and bent inwards, styles solitary or paired with linear or globose stigmas, and fruits are capsules and globose.

Next, go to level 3, which included pictures 12 & 13 (thick and thin stem). From the picture 12, the user goes to picture 14, in level 4, stem thicker than in other species, inflorescence is spike–like or raceme, flowers in interrupted spike with pink color, calyx tube is bell – like with 5 round and blunt lobes which are shorter or as long as the corolla tube erect with 5 round and blunt lobes, style 5 solitary, long with dried corolla, capsule conical and capped with detached corolla, and the main host plants are woody & fruit trees, and the creeping herbaceous plants.

Pic. (12)

Pic. (13)

Pic. (14)

Pic. (15)

Pic. (16)

## 2- الحامول

يتطفل الحامول على الجزء الخضرى من عوائله بعد أن يفقد صلته بالتربة بعد الإنبات وظهور ساقه فوق سطح التربة .

**وعموما يتميز نبات الحامول بـ**

**الساق :**تشبه الخيط مع اصفرار فى اللون ، ومن أعلاه يستدق الخيط إلى ما يشبه الخطاف وتوجد على الساق عدة براعم سواء خضرية أو زهرية مع أو بدون بعض الحراشيف الدقيقة فى الحجم )بديلة عن الاوراق (وأيضا على الساق توجد عدة ممصات وهى أماكن التصاق الحامول بالعائل بعد التفاف الخطاف عليه .

**الأوراق :**لا توجد أوراق أو تكون ما يشبه الحراشيف دقيقة الحجم .

**الأزهار :**تتجمع فى ما يشبه النورة الهامية .

**الثمرة :**كبسولة كروية الشكل وتحتوى على العديد من البذور صغيرة الحجم.

ويتم التمييز بين أنواع الحامول المختلفة بما يلى :سمك الساق ، شكل تجمع الأزهار ، عدد السبلات والبتلات "رباعية أو خماسية "، المتاع "قلم واحد أو اثنين "والمياسم "شريطية أو كروية"، استدامة أو عدم استدامة التويج حول الثمرة عند تمام النضج .

**أنواع الحامول -:**

الأول : *Cuscuta monogyne*

**الساق :**أسمك وأطول من الأنواع الأخرى .

**الأزهار :**تتجمع فى شكل غير منتظم فيما يشبه السنبلة أو النورة الراسمية وبنفسجية اللون .

**الكأس :**يتكون من 5 سبلات تلتحم من أسفل مكونة أنبوب يشبه الجرس ويصل طوله إلى أنبوبة التويج أو أقصر قليلا .

**التويج :**يتكون من 5 بتلات ملتحمة من أسفل .

**المتاع :**يتكون من قلم طويل ذو فصوص علوية .

**الثمرة :**كبسولة يستديم معها بتلات التويج عند النضج وتعطى شكل القمع .

***C. monogyna***

From picture 13, the user goes to pictures 15 and 16 in level 4. In picture 15 the flowers in loose cluster, calyx tube is bell-shaped with 5 round and blunt lobes, corolla tube remain at the mature capsule base, styles are 2 separated and slender with globose stigmas, capsules are large and much exposed, and the host plants are many i.e. vegetables, alfalfa, clover, weeds.

الثانى -: *Cuscuta campestris, C. arvensis, C. basarabica*

**أهم ما يميزه -:**

**الأزهار :**تتجمع فى نورات مفككة .

**الزهرة :**خماسية .

**الكأس :**من 5 سبلات تلتحم من أسفل مكونة أنبوب يشبه الجرس وطوله يغطى طول أنبوبة التويج .
**التويج :**من 5 بتلات تلتحم من أسفل مكونة أنبوب .
**المتاع :**من 2 قلم غير متحدين وأسطوانية الشكل مع ميسمين كروبين .
**الثمرة :**بتلات التويج تغطى الكبسولة الكبيرة الحجم عند تمام النضج وتستديم معها.

**C. campestris**

The latter picture 16 which stem is slender to meduim, not or little branched, flowers membranous, perianth 5-fid or sepals and petals are 5 each, calyx – lobes ovate and acute, styles are 2 with linear stigmas, stigmas rather thick and the main host plant is *linum usitatissimum.*

*Cuscuta epilinum* الثالث -:

**الساق :**غير متفرعة أو قليلة التفريع الأزهار غشائية .
**الكأس :**من 5 سبلات تلتحم من أسفل مكونة أنبوب مع 5 حواف بيضية الشكل ودقيقة الحجم.
**التتويج :**من 5 بتلات تلتحم من اسفل مكونة أنبوبة حوافها مثلثة الشكل .
**المتاع :**من 2 قلم مع ميسمين ريشيين .

***C.epilinum***

If the user return to level 1 in picture 2, you will find the partially parasitic weed. *Striga* spp. (witch weed or adaar) as semi parasitic on the roots of the host plant, its stem erect, quadrangular or four-sided, rough and hairy, leaves opposite, the leaves sessile and the lower leaves tapering with a short stalk, all the leaves lanceolate, rough and hairy, inflorescence as a long spike of paired sessile flowers (stalk less flowers), the flower is a long, pink and bilabiate with 4 stamen, corolla tube is bent in the middle and much exceeding the tubular calyx, and the fruit is a capsule with many minute seeds, the main host plants are sorghum, maize and sugar cane.

**3-العدار**

نبات يتطفل جزئيا طبقا لـ VIVI فإنه من ضمن الفلورا المصرية وموجود بالصعيد في بعض ح قول القصب ولكن لا يسبب مشكلة وإن كان ينتشر بالسودان وكثير من البلاد الأفريقية لذا وجب التعرف عليه نظرا لخطورتة الشديدة .

**الساق :**مستقيمة وذو تضليع من أربعة أوجه وخشنة مشعرة .
**الأوراق :**متقابلة والأوراق العليا جالسة والسفلى مستدقة الطرف ذو سويقة قصيرة "معنقة " وكل الأوراق رمحية الشكل خشنة ومشعرة .
**النورة :**سنبلة طويلة من أزهار جالسة فى أزواج .
**الأزهار :**طويلة لونها قرنفلى تميل الى الزرقة وذو شفتين .

**التويج :**من أنبوبة بها انحناء من الوسط وأطول كثيرا من انبوبة الكأس.
**الطلع:** 4 أسدية.
**الثمرة :**كبسولة من عديد من البذور الدقيقة .

If the user selects level 5, it will show the integrated control of the parasitic weeds in Egypt (picture 17).

**I - <u>Controlling of *Orobanche spp*</u> :-**

**<u>In *Vicia faba* (faba bean) crop</u>:**

**<u>Crop rotation</u> :**
Avoid the sowing in heavy infested fields.
Sowing after rice as flooded crop in summer.

**<u>Planting date</u>:**
Sowing is delayed from about middle of October to late November or early December.

**<u>Chemical method</u>:**
Application of glyphosate herbicide by 64.3 gm/ha in two to three sequences time with three weeks intervals after the beginning of flowering.

**<u>Hand – pulling</u>:**
Hand pulling the flowering stalks (spikes) above ground the soil at early emergence and before seeding stage or maturity. This method can only be recommended for low Orobanche infestations to prevent further increases of the parasite populations.

**<u>Biological control</u>:**
The use of *Phytomyza orobanchise* insect to destroy the ovaries inside the capsules of the spike.

**مكافحة الهالوك**
**أولا - : فى محصول الفول البلدى .**

1- استخدام الدورة الزراعية :
– منع الزراعة فى الحقول الموبوءة بكثافة شديدة .
– زراعة الفول بعد أرز فى العروة الصيفى .
**2 – ميعاد الزراعة -:**

**ينصح بتأخير ميعاد الزراعة الى النصف الثانى من شهر نوفمبر أو أوائل ديسمبر وذلك فى الأراضى الموبوءة بالهالوك .**

**3 – المكافحة الكيماوية -:**

- يستخدم مبيد الجليفوسيت "الراوند آب 48 " %من 2-3 مرات .
- الرشة الأولى تبدأ من بداية التزهير إلى أسبوعين منه بمعدل 75 سم3 للفدان والرشة الثانية بعد 21 يوم بنفس المعدل 75سم3 /ف .
- فى حالة الإصابة الشديدة تتم الرشة الثالثة بعد 21 يوم من الرشة الثانية بنفس المعدل السابق .

ويلاحظ أن حجم الماء اللازم لرش فدان يبلغ من 150 – 200 لتر /ف .

**4 – النقاوة اليدوية -:**

تستخدم فى تقليع الشماريخ الزهرية التى تظهر فوق سطح التربة ومبكرا قبل نضج البذور وخاصة فى الحقول ذات الإصابة الخفيفة .

**5 – المقاومة الحيوية -:**

استخدام حشرة فيتومايزا أوروبانيكيا التى تتغذى على مبايض الأزهار داخل كبسولات الهالوك وقبل نضج البذور .

***ƐGǤl Žt- Ùšü***

**1- التعقيم الشمسى -:**

- استخدام أغطية البلاستيك الشفافة من 4-8 أسابيع خلال اشهر الصيف وقبل زراعة العروة الشتوية للطماطم .
- استخدام معقمات التربة مثل حقن التربة بمبيد بروميد الميثيل أو الدازوميت مع ملاحظة أن تلك الطريقة تتم فى حدود ضيقة داخل الصوب المحكمة لشدة سمية هذه المبيدات أثناء التطبيق .

**2- الدورة الزراعية -:**

- منع زراعة الطماطم فى الأراضى الموبوءة بشدة .
- منع زراعة الطماطم فى العروة الشتوية فى الأراضى ذات الإصابة الخفيفة .

**3- النقاوة اليدوية -:**

يتم تقليع الشماريخ الزهرية مبكرا قبل نضج البذور .

**In *Lycopersicon esculentum* (tomatoes)**

**Soil solarization:**

Using transparent polyethylene sheets for 4 to 8 weeks during the summer season.

**Soil fumigants/sterilants:**

Using the soil fumigants such as methyl bromide and Dazomet.

Generally, the use of the above two methods is limited and in some green house.

**Crop rotation:**

Avoid the sowing in heavy infested fields.

Avoid the sowing in winter season.

**<u>Hand – pulling</u>:**
Hand pulling flowering stalks or closely cut aboveground the soil before the earliest spikes had seed mature. It use in low Orobanche infestation rate.
**<u>II Controlling of Cuscuta spp.</u>**

**1- <u>Seed cleaning : Sanitation method</u>**
Cleaning crop seeds from dodder seeds is essential part of control methods.

**2- <u>Patches / spot treatments</u>**
Initial patches / spots of dodder must be controlled by any mean (cutting, burning, or non-selective herbicide).

**3- <u>Cultural method</u>**
**<u>Tillage</u> :**

- Tillage at certain intervals will control the seedling of dodder.
- Keeping crops free of weeds especially broad leaf weeds.

**<u>Crop rotation</u> :**
Growing non-susceptible crops for 2 or more years to reduce the reservoir of dodder seeds in the infested soil.

**<u>Pruning</u> :**
Cutting the tree branches closest to the ground with good pruning in the suitable time.

**<u>Mature fertilization</u> :**
A good fermentation of the organic manure before using.

**4- <u>Chemical method</u>**
Glyphosate herbicide can be recommended for dodder control in citrus and alfalfa, it used at 100 ppm for controlling efficiently the dodder in citrus without toxicity.

**مكافحة الحامول**

**1 – نظافة البذور :**
استخدام التقاوى الخالية من بذور الحامول حيث تعتبر هذه الطريقة فعالة جدا فى منع انتشار الحامول .

**2 – معالجة البقع المصابة :**
وذلك إما باستخدام الحش او استخدام مبيدات تعمل بالملامسة وهى غير متخيرة . V

**3- طرق زراعية :**
**- عزيق التربة لأكثر من مرة كلما تظهر الإصابة بالحامول .**
- التخلص من الحشائش المصاحبة للمحصول وخاصة عريضة الأوراق والتى تساعد على انتشار الإصابة .
- الدورة الزراعية :عدم زراعة المحاصيل التى تصاب بشدة بالحامول لمدة سنتين أو اكثر لتقليل مخزون بذرة الحامول فى التربة المصابة مثل البرسيم والكتان .

**4- التقليم :**
قطع أفرع الأشجار القريبة من سطح التربة مع التقليم الجيد فى الوقت المناسب للأشجار .

**5- الأسمدة العضوية :**
استخدام أسمدة عضوية قديمة جيدة التخمر حتى لا تكون مصدرا للإصابة الجديدة .

**6- المقاومة الكيماوية :**
استخدام مبيد الجليفوسيت "راوند آب 48 " %فى أشجار الموالح والبرسيم الحجازى بمعدل 100 جزء فى المليون /اللتر لمكافحة الحامول بكفاءة وبدون حدوث ضرر أو ما يوازى 2جرام مادة تجارية /لتر ماء .

**III – <u>Controlling of *Striga* spp. </u>:**
**<u>cultural means</u>**
**<u>Hand – pulling </u>:**

Hand pulling the seedlings at early emergence and before flowering stage in low Striga infestation area.

**2- <u>Crop rotation </u>:**
Using non-host crops for several years in heavy Striga infestation area.

**1-2 <u>Spot applications </u>:**
Initial spots of Striga should be controlled by non-selective herbicides.

**مكافحة العدار**

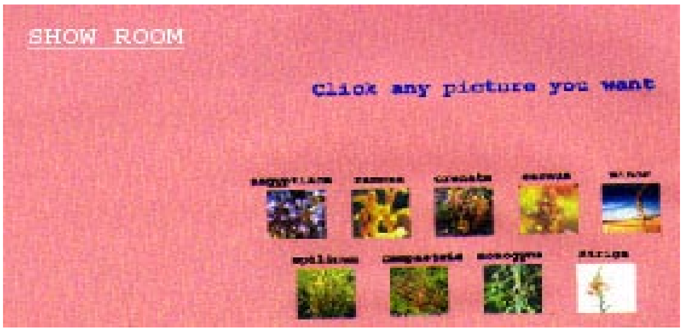
**1 – الطرق الزراعية -:**
باستخدام النقاوة البدوية يتم تقليع بادرات العدار فى بداية ظهوره فوق سطح التربة وقبل مرحلة الأزهار وخاصة فى الحقول ذات الإصابة الخفيفة .
**2- الدورة الزراعية -:**

يحسن عدم زراعة المحاصيل الحساسة للإصابة لعدة سنوات فى الأراضى الموبوءة مثل الذرة والقصب .

**3 – معاملة البقع كيماويا :-**

معالجة بقع الإصابة بميدات الحشائش الملامسة وهى غير متخيرة .

If the user select level 6, the system will show small icons for all species (picture 18).




## Hardware and Software requirements

The parasite weeds identification system requires minimum 8 Mb of RAM. Approximately 2 to 3 Mb of hard disk space is required. Each picture occupies about 20 Kb to 30 Kb hard disk space. The program is fully portable and is compatible with IBM and windows95 operating system. A colour monitor is recommended. To customize the system for specific weed population, both a scanner and digital camera are required to put the appropriate weed pictures into an electric format.

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**Schulthess, U., Schroeder, K., Kamel, A., Abd-El Ghani, A.M., Hassanein, E.E., Abd-Elhady, Sh., Abd-El Shafi, Ritehie, J. T., Ward, R.W., and Sticklen, J., (1966).** Neper – Weed: A Picture – Based Expert System for Weed Identification. Agronomy Journal, 88 (3) pages 365 – 506.

**Täckholm, V., (1974).** Students Flora of Egypt 2nd ed. Cairo., Cairo University.

**Zahran, M.K., Ibrahim, others, (1973).** Control of broomrape and Vegetable Crops in Egypt. Final Tech. Rept., Agric. Res. Prog., Public Law 480, Grant No. FG – EC. – 109 Project No. F4 – CR – 4, pp. 40.

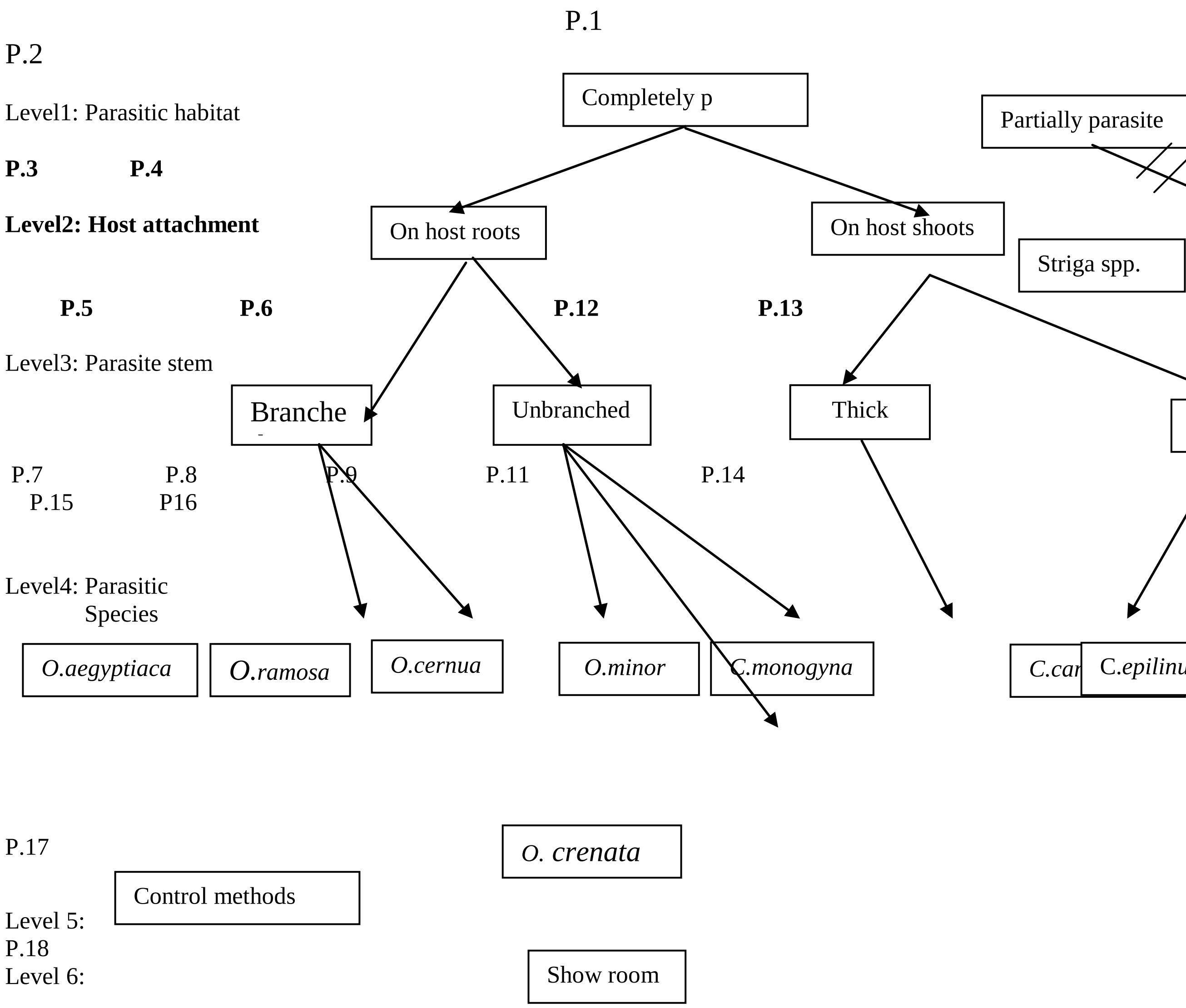



**Fig (1): Hierarchal classification tree of parasitic weeds according to Tackholm (1974)**

# Appendixes

## Publications

## Key publication reports, training and extension materials 1992/2000 period.

## Research papers

## A- 20 selected research paper were published through this period:

**Al- Marsafy H.T., and E.E. Hassanein (1997)**. Effect of crop rotation on the control of wild oat and other weeds in winter crops in upper Egypt. Six Arab Congress of plants Prants Protection, October 27-31, Beirut, Lebanon No. 3 p 403.

**Al-Marsafy, H.T., A.S., Kholousy, and A.N.M., Nassar (2000).** Effect of weed/wheat competition in wheat fields. X1$^{th}$ International Conference on Weed Biology, Dijon, France.

**Ghonima. A.N., E.E. Hassanein and El-Shater (1999).** An economic study on the impact of wild oat control in wheat production and returns in Egypt through 1992/93 – 1997/98 J. Agric. Sci. Mansura Univ., 24 (1) 205- 224

**Hassanein, E.E., Kholosy A.S., H.M. Ibrahim and L.A. El-Meshad (1995)**. Weed control in barley J. Agric Sci., Mansura Unive. 20 (6) : 2639 - .2647 .

**Hassanein, E.E., Elian, Salim, K.G., Abo El-Enin, R.A. (1996)**. Orobanche crenata, Forsk survey and control in faba bean (Vicia faba L.) and peas (Pisum sativa L.). Six Int. parasitic weed symp. Cordoba Spain April 16-18, (poster).

**Hassanein E.E., Kholosy, A.S. Abd All, M.M.S and Ibrahim H.M. (1996).** Effect of temperature degrees on seed germination and seedling vigour of different wild oat species Annals of Agric. Sci. Moshtohory 34 (4): 1373 – 1380.

**Hassanein, E.E. Al-Marsafy, A.S. Kholosy, R.A. Abo El-Enin (1997).** The estimation of the degrees of wheat seed contamination by Avena spp and other weed seeds. Sixth Arab Congress of plant Protection October 27-31, Beirut, Lebanon Abstract book No. p 402.

**Hassanein, E.E. Al-Marsafy, A.S. Kholosy and H.M., Ibrahim (1997)**. Variation in faba bean cultivars to Orobanche infection as measured by different reaction seeds. Annual Agric. Sci, Ain Shams Univ., 43 (1) 189-200.

**Hassanein, E.E., Salim, A.A., (1997).** Country paper about Orobanche and its control in Egypt in : J. Kroschel, M. Abd Abihi, Betz H. (eds), Advances in parasitic weed control Orobanche in the WANA Region. Nargraf Verlag Weikersheim, 27-35 (Book).

**Hassanein E.E. (1998).** Harvesting wheat not wild oats. ICARDA CARAVAN Issue No. 9 Summer/Autumn pp. 17-18.

**Hassanein, E.E., H.T. Al-Marsafy, H.R El-Wekil, Z.R. Yehia, S.E. El-Khanagry and A.A. Mahmoud (1998)**. Weed survey in Upper Egypt. 6 EWRS Mediterranean Symposium Montpellier France pp. 247-248.

**Hassanein, E.E. Ibrahim, H.M., Nael, M.F. and Abo El-Enin, R.A. (1998).** Estimation of number of cxhromosomes in Orobanche Spp. In Egypt. Annals of 4th Intern.l Workshop on Orobanche Research, 23-26 September, Albena, Bulgaria.

**Hassanein, E.E., Y.H. Fayed; F.F. Shalaby and A.S. Kholosy, (1998).** Natural role of phytomyza Orobanche Kalt ; A beneficial fly against the parasitic weeds Orobanche spp. infesting legumes and carrot in Egypt. Annual Agric Sai. Ain Shams Univ., 43 (1), 201-206.

**Hassanein, E.E., H.T., Al-Marsafy, M.M., Ibrahim and S.M., Sheble (1999).** The use of weed density to predict loss in wheat yield due to weed competition Bankok 17th Asian pacific weed science soc.

**Hassanin, E.E, H.M., Ibrahim, A.S. Kolosy, H.T. AL-Marsafy and R.A. Abo El-enin (1999).** Manuals of weed identification in wheat and their control mrthods. Weed Control Research Section, FCRI, ARC, in cooperation with European Union/ ICARDA pp. 1-144, Cairo, Egypt.

**Hassanein, E.E., G.R., Mekhail, H.M., Ibrahim, M.K., Zahran (1999).** Effect of crop rotation on the control of wild oat and other weeds in wheat in middle Egypt 17th Asian – pacific weed science. Conf. Bankok 668-673.

**Ibrahim H.M., A.S., Kholosy, M.K., Zahran and E.E., Hassanein, (1995)**. Study of wild oat (*Avena fatua*) competition wheat (*Triticum pp.*) Annals Agric. Sci., Ain Shams Univ., Cairo., 4092. 683 – 696.

**Kholousy, A.S., H.T., Al-Marsafy, A.N.M., Nassar and H.M., Ibrahim (2000).** Estimation the degree of wheat seed contamination by weeds seed. X1th International Conference on Weed Biology., Dijon, France.

**Salem, K.G., E.E., Hassanein and M.M. Abd El-Hamed (1997).** Broomrape control in peas (*Pisum satinvm* L.) Egypt. J. Appl, 12.7, 249 – 256.

Conferences

First Near East Conference on improved weed management., Cairo February5-8, 2000. 55 scientific papers included wild oat control activities was organized by Weed Control Research Section ARC, Near East working group for improved weed management and Arab organization for Agricultural development; which partially funded by wild oat project.

3rd International Crop Science Congress. August 17-22, 2000 by European Society of Agronomy, Hamburg, Germany, wheat 2 papers presented. The first paper was: estimation yield losses due to grassy weeds in wheat and second paper was: the beneficial natural of *Phytomyza Orobanchia* as biological agent for *Orobanche* control in faba bean fields.

X1eme Collogue International sur Biiologie des Mauvaises Herbes, Dijion. September, 6-8, 2000. 2 papers presented. The first paper: Estimation the degree of wheat seed contamination by weeds seed. The second paper: Effect of weed / wheat competition in wheat fields.

## C- Extension bulletins (In Arabic)

17 extension bulletins and posters through 1992-2000 periods in cooperation with extension administration were published and distributed to extension agents and farmers.

**Hassanein. E.E. (1993)** Wild oat control leaflet No. 169 (5000 copy).
Poster about wild control 1994.
Poster about wild oat control 1995.
**Hassanein, E.E. (1994).** Wild oat control leaflet No. 212.
**Hassanein, E.E.(1995).**Wild oat control leaflet No. 254(5000 copy).
**Hassanein, E.E. (1995).** Parasitic weed control bulletin No.258 pp 1-6 (5000 copy).
**Hassanein, E.E. (1995).** Parasitic weed control bulletin No.352 pp 1-8 (5000 copy).
**Hassanein, E.E. (1996).** Parasitic weed control bulletin No.299 pp 1-8, (5000 copy).
**Hassanein. E.E. (1996)**. Identification and control of wild oats in wheat bulletin No. 296, pp 1-20. (5000 copy).
**Hassanein. E.E. (1997).** wild oat Bulletin No. 342, pp 1-20 (5000 copy).

Poster about Orobanche control 1997.

**Hassanein E.E., H.T. Al-Marsafy, A.S. Kholosy (1998).** Integrated weed management in Egypt. Bulletin No. 443. pp 1-48 (5000 copy).

**Hassanein E.E.(1998).** Parasitic weeds and control methods. Bulletin No. 427. pp 112.

**Hassanein E.E.(1998).** Identification and control od wild oats in wheat. Bulletin no 419. pp. 1-20.

**Hassanein E.E. (1999).** Wild oats control in wheat extension bulletin No. (10000 copy).

**Hassanein E.E. (2000).** Wild oats control in old and new land Bulletin No. 635 (5000 copies).

**Hassanein E.E. (2002).** Wild oats control in old and new land Extension bulletin No. 760 (Appendix A).

## D- Books and articles related to wild oats program activities

**Hassanein E.E; Ibrahim, H.M., Kholosy. A.S; Al-Marsafy H.T. and Abo Elenin R.A. (2000)**. Manuals of weed identification in wheat and their control mrhtods. Weed Control Reseaech Section, FCRL. ARC, in cooperation with European Union ICARDA. 2nd edition Cairo, Egypt, (2000 copies).

**Hassanein E.E. (1998).** Harvesting wheat not wild oats. ICARDA / CARAVAN Issue No. 9 Summer / Autmn pp. 17-18.

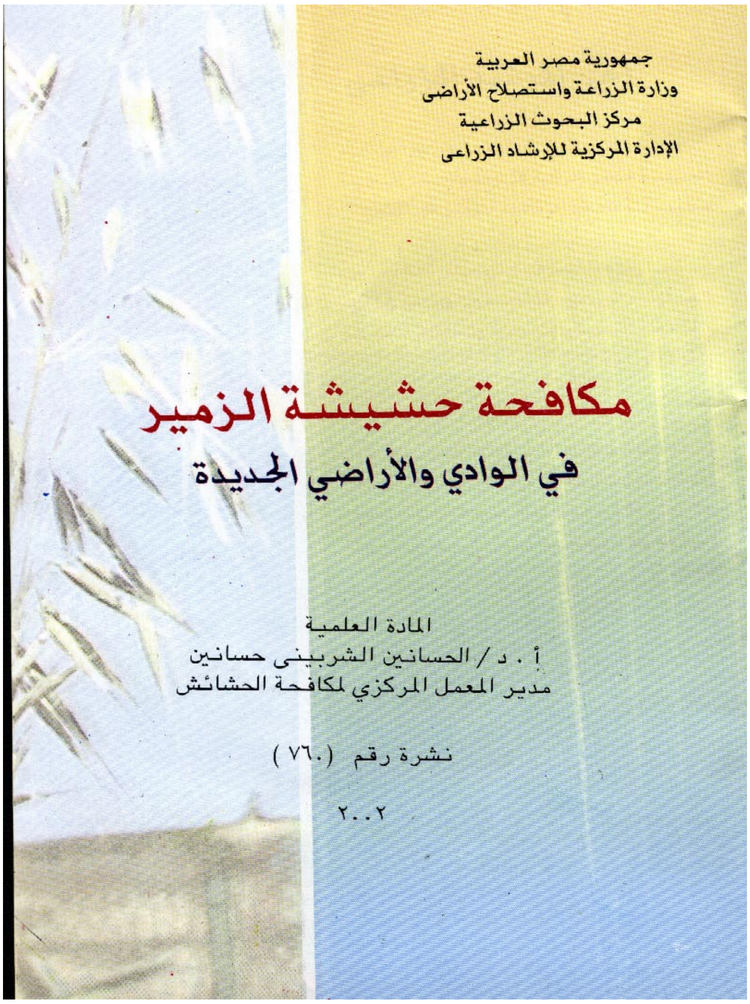
**Zahran M. (1998).** Broomrape “Orobanche spp.” Revised by E.E. Hassanein, Ministry of Agriculture, Egypt “ in Arabic”.

## E- Expert systems

**Schulthess, U., Schroeder, K., Kamel, Abd El-Ghani, A.M. Hassanien E.E. Shaban, A. Ghani, A.M.; El-Shafi, A.A., Richie, J., Ward, R., Stcklen, J. (1996)**. NEPER-Weed: a picture based expert system for weed identification, Agronomy, J. 88 (3), 427. (Appendix B).

**Ibrahim, H.M., Hassanein, E.E., Kholosy , A.S. and Al-Marsafy, H.T. (1998).** ES-Parasitic Weeds: A Computerized Expert System for parasitic Weed Identification and Management with special reference to Orobanche. Annals of Fourth International Workshop on Orobanshe Research, 23-26 September, Albena, Bulgaria. (Appendix D).


جمهورية مصر العربية
وزارة الزراعة واستصلاح الأراضي
مركز البحوث الزراعية
الإدارة المركزية للإرشاد الزراعي
مكافحة حشيشة الزمير
فى
الوادى والاراضي الجديدة
نشرة رقم : ٧٦٠
لسنة ٢٠٠٢
المادة العلمية
مركز البحوث الزراعية

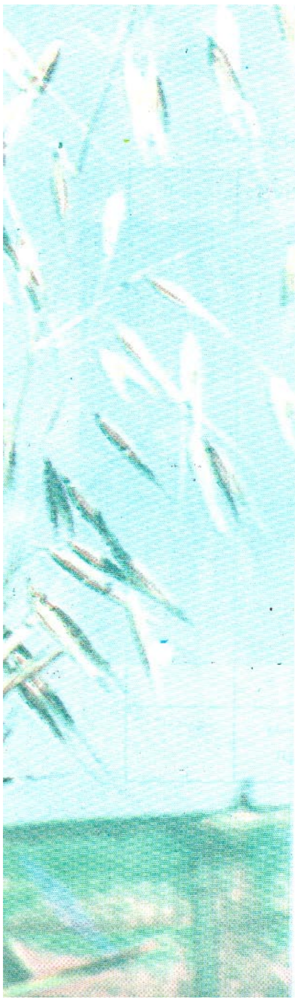

جمهورية مصر العربية
وزارة الزراعة واستصلاح الأراضى
مركز البحوث الزراعية
الإدارة المركزية للإرشاد الزراعى

# مكافحة حشيشة الزمير
## في الوادي والأراضي الجديدة

المادة العلمية
أ . د / الحسانين الشربينى حسانين
مدير المعمل المركزي لمكافحة الحشائش

نشرة رقم (٧٦٠)

٢٠٠٢



# أخى المرشد الزراعى

يعتبر التعرف على الزمير فى مراحل نموه المختلفة حجر الزاوية فى رسم استراتيجية سليمة للمكافحة المتكاملة للزمير فى القمح •

كما يلزم التعرف على مدى التكامل بين العمليات الزراعية المختلفة من دورات زراعية والمكافحة اليدوية والكيماوية والتقاوى النظيفة وطرق الزراعة •

لذا يسر الإدارة المركزية للإرشاد الزراعى أن تقدم هذه العجالة التى تضم الأسس العامة للمكافحة المتكاملة للزمير فى القمح في الوادي والأراضي الجديدة محتوية على خلاصة ماتوصل إليه قسم بحوث مقاومة الحشائش في هذا المجال •

## أولاً : التعرف على أنواع الزمير المنتشرة فى مصر

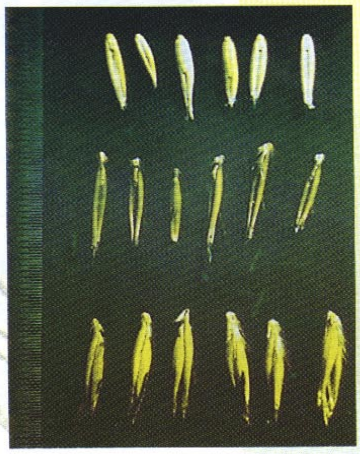
التمييز بين أنواع الزمير .Avena spp

| الصفة | A.sativa | A.sterilis | A.fatua |
|---|---|---|---|
| عدد الحبوب | ١-٢ ( غالبا ٢ ) | ٢ | ٢-٣ |
| السفا | ١-٢( السفلى أطول من العليا ) | ٢ | ٢-٣ |
| التساقط | لاتتساقط | تتساقط فى أزواج | تتساقط منفردة ( واحدة تلو الأخرى ) |
| الزغب على أغلفة الحبة | لايوجد (عارية ) | يوجد | يوجد |
| لون الحبوب | كريمى | كريمى إلى بنى داكن | كريمى إلى بنى داكن إلى الأسود |
| النضج | بعد نضج القمح | يسبق نضج القمح | يسبق نضج القمح |

٤

## تمييز حبوب وسنيبلات وداليات أنواع الزمير المختلفة

### ١ - الحبوب



A.sativa

لاتتساقط حبوبه ( تظل السنيبلات على حامل السنبلة )

A.fatua

تتساقط الحبوب ( حبة تلو الأخرى )

A.sterilis

تتساقط الحبوب فى أزواج

٥

## ٢- مرحلة البادرة

يمكن التعرف على بادرة النجيليات عن طريق بقايا الحبة الملتصقة بين الريشة والجذير بعد الإنبات عند إخراجها من التربة بحرص ٠

بادرات القمح والشعير والزمير

بادرة زمير　　بادرة شعير　　بادرة قمح

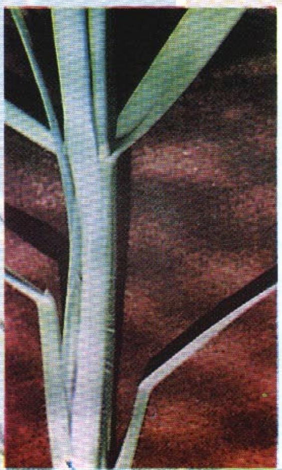
يلاحظ أن بادرات الزمير فى مراحل نموها الأولى
توجد بقايا الحبة عليها وأن نموها أقل قوة من بادرات القمح والشعير

## ٣- مرحلة النمو الخضرى

### التمييز بين نباتات القمح والزمير فى مراحل النمو الخضرى

قمح – زمير

فى نهاية نصل ورقة القمح يوجد لسين غشائى شفاف صغير مع أذينتين تلتفان حول قاعدة النصل أما فى نهاية نصل ورقة الزمير يوجد لسين غشائى شفاف طويل وبدون أذينات ٠



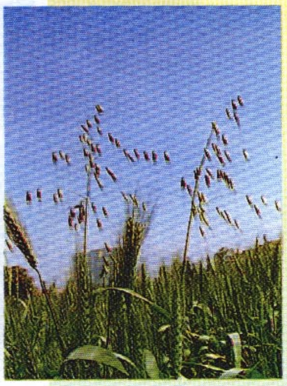
زمير

عند قاعدة نصل الورقة مع وجود شعيرات حول قاعدة النصل والغمد ٠

## ٤ - مرحلة طرد سنابل القمح وداليات الزمير

بداية طرد الداليات فى الزمير والسنابل فى القمح وفيها يمكن تمييز الزمير بسهولة عن القمح ·

( وعند بداية هذه المرحلة يجب الانتهاء من النقاوة اليدوية )



يظهر الزمير أعلى من نباتات القمح بعد طور طرد دالياته ، ويؤدى بقائها إلى انتشار حبوبها فى التربة أو تواجدها مع حبوب القمح لتكون مصدر عدوى فى السنوات القادمة ٠

## ٥- مرحلة النضج

نوع A.sativa

داليات توضح عدم سقوط السنيبلات وحبوبها من على حامل السنبلة ( توجد بالسنيبلة ٢ سفا تختلفان فى الطول )٠

نوع A.sterilis

داليات توضح شكل السنيبلات ( بداخل السنيبلة ٢ سفا متساويتان فى الطول ترمز لتواجد الحبوب فى أزواج )٠

نوع A.fatua

داليات توضح شكل السنيبلات ( بداخل السنيبلة ٢-٣ سفا تبعاً لعدد الحبوب داخلها وفيها تتساقط الحبوب منفردة ومن أعلى حامل السنبلة إلى أسفل )٠

١٠

١١

## ثانياً : المكافحة المتكاملة للزمير فى القمح

يبين الرسم التخطيطى بشكل (٤) ضرورة التكامل بين العمليات الزراعية المختلفة فى مكافحة الزمير فى القمح :

تأثير الدورات الزراعية على مكافحة الزمير فى القمح

يؤدى تكرار زراعة القمح عاما بعد اخر فى نفس الأرض إلى زيادة انتشار الزمير والذى ينافس القمح بشدة وتدهور إنتاجيته بدرجة كبيرة حيث إن وجود عدد ٢٢٧ دالية زمير فى المتر المربع يقلل إنتاجية القمح بمقدار ٩٣٪ وأن أنسب الدورات الزراعية هي التى يتخللها برسيم بالتبادل مع القمح كما فى جدول (١)٠

الجدول رقم (١)

تأثير الدورات الزراعية على مكافحة الزمير فى القمح عام ١٩٩٥

| التعاقب المحصولى | | | | عدد داليات الزمير /م٢ | محصول القمح طن / فدان |
|---|---|---|---|---|---|
| ٩٢/٩١ | ٩٣/٩٢ | ٩٤/٩٣ | ٩٥/٩٤ | | |
| القمح | القمح | القمح | القمح | ٢٢٧ | ,١٣ |
| برسيم | برسيم | برسيم | القمح | ١٤,١ | ١,٩٠ |
| برسيم | القمح | برسيم | القمح | ٣٣,٢ | ١,٦٣٤ |
| فول | برسيم | القمح | القمح | ١٢٩,٥ | ,٤٩٥ |

الجدول رقم ( ٢ )

تأثير الدورة الزراعية علي مكافحة الزمير في القمح بالأراضي الجديدة ١٩٩٩

| التعاقب المحصولى | | طرق المكافحة | وزن الزمير جم /م٢ | ٪ الخفض | القمح المحصول طن/ فدان | عدد حبوب الزمير/كجم قمح |
|---|---|---|---|---|---|---|
| ٧٩/٨٩ | ٩٨/٩٩ | | | | | |
| القمح | القمح | بدون المكافحة | ٣٧٥٥ | صفر | ,١٥٢ | ٧١٨ |
| برسيم | القمح | بدون المكافحة | ١٠٦٢ | ٧٢ | ١,٠٠١ | ٤٥ |
| القمح | القمح | جراسب لتر / فدان | ٣٦٢ | ٩٠ | ١,٤٢٢ | ٢٤ |
| برسيم | القمح | جراسب لتر / فدان | ١٥٣ | ٩٦ | ٢,١٩٨ | ٩ |
| القمح | القمح | نقاوة يدوية | ٣٠٣٣ | ١٩ | ,٣٤٤ | ٥٨٦ |
| برسيم | القمح | نقاوة يدوية | ٣١٧ | ٩٠ | ١,٢٩٥ | ٣٥ |

يتضح من جدول ( ٢ ) أنه في الأراضي الجديدة لا بد من اتباع أسلوب المكافحة المتكاملة للزمير في القمح باستخدام دورة زراعية يتخللها البرسيم كمحصول سابق متبوعاً بنقاوة يدوية أو مكافحة كيماوية للحصول علي أعلي محصول وأقل درجة تلوث للتقاوي بتقاوي الزمير ٠

## تأثير الدورات الزراعية علي محتوي التربة من حبوب الزمير

يبين جدول (٣) أن تكرار زراعة القمح فى نفس الأرض عاماً بعد آخر يؤدي إلى تلوث التربة ببذور الزمير بمقدار ٢٢,٩ حبة / ٥٠٠ جرام تربة فى الطبقة السطحية من التربة وتزيد عند الحصاد نتيجة تساقط حبوب الزمير فى التربة قبل حصاد القمح لتصل إلى ٩٨,٣ فى التربة ، كما يؤدى إتباع دورة

زراعية تحتوى على برسيم بالتبادل مع قمح إلى تقليل أعداد الزمير بالتربة بمقدار ٩٨,٧٪ وأن إعادة زراعة القمح تؤدى إلى تجدد تلوث التربة بالزمير مما يؤكد أهمية نقاوة الزمير المتخلف قبل تساقط التقاوى بالتربة حتى لاتتجدد الإصابة واستخدام تقاوى نظيفة خالية تماماً من الزمير ٠

جدول (٣)

تأثير الدورات الزراعية على عدد حبوب الزمير بالتربة عام ١٩٩٥

(Seed bank)

| التعاقب المحصولى | | | | عدد حبوب الزمير / ٥٠٠ جرام تربة | | |
|---|---|---|---|---|---|---|
| ٩٢/٩١ | ٩٣/٩٢ | ٩٤/٩٣ | ٩٥/٩٤ | عند الزراعة | عند الحصاد | الفروق |
| القمح | القمح | القمح | القمح | ٢٢,٩ | ٩٨,٣ | ٧٥,٣ |
| برسيم | برسيم | برسيم | القمح | ,٣ | ١١,٠ | ١٠,٧ |
| برسيم | القمح | برسيم | القمح | ,٨ | ٨,٤ | ٧,٦ |
| فول | برسيم | القمح | القمح | ١,٨ | ٦٠,٠ | ٥٨,٢ |

اختيار التقاوى النظيفة من الزمير :

من الضرورى اختيار تقاوى نظيفة خالية تماما من الزمير حتى لاتكون وسيلة إلى نقله إلى مناطق جديدة خالية منه فتسبب انتشاره بها ويفضل تنقية حبوب الزمير من تقاوي القمح أياً كان مصدرها وحرقها ٠

طريقة الزراعة

تلعب الزراعة الحراتى دوراً فى تقليل انتشار الزمير عن طريق إنباته وحرثه قبل الزراعة ، كما تفيد الزراعة بالتسطير فى سهولة عملية المكافحة

## مواعيد النقاوة اليدوية

يبين جدول (٤) أفضل وقت للنقاوة اليدوية للزمير فى القمح وإنه يلزم إجراء النقاوة اليدوية مرتين فى الفترة مابين ٣٠-٦٠ يوماً بعد الزراعة للحصول على أعلى محصول ممكن .

جدول (٤)
تأثير مواعيد وعدد مرات النقاوة اليدوية للزمير

| النقاوة اليدوية بعد زراعة القمح ( بالأيام ) | وزن الزمير (جم غض / م٢) | محصول القمح ( طن / فدان ) |
|---|---|---|
| ٣٠ | ٣٨٥ | ١,٩٧ |
| ٤٥ | ٢٥٢ | ١,٧٥ |
| ٦٠ | ٥٣٩ | ١,٦٧ |
| ٣٠ ، ٤٥ * | ١٤٦ | ٢,٢٥ |
| ٤٥ ، ٦٠ * | ١٣٥ | ٢,٠٤ |
| ٣٠ ، ٦٠ | ٢٩٦ | ١,٨١ |
| بدون معاملة | ٦٠٢ | ١,٠٣ |

* النقاوة مرتين بعد ٣٠ ، ٤٥ يوماً وكذلك بعد ٤٥ ، ٦٠ يوماً من زراعة القمح أعطت أقل وزن للزمير وأعلى محصول من القمح .

## المكافحة الكيماوية

تفيد هذه الطريقة فى الأراضى الموبوءة وذلك بفحص حقول القمح بعد شهر من الزراعة فإذا وجدت إصابة شديدة بالزمير يستخدم مبيد الجراسب ١٠٪ بمعدل واحد لتر للفدان رشا على النباتات والزمير أو السافيكس ٢٠٪ بمعدل ١,٢٥ لتر للفدان فى الأراضى التى بها زمير فقط أو توبيك ١٥٪ WP بمعدل ١٤٠جرام للفدان رشاً مع ٢٠٠ لتر ماء للفدان وذلك خلال شهر بعد رية المحاياة أو بوما سوبر ٧,٥ ٪ EWبمعدل ٥٠٠ سم٣ للفدان رشاً في طور ٤ أوراق للقمح أو أسيرت ٢٥٪ EC بمعدل ٨٥٠سم٣ للفدان رشاً بعد ٣٠ -٣٥ يوماً من الزراعة حيث يتم الرش بالرشاشات الظهرية مع ٢٠٠ لتر ماء للفدان .

## متابعة المناطق الخالية من الإصابة

- تلاحظ حقول القمح باستمرار وتقلع أى نباتات زمير تظهر حتى لاتلقى بتقاويها فى التربة وتكون مصدر عدوى ٠

## متابعة حواف الحقول والمراوي والمصارف

- مراعاة تنظيفها باستمرار للتأكد من خلوها من الزمير ٠
- نقاوة مخلفات الزمير بعد المعالجة الكيماوية بشهر ٠

## المكافحة المتكاملة للزمير

ويتم ذلك باتباع الطرق الزراعية واليدوية والكيماوية طبقاً للأساليب الموضحة بالشكل التالى

| | |
|---|---|
| اتباع الدورة الزراعية المناسبة | أفضل الدورات الزراعية فى تقليل انتشار الزمير تتم بزراعة القمح مسبوقاً فى الموسم الشتوى السابق بمحصول البرسيم خصوصاً فى الأراضى الموبوءة• |
| اختيار التقاوى النظيفة من الزمير | اختيار التقاوى المنتقاة الخالية من بذور الزمير يمنع انتشاره فى المناطق غير الموبوءة• |
| طريقة الزراعة المناسبة | يفضل الزراعة عفير تسطير لسهولة النقاوة اليدوية بين السطور أو الزراعة الحراتى بإعطاء رية كدابة ثم حرث الأرض بعد إنبات الحشائش والتخلص منها قبل الزراعة• |
| النقاوة اليدوية فى التوقيت المناسب | يعتبر أفضل وقت بعد شهر من الزراعة إلى شهرين قبل بداية طرد داليات الزمير والسنابل فى القمح• |
| المكافحة الكيماوية | تتم فى الأرض الموبوءة بالزمير بعد الفحص بحوالى شهر من زراعة القمح باستخدام مبيد جراسب ١٠٪ بمعدل واحد لتر للفدان بعد ٤٠–٤٥ يوماً من الزراعة أو فى طور ٤–٥ أوراق وذلك فى وجود الزمير والحشائش النجيلية الأخرى، استخدام السافيكس ٢٠٪ بمعدل ١,٢٥ لتر للفدان فى الأراضى التى بها زمير فقط فى طور ٥–٧ أوراق ويلاحظ وجود رطوبة مناسبة للتربة أثناء الرش مع ١٥٠–٢٠٠ لتر ماء / فدان أو توبيك ١٥٪ WP بمعدل ١٤٠ جم للفدان رشاً خلال شهر بعد رية المحاياة أو بوما سوبر ٧,٥٪ E.W بمعدل ٥٠٠ سم٣ للفدان رشاً في طور ٢–٤ أوراق للقمح، أو أسيرت ٢٥٪ EC بمعدل ٨٥٠ سم٣ للفدان رشاً بعد ٣٠–٣٥ يوماً من الزراعة• |
| نقاوة مخلفات الزمير | تتم نقاوة مخلفات الزمير بعد المعالجة الكيماوية بشهر وكذا الزمير الموجود على حواف الحقول والمراوى والمصارف• |

شكل (٥) رسم تخطيطى يبين الأساليب المختلفة للمكافحة المتكاملة للزمير فى القمح والذى باتباعه يمكن الوصول إلى نجاح مكافحة الزمير مع إعطاء أعلى إنتاجية من القمح

# المكافحة المتكاملة للزمير في القمح

اتبع منظومة المكافحة المتكاملة لحشيشة الزمير في القمح يسلم محصولك .

١ – اتباع الدورة الزراعية المناسبة بتبادل زراعة البرسيم مع القمح.
٢ – اختيار التقاوي النظيفة الخالية من الزمير.
٣ – الزراعة عفير تسطير لسهولة النقاوة من السطور ، أو الزراعة الحراتي بإعطاء رية كدابة ثم حرث الأرض بعد إنبات الحشائش والتخلص منها قبل الزراعة.
٤ – النقاوة اليدوية في التوقيت المناسب.
٥ – المكافحة الكيماوية طبقاً لتوصيات وزارة الزراعة .
٦ – نقاوة مخلفات الزمير بعد المكافحة اليدوية .

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