# INTEGRATED CONTROL MANAGEMENT OF FABA BEAN ROOT- ROT DISEASE IN FAYOUM



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# APPROVAL SHEET

## " INTEGRATED CONTROL MANAGEMENT OF FABA BEAN ROOT- ROT DISEASE IN FAYOUM"

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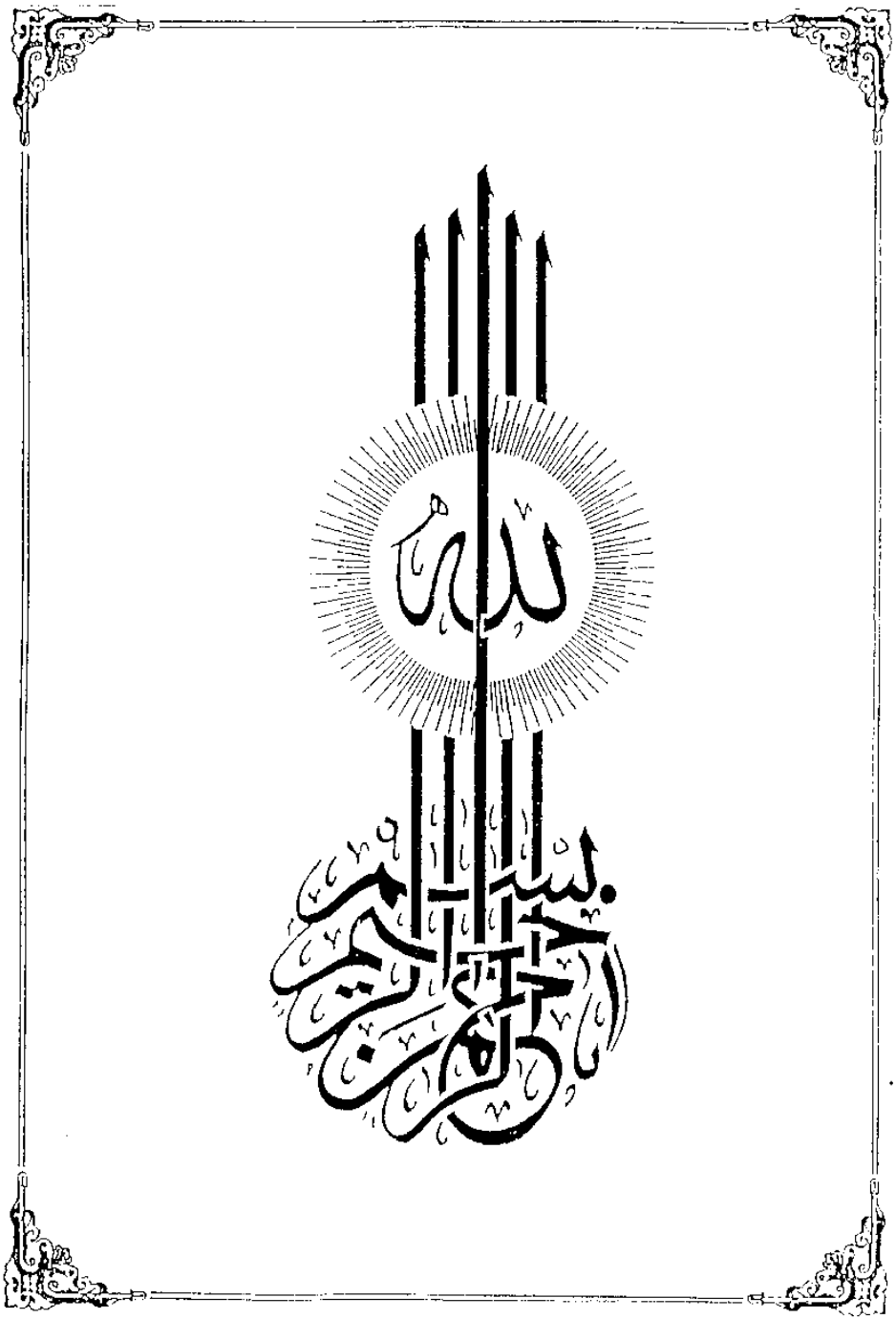

# ABSTRACT

Experimental results proved that root rot disease of faba bean is a disease complex caused by *Rhizoctonia solani, Fusarium solani*, and *Sclerotium bataticola* which were isolated from diseased roots of faba bean plants. The maximum fungal growth on solid and liquid media obtained in the range of pH 5.7 to 7.5. Fungi optained by Isolation from soil rhizosphere of healthy and diseased faba bean plants were identified as *Aspergillus flavus, A. niger, Cladosporium herbarum, Curvularia lunata, Fusarium oxysporum, F. semitectum, Penicillium* sp., *Trichoderma album, T. lignorum*, and *Verticillium tricorpus*. Antagonistic studies proved that *Trichoderma album, T. lignorum*, and *Bacillus subtilis* were effective against the causal organisms. Interactions between the three causal fungi showed that a combination of *Rhizoctonia solani and Fusarium solani* was greater effective on the percentage of dead plants than individually or other combination treatments. The percentage of dead plants increased when the soil was inoculated by *R. solani* and *S. bataticola* at pH value ranged from 7.29 to 7.47 and 7.13 to 7.47, also pH value ranged from 6.05 to 7.47 in case of *F. solani*. The fresh and dry weight of the inoculated faba bean plants by the three pathogenic fungi were lower in soil pH value ranged from 7.21 to 7.34. The percentage of dead plants was reduced when the soil was inoculated with *T.lignorum* and *T. album* and the seeds were coated with *B.subtilis*. Under field conditions, irrigation every 15 days caused an increase in percentage of dead plants, while every 30 or 45 days, reduced this percentage. However, irrigation every 15 and 30 days increased the average weight of 100 seeds. While 30 days interval increased only the total seed yield. The low plant density of 14 plant/m2, while the weight of 100 seeds were increased by using 14 plant/m2. Total seed yield was increased in treatments of 18 and 22 plant/m2. Crowing faba bean plants after maize and rice reduced the percentage of dead plants, while it increased after tomato and sesame. Growing faba bean after rice, tomato and maize increased the average weight of 100 seeds compared with sesame. Total seed yield decreased by growing faba bean plants after sesame and vice-versa after the other crops. Field soil pH increased the percentage of dead plants when faba bean grown in the range of 7.32 to 7.79, also 100 seed yield decreased in the range of 7.19 to 6.38. At last the integrated control management of faba bean root rot disease under field conditions at Fayoum Governorate planned in an experiment using Giza 3 cv., 1st November sowing date, N50 P200 K50 fertilizer level/feddan and seed treatment with the bioagents; *T. lignorum* and *B. subtilis* in addition to dose 1.5 g Rizolix -T for soil before planting reduced the percentage of dead plants. In general, total phenols were much higher in rotted roots than the healthy ones and total phenol content was slightly higher in the less susceptible faba bean cultivars Giza 402. The activity of oxidative-reductive enzymes i.e. polyphenoloxidase, pyroxidase and ascorbic acid oxidase was higher in the rotted roots than in the healthy ones, and it reached the maximum in roots of Giza 3 and Giza 402 Cultivars.

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# CONTENTS

# INTRODUCTION

# INTRODUCTION

Faba bean (*Vicia faba L.*) is one of the most important field crops in Egypt, and the major food legumes in the world (Singh et al, 1988). It is grown mostly to fulfill food and feed requirements for human and animal consumption. Millions of people in Egypt particularly those in the low and middle income brackets, depend on faba bean as a main staple food for both breakfast and dinner.

According to the records of the Department of Agricultural and Economical Statistics, Ministry of Agriculture, A.R. Egypt the total cultivated area with this crop in Egypt, was 361.000 feddans in which yielded about 3.419.000 Ardab of seeds with an average of 9.41 Ardab/feddan during 1996. These figures were different during 1997 growing season, as the total cultivated area was decreased to 324.000 feddans, produced a total of 2.948.400 Ardab, with the average of 9.10 Ardab/feddan.

Diseases are the major constraints of faba been production in Egypt, as they cause enormous losses in the yield and its quality. The most important diseases attacking this crop in Egypt are chocolate spot, rust, stemphyllium leaf spot, powdery and downy mildews, wilt and root-rot.

The later is the most serious and widely spread disease of different localities in Egypt, it is considered the most destructive disease in many fields of Fayoum Governorate. In the last few years, many farmers in this area hesitated to grow this crop because of the severe attacks of the disease.

In the northern part of the country, as well as in the areas under the overhead irrigation system, high humidity, rain fall and

favorable air temperature are prevailing during the crop growth. These factors are correlated with the disease incidence to the suscptible hosts, since they are favorable for disease spread, infection and disease development, which are widely distributed in the country.

Faba bean growers at Fayoum Governorate always claim that high percentage of their plants die before maturity due to the root-rot diseases. The course of this study was undertaken and carried out in the laboratory, greenhouse and field of Botany Department and experimental station, Faculty at Agriculture of Fayoum, with the following objectives:-

1) Study the effect of pH values on growth of the main pathogenic fungi. Microphlora population of the rhizosphere and plates antagonistic studies were also investigated.
2) Study the effect of single and /or combined root-rot pathogen, soil pH, certain crops preceding faba bean and bioagent of two fungi, i.e. *Trichoderma lignorum, T. album* as well as a bacterial isolate, i.e. *Bacillus subtilis* II on the disease incidence of faba bean root-rot under greenhouse conditions.
3) Study the effect of some culture practices i.e. irrigation intervals, plant density and preceding crops as well as the effect of soil pH on the development of root-rot diseases of faba bean under natural field conditions. In addition, condensing experiment was carried out to combine the factors which could be integrated to control the faba bean root rot disease control.
4) Estimated the biochemical changes in susceptible and moderate resistance faba bean cultivars in both healthy and diseased plants to clarify the resistant of some faba bean cultivars.

# REVIEW OF LITERATURE

# REVIEW OF LITERATURE

Faba bean root rot disease has been increased and recognized as major problem in Fayoum Govarnorate. This disease are considered one of the most important factors which limitng the cultivation and yield of this important crop in many parts of Egypt. The auther (1991) stated that many factores were conducted to study their effects on faba bean root rot disease incidence i.e., different inoculum levels, soil type, planting methods, depth of sowing, varietal susceptibility and fertilizer levels, also effect of sowing dates were studied by Attia et al, (1991) in addition to the effect of seed treatment with various fungicides on the incidence of faba bean root rot, 100 seed weight and seed yield (Barakat et al,1991).

The results obtained from Master course could be summarized as follows :

1- The mean of infection percentage of root rot disease of faba bean in Fayoum Governorate ranged between 30.0 - 67.0% during Februrary and April 1989.

2- *Rhizoctonia solani, Fusarium solani, Sclerotium bataticola* and *Fusarium moniliforme* were the most frequency and virulent pathogenic fungi for faba bean.

3- Percentage of dead plants of faba bean cultivars by each of the forementioned fungi gradually increased with increasing the inoculum level from 2.5 to 7.5%.

4- Sandy soil significantly increased the seedling and root rot disease of faba bean compared with loamy and clay soil.

5- Rizolex - T, Vitavax -300 and Benlate were the most fungistatic chemicals for the main pathogenic fungi.

6- Afir planting method reduced the seedling and root rot diseases of faba bean more than herati planting method.

7- Giza-3 and Giza-402 cvs. were the least affected with seedling and root rot diseases of faba bean and may be considered the most tolerant. While Giza-2 cv. was relatively more sensitive.

8- Nitrogen, phosphorus and potassium application ($N_{50}$ $P_{200}$ $K_{50}$ Kg/feddan) showed the lowest percentage of dead plants compared with the other fretilizer treatments.

## 1- LABORATORY STUDIES :

### 1.1. Effect of pH value on the fungal growth :

West and Stuckey (1931) reported that in pure culture, acidic medium favored the growth of *Sclerotium bataticola* although it was able to develop at pH values ranging from 3 to 9.

El-Arosi (1957) mentioned that *Fusarium solani* gave the best growth at pH between 5.9 - 8.1 .

Ashour and Gamal El-Din (1962) found that the optimum pH value for *Fusarium* growth was 5.1. *Rhizoctonia solani* isolates were differed according to their optimum pH values. These values were generally ranges from 3.8 - 11.4. The most isolates were recorded their optimum on the acidic side.

Attia (1966) found that the optimum levels for the fungal growth of *S. bataticola* ranged between 3.9 - 8.4 on the liquid media.

Aly (1967) found that the optimum pH value for *Rhizoctonia solani* was 6.8 - 8.1. No growth occurred at pH 3.1. *Fusarium solani* gave its best growth at pH values ranged from 5.9 to 8.1.

Abdallah (1969) stated that *Rhizoctonia solani* was found to thrive most at pH 7.1 - 8.1 and the growth decreased as the pH value became acidic.

Farahat (1970) claimed that the optimum pH value for *Rhizoctonia solani* ranged between 6.8 - 7.1 . No growth occurred at pH .3.1.

Abada (1986) found that *Sclerotium rolfsii, Rhizoctonia fragariae* and *S. bataticola* were able to grow *in vitro* at pH values ranged between 5.7- 8.1 . The optimum rate of mycelial growth was obtained at pH 5.7 for the three fungi.

Abdel-Rahim (1988) found that *Rhizoctonia solani* gave the optimum rate of growth on liquid media with pH ranged between 5 - 8, but the best amount of the growth was obtained at pH 6. He also found that *Fusarium* sp.grew on a wide range of acid and alkaline media (pH 3 - 9), while good growth was obtained on the liquid media at pH 6.

## 1.2 . Rhizospheric studies :

### - Population of the rhizospheric microflora :

Kadry et al (1961) found that roots of the host plants encourage the growth of the different microorganisms. The microbial densities of the rhizosphere of leguminous plants are generally found to be very much higher than those of non - leguminous plants. They found that the predominate fungi present in the rhizosphere depend on the species and age of the plants. *Aspergillus*, *Fusarium* and *Rhizopus* are the dominant fungi in the rhizosphere of the leguminous plants. However, *Aspergillus*,

*Fusarium* and *Penicillium* are the dominant fungi in non-leguminous plants.

Lugauskas (1963) reported that *Penicillium*, *Fusarium* ,*Trichoderma*, *Mucor*, *Rizhopus*, *Cladosporium*, *Alternaria*, *Gliocladium* and *Cephalosporium* were predominant in the rhizosphere of clover and lupine.

Aly (1974) mentioned that *Fusarium, Aspergillus, Penicillium, Myrothecium, Alternaria, Helminthosporium, Trichoderma* and *Bacteria* were isolated from lupine rhizosphere. *Cephalosporium* spp. *Trichoderma* sp., *Fusarium* sp. and other fungi were found in the soil under lupine monoculture.

Osman et al (1986) stated that the total numbers of bacteria and fungi in the rizosphere of the healthy lupine plants increased as the plants grew reaching their maximum when the plants were 120-day-old. On the other hand, the total number of bacteria in the rhizosphere of the diseased plants increased by time, till the plants were 60 day-old, then decreased, while the total fungal count showed the opposite pattern. They also found that *Fusarium* sp., *Penicillium* spp., *Aspergillus* spp., *Trichoderma* sp., *Mucor* sp., and *Alternaria* sp. were the most frequently isolated fungi from the rhizosphere of the healthy and diseased lupine plants.

Ziedan (1993) found that the rhizospheric microbial activity increased around the roots of sesame plants infected by wilt pathogen compared with the healthy plants. Actinomycetes count increased around the roots of sesame healthy plants, but total *Fusarium* count decreased and vice-versa was found in the infected plants.