Original Research Article

Effect of Intercropping and Phosphorus Fertilizer Treatments on Incidence of *Rhizoctonia* Root-Rot Disease of Faba Bean

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**Abstract**

In greenhouse and field experiments, conducted in two successive winter seasons 2012/2013 & 2013/2014 the effect of intercropping three cultivars of faba bean (Giza 3 Mohassan & Giza 40 and Sakha 1) with wheat (Sakha 93). As well as the effect of phosphorus fertilizer treatments on incidence of root rot of three cultivars faba bean, as well as yield component three cultivars faba bean, as well as yield component was studied. Application of phosphorus fertilizer (100 and 200 Kg/fed) as superphosphate (15.5 % P₂O₅) before planting caused a reduction in incidence and disease severity on plants of the three cultivars of faba bean in greenhouse and field experiments. In field experiments, were intercropping and phosphorus fertilization at (100 and 200 Kg/fed) respectively, which reduced the root-rot diseases. Intercropping three cultivars of faba bean (Giza 3 Mohassan Giza 40 and Sakha 1) with wheat Sakha 93 and phosphorus fertilizer significantly increased yield characters i.e., plant height, number of branches, number of pods plant, 100 seeds/weight and seed weight ardad/fed.

**Keywords**

Faba bean, Intercropping, phosphorus fertilizer, *Rhizoctonia solani* and root-rot

**Introduction**

Faba bean (*Vicia faba* L.) is used as an important human food in developing countries and as an animal feeds mainly for pigs, horses, poultry and pigeons in industrialized countries. Feeding value of faba bean is high and this legume has been considered a meat extender of substitute due to its high protein content (20-41 %) (Chavan *et al.*, 1989). Root-rot and wilt diseases caused by several soil borne fungal pathogens are wide spread and serious in many crop cultivated in different soil types. Faba bean is subjected to attack by many pathogenic organisms wherever the crop grown. In this respect, root-rot disease is among the most important fungal diseases affecting faba bean production in Egypt. Omer (1986) tested several pathogens, and found that *Rhizoctonia solani* was the most pathogenic in causing root-rot disease. Metwely (2004) found that *Rhizoctonia solani* isolated from Kafr El-sheikh governorate was more virulent than that of Sharkia governorate. Several root-rot and...
wilt pathogens such as *Rhizoctonia solani*, *Fusarium solani*, *Macrophomina phaseolina* are reported to attack faba bean roots and stem base causing serious losses in seed germination and plant stand as well (Adelkader et al., 2011). Intercropping can be defined as the growth of two or more crops in the same space at the same time (Andrews and Kassam 1976).

This technology may enable the intensification of a forming system, leading to increased general productivity and biodiversity in the intercropped fields as compared to monocultivares of the individual intercropped species (Vandermeer et al., 1998). Further, intercropping can be advantageous for controlling plant diseases such as common bacterial blight and fungal rust (Boudreau and Mundt 1992, Fininsa 1996). In organic field trials, a disease reduction has been observed in intercrops of barley (*Hordeum vulgare L.*) with pea (*Pisum sativum L.*), faba bean disease reduction has been observed in intercrops of barley (*Hordeum vulgare L.*) with pea (*Pisum sativum L.*), faba bean (*Vicia faba L.*) and lupin (*Lupinus sp.*) Kinane and Lyngkjaer 2002). In addition increasing diversity through intercropping many reduce pest and disease incidence leading to less pesticide application increased habitat for beneficial insects and microorganisms, and an overall reduction in farm inputs (Kontturi et al., 2011). Development of disease resistant variety was the most economical mean of control. Phosphorus has been called (the key to life) because it is directly involved in most life process. It exerts many and varied functions in plant metabolism and hence inadequate phosphate supply to the plant seriously affect numerous metabolic processes. Singh et al., (1981) found that phosphorus applied at 60 and 90 Kg/ha significantly increased yields in comparison with 30 Kg P. When four level of P (0, 30, 60 and 90 Kg/ha) were applied. Negm et al., (1992) reported that phosphorus application increased the number of branches and flowers per plant. Jain et al., (1999) and Khurana and Sharma (2000) showed that the combined inoculation of *Rhizobium* and phosphate solubilizing bacteria increased nodulation, yield of pea and total biomass of chickpea compared with either individual inoculation or the uninoculated control (Rudresh et al., 2005). Rania et al., (2010) found that the soil application of phosphorus fertilizer increased plant height, number of branches/plant, number of pods/plant, 100 seed weight/g and seed weight ardab/fed in both seasons of the three legume verities. Jafar (2014) found that, application of biological phosphorus fertilizer significantly increased the yield and yield components in faba bean plant.

**Materials and Methods**

This work has been combined out at experimental Farm of Sers El-layian Agricultural Research station (SEARS), Minufiya Governorate, Egypt. The mechanical and chemical properties of the experimental soil for the upper foot layer (0-30 cm) and available phosphorus of the experimental soil table (1) were determined before sowing in the two seasons according to the method described by (Chapman and Pratt 1961) and presented in table (1). Mechanical and chemical properties of the experimental sites revealed that the texture of the soil was sandy clay with a low P concentration the two growing seasons table (1)

**Source of the Pathogen**

A pathogenic isolate of *Rhizoctonia solani* was selected from the gene bank of the Plant Pathology Research Institute - Agricultural
Research Centre. The isolate was tested to confirm its virulence.

**Greenhouse Experiments**

**Determination the Effect of Intercropping between Three Cultivars Faba Bean and Wheat on Root-rot Incidence**

Three cultivars faba bean C.V. Giza 3 Mohassan, Giza 40 and sakha1 were intercropping with wheat (sakha 93) under greenhouse conditions at Sers El-layian Agricultural Research station, in 2012 growing season. Pots (25 cm) were sterilized by dipping in 5% formalin solution for 5 min and then left in a pone air till dryness. Soil sterilization was accomplished with 50% formalin solution mixed thoroughly, covered with plastic sheet for one week and then the plastic sheet was removed in order to complete formalin evaporation. Soil infestation with each individual fungus R. solani was carried out at the rate of the rate of 3.5 % of soil weight. Fungus was individually grown on sand-barley (SB) medium (25 clean sand 759 barley and enough water to cover the mixture).

Flasks contained sterilized medium were incubated with each particular fungus and incubated at 25°C for two weeks. Potted soil was watered daily for week to enhance fungal growth. Soil of control pots was mixed with the same amount of sterilized sand-barley (SB) medium.

Five surface sterilized seeds of faba bean were sown in the opposite side with the transplanted wheat (Sakha 93) in each pot. While five faba bean seeds were sterilized and only treatment. Percentage of pre- and post-emergence damping–off and survival plant were recorded at 15 and 30 days. While disease severity was estimated at 45 days after sowing (Soleman *et al.*, 1988).

**Determination the Effect of Different Rates from Phosphorus Fertilizer Treatments on Root-rot Incidence**

Pots (25 cm) filled with 5 Kg clay soil were sterilized as mentioned before than the soil was infested with the inocula of the fungus (R. solani) at rate of 3.5 % w/w. as mentioned before. The phosphorus fertilizer rates (0, 100 and 200 kg/fa) was mixed with the top later of the soil before sowing. Five seeds of fababean (Giza 3 Mohassan, Giza 40 and sakha1 were sown in each pot, and three replicates were used for each treatment. Percentages of pre-and post-emergence damping-off as well as healthy survival plants in each treatment were determined 15 days after sowing, respectively using the next formula according to El-Helaly *et al.*, (1970) and disease severity was estimated at 45 days after sowing.

**Field Experiments**

**Determination the Effect of Intercropping between Three Cultivars of Faba Bean and Wheat (Sakha 3) in Naturally Infested Soil**

These experiments were conducted in naturally infested soil at Sers El-layian Agriculture Research Station (SEARS), Munfiya governorate, Egypt, during two winter season (2012/2013). The experimental layout was in completely randomized block design. The plot of 3 m x 3.5 m was used in this study. Four plots contained five rows (apart) per each assembled treatment wheat Shakha93 was individually intercropping with each of the tested three cultivar of faba bean (c.v. Giza 3 Mohassan Giza 40 and sakha 1) were used: 2 row (faba bean with 2 row wheat), 3 row (faba bean with 3 row wheat) and 2 row (faba bean with 4 row wheat).
Control plot had five rows of faba bean plants only.

The recorded data were:

Pre-emergence damping-off after 15 days from sowing.

Post-emergence damping-off and survival plants after 30 days from sowing.

Average plant height after harvest, number of branches, number of pods/plant, 100 seeds/weight and total yield/fed were recorded.

**Determination of the effect of fertilization phosphorus treatments faba bean in naturally infested soil on root-rot disease**

Two field experiments were carried out in the experimental Farm of SEARS, Munfiya governorate, Egypt, during two winter season (2012/2013) and (2013/2014). Each experiment included three cultivars of faba bean (Giza 3 Mohassan Giza 40 and Sakha 1) in the main plots extraction solution of phosphorus fertilizer was prepared by dissolved calcium superphosphate 15.5 % (P$_2$O$_5$). For each experiment, a split – split plots design with three replicates of five rows. The plot size was 6 cm consisting of five rows, each row 3 meter long spaced at 60 cm. the rates of phosphorus fertilization (0,100 and 200 kg/fa) were applied as super phosphate 15.5 % P$_2$O$_5$ before planting.

The recorded data were:

Pre-emergence damping-off after 15 days from sowing.

Post-emergence damping-off and survival plants after 30 days from sowing.

Average plant height, fresh weight and dry weight after 45 days from sowing.

At maturity, plants were harvest and the following yield characters i.e. plant height, number of branches, number of pods/plant, 100 seeds/weight and total yield/fed were recorded.

Seed samples of each crops were taken and dried, then ground to powder for chemical analysis. Nitrogen content was determined using improving macro-kjeldahl method (A.O.A.C. 1980). The percentage of seed protein content was calculated by multiplying the percentage of nitrogen content was determined calorimetrically using spectrophotometer according to Chapman and Pratt (1961).

**Statistical Analysis**

All collected data were subjected to statistical analysis for each season and to combined analysis over years according to Gomez and Gomez (1984).

**Results and Discussion**

**Effect of Intercropping between Three Cultivars of Faba Bean with Wheat Plants in Greenhouse Conditions**

As shown in table (2) intercropping three faba bean with wheat significantly reduced both pre- and post-emergence damping-off root rot disease caused by the fungal pathogens. *Rhizoctonia solani* compared to untreated one (control). However all cultivars significantly reduced the disease severity of root-rot symptoms caused by *Rhizoctonia solani*.

**Effect of Super Phosphate on Root-rot Incidence, under Greenhouse Condition**

Data in table (3) clearly show the effect of super phosphate (0, 100, 200 Kg/fa) on the percentage of pre- and post- emergence damping-off, root-rot disease severity
caused by the fungal pathogens, *R. soloni*. All tested phosphorus fertilizer significantly reduced the development of root-rot disease, the highest percentage of survival plant in all three cultivars faba bean was resulted in soil fertilized with super phosphate at 200 Kg/fed).

**Effect of Intercropping between Three Cultivars of Faba Bean with Wheat on Root-rot Under Field Conditions**

This experiment was conducted during two successive seasons (2012/2013) and (2013/2014) to study the effect of intercropping between three cultivars of faba bean with wheat on root-rot infestation and some related growth characters. In this respect data in table (4) show that the intercropping in form of row (faba bean X 4 row wheat), of the first season (2012/2013) incited a significant reduction in pre-emergence and post-emergence damping off of three cultivars faba bean with wheat respectively.

In the second season similar trend of result was detected with minor variation in the rank. Healthy fababean survival plants were increased in case of three cultivars of faba bean with wheat than the corresponding faba bean with wheat than the corresponding faba bean grown alone.

As for the effect of intercropping between three cultivars of faba bean with wheat on disease incidence, growth and yield component of faba bean under field conditions, the obtained data in table (5) revealed significant positive effects of intercropping when compared with the control where they lowered the disease incidence while increased the plant height, number of branches, number of pods per plant, 100-seed weight and seed weight ardab/fed.

**Effect of Phosphorus Fertilizers on the Incidence of Three Cultivars Faba Bean Root-rot under Field Conditions**

Data in table (6) clearly show the influence of super phosphate (0, 100 and 200 kg/fed.) on pre- and post- emergence damping-off, three cultivars of faba bean under field conditions during two seasons. The results revealed that application of both fertilizer rates (100 and 200 kg/fed.) significantly reduced pre- and post- emergence damping-off when compared to the untreated plants (control). Both fertilizer rates (100 and 200 kg/fed.) the highest level of the disease control with the highest number of survived plants. In general fertilizer applied degree offered by superphosphate fertilizer applied at rate of 200 kg/fed was much higher then untreated control.

Data in table (7,8) revealed of significant effect of fertilization with super phosphate over the control where these effect were shown in case of plant height, fresh weight, dry weight and plant height after harvest, number of branches, number of pods, 100 seed weight and seed weight ardab/fed. the obtained results were confirmed from the two experiments conducted in 2012/2013-2013/2014 seasons respectively. However, the great effect on plant growth and yield component was given by super phosphate at 200 kg/fed) application compared with non-fertilized control.

**Effect of Intercropping Three Cultivars of Faba Bean with Wheat and Super Phosphate Fertilizers on Chemical Composition of Faba Bean Plants**

The present results indicated that the intercropping three cultivars of faba bean and super phosphate fertilizers with different rates applied to soils (0,100 and 200 kg/fed) caused significant increase in phosphorus, nitrogen contents in there cultivars faba bean.
Table 1 Physical and Chemical Properties of the Experimental Soil for Upper Foot Layer (0-30 Cm) in the Two Growing Seasons

| seasons | sites | Textur e  | Physical properties | Chemical properties | E.C.m | pH (1:2.5) | Caco₃ (%) | Cations ml/100 g | Anions/ml/ 100 g | N % | P % | K % |
|---------|-------|----------|---------------------|---------------------|------|------------|-----------|----------------|----------------|-----|-----|-----|
| 2012/2 | 1     | Sandy clay | 1.7 51.1 25 19     | 7.40 0.37 2.3 1.3 1.14 0.43 --- | 20  | 7.40     | 2.3       | 1.3            | 1.14           | 0.43 | 0.37 | 0.37 |
| 2013/2 | 2     | Sandy clay | 1.9 50.9 26 20     | 8.10 0.38 2.5 1.2 1.20 0.50 0.5 | 76.67 | 73.34   | 6.21       | 8.34           | 12.83 | 6.91 | 0.02 |

Table 2 Effect of Intercropping Three Cultivars of Faba Bean and Wheat, Grown in Soil Infested with Specific Pathogen Species Of Rhizoctoniasoloni under Greenhouse Conditions

| Cultivars                  | Pre-emergence damping-off | Post-emergence damping-off | Survival plant | Disease severity |
|----------------------------|---------------------------|-----------------------------|----------------|------------------|
| Faba bean (Giza 3 Mohassan)+ wheat | 13.33                     | 13.33                      | 73.34          | 40.00            |
| Faba bean (Giza 40) + wheat     | 16.67                     | 18.67                      | 64.66          | 53.33            |
| Faba bean (Sakha 1) + Wheat     | 10.0                      | 13.33                      | 76.67          | 30.00            |
| Faba bean (Giza 3 Mohassan)     | 23.33                     | 20.0                       | 56.67          | 63.33            |
| Faba bean (Giza 40)             | 26.62                     | 23.33                      | 50.05          | 68.88            |
| Faba bean (Sakha 1)             | 18.86                     | 13.33                      | 67.81          | 43.33            |
| L.S.D at 0.05                  | 8.21                      | 8.34                       | 12.83          | 6.91             |
Table 3: Effect of Superphosphate on Root-rot Incidence, under Greenhouse Condition

| Cultivars of faba bean | Concentrations of superphosphate as kg/fed | fungus | Pre-emergence damping –off % | Post-emergence damping off % | Survival plant % | Disease severity % |
|------------------------|--------------------------------------------|--------|------------------------------|----------------------------|------------------|-------------------|
| Giza 3 Mohassan        | 10                                         | R. solani | 20.00                        | 13.33                      | 66.67           | 55.55             |
|                        | 100                                        |         | 10.00                        | 10.0                       | 80.0            | 40.00             |
|                        | 200                                        |         | 6.67                         | 3.37                       | 89.96           | 29.99             |
| Mean                   |                                            |         | 12.22                        | 8.9                        | 78.88           | 41.85             |
| Giza 40                | 10                                         | R. solani | 23.33                        | 16.67                      | 60.0            | 67.77             |
|                        | 100                                        |         | 20.00                        | 13.33                      | 66.67           | 55.55             |
|                        | 200                                        |         | 13.33                        | 10.0                       | 78.67           | 36.66             |
| Mean                   |                                            |         | 18.99                        | 13.33                      | 67.78           | 53.32             |
| Sakha 1                | 0                                          | R. solani | 10.00                        | 10.0                       | 80.0            | 40.00             |
|                        | 100                                        |         | 6.67                         | 6.67                       | 86.66           | 28.88             |
|                        | 200                                        |         | 3.34                         | 3.33                       | 93.33           | 20.00             |
| Mean                   |                                            |         | 6.66                         | 6.67                       | 86.66           | 29.63             |
| L.S.D at 0.05          |                                            |         | 7.53                         | 7.15                       | 11.23           | 5.89              |

Table 4: Effect of Intercropping Three Cultivars of Faba Bean with Wheat Incidence of Root-Rot Disease during Two Seasons Under Field Conditions

| cultivars | Intercropping | 2012/2013 | 2013/2014 | 2013/2014 | 2013/2014 |
|-----------|---------------|-----------|-----------|-----------|-----------|
|           |               | Pre-emergence damping –off % | Post-emergence damping off % | Survival plant % | Pre-emergence damping –off % | Post-emergence damping off % | Survival plant % |
| Giza3 Mohassan | 2 rowX 2 row (wheat) | 0.0 | 6.67 | 93.33 | 3.33 | 6.67 | 90.0 |
|            | 3 rowX 3 row (wheat) | 3.33 | 3.33 | 93.34 | 6.67 | 6.67 | 86.66 |
|            | 2 rowX 4 row (wheat) | 0.0 | 10.0 | 90.0 | 3.33 | 10.0 | 86.67 |
| Faba bean alone | 16.67 | 16.67 | 16.67 | 20.00 | 63.33 |
| mean       | 5.00          | 9.17     | 85.83    | 7.5      | 10.84    | 81.67    |
| Giza 40    | 2 rowX 2 row (wheat) | 3.33 | 10.0 | 86.67 | 6.67 | 6.67 | 86.66 |
|            | 3 rowX 3 row (wheat) | 10.00 | 10.0 | 80.00 | 6.67 | 10.0 | 83.33 |
|            | 2 rowX 4 row (wheat) | 6.67 | 10.0 | 83.33 | 13.33 | 10.0 | 76.67 |
| Faba bean alone | 20.0 | 16.67 | 63.33 | 20.0 | 13.33 | 66.67 |
| mean       | 10.0          | 11.67    | 78.33    | 11.67    | 10.0     | 78.33    |
| Sakha 1    | 2 rowX 2 row (wheat) | 0.0 | 3.33 | 96.67 | 3.33 | 3.34 | 93.33 |
|            | 3 rowX 3 row (wheat) | 3.33 | 0.0 | 96.67 | 3.33 | 6.67 | 90.0 |
|            | 2 rowX 4 row (wheat) | 0.0 | 0.0 | 100.0 | 0.0 | 3.33 | 96.67 |
| Faba bean alone | 10.0 | 20.0 | 70.0 | 13.33 | 10.0 | 76.67 |
| mean       | 3.33          | 5.83     | 90.87    | 4.99     | 5.84     | 89.17    |
| L.S.D at 0.05 | 3.15 | 2.91 | 6.00 | 4.35 | 4.83 | 8.55 |
|            | 6.11          | 6.18     | 8.91     | 6.73     | 4.00     | 10.23    |
|            | 8.27          | 6.33     | 10.14    | 8.20     | 7.38     | 14.41    |
Table 5: Effect Intercropping Three Cultivars of Faba Bean with Wheat on Some Yield Component Plant during Two Seasons under Field Conditions

| cultivars      | Intercropping             | 2012/2013 |                      |                          |                      |                          | 2013/2014 |                      |                          |                      |
|----------------|---------------------------|-----------|-----------------------|--------------------------|-----------------------|--------------------------|-----------|-----------------------|--------------------------|-----------------------|
|                |                           | Plant height after harvest | Branches plant | No seeds pods | 100 seed weight ardab/fed | Plant height after harvest | Branches plant | No seeds pods | 100 seed weight ardab/fed |
| Giza3 Mohassan | 2 rowX 2 row (wheat)      | 100.0     | 3.00                  | 19.05                   | 83.00                 | 3.31                     | 103       | 2.90                  | 18.0                    | 81.0                  | 3.00                     |
|                | 3 rowX 3 row (wheat)      | 101.0     | 3.05                  | 21.00                   | 89.00                 | 3.55                     | 105       | 3.11                  | 20.0                    | 85.0                  | 3.30                     |
|                | 2 rowX 4 row (wheat)      | 98.0      | 3.95                  | 23.00                   | 92.00                 | 4.00                     | 101       | 3.50                  | 22.0                    | 88.0                  | 3.50                     |
|                | Faba bean alone           | 90.1      | 2.99                  | 14                      | 75.00                 | 3.00                     | 93        | 2.75                  | 12.0                    | 73.0                  | 2.88                     |
|                |                           | mean      |                       |                          |                       |                           | 97.28     | 3.25                  | 19.26                   | 84.75                 | 3.47                     |
| Giza 40        | 2 rowX 2 row (wheat)      | 90.0      | 2.90                  | 17.0                    | 70.00                 | 2.90                     | 85.0      | 2.33                  | 16.0                    | 68.0                  | 2.70                     |
|                | 3 rowX 3 row (wheat)      | 93.0      | 3.0                   | 19.0                    | 72.00                 | 2.95                     | 89.0      | 2.67                  | 18.0                    | 70.0                  | 2.90                     |
|                | 2 rowX 4 row (wheat)      | 90.0      | 3.0                   | 20.0                    | 75.00                 | 3.00                     | 93.0      | 2.77                  | 19.0                    | 75.0                  | 3.15                     |
|                | Faba bean alone           | 85.0      | 2.33                  | 12.0                    | 60.00                 | 2.55                     | 81.0      | 2.10                  | 11.0                    | 58.0                  | 2.40                     |
|                |                           | mean      |                       |                          |                       |                           | 89.5      | 2.81                  | 17.0                    | 69.25                 | 3.09                     |
| Sakha1         | 2 rowX 2 row (wheat)      | 109.0     | 3.55                  | 22.0                    | 90.00                 | 4.30                     | 110.0     | 3.14                  | 23.0                    | 88.0                  | 4.00                     |
|                | 3 rowX 3 row (wheat)      | 113.0     | 3.95                  | 24.0                    | 95.00                 | 4.40                     | 115.0     | 3.31                  | 24.0                    | 93.0                  | 4.30                     |
|                | 2 rowX 4 row (wheat)      | 108.0     | 4.00                  | 26.0                    | 98.00                 | 4.60                     | 112.0     | 3.50                  | 25.0                    | 95.0                  | 4.50                     |
|                | Faba bean alone           | 101.0     | 3.40                  | 16.0                    | 80.00                 | 3.90                     | 105.0     | 3.00                  | 17.0                    | 78.0                  | 3.73                     |
|                |                           | mean      |                       |                          |                       |                           | 107.75    | 3.73                  | 22.0                    | 90.75                 | 4.3                      |
| L.S.D. at 0.05 |                           |           |                       |                          |                       |                           | 1.08      | 0.15                  | 0.43                    | 0.32                   | 0.61                     |
|                |                           |           |                       |                          |                       |                           | 2.91      | 0.21                  | 1.33                    | 1.00                   | 0.88                     |
|                |                           |           |                       |                          |                       |                           | 3.50      | 0.53                  | 1.52                    | 1.24                   | 1.18                     |

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Table 6 Effect of Different Rates (0,100,200 Kg/Fed) of Superphosphate Soil Fertilizer on Incidence of Root-Rot Disease of Cultivars of Faba Bean during Two Seasons under Field Conditions.

| Cultivars | Concentrations of superphosphate as kg/fed | Disease incidence | Disease incidence |
|-----------|-------------------------------------------|-------------------|-------------------|
|           | Pre-emergence damping – off % | Post-emergence damping off % | Survival plant % | Pre-emergence damping – off % | Post-emergence damping off % | Survival plant % |
| Giza 3 Mohassan | 0 | 16.67 | 10.0 | 73.33 | 16.67 | 13.33 | 70.0 |
|          | 100 | 6.67 | 3.3 | 90.0 | 10.00 | 13.33 | 76.67 |
|          | 200 | 3.34 | 3.33 | 93.33 | 3.34 | 6.67 | 89.99 |
| Mean     | 8.89 | 5.55 | 85.55 | 10.00 | 11.11 | 78.89 |
| Giza 40  | 0 | 20.0 | 16.67 | 63.33 | 23.34 | 18.33 | 58.33 |
|          | 100 | 16.67 | 13.33 | 70.0 | 20.00 | 16.67 | 63.33 |
|          | 200 | 10.0 | 10.00 | 80.0 | 16.67 | 13.33 | 70.00 |
| Mean     | 15.56 | 13.33 | 71.11 | 20.00 | 16.11 | 63.89 |
| Sakh 1   | 0 | 10.0 | 3.34 | 86.66 | 13.34 | 10.0 | 76.66 |
|          | 100 | 0.0 | 3.34 | 96.66 | 6.67 | 3.33 | 90.0 |
|          | 200 | 0.0 | 0.00 | 100.0 | 3.34 | 3.33 | 93.33 |
| Mean     | 3.33 | 2.22 | 94.44 | 7.78 | 5.55 | 86.66 |
| cultivars treatment interaction | 4.95 | 4.01 | 5.83 | 5.10 | 4.87 | 8.76 |
| L.S.D. at 0.05 | 6.73 | 7.13 | 8.85 | 8.23 | 4.92 | 11.18 |
|           | 8.96 | 8.20 | 10.18 | 9.13 | 7.95 | 14.90 |
### Table 7 Effect of Different Rates (0, 100 and 200 Kg/Fed) of Superphosphate on Some Growth Characters of Three Cultivars of Faba Bean Grown during Two Seasons under Field Conditions

| Cultivars          | Superphosphate (Kg/fed) | Crop parameters of faba bean plant |          |          |          |          |          |          |          |
|--------------------|-------------------------|-----------------------------------|----------|----------|----------|----------|----------|----------|----------|
|                    |                         | Plant height (cm) | Fresh weight plant (g) | Dry weight plant (g) | Plant height (cm) | Fresh weight plant (g) | Dry weight plant (g) |          |          |
| Giza3 Mohassan     | 0                       | 29.13                | 9.88        | 0.91     | 28.12                | 9.00        | 0.86     |          |          |
|                    | 100                     | 32.55                | 10.00       | 0.94     | 33.18                | 10.35       | 0.89     |          |          |
|                    | 200                     | 33.00                | 10.13       | 0.95     | 35.15                | 11.00       | 0.91     |          |          |
| mean               |                         | 31.56                | 10.0        | 0.93     | 32.15                | 10.12       | 0.89     |          |          |
| Giza 40            | 0                       | 24.0                 | 7.66        | 0.78     | 25.21                | 8.65        | 0.80     |          |          |
|                    | 100                     | 26.0                 | 9.33        | 0.89     | 27.19                | 10.17       | 0.90     |          |          |
|                    | 200                     | 29.0                 | 10.00       | 0.91     | 28.67                | 10.30       | 0.90     |          |          |
| mean               |                         | 26.33                | 8.99        | 0.86     | 27.02                | 9.71        | 0.87     |          |          |
| Sakha1             | 0                       | 32.28                | 10.35       | 1.13     | 33.08                | 11.00       | 1.23     |          |          |
|                    | 100                     | 34.00                | 11.67       | 1.16     | 35.07                | 12.65       | 1.29     |          |          |
|                    | 200                     | 37.00                | 12.00       | 1.20     | 38.13                | 12.90       | 1.33     |          |          |
| mean               |                         | 34.43                | 11.34       | 1.16     | 35.43                | 12.18       | 1.28     |          |          |
| cultivars treatment interaction |          |                      |            |          |          |          |          |          |          |
| L.S.D. at 0.05     | 0.69                    | 0.21                 | 0.01        | 0.79     | 0.31        | 0.12     |          |          |          |
|                    | 0.98                    | 0.13                 | 0.12        | 1.10     | 0.29        | 0.09     |          |          |          |
|                    | 1.43                    | 0.36                 | 0.16        | 1.32     | 0.70        | 0.18     |          |          |          |
Table 8: Effect of Superphosphate on Some Yield Component of Three Cultivars of Faba Bean under Field Conditions

| Cultivars     | Superphosphate Kg/fed | 2012/2013 | 2013/2014 |
|--------------|------------------------|-----------|-----------|
|              | Plant height (cm)      | Branche s/ plant | No seeds pods | 100 seed weight (g) | Seed weight ardab/fe d | Plant height (cm) | Branche s/ plant | No seeds pods | 100 seed weight (g) | Seed weight ardab/fe d |
| Giza3 Mohassan |                        |           |           |                   |                       |                   |                   |           |                   |                       |
| 0            | 92.0                   | 2.65      | 18.00     | 65               | 3.35                  | 89                | 2.50              | 17           | 70               | 3.10                  |
| 100          | 95.0                   | 2.95      | 23.0      | 75               | 3.80                  | 93                | 2.65              | 22           | 75               | 3.50                  |
| 200          | 98.0                   | 2.98      | 24.0      | 80               | 4.00                  | 95                | 2.70              | 22           | 80               | 3.80                  |
| Mean         | 95                     | 2.86      | 21.67     | 73.33            | 3.72                  | 92.33             | 2.62              | 20.3/3       | 75               | 3.47                  |
| Giza 40      |                        |           |           |                   |                       |                   |                   |           |                   |                       |
| 0            | 85                     | 2.00      | 13        | 65               | 3.13                  | 83                | 2.00              | 11           | 60               | 3.00                  |
| 100          | 89                     | 2.20      | 16        | 76               | 3.20                  | 88                | 2.23              | 15           | 65               | 3.25                  |
| 200          | 90                     | 2.33      | 17        | 70               | 3.17                  | 89                | 2.33              | 16           | 70               | 3.35                  |
| Mean         | 88                     | 2.18      | 15.33     | 68.33            | 3.27                  | 86.67             | 2.19              | 14           | 65               | 3.20                  |
| Sakha 1      |                        |           |           |                   |                       |                   |                   |           |                   |                       |
| 0            | 95                     | 2.55      | 19        | 80               | 3.90                  | 93                | 2.60              | 20           | 85               | 3.70                  |
| 100          | 100                    | 2.60      | 26        | 90               | 4.25                  | 99                | 2.70              | 26           | 90               | 4.00                  |
| 200          | 103                    | 2.65      | 27        | 95               | 4.40                  | 101               | 2.70              | 28           | 95               | 4.50                  |
| Mean         | 99.33                  | 2.60      | 24        | 88.33            | 4.18                  | 97.67             | 2.67              | 24.6/7       | 90               | 4.07                  |
| L.S.D. at 0.05 |                    |           |           |                   |                       |                   |                   |           |                   |                       |
|              | 1.50                   | 0.15      | 0.54      | 0.40             | 0.66                  | 1.27              | 0.11              | 0.61         | 8.35             | 0.11                  |
|              | 3.04                   | 0.31      | 1.31      | 0.98             | 1.00                  | 2.13              | 0.34              | 1.14         | 1.42             | 0.31                  |
|              | 3.55                   | 0.63      | 1.59      | 1.35             | 1.60                  | 3.80              | 0.65              | 1.68         | 1.32             | 0.91                  |
Table 9 Effect of Superphosphate and Intercropping Three Cultivars of Faba Bean with Wheat Treatments on Chemical Composition of Three Cultivars of Faba Bean under Field Conditions

| Cultivars | Treatments                  | 2012/2013 | 2013/2014 |
|----------|-----------------------------|-----------|-----------|
|          | P % | N % | Protein % | P % | N % | Protein % |
| Giza3 Mohassan |     |    |           |     |    |           |
| 0        | 0.40 | 4.15 | 25.94     | 0.37 | 4.10 | 25.63     |
| 100      | 0.50 | 4.50 | 28.13     | 0.47 | 4.40 | 27.50     |
| 200      | 0.57 | 4.80 | 30.0      | 0.54 | 4.75 | 29.69     |
| Giza 40  |     |    |           |     |    |           |
| 0        | 0.33 | 3.99 | 24.94     | 0.32 | 3.88 | 24.25     |
| 100      | 0.40 | 4.15 | 25.94     | 0.38 | 4.12 | 25.75     |
| 200      | 0.45 | 4.30 | 26.88     | 0.43 | 4.25 | 26.56     |
| Sakha1   |     |    |           |     |    |           |
| 0        | 0.44 | 4.66 | 29.13     | 0.41 | 4.63 | 28.94     |
| 100      | 0.52 | 4.90 | 30.63     | 0.49 | 4.85 | 30.31     |
| 200      | 0.59 | 5.00 | 31.25     | 0.55 | 4.90 | 30.63     |
| Giza3 Mohassan | 2 row X 2 row (wheat) | 0.36 | 4.00 | 25.63 | 0.33 | 4.00 | 25.00 |
| 3 row X 3 row (wheat) | 0.45 | 4.40 | 27.50 | 0.44 | 4.35 | 27.19 |
| 2 row X 4 row (wheat) | 0.53 | 4.60 | 28.75 | 0.50 | 4.55 | 28.44 |
| Faba bean alone | 0.35 | 4.00 | 25.00 | 0.32 | 3.95 | 24.69 |
| Giza 40  | 2 row X 2 row (wheat) | 0.32 | 3.91 | 24.43 | 0.31 | 3.77 | 23.56 |
| 3 row X 3 row (wheat) | 0.36 | 4.00 | 25.00 | 0.32 | 3.98 | 24.88 |
| 2 row X 4 row (wheat) | 0.40 | 4.10 | 25.63 | 0.36 | 4.00 | 25.00 |
| Faba bean alone | 0.30 | 4.88 | 24.25 | 0.30 | 3.70 | 23.13 |
| Sakha1   | 2 row X 2 row (wheat) | 0.42 | 4.13 | 25.81 | 0.38 | 4.20 | 26.25 |
| 3 row X 3 row (wheat) | 0.46 | 4.50 | 28.13 | 0.44 | 4.45 | 27.81 |
| 2 row X 4 row (wheat) | 0.55 | 4.70 | 29.38 | 0.53 | 4.68 | 29.25 |
| Faba bean alone | 0.40 | 4.00 | 25.00 | 0.36 | 4.10 | 25.63 |

The present results in table (9) are agreed with those obtained by Mengle and Krikby (1987). They found that, in seeds and grains, P contents in the range of 0.4 to 0.5 % in the dry matter.

Faba bean (*Viciafaba L.*) is one of the most important legume crops. It is infested with many fungal pathogens causing considerable yield losses where damping-off, root-rot, wilted diseases affecting faba bean production in Egypt Abdel-Kader et al., (2011). In this study induced resistance against root-rot were shown when intercropping and fertilization also decreased the fungal growth of *R. soloni* in vivo. The greenhouse results indicate that such intercropping reduce the percentage of pre-emergence and post-emergence damping-off. This results are agreement with the finding of (Boudreau and Mundt 1992, and Fininsa 1996) and (Kinane and Lyngkjaer 2002). It seems that intercropping affected positively to somewhat faba plant height. Meanwhile, the results revealed that intercropping three cultivars of faba bean (Giza 3 Mohassan, Giza 40 and sakha 1) with wheat sakha 93 increased significantly plant height after harvest, number of branches, plant number of pods/plant, 100 seed weight/g and seed weight ardab/fed in both seasons of the three cultivar of faba bean.

In green house and field condition, super phosphate treatment significantly reduced pre and post-emergence damping off as well as root-rot disease, consequently increased germination percentage and healthy plants. In addition, super phosphate treatment increased significantly vegetation growth parameters and yield component. Such enhancement
effect of super phosphate on the vegetative growth parameters might be attributed to its effect on nodulation and yield parameters (Jain et al., 1999, Khurana and Sharma 2000, Rudresh et al., 2005 and Rania et al., 2010). Application of phosphorus fertilizer increased plant height harvest, number of branches / plant. Number of pods/plant, 100-seed weight/g) and seed weight ardab/fed in both seasons of the three cultivars of faba bean. These results are in agreement with Ahmed et al., (1992), they found the, the application phosphorus fertilizer increased significantly protein content and carbohydrate content in seed and different plant parts.

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