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# EFFICACY OF BIOFERTILIZERS ON FUSILADE HERBICIDE ACTIVITY, GROWTH AND PRODUCTIVITY OF BROAD BEAN (*Vicia faba*).

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## ABSTRACT

Two field experiments were performed at 2009/2010 and 2010/2011 to study the interaction effect between biofertilizers and fusilade herbicide at (1.5 L/fed. as a recommended dose) alone and in combination with additives at (1.0 L/fed.) to enhance narrow weeds control and broad bean productivity. During the two seasons, a positive correlation was found between biofertilizers and broad bean plant height, number of branches, number of nodules, fresh and dry weight, seed germination as well as number and activity of soil microbes. Inoculated broad bean seeds with *Rhizobium leguminosarum* or dual inoculation with (*Rhizobium leguminosarum* plus *Bacillus megaterium)* were encourage the capability of the plants to produce vigorous vegetable growth and increasing yield productivity of broad bean than non bio-fertilized treatment. The inoculation with *R. leguminosarum* as a single inoculants or dual inoculants with *B. megaterium* increased microorganism densities and activity which reflected on broad bean growth, yield and tolerability to the stress of fusilade herbicide. During1$^{st}$year fusilade at micro rate (1.0 L/fed.) with mineral oil achieved the maximum inhibition in *Phalaris minor* fresh and dry weigh by 62.4 and 61.76 %, respectively comparing with untreated control. While in the 2$^{nd}$ year fusilade at the same micro rate with glue achieved the highest reduction in *P. minor* fresh and dry weight by 45.6 and 56.3% respectively comparing with the control. The highest reduction in *Staria* sp. fresh and dry weigh achieved from fusilade at micro rate with mineral oil by 65.31 and 71.18(1$^{st}$year) and with rape seed oil 54.6 and 56.8% (2$^{nd}$year) respectively than its respectable control. There's no change in seed proteins types and percentage were detected after applying fusilade on broad bean in the presence or absence of biofertilizers. While the dual inoculation proved to be the most effective biofertilizers that increase protein components at the both seasons by (12.8% and 12.04%, respectively). Generally, a positive correlation was found between biofertilizers and fusilade on broad bean yield, so that to maximize broad bean productivity and reducing production costs as well as weed suppression, thus it is recommended for cultivating broad bean with dual inoculation (*R. leguminosarum* plus *B. megaterium*) as biofertilizers and using fusilade at (1.0 L/fed.) with spray tank additives for a narrow weed control which increased productivity of broad bean during the two years ranged from 324.01 to 349.27% (mineral oil) and with 296.06 and 340.32% (glue), respectively, and seed protein than untreated control.

**Keywords**; Biofertilizers, fusilade, additives, broad bean, productivity and Quality.

## INTRODUCTION

Broad bean (*Vicia faba L.)* is an important legume crop grown for its green pods which considered as a good source of protein. Due to its high nutritive value, it is a primary source of protein in the diet of masses. Millions of people in Egypt, particularly those in the low and middle income brackets, depend on broad beans as a main staple food for both breakfast and dinner

Nassib *et al.*, (1991). To achieve the highest productively, chemical fertilizers were used intensively around the world. However, they started displaying their harmful effects to the environment Watson, (1981). Meanwhile, fertilizers such as phosphorus and nitrogen are very important nutrient for crop growth and high yield with good quality. In new cultivated sandy soils, may have some nutrient problems such as less fertility in general and less availability of some elements such as phosphorus in case of high pH value. The primary nutrients are nitrogen, phosphorus, and potassium. All plants need nitrogen to make amino acids, proteins and DNA, but the nitrogen in the atmosphere is not in a form that they can use. Phosphorus plays a key role in metabolic process such as the conversion of sugar into starch and cellulose. In the context, yield and its components showed a positive response to phosphorus fertilizers, As a result, phosphorus deficiency causes stunting, delayed maturity and shriveled seeds, Abd-Alla (2002), Mokhtar, (2001), El- Douby and Mouhamed, (2002). Therefore, biofertilizers were introduced as alternative tools to the farmers for reducing the usage of the chemical fertilizers and developed the number of branches, pods per plant, seeds per pod and seed weight to maximizing yield of a broad bean crop its yield components as well as preserving the environment in the long run. El Habbasha *et al.*, (2007) indicated that increasing phosphorous levels from zero 2 5 to 45 kg P O /faddan in combination with Rhizobium, Nitrobein or Rhizobium + Nitrobein increased significantly the most of studied characters compared to control treatment. El-Wakeil and El-Sebai, (2007) reported that bacterial total count was higher significantly in mixed inoculant's strains than in single inoculant. Either single or mixed inoculants strains showed positive response on seeds weight compared to NPK plots. The highest number of pods was achieved in treatment of rhizobia mixed with mycorrhizal or pseudomonas. Unfortunately, weeds represent a major obstacle of broad bean high yielding productivity. they are compete for nutrients, space, light and exert lot of harmful effects by reducing the quality, as well as quantity of the crop, if the weed populations are left un-controlled Halford *et al.*, (2001). To overcome this problem many suitable herbicides recommended Hassanein *et al.*, (1987). Also, to minimize requirements for cultivation multifaceted weed management strategies that are site specific and adopt a holistic approach aiming to optimize the whole herbicides efficiency are to be developed by using the spray tank additives. Additives can be especially effective in improving the biological activity of phenoxy herbicides specifically; the addition of a methylated seed oil or surfactants adjuvant to spray solutions can enhance spray retention, foliar absorption of the herbicide, and subsequent herbicide efficacy Bunting *et al.*, (2004); Hart *et al.*, (1992); Nalewaja *et al.*, (1995). The aim of this work was to study the interaction effect between using bio fertilizers nitrogen fixing bacteria (*R. leguminosarum*) and phosphate dissolving bacteria *B. megaterium* (PDB) and their dual inoculation (*R. leguminosarum* and *B. megaterium*) and fusilade as a narrow weed control herbicides without and with additives to enhancing its herbicidal efficacy for controlling weeds and for increasing broad bean productivity and quality which considered to be main crop for facing the big shortage of protein component in Egypt.

# MATERIALS AND METHODS

**Source of Microorganisms:**

Two active bacterial strains were used in this investigation; *R. leguminosarum* was obtained from Soil Microbiology and Fertility Dep. (DRC) and *Bacillus megaterium* which previously isolated from soil of faba bean field at Maryout Experimental Station.

Source of seeds:

Broad bean (*Vicia faba L.*) seeds (Roumi Kacere aspainy cultivar) were obtained from, Field Crops Res. Inst., ARC, Giza, Egypt.

Bio-fertilizers preparation:

*B.megaterium* and *R. leguminosarum* bacterial isolates were grown on modified Bunt and Rovira medium (Abd El-Hafez, 1966) and yeast extract mannitol agar ( Allen, 1959) for 7 days at 28+ 2$^{o}$C, respectively. Two hundred fifty ml erlenmeyer flasks containing 100 ml of sterilized media were inoculated with one ml of standard inoculums from *R. leguminosarum* or *B. megaterium* and shaked with a rotary shaker (160 rpm) for 46 hours at 30 $^{0}$C.

**Biofertilizers treatment**

Seeds of broad beans were successively washed and soaked in bacterial suspension either with 5% Carboxy methyl cellulose (CMC) containing about $10^{8}$ cells/ml for 20 minutes or in uninoculated medium to conserve as a control. Seeds were air dried for 12 hr. at 25-28 $^{0}$C in shade place till dried.

**Herbicide treatment:**

Fusilade super (fluazifop-butyl) 12.5% EC, supplied by Syngenta Company, fusilade was used at the recommended rate (1.5 L/fed. as a recommended dose) alone or at (1.0 L/fed.) mixing with three additives by 20% (v/v) including crop seed oil (rape seed oil) (200 ml), mineral oil 200 ml (KZ company) and by 20% (v/w) for glue as sticking agent (200 gm). Application time was done at the 3-4 leaf stage (one month from emergence).

Field experiments

Two field experiments were carried out during two growing seasons *i.e.* 2009/2010 and 2010/2011 at Maryout Experimental Station, Desert Research Center (DRC) to investigate the effect of bio-fertilizers as single strains of *Rhizobium leguminosarum* and *Bacillus megaterium* or dual strains *R.leguminosarum* and *B. megaterium* on fusilade herbicide (with and without additives) activity for narrow weed controls as well as faba bean growth and productivity.

The experiment was established in Split- plot design with five replications. Where bio fertilizers treatments in the main plots and the herbicides treatments in the sub plot. The plot area was 4×1.5 $m^2$ and consisted of 5 rows, each row was 4 m length and 30 cm width. Two seeds were sown per hill at 1-5 cm a part. Twenty $m^2$ of organic manure was added to the soil, in addition to some mineral fertilizer (120 kg/ fed. ammonium sulphate and 150 kg.fed. super phosphate (15.5% P2O5) and 100 kg/fed sulphate potassium.divided at two times during the seed bed preparation and before the first irrigation such as Experimental soil texture is sandy clay loam with pH 7.81 and organic matter 0.93 and with chemical properties was $CaCo_3$ 39.43% and the soluble cations (meq/100 g) 28.34 ($Na^+$), 1.02 for ($K^+$), 15.32 for ($Ca^{++}$), 9.56($Mg^{++}$) and soluble anions (meq/100 g) 38.76 ($Cl^-$), 20.21 ($SO4^-$) and 1.43 ($HCO_3^-$). During the growing season, recommended cultural practices were followed and surface irrigation system was applied. After 30 days from seed sowing, the plants were sprayed with the herbicides and the remaining broad leaf weeds were hand pulling up.

**Faba bean characters**

Plant height, number of branches per plant and total fresh and dry weight of vegetative part of plant (leaves + stem were recorded after 35, 70 and 120 days from sowing. The third faba bean top leaf was taken after three weeks from treatment for total chlorophyll determination using chlorophyll meter (SPAD). Total protein was extracted according to Landry and Moureaux (1976) and fractionated by (SDS-PAGE) according to Weber and Osberne (1969).

During the harvest, total pods yield (green pods yields) was calculated and the total pods yield was calculated at the end of harvesting season. At the second harvest, random samples of green pods were taken from each plot and oven dried at $700^0C$ till constant, the dry matter.

**Weeds characters**

Fresh and dry weight, density, abundance, dominance and frequency of weeds were recorded after three weeks from treatment. Data was summarized and analyzed as relative abundance according to the formula used by Thomas, (1985). Also, coefficient of similarity percent was determined according to the methods described by Newsome and Dix, (1986).

**Microbiological determinations:**

Rhizosphere soil samples were taken during the experimental period and subjected to microbial determination. Total bacterial count was determined on soil extract agar Page *et al.*, (1982). Phosphate dissolving bacterial count was determined on Bunt and Rovira agar medium after modification by Taha *et al.*, (1970). $CO_2$ evolution (Yeast extract manitol agar (YMA) medium was used according to Allen, 1959) was determined as index to microbial activity in soil according to Atef and Nannipien, (1995).

**Assessment of $N_2$-ase activity of root nodules:**

Nitrogenase activity of root nodules was determined by acetylene reduction method ($C_2H_2$-> $C_2H_4$) according to Dart *et al.*, (1972). As soon as, the legume plants were uprooted, washed and the roots were separated and put in 600ml. serum bottles and then sealed with tide rubber stopper. The suitable volume of acetylene was then injected into the bottles using plastic syringe to give acetylene concentration of 10%of atmosphere. The bottles were left under ambient temperature for one hour. Then 0.125ml gas samples were withdrawn and assayed for acetylene concentration using a Hewlett-Packard model 5890 gas chromatograph equipped with a hp-plot $Al_2O_3$ capillary column (0.53 mm. by 50 m. and 15.0 um film thickens); a flame ionization detector and a Hewlett Packard model vactra 486/33 VL computer. Peaks were automatically integrated and acetylene amounts were calculated. The gas chromatographic parameters were as follows: carrier gas; ultrahigh purity nitrogen, 10ml./Min. column temperature; 120 °C; injection port temperature 170 C°. Hydrogen and air for the flame were at rates of 30 and 300ml./min. respectively. The retention times of ethylene and acetylene were 1.3 and 1.9 minutes respectively. To calculate the nitrogenase activity of samples; the following equation was used:

$$C_2H_4.g^{-1} \text{ dry nod. } hr^{-1} = \frac{A \times V1}{V2 \times T}$$

Where; A= µl $C_2H_4$ calculated by computer, V2= Total volume of bottle, V1= injected volume in G C. (0.125), T = Incubation time

**Statistical analysis**

Data were analyzed using ANOVA according to Snedecor and Cochran (1990). Effects were considered significant for P=0.05 from the F-test. Least significant differences LSD analysis and Duncan multiple range test were conducted for mean comparison.

## RESULTS AND DISCUSSION

In Egypt, Chemical fertilizers beside biofertilizers were used to full the need of nutrients on new cultivated land.. Also, herbicide application and pulling up with hand are important methods of weed control in broad bean productivity. During the two years, broad bean seeds were inoculated with biofertlizers compared with uninoculated treatments beside assessment of soil microbiology component, in addition to weed species, relative abundance and coefficient of similarity between plots were implemented under the field conditions. Also, the role of additives in fusilade activity against narrow leaved weeds and its impact on broad bean productivity were conducted. Data presented in (Table 1) demonstrate that total bacterial count affected in the presence of fusilade and bio fertilizers by decreasing and increasing trend respectively during the three stages at the two seasons. The addition of dual inoculation (*B. megaterium* and *R. leguminosarum*) without herbicides increased total bacterial count at 35, 70 and 120 days by 472.1, 512.5 and 570.0 % (1$^{st}$year) and 570.0,656 and 457.1 % (2$^{nd}$year) as compared with un inoculated control. Application of fusilade alone or with additives resulted reduction in the total bacterial count on the state of the first period 35 days from broad bean sowing. However, inoculation with biofertilizers increased microbe numbers. Meanwhile the highest microbial total count achieved from the double inoculation during the three stages. It was noted that the addition of rape seed oil to fusilade at (1.0 L/fed.) clearly reduced the total bacterial count at 1$^{st}$ and 2$^{nd}$ year which caused the maximum decreasing in both biofertilizers and non biofertilizers plots as compared with its respectable control. According to PDB densities (counts x $10^4$ CFU/g dry soil), PDB affected regardless of the presence or the absence of both herbicide and biofertilizers at both seasons depending on the state of inoculation and broad bean stage (Table 1). Seed inoculation with *B. megaterium* or the dual inoculation induced PDB densities during the three stages in both seasons than untreated control, while the highest induced in PDB densities was recorded at 70 days then at 35 and 120 day which achieved from dual inoculation. Application of mixed inoculation without herbicides increased PDB densities at 35, 70 and 120 days by 200, 266.7 and 262.5 % (1[st]year) and 238.2, 320and 247.8 % (2[nd]year) as compared with un inoculated control.

**Table (1): Total bacterial count and PDB densities in the rhizosphere of broad bean affected by biofertilizers inoculation and fusilade herbicide application during 2009/2010 and 2010/2011 seasons, at Maryout Experimental Station.**

| Biofertilizers | Herbicide treatments | 1st. Year (2009/2010) | | | 2st. Year (2010/2011) | | | 1st. Year (2009/2010) | | | 2st. Year (2010/2011) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Total bacterial counts (counts x $10^6$) CFU)/g dry soil* | | | | | | PDB densities (counts x $10^4$ CFU/g dry soil) | | | PDB densities (counts x $10^4$ CFU/g dry soil) | | |
| | | Days after sowing | | | | | | | | | | | |
| | | 35 | 70 | 120 | 35 | 70 | 120 | 35 | 70 | 120 | 35 | 70 | 120 |
| Non Inoculation | Control | 0.19 | 0.40 | 0.30 | 0.25 | 0.70 | 0.42 | 35 | 45 | 40 | 34 | 50 | 46 |
| | Fusilade alone | 0.16 | 0.36 | 0.23 | 0.21 | 0.58 | 0.30 | 30 | 35 | 32 | 30 | 35 | 32 |
| | Fusilade+ glue | 0.15 | 0.35 | 0.22 | 0.19 | 0.60 | 0.36 | 32 | 36 | 34 | 32 | 40 | 35 |
| | Fusilade+ mineral oil | 0.14 | 0.32 | 0.21 | 0.20 | 0.51 | 0.33 | 32 | 37 | 35 | 30 | 37 | 34 |
| | Fusilade+ rape seed oil | 0.12 | 0.30 | 0.20 | 0.17 | 0.40 | 0.19 | 30 | 35 | 32 | 30 | 35 | 32 |
| *R. leguminosarum* | Control | 0.42 | 1.90 | 1.40 | 0.95 | 2.38 | 2.12 | 70 | 100 | 80 | 75 | 110 | 85 |
| | Fusilade alone | 0.32 | 1.30 | 1.10 | 0.69 | 2.01 | 1.60 | 50 | 70 | 65 | 50 | 78 | 70 |
| | Fusilade+ glue | 0.30 | 1.34 | 1.15 | 0.70 | 2.02 | 1.70 | 54 | 75 | 67 | 54 | 80 | 70 |
| | Fusilade+ mineral oil | 0.34 | 1.24 | 1.00 | 0.58 | 1.89 | 155 | 55 | 70 | 60 | 55 | 75 | 67 |
| | Fusilade+ rape seed oil | 0.25 | 1.04 | 0.70 | 0.51 | 1.40 | 1.04 | 40 | 65 | 55 | 46 | 70 | 60 |
| *B. megaterium* | Control | 0.40 | 1.70 | 1.24 | 0.90 | 2.20 | 1.55 | 80 | 115 | 100 | 85 | 115 | 105 |
| | Fusilade alone | 0.35 | 1.40 | 1.04 | 0.70 | 1.65 | 1.30 | 57 | 105 | 70 | 70 | 110 | 85 |
| | Fusilade+ glue | 0.36 | 1.55 | 1.15 | 0.72 | 1.95 | 1.34 | 60 | 110 | 78 | 75 | 110 | 95 |
| | Fusilade+ mineral oil | 0.32 | 1.40 | 1.05 | 0.70 | 2.00 | 1.40 | 55 | 100 | 75 | 70 | 105 | 90 |
| | Fusilade+ rape seed oil | 0.30 | 1.15 | 1.00 | 0.48 | 1.35 | 1.04 | 46 | 80 | 70 | 65 | 100 | 80 |
| Dual inoculants | Control | 1.60 | 2.45 | 2.01 | 1.89 | 3.90 | 2.85 | 105 | 165 | 145 | 115 | 210 | 160 |
| | Fusilade alone | 1.55 | 1.89 | 1.55 | 1.55 | 2.85 | 2.11 | 78 | 145 | 110 | 100 | 160 | 145 |
| | Fusilade+ glue | 1.40 | 1.95 | 1.60 | 1.60 | 2.65 | 2.10 | 85 | 155 | 115 | 105 | 165 | 150 |
| | Fusilade+ mineral oil | 1.30 | 1.65 | 1.30 | 1.40 | 2.75 | 2.02 | 75 | 115 | 100 | 105 | 160 | 150 |
| | Fusilade+ rape seed oil | 1.04 | 1.40 | 1.15 | 1.24 | 2.10 | 1.84 | 70 | 110 | 90 | 90 | 145 | 115 |

*- Initial total bacterial count was 60 x $10^2$ (CFU/g dry soil).

The results indicated that application of all additives with fusilade herbicides or without at the recommended dose caused a markedly decrease in PDB densities depending on the state of additives, while fusilade alone caused the highest decreasing as compared with untreated control.

The obtained $CO_2$ evolution recorded in (Table 2) during the three stage of broad bean growth as a mean value. Meanwhile, there is a strong relationship between the living biomass and $CO_2$ rate, while the highest rate of $CO_2$ was observed in treatments inoculated with a dual inoculation as comparing with other treatment, thus followed by treatment inoculated with *R. leguminosarum*.

**Table (2): Soil $CO_2$ and nitrogenase activity of broad bean nodules affected by biofertilizers and fusilade herbicide application in the field experiments conducting during the two years, at Maryout Experimental Station..**

| Biofertilizers | Herbicide treatments | Herbicide treatments | | | 2st. Year (2010/2011) | | | 1st. Year (2009/2010) | 2st. Year (2010/2011) |
|---|---|---|---|---|---|---|---|---|---|
| | | Days after sowing | | | | | | Nitrogenase in nodules of broad bean µL$C_2h_4$/g$^{-1}$ dry nodule/hr | |
| | | 35 | 70 | 120 | 35 | 70 | 120 | | |
| Non Inoculation | Control | 16.12 | 63 | 16.77 | 17.12 | 17.50 | 17.14 | 0.0 | 0.0 |
| | Fusilade alone | 15.61 | 74 | 15.80 | 16.20 | 16.80 | 16.56 | 0.0 | 0.0 |
| | Fusilade+ glue | 15.80 | 64 | 16.12 | 16.80 | 16.88 | 16.62 | 0.0 | 0.0 |
| | Fusilade+ mineral oil | 15.66 | 59 | 15.66 | 16.77 | 16.80 | 16.20 | 0.0 | 0.0 |
| | Fusilade+ rape seed oil | 15.10 | 79 | 15.61 | 16.12 | 16.62 | 16.12 | 0.0 | 0.0 |
| *R.leguminosarum* | Control | 16.88 | 76 | 17.82 | 17.81 | 19.60 | 18.38 | 310.2 | 411.4 |
| | Fusilade alone | 16.20 | 78 | 17.22 | 16.88 | 18.71 | 18.11 | 119.6 | 126.1 |
| | Fusilade+ glue | 16.77 | 78 | 17.60 | 17.33 | 19.41 | 18.16 | 144.2 | 164.6 |
| | Fusilade+ mineral oil | 16.62 | 71 | 17.50 | 17.10 | 19.20 | 18.13 | 162.7 | 184.8 |
| | Fusilade+ rape seed oil | 16.12 | 77 | 17.10 | 16.62 | 19.00 | 18.10 | 48.3 | 64.4 |
| *B. megaterium* | Control | 16.62 | 73 | 17.60 | 17.60 | 19.41 | 18.22 | 193.4 | 209.5 |
| | Fusilade alone | 16.12 | 73 | 17.22 | 17.33 | 19.20 | 18.13 | 38.2 | 44.6 |
| | Fusilade+ glue | 16.56 | 74 | 17.50 | 17.50 | 19.21 | 18.16 | 36.1 | 47.4 |
| | Fusilade+ mineral oil | 16.20 | 66 | 17.33 | 17.22 | 19.18 | 18.10 | 25.2 | 23.2 |
| | Fusilade+ rape seed oil | 15.80 | 100 | 17.10 | 17.12 | 19.00 | 18.10 | 0.0 | 0.0 |
| Dual inoculants | Control | 17.60 | 88 | 18.49 | 17.81 | 21.42 | 20.10 | 1132.2 | 2141.6 |
| | Fusilade alone | 17.22 | 93 | 18.11 | 17.33 | 21.24 | 19.64 | 252.4 | 262.2 |
| | Fusilade+ glue | 17.50 | 86 | 18.21 | 17.56 | 21.30 | 19.70 | 279.6 | 391.3 |
| | Fusilade+ mineral oil | 17.33 | 79 | 18.13 | 17.50 | 21.22 | 19.50 | 302.1 | 409.1 |
| | Fusilade+ rape seed oil | 17.10 | 4.31 | 18.10 | 17.10 | 21.02 | 19.41 | 205.3 | 208.3 |

*- Initial $Co_2$ evolution 14.82 mg/100 g soil/24 hr.

However, inoculations with *B. megaterium* come in a descending order in both seasons. The dual inoculation without herbicides increased the rate of $CO_2$ at 35, 70 and 120 days by 9.18, 38.68and 10.26 % (1st year) and 4.03, 22.40and 17.27 % (2nd year) as compared with un inoculated control. These data suggest that there was stimulation in the microbial activity regardless of using biofertilizers inoculation while, dual inoculation increased the amount of CO2 than the single inoculation. On the other hand, fusilade herbicides with or without additives decreased the amount of $CO_2$ as compared with its respective control, but in varied reduction depending on the stage of broad bean growth and the type of additives.

Nitrogenase is the enzyme used by some organisms to fix atmospheric nitrogen gas (N2), during the studying seasons; nitrogenase activity was not detected in non inoculated plots, while the fertilized plots with dual strains recorded the highest level of nitrogenase followed with inoculation by *R. leguminosarum* in the second level and finally with *B. megaterium* in the lowest third level. However, in general treating with fusilade decreased the level of nitrogenase than its respectable control in both seasons depending on the type of additives and amount of herbicide. It is normally considered that biofertilizers added to broad bean seeds that are likely resulted in the activity of nitrogenase than uninoculated plots. Data report that there was a correlation between *R. leguminosarum* with nitrogenase activity under the field conditions, showing limitations offered by the broad bean seed inoculated with *B. megaterium* to the expression of nitrogenase in nodules. It is possible to depending on nitrogenase activity as an indicator of biofertilizers strains performance. During the two years of demographic study, 20 species within 14 families, belonging to the three classes of weeds were reported by survey analysis in the experimental locations. The poaceae family was the most abundant family and *Staria* sp *is* the most abundant species, followed with *Phalars minor* for non bio-fertilizers and fertilized plots. While broad leaved weeds came in the second category as a dominant weed such as *M. pariviflora* in the first seasons and *M. indicus, C. murale* in the second season (Table 3). In this community there was *R. dentatus, M. polymorpha and C. pumilum* broad leaved weeds very rare. The relative abundance of most *perennial* weeds (*C. arvensis* and *C. rotundus*) was recorded almost in moderate values. During the two seasons, broad leaved weeds were the most abundance than narrow leaved weeds which came in the second order and followed by perennial weeds in last order.

Based on species composition, coefficient of similarity (CS) is used to compare pairs of communities. Communities that are exactly the same will have 100% similarity, while dissimilar communities will have low percent similarity values. In 1st year the lowest coefficient of similarity between the two plots which fertilized by single microbe (*B. megaterium)* and dual inoculation by 74.13 percent similarity. However the highest coefficient of similarity was found between *B. megaterium* alone and dual inoculation plots by 85.63% percent similarity. In 2nd year, the lowest coefficient of similarity appeared between the non fertilizers and *R. leguminosarum* communities by 88.45% percent similarity. However the highest coefficient of similarity was found between *B. megaterium* and dual inoculation plots by 92.4% (data not shown).

**Table (3): Relative abundance of weeds species in broad bean in the field experiments conducting during 2009/2010 and 2010/2011 seasons, at Maryout Experimental Station.**

| Weed classification | | | 1st. Year (2008/2009) | | | | 2nd. Year (2009/2010) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No | Weed type | Scientific name | Non inoculants | *R. leguminosaru* | *B.megaterium* | *R. leguminosarum + B. megaterium* | Non inoculants | *R. leguminosaru* | *B.megaterium* | *R. leguminosarum + B. megaterium* |
| 1 | *Narrow leaved* | *Staria* sp | 155.8 | 143.8 | 145.8 | 144.8 | 239.7 | 220.7 | 211.7 | 221.7 |
| 2 | | *P. minor* | 122.8 | 114.8 | 116.8 | 93.6 | 92.7 | 89.7 | 97.7 | 82.6 |
| 3 | | *P. annua* | 0.0 | 19.2 | 19.2 | 20.2 | 0.00 | 19.1 | 19.1 | 19.1 |
| 4 | | *P. Monospeliensis* | 27.0 | 43.0 | 46.2 | 69.3 | 0.00 | 0.00 | 19.1 | 37.3 |
| 5 | | *H. marinum* | 28.2 | 13.2 | 44.3 | 79.8 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Total | | 333.8 | 334 | 372.3 | 407.7 | 332.5 | 329.7 | 347.8 | 360.8 |
| 6 | Broad leaved | *M. pariviflora* | 89.8 | 76.6 | 100.6 | 110.8 | 19.1 | 19.1 | 42.3 | 105.7 |
| 7 | | *C. murale* | 84.6 | 74.5 | 89.6 | 82.6 | 103.7 | 84.6 | 92.6 | 108.7 |
| 8 | | *B. vulgaris* | 49.2 | 45.0 | 43.0 | 58.2 | 91.6 | 66.4 | 96.6 | 94.6 |
| 9 | | *C. bursa-pastoris* | 52.6 | 39.5 | 26.3 | 29.2 | 20.16 | 0.00 | 0.00 | 19.1 |
| 10 | | *S. oleraceus* | 77.6 | 72.6 | 59.6 | 40.3 | 79.6 | 60.4 | 38.3 | 19.1 |
| 11 | | *S. irio* | 26.2 | 2.0 | 27.0 | 12.0 | 77.6 | 76.6 | 78.6 | 38.3 |
| 12 | | *M. indicus* | 12.0 | 13.2 | 0.0 | 0.0 | 19.16 | 0.00 | 0.00 | 0.00 |
| 13 | | *R. dentatus* | 0.0 | 26.2 | 0.0 | 0.0 | 0.00 | 20.1 | 0.00 | 0.00 |
| 14 | | *M. polymorpha .* | 0.0 | 52.5 | 13.2 | 13.2 | 0.00 | 19.1 | 0.00 | 0.00 |
| 15 | | *C. squamatus* | 0.0 | 23.2 | 6.0 | 6.0 | 0.00 | 58.4 | 20.1 | 20.1 |
| 16 | | C. pumilum | 26.3 | 8.0 | 0.0 | 13.2 | 0.00 | 19.1 | 0.00 | 0.00 |
| | Total | | 418.3 | 433.3 | 365.3 | 365.5 | 411.2 | 424.3 | 368.7 | 406.0 |
| 17 | Perennial weeds | *C. arvensis* | 64.6 | 45.5 | 39.5 | 46.5 | 38.3 | 0.00 | 0.00 | 19.1 |
| 18 | | *P. Communis* | 39.5 | 67.6 | 70.6 | 59.5 | 77.6 | 60.4 | 59.4 | 59.4 |
| 19 | | *C. rotundus* | 53.5 | 71.0 | 73.0 | 73.0 | 57.4 | 76.6 | 78.6 | 60.4 |
| 20 | | *C. dactylon* | 38.32 | 0.00 | 0.00 | 19.16 | 22.99 | 11.49 | 0.00 | 11.49 |
| | Total | | 195.9 | 184.1 | 183.1 | 198.1 | 196.2 | 148.4 | 138 | 150.3 |
| Total | | | 948.0 | 951.4 | 920.7 | 971.4 | 940.0 | 902.5 | 854.5 | 917.2 |

Data in (Table 4) illustrated that application fusilade with and without additives significantly decreased total narrow weed fresh weight (p=0.05) in the two season regardless of the absence more than the presence of bio fertilizers, otherwise, the reduction effect in the presence of *R. leguminosarum* was slightly affected than other plot inoculated with *B. megaterium* and dual inoculation. According to total dry weight, the addition of all applied additives to fusillade at (1.0 L/fed.) resulted a significant (p=0.05) reduction in total dry weight of narrow weeds after three weeks from the treatment than the untreated check in the absence more than the presence of bio fertilizers in generally followed by the presence of inoculation with *R. leguminosarm*. While mixing mineral oil with fusilade during 1st and 2nd years were the most effective additives in reducing narrow leaf weeds fresh weight by 86.6 and 72.0%, respectively compared with its control. Addition of mineral oil and rape seed oil promote the efficiency of fusillade at (1.0 L/fed.) more than adding glue in total narrow weed control. On the other hand, fusillade alone at (1.5 L/fed.) present a lower efficiency in narrow weed control than when mixed at the micro rate with additives (Table 4). During 1st and 2nd years using fusilade at (1.0 L/fed.) plus mineral oil achieved the highest significant reduction in total narrow leaved weeds dry weight by 84.7 and 77.4% respectively as compared with its control.

**Table (4): Narrow weed total biomass (gm/ m²) affected by treating broad bean with fusilade treatment during 2009/2010 and 2010/2011 seasons, at Maryout Experimental Station.**

| Biofertilizers | Herbicide treatments | 1st. Year (2009/2010) | | | | | | 2nd. Year (2010/2011) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Fresh weight | Dry weight | Fresh weight | | Dry weight | | Fresh weight | Dry weight | Fresh weight | | Dry weight | |
| | | Total Narrow weeds | Total Narrow weeds | *P. minor* | *Staria sp* | *P. minor* | *Staria sp* | Total Narrow weeds | Total Narrow weeds | *P. minor* | *Staria sp* | *P. minor* | *Staria sp* |
| Non inoculants | Control | 454.5 | 65.1 | 18.7 | 44.1 | 2.9 | 6.7 | 473.00 | 49.70 | 5.86 | 58.0 | 0.16 | 6.17 |
| | Fusilade alone | 229.9 | 20.9 | 12.5 | 27.5 | 2.1 | 3.6 | 159.93 | 25.62 | 3.93 | 46.7 | 0.12 | 3.66 |
| | Fusilade+ glue | 219.3 | 36.6 | 11.0 | 19.1 | 2.4 | 3.0 | 146.70 | 16.32 | 3.19 | 27.1 | 0.07 | 2.87 |
| | Fusilade+ mineral oil | 60.0 | 18.4 | 10.7 | 15.3 | 1.3 | 3.1 | 145.63 | 14.31 | 3.27 | 37.0 | 0.07 | 2.86 |
| | Fusilade+ rape seed oil | 128.3 | 19.2 | 9.6 | 16.5 | 2.o | 3.0 | 134.90 | 14.29 | 3.20 | 26.3 | 0.09 | 2.96 |
| *R.leguminosarum* | Control | 342.3 | 58.1 | 18.0 | 40.7 | 3.4 | 5.9 | 370.50 | 48.93 | 5.50 | 53.7 | 0.19 | 6.00 |
| | Fusilade alone | 93.8 | 18.0 | 8.5 | 23.0 | 2.4 | 3.4 | 169.10 | 25.18 | 4.20 | 50.0 | 0.13 | 3.63 |
| | Fusilade+ glue | 178.5 | 22.0 | 9.2 | 29.6 | 2.2 | 4.3 | 147.40 | 15.10 | 4.67 | 45.5 | 0.12 | 3.07 |
| | Fusilade+ mineral oil | 71.3 | 19.4 | 6.9 | 21.7 | 1.8 | 1.7 | 137.60 | 13.55 | 4.27 | 26.3 | 0.10 | 3.10 |
| | Fusilade+ rape seed oil | 127.0 | 38.9 | 8.5 | 22.9 | 2.0 | 3.3 | 151.03 | 13.57 | 4.60 | 49.3 | 0.11 | 3.15 |
| *B. megaterium* | Control | 337.5 | 52.3 | 17.3 | 35.5 | 3.4 | 6.3 | 476.83 | 58.48 | 5.50 | 55.8 | 0.19 | 6.16 |
| | Fusilade alone | 132.4 | 18.3 | 11.7 | 20.5 | 1.7 | 4.4 | 162.53 | 14.25 | 4.40 | 50.9 | 0.12 | 3.84 |
| | Fusilade+ glue | 86.8 | 8.4 | 14.7 | 21.7 | 1.4 | 2.8 | 166.40 | 14.17 | 4.00 | 55.4 | 0.13 | 3.59 |
| | Fusilade+ mineral oil | 74.2 | 8.0 | 6.5 | 19.6 | 1.3 | 2.8 | 169.90 | 13.23 | 3.37 | 58.0 | 0.10 | 3.28 |
| | Fusilade+ rape seed oil | 65.0 | 9.4 | 10.0 | 24.0 | 1.5 | 3.4 | 155.66 | 13.29 | 3.40 | 43.7 | 0.13 | 3.37 |
| Dual inoculants | Control | 441.0 | 42.5 | 11.0 | 33.8 | 3.2 | 6.8 | 581.00 | 68.90 | 4.97 | 64.5 | 0.19 | 6.99 |
| | Fusilade alone | 118.0 | 22.5 | 14.6 | 31.2 | 1.7 | 3.7 | 171.50 | 31.23 | 4.47 | 42.1 | 0.14 | 4.00 |
| | Fusilade+ glue | 76.0 | 21.5 | 6.9 | 21.7 | 1.3 | 3.5 | 172.26 | 25.20 | - | 62.2 | - | 3.25 |
| | Fusilade+ mineral oil | 73.7 | 18.3 | 9.0 | 16.3 | 1.2 | 2.8 | 162.20 | 21.19 | 3.13 | 50.5 | 0.12 | 3.28 |
| | Fusilade+ rape seed oil | 74.1 | 19.6 | 13.3 | 19.2 | 1.4 | 3.1 | 170.40 | 24.24 | 3.13 | 58.7 | 0.13 | 3.02 |
| LSD (5%) value of bio fertilizers | | 1.521 | 4.17 | 2.78 | 1.69 | 3.39 | 0.75 | 3.10 | 3.40 | 1.23 | 4.76 | 0.73 | 2.31 |
| LSD (5%) value of fusilade | | 0.657 | 5.79 | 3.89 | 2.06 | 2.06 | 0.05 | 2.44 | 6.44 | 2.01 | 5.65 | 0.05 | 2.65 |
| LSD (5%) of bio fertilizer × fusilade | | 0.880 | 1.58 | 1.84 | 1.53 | 1.61 | 0.60 | ns | 1.79 | ns | 1.24 | 0.61 | ns |

The present data at (Table 4) clearly demonstrate that all additives mixed with fusilade at (1.0 L/fed.) increased its reduction activity significantly (p=0.05) than fusilade alone at the recommended dose against *P. minor* total dry weight after three weeks from application but in different varying levels in fertilized plots with *R. leguminosarum* and its respectable control. Whoever, fusilade activity decreased in plots inoculated with *B. megaterium* and dual inoculation plots. Meanwhile inside this plots, applying fusilade at (1.0 L/fed.) plus mineral oil caused a significant activity in *P. minor* dry weight than its control at both seasons. According to *P. minor* fresh weight, during1$^{st}$years mixing fusilade at (1.0 L/fed.) with mineral oil achieved the maximum inhibition in *P. minor* fresh weigh by 62.4 and 45.6 % comparing with its controls. While during the 2$^{nd}$ season fusilade at micro rate with glue achieved the highest reduction in *P. minor* fresh and dry weight by 45.6 and 56.3% respectively comparing with the control. Data also indicated that there was a significant reduction during the two seasons in *Staria* sp dry weight after treated with fusilade with and without additives in either inoculated or non inoculated plots. In this issue the reduction activity of fusilade with or without additives increased in non inoculated plots followed with plots inoculated with *R. leguminosarum,* and dual inoculation in the second class. The above mentioned results represented that treating of bio–fertilizers was significantly sufficient to encourage the capability of the broad bean plants to produce vigorous vegetable growth than the control. Applying fusilade at (1.0 L/fed.) with glue or with rape seed oil achieved the maximum inhibition in *Staria* sp fresh weigh by 65.3 and 54.7 % comparing with its controls. However, applying fusilade at (1.0 L/fed.) with mineral oil or with rape seed oil showed the maximum inhibition in *Staria* sp dry weigh by 58.8 (1$^{st}$ year) and 56.8% (2$^{nd}$ year) respectively than its respectable control.

Information on weed abundance, community composition and ecological characteristics in conjunction with agro-ecosystem analysis create the basic knowledge for selection and evaluation of weed control tactical options. Adoption of tactics that can be directed at weeds type which causes the highest reduction in the crop productivity or the life cycles of most dominance weeds such as: seed, vegetative and generative phases of weeds populations. Meanwhile, *Staria* sp classified as a summer annual weeds, while it's able to germinate and growing healthy with high density in broad bean in winter season, it may be due to the increasing of temperature as a result of extending the summer season and delaying the cold season a side effect of climatic changes over the world. The above mention results showed that adding mineral oil or glue or rape seed oil in binary mixtures with fusilade at low rate at (1.0 L/fed.) in the spray tank increasing the effectiveness of the herbicides as compared with fusilade at recommended dose. It is clear from the reduction in weeds biomass fresh and dry weights as a result from the changing in chemical properties of the spray tank regardless of the addition of additives. While mixing rape seed oil with fusilade at (1.0 L/fed.) have slightly affected on the total count of microbes as compared with others treatment. According to the results, weeds growth in the inoculated broad bean seeds plots were grown stronger than in un inoculated plots with bio fertilizers and have a less response to fusilade herbicides which reflecting the adoption of weeds to have their nutrition needs from the hosting crop. These findings are in agreement with Harker,(1992) and lead to convenient recommendation with fusilade at 1.0 L/fed. plus mineral oil or glue and 3% of the later for the most significant results could be obtained on increasing yield and eliminating growth of associated weeds of broad bean crop. Our results are in agreement with El-Shahawy, (2008) found a significant role of using nitrogen- containing fertilizers on increasing the herbicidal efficiency of fusilade herbicides for controlling weeds associated with faba bean (*Vicia faba L.*)

**Table (5): Effect of microbial inoculation and fusilade treatment on height and number of branches of broad bean plants during 2009/2010 and 2010/2011 seasons, at Maryout Experimental Station.**

| Biofertilizers | Herbicide treatments | Height(cm) | | | | | | Number of branches /plants | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1st. Year (2009/2010) | | | 2st. Year (2010/2011) | | | 1st. Year (2009/2010) | | | 2st. Year (2010/2011) | | |
| | | Days after sowing | | | | | | | | | | | |
| | | 35 | 70 | 120 | 35 | 70 | 120 | 35 | 70 | 120 | 35 | 70 | 120 |
| Non inoculants | Control | 25.8 | 37.0 | 45.2 | 33.6 | 45.0 | 61.2 | 3.0 | 5.0 | 6.7 | 4.0 | 6.0 | 7.3 |
| | Fusilade alone | 20.3 | 34.0 | 40.4 | 31.2 | 45.3 | 60.2 | 2.7 | 4.7 | 5.3 | 3.7 | 6.0 | 7.0 |
| | Fusilade+ glue | 19.0 | 33.0 | 42.0 | 29.1 | 43.7 | 51.6 | 2.3 | 4.7 | 6.0 | 3.3 | 5.7 | 7.3 |
| | Fusilade+ mineral oil | 21.7 | 43.0 | 42.2 | 30.6 | 47.0 | 57.8 | 2.0 | 4.0 | 5.3 | 3.3 | 5.7 | 6.7 |
| | Fusilade+ rape seed oil | 22.3 | 37.0 | 44.2 | 28.7 | 43.7 | 50.9 | 2.7 | 3.3 | 5.3 | 3.0 | 5.3 | 6.7 |
| *R.leguminosarum* | Control | 28.6 | 40.0 | 58.3 | 45.6 | 65.0 | 76.4 | 4.0 | 6.0 | 7.3 | 5.0 | 8.3 | 8.7 |
| | Fusilade alone | 25.4 | 51.0 | 55.6 | 42.7 | 62.3 | 71.1 | 3.3 | 4.7 | 7.0 | 4.7 | 7.3 | 7.7 |
| | Fusilade+ glue | 27.5 | 52.7 | 57.9 | 47.3 | 61.9 | 73.6 | 3.0 | 5.0 | 7.0 | 4.3 | 7.0 | 7.0 |
| | Fusilade+ mineral oil | 23.8 | 54.0 | 57.7 | 45.1 | 62.3 | 75.4 | 3.3 | 4.0 | 6.3 | 4.3 | 7.3 | 7.3 |
| | Fusilade+ rape seed oil | 26.4 | 48.0 | 55.8 | 44.8 | 61.7 | 74.2 | 2.3 | 4.0 | 6.0 | 4.0 | 7.0 | 7.0 |
| *B. megaterium* | Control | 25.8 | 41.0 | 54.6 | 41.6 | 63.0 | 70.8 | 4.7 | 6.0 | 7.0 | 5.3 | 8.0 | 8.0 |
| | Fusilade alone | 21.4 | 43.3 | 50.9 | 39.7 | 58.6 | 67.8 | 4.0 | 5.0 | 6.3 | 5.3 | 7.3 | 7.3 |
| | Fusilade+ glue | 23.7 | 47.0 | 55.8 | 40.5 | 60.0 | 69.1 | 4.0 | 5.0 | 6.3 | 4.7 | 7.0 | 7.7 |
| | Fusilade+ mineral oil | 22.9 | 44.0 | 52.6 | 42.0 | 62.7 | 70.2 | 4.0 | 4.7 | 6.0 | 4.0 | 7.0 | 7.3 |
| | Fusilade+ rape seed oil | 20.7 | 40.0 | 52.0 | 40.9 | 60.0 | 68.4 | 3.3 | 4.3 | 5.7 | 4.3 | 6.7 | 7.0 |
| Dual inoculants | Control | 33.8 | 55.0 | 67.2 | 47.6 | 75.3 | 87.4 | 6.0 | 8.0 | 9.0 | 6.7 | 9.7 | 11.0 |
| | Fusilade alone | 29.7 | 48.0 | .63.7 | 44.3 | 70.3 | 81.7 | 5.0 | 7.7 | 8.3 | 5.7 | 9.0 | 10.7 |
| | Fusilade+ glue | 26.6 | 44.0 | 61.9 | 45.6 | 72.7 | 80.6 | 4.0 | 7.7 | 8.7 | 6.0 | 9.3 | 11.0 |
| | Fusilade+ mineral oil | 25.2 | 41.0 | 61.0 | 45.8 | 73.0 | 84.3 | 4.7 | 7.3 | 8.0 | 6.0 | 9.0 | 10.3 |
| | Fusilade+ rape seed oil | 24.7 | 34.0 | 60.4 | 45.0 | 72.4 | 82.0 | 4.0 | 7.0 | 7.3 | 5.7 | 8.7 | 10.0 |
| LSD (5%) value of bio fertilizers | | 1.521 | 0.809 | 1.432 | 2.314 | 1.305 | 1.225 | .26 | 0.77 | 0.88 | 0.53 | 0.89 | 0.76 |
| LSD (5%) value of fusilade | | 0.657 | ns | ns | 1.237 | ns | ns | 002 | ns | ns | ns | ns | ns |
| LSD (5%) to bio fertilizer × fusilade | | 0.880 | Ns | ns | 0.956 | 0.687 | ns | 0.18 | ns | 0.10 | 0.43 | ns | 0.54 |

Broad bean data (Table 5) were mentioned with growth and productivity traits and its response to both biofertilizers and fusilade application. As for the plant height evaluation, biofertilizers significantly increase broad bean height at 35, 70 and 120 days (p=0.05) regardless of the presence of single or dual inoculation at the two seasons which achieved the highest length in broad bean than uninoculated treatment. Meanwhile, fusilade with or without additives have a slightly effect on broad bean height at 35 days than the stages of 70 and 120 days which did not recorded any significant reduction effect during the two seasons. The highest broad bean height was obtained when the plants were treated with dual inoculation in the absence or the presence of fusilade treatments as compared with non treated control. Concerning the broad bean branches, these induced significantly at 35 days with bio fertilizers. Meanwhile, number of branches slightly induced at 70 and 120 days through the both seasons. In this respect the interaction effect between bio fertilizers and fusilade herbicides on the broad bean branches number appeared at 35 days than 70 and 120 days (Table 5). The maximum branches number per plant was obtained when the plants were treated with the dual inoculation in the absence and the presence of fusilade application at 120 days as compared with untreated control.

Data in (Table 6) illustrated the interaction effect between bio fertilizers and fusilade herbicides on broad bean fresh weight at the three stages (35, 70 and 120 days). It was noticed that bio fertilizers increasing broad bean fresh weight significantly than untreated control. In general, there were significance reduction differences in broad bean fresh weight regardless of fusilade treatment than untreated control, while fusilade alone at 1.5 L/fed. recorded the highest decreased in broad bean fresh weight in both seasons. During 1$^{st}$ year, the result showed that fusilade at 1.5 L/fed. caused the maximum inhibition in broad bean fresh weight at 70 and 120 days by 40.5 and 33.1%, respectively, than untreated control. However, during 2$^{nd}$ year fusilade at 1.5 L/fed. through 35, 70 and 120 days caused the highest reduction in broad bean fresh weight by 32.2, 20.9 and 30.1%, respectively as compared with the control. As for broad bean nodules number, bio fertilizers at 35,70 and 120 days stimulate nodules numbers significantly (p= 0.05) than non fertilized treatment which did not recorded any number of nodules during both stages and seasons. The highest number of nodules recorded at 70 days from using double microbes (*B. megaterium* and *R. leguminosarum*) than others plots. The lowest nodules number achieved from inoculation with *B. megaterium* as compared with others bio fertilizers. The present result clearly demonstrates the addition of rape seed oil to fusilade at 1.0 L/fed. significantly reduced number of nodules at 35,70 and 120 days by 28.8,29.5 and 37.1% (1$^{st}$year) and 20.1, 14.1 and 23.8% (2$^{nd}$year) as compared with its respectable control.

**Table (6): Effect of biofertilizers and fusilade treatment on fresh weight and number of nodules of broad bean during 2009/2010 and 2010/2011 seasons, at Maryout Experimental Station.**

| Biofertilizers | Herbicide treatments | Broad bean fresh weights | | | | | | Number of nodules/5 plant | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1st. Year (2009/2010) | | | 2st. Year (2010/2011) | | | 1st. Year (2009/2010) | | | 2st. Year (2010/2011) | | |
| | | Days after sowing | | | | | | | | | | | |
| | | 35 | 70 | 120 | 35 | 70 | 120 | 35 | 70 | 120 | 35 | 70 | 120 |
| Non inoculants | Control | 32.8 | 46.4 | 53.6 | 33.6 | 49.3 | 62.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Fusilade alone | 30.2 | 45.1 | 48.9 | 29.8 | 42.3 | 53.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Fusilade+ glue | 26.7 | 42.3 | 50.1 | 27.3 | 41.3 | 50.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Fusilade+ mineral oil | 28.3 | 46.5 | 49.2 | 29.2 | 47.7 | 55.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Fusilade+ rape seed oil | 31.4 | 45.8 | 48.3 | 32.1 | 43.3 | 52.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *R. leguminosarum* | Control | 61.7 | 96.9 | 112.4 | 78.6 | 97.3 | 121.6 | 72.7 | 92.7 | 78.3 | 97.3 | 144.0 | 114.0 |
| | Fusilade alone | 50.4 | 77.8 | 89.4 | 53.3 | 80.7 | 93.4 | 57.0 | 77.0 | 62.0 | 81.7 | 128.0 | 97.7 |
| | Fusilade+ glue | 53.6 | 69.5 | 86.2 | 62.3 | 85.0 | 106.4 | 60.0 | 75.0 | 60.0 | 84.7 | 126.3 | 95.0 |
| | Fusilade+ mineral oil | 58.1 | 84.0 | 102.7 | 67.3 | 90.7 | 115.2 | 65.7 | 86.7 | 71.7 | 90.3 | 138.0 | 106.7 |
| | Fusilade+ rape seed oil | 53.9 | 83.7 | 82.4 | 71.3 | 88.3 | 109.8 | 53.0 | 72.3 | 57.3 | 77.7 | 123.7 | 93.0 |
| *B. egaterium* | Control | 53.4 | 84.2 | 104.8 | 62.4 | 96.0 | 111.5 | 41.7 | 60.0 | 45.0 | 67.3 | 114.7 | 84.0 |
| | Fusilade alone | 46.2 | 70.3 | 80.8 | 51.3 | 88.7 | 89.2 | 33.0 | 51.0 | 36.0 | 57.7 | 102.3 | 71.7 |
| | Fusilade+ glue | 47.1 | 69.2 | 76.4 | 54.6 | 90.3 | 77.9 | 34.0 | 54.3 | 39.3 | 58.7 | 105.3 | 75.0 |
| | Fusilade+ mineral oil | 49.2 | 82.4 | 94.7 | 57.4 | 86.3 | 91.3 | 37.0 | 56.0 | 41.0 | 61.7 | 107.3 | 76.7 |
| | Fusilade+ rape seed oil | 46.9 | 78.0 | 86.8 | 56.8 | 84.3 | 91.7 | 29.7 | 42.3 | 28.3 | 54.3 | 93.7 | 64.0 |
| Dual inoculants | Control | 92.6 | 182.0 | 210.1 | 97.6 | 148.3 | 178.4 | 84.3 | 120.7 | 105.7 | 112.3 | 172.0 | 141.3 |
| | Fusilade alone | 75.1 | 108.2 | 140.6 | 85.1 | 117.3 | 155.6 | 73.3 | 104.7 | 86.3 | 98.0 | 156.0 | 122.0 |
| | Fusilade+ glue | 80.9 | 141.3 | 162.8 | 90.1 | 120.3 | 164.2 | 75.7 | 110.0 | 91.7 | 100.3 | 161.3 | 127.3 |
| | Fusilade+ mineral oil | 84.3 | 152.0 | 171.3 | 93.3 | 135.3 | 167.8 | 81.7 | 120.3 | 95.3 | 106.3 | 171.7 | 131.0 |
| | Fusilade+ rape seed oil | 82.7 | 143.6 | 165.1 | 92.5 | 125.3 | 165.7 | 68.7 | 103.0 | 84.7 | 93.3 | 154.3 | 123.7 |
| LSD (5%) value of bio fertilizers | | 3.41 | 2.76 | 3.10 | 2.31 | 2.56 | 3.16 | 1.16 | 1.02 | 2.21 | 1.71 | 3.10 | 2.17 |
| LSD (5%) value of fusilade | | 1.73 | 1.80 | 2.72 | 2.53 | 3.00 | 1.75 | 1.27 | 1.20 | 1.23 | 0.87 | 1.72 | 1.90 |
| LSD (5%)= bio fertilizer × fusilade | | 1.04 | 1.36 | 2.10 | 1.74 | 2.12 | 0.31 | 0.87 | 0.85 | 0.22 | 0.52 | 1.54 | 1.47 |

The data revealed that sowing seeds were stimulated resulted in with inoculation with the dual inoculation (*R. leguminosarum* + *B. megaterium)* have significant effect (p=0.05) on germination percentage than non biofertilized treatments (Table 7), while others biofertilized and non fertilized treatments have a slightly effect in broad bean germination in both seasons. The seed pod yield fresh weight was markedly affected by bio fertilizers and fusilade application but in different levels in both seasons. Treatment fertilized with double microbes recorded the highest increasing in broad bean productivity followed by treatments inoculated by *R. leguminosarum* and in the third category treatments inoculated with *B. megaterium*. However, the lowest productivity recorded in uninoculated plots. In this respect, treated with mixing fusilade at 1.0 L/fed. with glue recorded the low yield quantity as compared with other additives mixture, while fusilade alone recorded the highest reduction values in broad bean productivity during the two seasons. Broad bean yield affected greatly by activation resulted in inoculation with biofertilizers appeared in than uninoculated plots. Meanwhile, weed control with fusilade with or without additives increased broad bean pod yield fresh weight ranged from (16.2 to 37.3) 1$^{st}$ year and (23.3 and 50.1 %) 2$^{nd}$ year as compared with its control. Single inoculation with *R .leguminosarum* increased broad bean pod yield fresh weight at 1$^{st}$ and 2$^{nd}$ year by 134.1 and 181.8% respectively than untreated treatment. While inoculation with single strain *(B. megaterium)* caused activation during the both seasons in broad bean productivity by 85.4 and 97.5% respectively. Finally dual inoculation (*R. leguminosarum +B. megaterium*) in the absent of fusilade posses the maximum increasing in broad bean yield at the two season by 239.1 and 256.1% respectively as compared with non fertilized plots. While the dual inoculation in the presence of all applied additives with fusilade or without additives increased broad bean pod yield fresh weight ranging from 147.8 to 324.01% (1$^{st}$year) and 157.71 to 349.27% (2$^{nd}$ year) as compared with non treated control with biofertilizers and fusilade herbicides. Generally, to maximize broad bean productivity and reducing production costs as well as weed suppression, thus it is recommended for cultivating broad bean with dual inoculation (*R. leguminosarum* plus *B. megaterium*) as biofertilizers and using fusilade at (1.0 L/fed.) with spray tank additives for a narrow weed control which increased productivity of broad bean during the two years ranged from 324.01 to 349.27% (mineral oil) and 296.06 and 340.32% (glue), respectively, and seed protein than untreated control.

Data in (Table 7) indicated that the dual inoculation with (*R. leguminosarum +B. megaterium*) proved to be the most effective biofertilizers that increase broad bean seed protein during the two seasons by (12.8% and 12.04%, respectively). However, the present of fusilade with or without additives slightly affect total protein as compared with its respectable control. In the presence of biofertilizers, fusilade alone at the recommended rate showed the lowest increase in protein percentage at the two seasons (1.7 and 1.6%), respectively, while the highest protein value appear from using fusilade at the micro rate with additives as glue or rape seed oil ranging from 11.5 to 7.8% (1$^{st}$ year) and 8.54 to 7.49% (2$^{nd}$ year), respectively as compared with non treated control. In the present study, broad bean chlorophyll value were recorded with chlorophyll matter after three weeks from spraying with fusilade and the data revealed that broad bean plants slightly affected with fusilade while fusilade selectivity remains very good on broad bean in both causes when used alone or when mixed with additives. Seed protein were fractionations with SDS-PAGE and data showed there no significant effect between treatment than control treatment, while scanning analysis of SDS-PAGE gel revealed the presence of about16 protein bands with molecular weights ranging from 200 to 10 KDa, This findings indicated that there no bade interaction effect between fusilade and biofertilizers on the type of broad bean proteins (data were not shown).

**Table (7): Effect of biofertilizers and fusilade treatment on broad bean germination, total chlorophyll, Pod fresh weight yield and seed protein percentage during 2009/2010 and 2010/2011 seasons, at Maryout Experimental Station**

| Biofertilizers | Herbicide treatments | 1st. Year (2009/2010) | 2st. Year (2010/2011) | 1st. Year (2009/2010) | | | 2st. Year (2010/2011) | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Germination % | | Total Chlorophyll SPAD | Pod fresh yield Kg/fed. | Protein % | Total Chlorophyll SPAD | Pod fresh yield Kg/fed. | Protein % |
| Non Inoculation | Control | 75 | 82 | 39.0 | 2502.4 | 23.5 | 36.00 | 2563.8 | 23.8 |
| | Fusilade alone | 63 | 70 | 35.1 | 3084.8 | 22.8 | 40.37 | 2979.8 | 22.7 |
| | Fusilade+ glue | 74 | 81 | 34.6 | 3756.8 | 23.6 | 30.00 | 3430.4 | 23.8 |
| | Fusilade+ mineral oil | 64 | 71 | 33.1 | 3304.6 | 23.3 | 32.67 | 3520.0 | 23.0 |
| | Fusilade+ rape seed oil | 59 | 66 | 36.0 | 3315.2 | 22.6 | 31.77 | 3139.8 | 22.8 |
| *R.leguminosarum* | Control | 79 | 86 | 36.5 | 7052.8 | 25.3 | 43.53 | 6003.2 | 25.2 |
| | Fusilade alone | 76 | 83 | 33.8 | 6807.4 | 24.2 | 33.40 | 5879.0 | 24.0 |
| | Fusilade+ glue | 78 | 85 | 34.9 | 6165.4 | 25.5 | 34.90 | 5597.4 | 24.9 |
| | Fusilade+ mineral oil | 78 | 85 | 34.5 | 6112.0 | 24.1 | 36.17 | 5222.4 | 23.8 |
| | Fusilade+ rape seed oil | 71 | 78 | 34.3 | 5203.2 | 24.5 | 30.63 | 4902.4 | 25.3 |
| *B. megaterium* | Control | 77 | 84 | 34.0 | 4943.0 | 24. 6 | 44.53 | 4752.6 | 24.8 |
| | Fusilade alone | 73 | 80 | 31.4 | 5408.0 | 23.3 | 30.60 | 4979.2 | 22.2 |
| | Fusilade+ glue | 73 | 80 | 31.6 | 5555.2 | 24.2 | 32.43 | 4535.0 | 24.4 |
| | Fusilade+ mineral oil | 74 | 81 | 33.4 | 5205.4 | 22.3 | 32.67 | 4659.2 | 22.4 |
| | Fusilade+ rape seed oil | 66 | 73 | 33.5 | 3842.2 | 23.2 | 27.93 | 3481.6 | 23.3 |
| Dual inoculants | Control | 100 | 100 | 37.6 | 8911.0 | 26.5 | 44.00 | 8695.0 | 26.7 |
| | Fusilade alone | 88 | 95 | 36.0 | 6449.0 | 23.9 | 45.07 | 6352.6 | 24.2 |
| | Fusilade+ glue | 93 | 100 | 33.2 | 11018.6 | 26.2 | 32.20 | 10154.2 | 25.8 |
| | Fusilade+ mineral oil | 86 | 93 | 34.0 | 11242.6 | 24.9 | 32.57 | 10871.0 | 25.0 |
| | Fusilade+ rape seed oil | 79 | 86 | 34.1 | 8797.8 | 25.3 | 30.60 | 9258.2 | 25.6 |
| LSD (5%) value of bio fertilizers | | 3.31 | 2.31 | 3.35 | 25.00 | 0.15 | 0.57 | 40.30 | 0.23 |
| LSD (5%) value of fusilade | | Ns | Ns | 1.76 | 10.962 | 0.12 | 0.20 | 10.02 | 0.17 |
| LSD (5%) bio fertilizer × fusilade | | ns | ns | 2.00 | 12.40 | ns | 0.37 | 11.30 | ns |

The obtained results clearly mentioned that there was a significant positive effect of rhizobia strains in single or mixed inoculants (*R. leguminosarum+B. megaterium)* as evident from fresh and dry weight of broad bean leaves and stems height, number of brunches as well as the number of nodules compared to non treated plots. In this respect, single or mixed inoculants' with rhizobia increased total bacterial count and achieved higher significantly in mixed inoculants strains than in single inoculants or non inoculants plots. Our results are in agreement with El-Wakeil and El-Sebai, (2007). Plant height, number of pods and seeds/plant as well as weight of pods and seeds/plant, seed, straw and biological yield/fad. and seed protein percentage were increased due to phosphorus fertilizer applications Abou Hussien *et al.,* (2002). Faba bean is one of the best N fixers in legume species. N fixation in faba bean in the 2 range of 165-240 kg N /ha with a net gain to the 2 system of 84 kg N /ha when only grain was removed Maidl *et al.,* (1996). Seed inoculation with nitrogen fixers could improve growth, yield and yield attributes of faba bean El-Ahmed *et al.,* (2003), Salah *et al.,* (2000).The highest number of pods was achieved in treatment of rhizobia mixed with mycorrhizal or pseudomonas *Rhizobium* and phosphorus (P) solubilizing bacteria are important to plant nutrition. These microbes also play a significant role as plant growth-promoting rhizobacteria (PGPR) in the biofertilization of crops Afzal and Asghari, (2008). Inoculations of broad bean with *Rhizobium leguminosarum* or mixed with others may improved plant growth, nodulation, nitrogen fixation and yield these results are in agreement with El Habbasha *et al.,* (2007) found the combination with Rhizobium, Nitrobein or Rhizobium plus Nitrobein increased significantly the most of studied characters compared to control treatment.

In Summary, the obtained results indicated that inoculation with *R. leguminosarum* as a single inoculants or dual inoculants with *B. megaterium* increased microorganism densities and activity which reflected on broad bean growth and tolerability to the stress of fusilade herbicide. Under these conditions of this study it could be concluded that using bio fertilizers as a source of natural growth regulators lead to increase the plant growth, total green pod and enhancing the pod characters of bean plants as well as increased soil microbial number and activity. It also can be a way of reducing the using of chemical for weed control by using spray tank additives that lead to decreased cost and increases the growth benefits.

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## كفاءة الاسمدة الحيوية على فعالية مبيد الحشائش الفيوزيليد ونمو وإنتاجية الفول الرومى

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أجريت الدراسة خلال موسمى ٢٠٠٩ /٢٠١٠ و٢٠١٠/٢٠١١ لدراسة كفاءة إستخدام الاسمدة الحيوية وأثرها على المبيد العشبي الفيوزيليد بدون مواد اضافية على التركيز الموصى بة (١.٥ لتر/ فدان) أومع المواد الاضافية بتركيز(١.٠ لتر/ فدان) لزيادة فاعليتة على الحشائش ضيقة الاوراق وكذلك أثرها على تحسين انتاجية محصول الفول الرومى، ويمكن تلخيص اهم نتائج:

حيث وجد خلال موسمى الدراسة ارتباط موجب بين استخدام الاسمدة الحيوية وصفات المحصول مثل طول النبات،عدد الافرع، أعداد العقد ووزن النبات الخضرى و الجاف، الى جانب زيادة أعداد ونشاط ميكروبات التربة. كمااحدث التلقيح الفردى لبذور الفول الرومى بكتربا الريزوبيم او التلقيح المزدوج بالريزوبيم والباسيلس ميجاتريم لتشجيع النبات على النمو الخضرى بدرجة كافية لزيادة الانتاجية بالمقارنة بالمعاملات الاخرى. كما كان لهذا التلقيح تاثير على ميكروبات التربة بزيادة اعداد ونشاط الميكروبات وانعكس ذلك على نمو وانتاجية المحصول وكذلك على تحمل نبات الفول الرومى للأجهاد الناشئ عن الرش بمبيد الفيوزيليد. خلال الموسم الاول ادى استخدام الفيوزيليد بتركيز(١.٠ لتر/ فدان) مع الزيت المعدنى لاحداث اكبر انخفاض فى الوزن الطازج و الجاف للفلارس حوالي ٦٢.٤ و1.76 ٦ % على التوالي بالمقارنة بالكنترول، بينما فى الموسم التالى احدث خلط الفيوزيليد مع الغراء اكبر انخفاض فى الوزن الطازج و الجاف للفلارس حوالي ٤٥.٦ و ٣ . ٥٦ % على التوالي بالمقارنة بالكنترول . بينما حدث انخفاض فى الوزن الخضرى و الجاف لحشيشة ا للصيق من خلط الفيوزيليد بتركيز(١.٠ لتر/ فدان) مع الزيت المعدنى حوالي ٦٥.٣ و ١٨. ٧١ % فى السنة الاولى ومع زيت الراب حوالي ٥٤.٦ و ٨ . ٥٦ % فى السنة الثانية. كما لم يتم تسجيل اى تغير معنوى من جراء استخدام الفيوزيليد فى نوع ونسبة البروتين فى وجود اوغياب الاسمدة الحيوية. فحين المعاملة باللقاح المزدوج ادى لتحسين نسبة البروتينات فى الموسمين حوالي ١٢.٨ و١٢.٠٤%على التوالى. عموماً وجد ارتباط موجب بين استخدام الاسمدة الحيوية و مبيد الفيوزيليد وبين زيادة الانتاج مع خفض نمو الحشائش وبتالى تقليل تكلفة الانتاج نتيجة خفض كمية المبيد. ولذلك يمكن التوصية بزراعة الفول الرومى بتلقيح البذور بمخلوط اللقحات المزدوجة (الريزوبيم والباسيلس) مع استخدام الفيوزيليد بتركيز(١.٠ لتر/ فدان) لمكافحة الحشائش الرفيعة فى وجود الزيت المعدنى التى ادت لزيادة الانتاج من٠١. ٣٢٤ و ٢٧ . ٣٤٩ %، و فى وجود الغراء ٠٦. ٢٩٦ و ٣٢ . ٣٤٠ % خلال موسمي الدراسة بالمقارنة بالكنترول.

قام بتحكيم البحث

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