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# Effect of Biofilterizers and Control Treatments on Roots Nodulation, Yield and Associated Weeds of Soybean Crop

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## ABSTRACT

This study was carried out during 2013 and 2014 seasons to investigate the effect of different biofertilizers (microbin, phosphorine and rhizobecteren) and weeds control treatments (flauzifop-p-butyl, bentazon, flauzifop-p-butyl + bentazon, hand hoeing twice and three times) on roots nodulation, crop yield and associated weeds of soybean. The results showed that the bio-fertilizers and weeds control treatments significantly decreased the dry weight of grassy weeds, broad-leaved and total weeds. Also bio-fertilizers and weeds control treatments increased nodulation (number and fresh weight nodules) and soybean growth and yield characters (plant height, number of branches, number of pods, weight of pods, weight of seeds, number of seeds per plant as well as seeds yield $ha^{-1}$) in both growing seasons. Moreover, bio-fertilizers and weeds control treatments increased seeds quality parameters (oil, protein and nutrients content) as well as enhanced nitrate reductase activity (NRA) in leaves and seeds of soybean in both growing seasons. Interaction between biofertlizers and weeds control treatments showed significant control of soybean weeds and increased crop yield of soybean.

**Keywords**: Biofertilizers; weeds; herbicide; hand hoeing; soybean; yield.

## INTRODUCTION

Soybean (*Glycine max* L.) is the world most important grains legume crop. Soybean is used in the production of oil and protein. Special attention should be directed toward the proper choice of cultivars and management practices to increase both seed yield and oil production.

Weeds are considered the major constraints affecting growth and crop yields. Successful weed control is one of the most important practices for economical soybean production in Egypt. Losses due to weeds have been one of the major limiting factors in soybean production. Weeds compete with soybeans for light, moisture, and nutrients with early-season competition being the most critical. Most of the yield reduction due to weeds competition occurs during the first six weeks after planting. However, producing a good crop of soybeans is only half the battle and will not be profitable unless the soybeans can be harvested. However, this requires good management practices in all phases of soybean production. Good soybean weeds control involves utilizing all methods available and combining them in an integrated weeds management system.

Weeds control is achieved directly by herbicides application, or by hand hoeing and other indirect methods. Hand hoeing of soybean weeds increased oil content, Zn, Mn, Fe and Cu content of soybean seeds (El-quesni *et al*. 1992). Also, hand weeding twice at 25 and 45 days after sowing had significantly lower dry matter and weeds counts of all the weed species and increased soybean yields (Angiras and Rana 1995). Chemical herbicides application considered one of the most effective method to control soybean weeds effectively. Schmid *et al*. (1996) found that fenoxaprop-ethyl and acifluorfen herbicides were more effective in controlling weeds compared with pre-emergence herbicides.

The effect of weeds control methods on growth and yield characters of soybean should takes in consideration when evaluating these methods. Many researcher reported that hand weeding and herbicides significantly increased growth and yield characters of soybean crop plant height, number of branches, number of pods per plant, weight of pods per plant, number of seeds, weight of seeds per plant and decreased the dry matter of weeds (Chavan *et al.* 2000; Tiwari and Mathew 2002; Balasubramanian *et al*. 2002; Peneva 2003; Bhattacharya *et al*. 2004; Galal 2004; Pandya *et al*. 2004; Pandya *et al*. 2005; Tiwari *et al*. 2006; Abd El Hamid and El Metwally 2008).

The use of chemical fertilizers let to the pollution of water, air and soil. So the present pattern is to use bio or organic fertilizers that are ecofriendly and cost-effective instead of chemical ones. A considerable number of bacterial species, mostly those associated with the plant rhizosphere, are able to exert a beneficial effect upon plant growth. Therefore, their use as biofertilizers or control agents for agriculture improvement has been a focus of numerous researchers for a number of years (Glick 1995). Several investigators found that application of biofertlizers led to enhance nodulation (nodule fresh weights and nodule numbers) and soybean yield characters such as pods/plant, seeds/pod, 1000-seed weight , seed yield, Sharma and Namdeo 1999; Zayed 2003; Agha *et al.* 2004; Raut *et al.* 2004 Tapas & Gupta 2005). Moreover, nitrate reductase (NR) activity of soybean was significantly increased by *B. jabonicum* inoculation and high values for the enzymatic activity were achieved with treatment a mixture of *B. jabonicum* and *A. chrococcum* strains (Milic *et al.* 2002; Ghosh *et al.* 2004).

Nodulation of legumes is one of the processes in the soil that is liable to be adversely affected by the application of herbicides. The risk of herbicide toxicity to micro-organisms may be increased, since the products of metabolism can inhibit biochemical processes related to symbiosis between plants and micro-organisms (Gonza'lez *et al.* 1996). Application of post emergence herbicides, such as acifluorfen and chlorimuron reduce $N^2$ fixation and nodulation in soybean plants ( Ricardo 1993; Joachim *et al*. 2001; Abd El Hamid and El Metwally 2008).

This work was carried out to evaluate the use of some bio-fertilizers (microbin, phosphorine and rhizobecteren) and some weeds control treatments (flauzifop-p-butyl, bentazon, flauzifop-p-butyl + bentazon, hand hoeing twice at 15, 30 days after sowing and hand hoeing three at 15, 30 and 45 days after sowing) and their beneficial effects on nodules, weeds control and yield of soybean field conditions.

## MATERIALS AND METHODS

**Field experiment**

The experimental work was carried at Sakha Research Station, Agriculture Research Centre during 2013 and 2014 seasons, to study the effect of some weeds control treatments and biofertilizers on nodules, weeds, yield and yield components in soybean (*Glycine max* L.). Soybean cultivar (Giza 111) was used. Seeds were planted on 20 and 24 of July in the first and the second seasons, respectively. Seeds were planted after seeds inoculation with the appropriate treatments**.** The proceeding crop was wheat (*Triticum Spp*.) in both seasons.

After soil preparation, the experiment area was divided into 10.5 $m^2$ sub plots which consisted of five rows of 3.5 m long and 0.6 m apart. A split plot design with three replicates was used in both seasons. Biofertilizers were allocated in the main plots which were Microbin (a mixture of phosphorus dissolving and $N_2$-fixing bacteria), Phosphorine (phosphorus dissolving), Rhizobecteren, ($N_2$-fixing bacteria) and Un-fertilized. The single inoculation was carried out by mixing the bacterial inoculums with soybean seeds; for the combined bacterial inoculations, equal amounts of each inoculum were mixed and soybean seeds were treated with the mixture. Inoculation was performed through mixing seeds with the appropriate amount of them (50 g/ 1 kg seeds) by using Arabic gum as an adhesive material just prior of sowing**.** The population of bacteria in the used bio-fertilizers were $10^8$ per gram.

While sub plots were assigned to weeds control treatments which were Fusilade super EC 12.5 % (fluazifop-p-butyl) at rate of 3.57 L $ha^{-1}$ after 30 days after sowing, Basagran AS 48 % (bentazon) at rate of 2.39 L $ha^{-1}$ after 30 days after sowing (DAS), Fusilade super at rate of 3.57 L $ha^{-1}$ + Basagran at rate of 2.39 L $ha^{-1}$, hand hoeing twice at 15, 30 days after sowing, hand hoeing thrice at 15, 30 and 45 days after sowing and unweeded treatment.

The recommended doses of nitrogen, phosphorus and potassium (N, P and K) were added as the following: N-fertilizer was added at 71.42 kg N/ha and applied as urea (46.5% N) in one dose before the first irrigation. Phosphorus fertilizer was added as super phosphate (15.5% $P_2O_5$) at the rate of 53.57 kg $P_2O_5$/ha before sowing, and potassium as potassium sulfate $K_2SO_4$ (48% $K_2O$) was added to the soil before the first irrigation at the rate of 57.14 kg/ha. The recommended agricultural practices were carried out throughout the two growing seasons.

Weeds from one $m^2$ in each sub plot were pulled out after 60 days after sowing (DAS), separated to broad and narrow leaved weeds and air dried at 70 °C until a constant weight to record the following items; dry weight of narrow-leaf weeds (g $m^{-2}$), dry weight of broad-leaf weeds (g $m^{-2}$) and dry weight of total narrow- and broad-leaf weeds (g $m^{-2}$). The dominant weed species counted in the experimental plots in both growing seasons were shown in Table 2. At 60 days after planting, root samples were collected and washed from soil particles on 1 mm sieve holes. Number of nodules $plant^{-1}$, fresh weight (active and inactive) nodules $plant^{-1}$ (g) and number of nodules inactive were counted. At harvest, the following characters were determined in a sample of 10 represented plants from each sub plot: plant height (cm), number of branches $plant^{-1}$, number of pods $plant^{-1}$, weight of pods $plant^{-1}$ (g), weight of seeds $plant^{-1}$ (g) and number of seeds $plant^{-1}$ were recorded for each sample. A bulk seeds sample from each plot was chosen to determine the weigh of 100 seeds (g). The seed yield $ha^{-1}$ was calculated from the weight $plot^{-1}$.

**Table 1. Soil characterization for the experimental sites in this study**.

| Seasons | Texture | $CaCO_3$ | pH | O.M % | Available nutrients in soil (ppm) | | |
|---|---|---|---|---|---|---|---|
| | | | | | N | P | K |
| 2013 | Sandy loom | 7.57 | 7.8 | 0.7 | 14 | 19 | 12 |
| 2014 | Sandy loom | 7.52 | 7.6 | 0.8 | 15 | 18 | 13 |

***O.M= organic matter**

**Oil and protein analysis**

Oil content of soybean seeds was determined using Soxhlet apparatus as described by Sorenson (1947). Protein was determined as total nitrogen by Micro-Kjeldahl method according to A.O.A.C. (1975), then N was multiplied by 6.25 (Tripathi *et al.* 1971) to obtain protein content in soybean seeds.

**Enzyme activity determination**

For the in vivo assay of nitrate reductase enzyme activity according to Jaworski (1971), the leaves were cut into small pieces. Leaf pieces were incubated in anaerobic dark conditions for 1 hr in 5 mL of 0.1 M K-phosphate (pH=7.5) containing 50 mM $KNO_3$ and 1% (v/v) n-propanol at 28 °C. The reaction was stopped by boiling in water bath for 5 min and then filtered to remove debris. One mL sample mixed well with two mL 1% (w/v) sulfanilamide in 1N HCl and two mL 0.1% (w/v) N-(1-naphthyl) ethylenediamine dihydrochloride in distilled water. The absorbance of mixture was measured by using spectrophotometer (SPEKOL 11 spectrophotometer VEB Carl Zeiss JENA. DDR) at 540 nm. Nitrate reductase activity was expressed as µg $NO_2$ $g^{-1}$ fw $hr^{-1}$.

**Nitrogen, phosphorus and potassium determination**

For nitrogen phosphorus and potassium determination, plant materials (leaves and seeds) were wet digested using a mixture of concentrated sulphuric acid and hydrogen peroxides (Jackson 1958). Phosphorus was determined using chlorostannous reduced molybdophosphoric blue color method in $H_2SO_4$ system and colormetrically determined following the method introduced by Jackson (1967). Potassium was photometrically determined by using a flame photometer as described by Jackson (1958). The collected data were statistically analyzed according to the method of Snedecor and Cochran (1981). Least Significant Differences (LSD-Received) test was used for treatments mean separation.

# RESULTS

**Effect of biofertilizers and weed treatments on soybean weeds**

The effect of biofertilizers and control treatments on dry weight of soybean weeds presented in Table (3). The results showed that biofertilizers caused a significant decrease of the dry weight of grassy, broad-leaved and total weeds in both growing seasons. Phosphorine, rhizobecteren and microbin reduced the dry weight of grassy by 34.1, 55.1 and 94.8%, broad-leaved by 35.9, 50.2 and 58.2% and total weeds by 35.2, 52.0 and 58.0% in first season, respictively. While the reduction in weeds dry wieght in second season were 35.4, 40.3 and 50.4% for greassy weeds, 20.0, 50.0 and 53.7% for broad-leaved weeds and 26.8, 47.8 and 50.0% for total weeds, respectivly compared to unfertlized plots.

**Table 3. Effect of biofertilization and weeds control on narrow, broad and total weeds 2013 and 2014 seasons**

| Treatments | Dry weight of weeds (g $m^{-2}$) | | | | | |
|---|---|---|---|---|---|---|
| | Narrow-leaf weeds | | Broad-leaved weeds | | Total weeds | |
| | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 |
| Biofertilizers | | | | | | |
| Microbin | 102.3 | 80.7 | 170.1 | 129.7 | 272.4 | 210.4 |
| Rhizobacteren | 69.9 | 74.6 | 132.2 | 81.2 | 202.1 | 155.8 |
| Phosphorine | 60.9 | 62.0 | 116.2 | 75.1 | 177.1 | 137.1 |
| Unfertilized | 155.7 | 125.0 | 265.3 | 162.2 | 421.0 | 287.2 |
| L.S.D. at 0.05 | 12.11 | 11.01 | 28.87 | 8.18 | 31.06 | 17.17 |
| Weeds control treatments | | | | | | |
| $T_1$-Fluazifop-p-butyl | 50.64 | 48.61 | 309.20 | 219.73 | 359.84 | 268.34 |
| $T_2$-Bentazon | 174.27 | 150.66 | 159.39 | 91.85 | 333.67 | 242.51 |
| $T_3$-Fluazifop + Bentazon | 66.33 | 98.99 | 95.50 | 60.46 | 161.83 | 109.45 |
| $T_4$-Hand hoeing twice | 40.05 | 31.70 | 78.67 | 34.84 | 118.74 | 66.54 |
| $T_5$-Hand hoeing three | 30.25 | 20.12 | 21.29 | 18.95 | 51.54 | 39.07 |
| $T_6$-Un-weeded | 221.99 | 213.42 | 361.61 | 246.55 | 583.60 | 459.97 |
| L.S.D. at 0.05 | 13.88 | 12.66 | 21.78 | 17.97 | 28.44 | 21.99 |

Weeds control treatments decreased significantly the dry weight of grassy, broad-leaved and total weeds in both growing seasons. It's was clear that hand hoeing three times at 15, 30 and 45 DAS, hand hoeing twice at 15, 30 DAS, and fluazifop-p-butyl + bentazon significantly caused reduced of annual grasses in soybean field by 86.90, 83.17 and 74.19% in first season and by 90.59, 86.25 and 77.01% in second season, respectively compared to untreated plot (Table 3). Moreover, the same treatments as mentioned above significantly reduced the dry weight of broad-leaved by 94.21, 86.18 and 81.59% in the first season and by 92.58, 87.35 and 76.26% in the second season, respectively compared to untreated plot. All interactions between biofertilizers and weeds control treatments were pronouncedly affected the dry weight of grassy, broad-leaved and total weeds in both seasons. Hand hoeing three times and hand hoeing twice gave the highest reduction in dry weight of grassy, broad-leaved and total weeds under fertilization by microbin in both growing seasons (Table 4).

**Effect of biofertilizers and weeds control treatments on nodulation**

Data in Table (5) showed the effect of biofertilizers and weeds control treatments on the number of fresh, active and inactive nodules of soybean roots in both grwoing seasons. Inoculation of soybean seeds by microbin, rhizobecteren and phosphoreine significantly increased in nodules number, fresh weight of nodules and inactive nodules compared with unfertilized seeds in both growing seasons. Microbin and rhizobecteren gave the highest number of nodules (60.87 and 54.78) and weight of nodules (2.55 and 2.48 g) in first and second seasons, respectively, compared to unfertilized one. Biofertilizer didn't affect the number of inactive nodules in both grwoing seasons.

Weeds control treatments significantly increased the number and fresh weight of nodules in both growing seasons. Hand hoeing three times, hand hoeing twice and fluazifop-butyl + bentazon gave the highest number and fresh weight of nodules. The numbers of nodules for hand hoeing three times were 48.87 and 51.12, hands hoeing twice were 46.39 and 47.05 and fluazifop-butyl + bentazon were 41.64 and 41.06 in first and second seasons, respectively compared to uncontrolled treatment. While fresh weight of nodules for hand hoeing three times were 2.20 and 2.23, hand hoeing twice were 2.12 and 2.17 and fluazifop-butyl + bentazon were 2.11 and 2.03, in first and second seasons, respectively compared to uncontrolled treatment. Herbicide treatments increased the number of inactive nodules with 7.92 and 7.16 for fluazifop-butyl , 7.58 and 6.50 for bentazon and 8.17 and 7.00 for fluazifop-butyl + bentazon than hand hoeing three times (3.25 and 2.58), hand hoeing twice (3.33 and 2.92) and uncontrolled treatment (3.17 and 2.83) in both growing seasons, respectively. All interactions between biofertilizers and weeds control treatments markedly increased number of and weight of nodules in both seasons growing seasons. Hand weeding three times with microbin inoculation gave the highest number and weight of nodules in both growing seasons (Table 6).

**Table 4. Effect of the interaction between biofertilizers and weeds control treatments on narrow, broad and total weeds, in 2013 and 2014 seasons.**

| Biofertilizers | Weeds control treatments | Narrow-leaf weeds g-2 | | Broad-leaf weeds g-2 | | Total dry weeds g-2 | |
|---|---|---|---|---|---|---|---|
| | | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 |
| Microbin | $T_1$ | 56.47 | 44.67 | 310.50 | 235.37 | 366.97 | 280.03 |
| | $T_2$ | 179.97 | 130.03 | 155.50 | 111.90 | 335.47 | 241.93 |
| | $T_3$ | 74.47 | 54.90 | 66.37 | 88.93 | 140.83 | 143.83 |
| | $T_4$ | 45.13 | 34.30 | 51.60 | 40.63 | 96.73 | 74.93 |
| | $T_5$ | 32.30 | 22.17 | 18.70 | 16.10 | 51.00 | 38.27 |
| | $T_6$ | 227.10 | 198.43 | 418.13 | 285.13 | 645.23 | 483.57 |
| Rhizobacteren | $T_1$ | 45.00 | 36.03 | 244.83 | 154.80 | 289.83 | 190.83 |
| | $T_2$ | 125.70 | 103.87 | 150.53 | 92.73 | 276.23 | 196.60 |
| | $T_3$ | 35.87 | 43.50 | 56.60 | 43.77 | 92.47 | 87.27 |
| | $T_4$ | 24.67 | 25.00 | 40.43 | 18.87 | 65.10 | 42.87 |
| | $T_5$ | 15.33 | 18.10 | 15.93 | 11.30 | 31.27 | 29.40 |
| | $T_6$ | 172.67 | 146.03 | 284.87 | 166.00 | 457.53 | 312.03 |
| Phosphorine | $T_1$ | 32.43 | 67.83 | 216.37 | 166.57 | 248.80 | 234.40 |
| | $T_2$ | 131.60 | 182.80 | 142.03 | 29.47 | 273.63 | 212.27 |
| | $T_3$ | 22.70 | 34.00 | 52.70 | 23.37 | 75.40 | 57.37 |
| | $T_4$ | 13.60 | 16.03 | 36.93 | 23.13 | 50.53 | 39.17 |
| | $T_5$ | 8.53 | 13.03 | 13.20 | 23.63 | 21.73 | 36.67 |
| | $T_6$ | 156.67 | 134.23 | 235.77 | 184.33 | 392.43 | 318.57 |
| Unfertilized | $T_1$ | 68.67 | 45.90 | 465.10 | 322.30 | 533.77 | 368.40 |
| | $T_2$ | 259.83 | 185.93 | 189.50 | 133.30 | 449.33 | 319.25 |
| | $T_3$ | 132.30 | 63.57 | 206.33 | 85.77 | 338.63 | 149.33 |
| | $T_4$ | 76.80 | 52.47 | 185.70 | 56.73 | 262.50 | 109.20 |
| | $T_5$ | 64.83 | 27.20 | 37.33 | 24.77 | 102.7 | 51.97 |
| | $T_6$ | 331.53 | 375.00 | 507.67 | 350.73 | 739.20 | 725.73 |
| L.S.D. at $_{0.05}$ | | 32.52 | 45.37 | 42.72 | 37.27 | 66.71 | 74.82 |

**Table 5. Effect of biofertilization and weeds control on nodules at 60 days after sowing in 2013 and 2014 seasons.**

| Treatments | Nodules plant-1: Number of active nodules | | Weight of active nodules (g) | | Number of inactive nodules | |
|---|---|---|---|---|---|---|
| | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 |
| | | | Biofertilizers | | | |
| Microbin | 60.87 | 54.78 | 2.55 | 2.48 | 5.78 | 4.89 |
| Rhizobacteren | 53.31 | 52.65 | 2.41 | 2.42 | 5.67 | 4.72 |
| Phosphorine | 30.02 | 34.63 | 1.72 | 1.94 | 5.50 | 5.11 |
| Unfertilized | 22.87 | 28.94 | 1.16 | 1.25 | 5.33 | 4.61 |
| L.S.D. at $_{0.05}$ | 5.28 | 3.29 | 0.05 | 0.16 | N.S. | N.S. |
| | | | Weeds control treatments | | | |
| Fluazifop-p-butyl | 39.81 | 41.71 | 1.82 | 2.03 | 7.92 | 7.16 |
| Bentazon | 39.07 | 39.00 | 1.87 | 1.98 | 7.58 | 6.50 |
| Fluazifop+ Bentazon | 41.64 | 41.06 | 2.11 | 2.00 | 8.17 | 7.00 |
| Hand hoeing twice | 46.39 | 47.05 | 2.12 | 2.23 | 3.33 | 2.92 |
| Hand hoeing three | 48.87 | 51.12 | 2.20 | 2.17 | 3.25 | 2.58 |
| Un-weeded | 35.82 | 36.58 | 1.65 | 1.74 | 3.17 | 2.83 |
| L.S.D. at $_{0.05}$ | 4.04 | 3.13 | 0.10 | 0.13 | 0.53 | 0.95 |

***N. S. = not significant**

Figure 1, showd the effect of biofertilizers (microbein, rhizobecteren, and phosphorine) relative to unfertlized on number of nodules after 60 days from planting under

hand hoeing . Biofertlized soybean gave the highest number of nuodlues compared with unfertilized under hand hoeing in both growing seasons.

**Effect of biofertilizers and weed treatments on soybean yield**

The results in Table (7) showed that biofertlizers could increase soybean yield (plant height, number of branches plant$^{-1}$, number of pods plant$^{-1}$, weight of pods plant$^{-1}$, number of seed pod$^{-1}$ ,weight of seeds pod$^{-1}$ , weight of seeds plant$^{-1}$, seed index and seeds yield ha$^{-1}$) in both growing seasons. Highest values of the previously mentioned parameters were recorded with microbin and rhizobecteren application in all treatments in this study in both growing seasons. Microbin and rhizobecteren increased the weight of pods plant$^{-1}$ in the first season to 99.88 and 92.64 g and 80.75 and 72.99 g in second season, respectively. Treating of soybean seeds by microbin and rhizobecteren increased the weight of seeds plant$^{-1}$ to78.97 and 68.42 g in the first season and to 59.72 and 52.60 g in the second season, respectively. Moreover, microbin and rhizobecteren inoculation increased seeds index to 21.57 and 20.83 in the first season and to 19.40 and 19.89 in the second season, respectively. Finally, the seeds yield increased to 6.02 and 6.24 kg/ha in both growing seasons, respectively compared to unfertilized treatment.

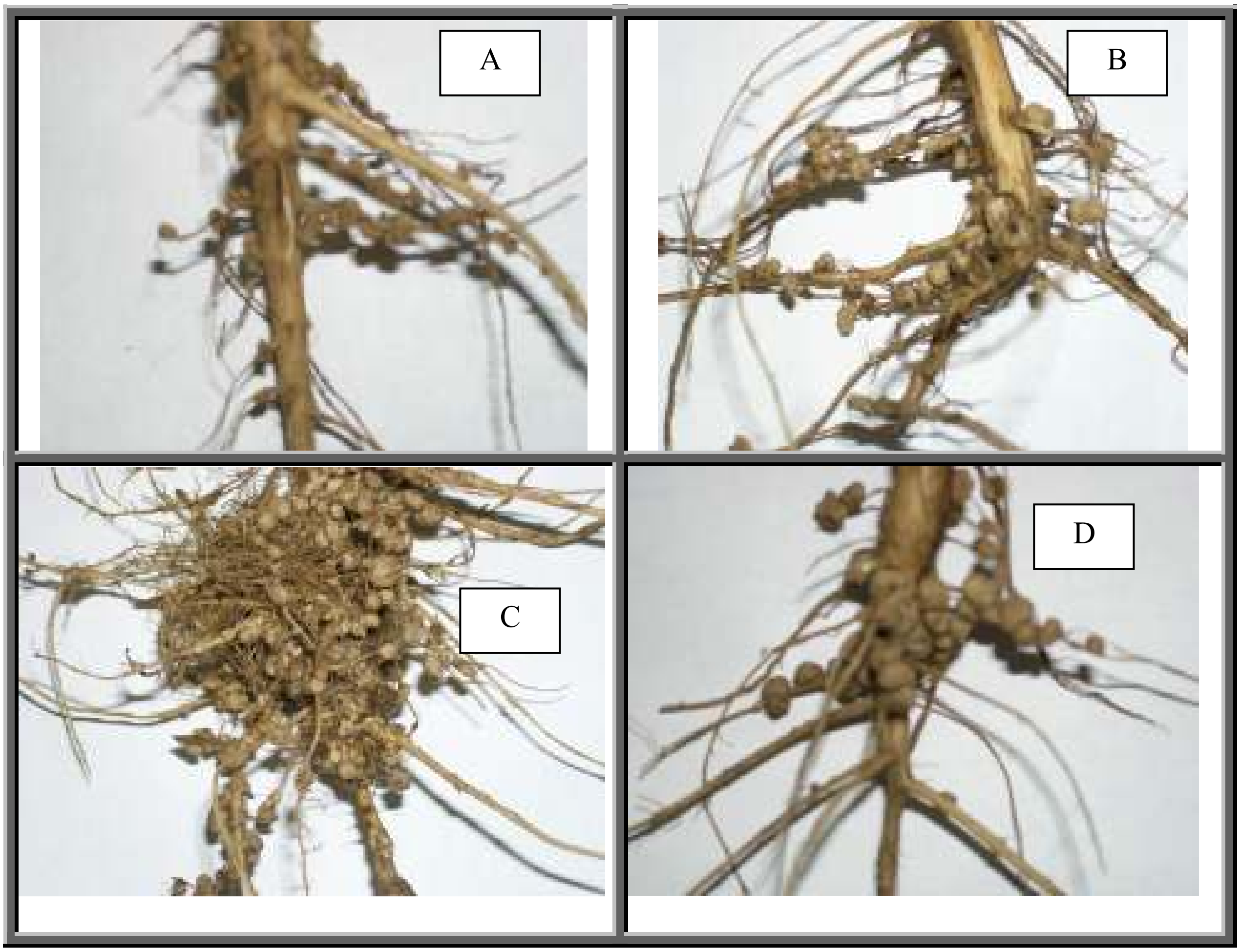


**Fig 1. ect of phosphorine (A), rhizobecteren (B) and microbin (C) on soybean nodules relative to unfertilizered soybean (D) after 60 days from planting.**

**Table 6. Effect of the interaction between biofertilization and weeds control treatments on number of nodules plant$^{-1}$ and weight of nodules plant$^{-1}$ in 2013 and 2014 seasons**

| Biofertilizers | Weed control treatments | Number of nodules plant$^{-1}$ | | Weight of nodules plant$^{-1}$ g | |
|---|---|---|---|---|---|
| | | 2013 | 2014 | 2013 | 2014 |
| Microbin | $T_1$ | 56.90 | 51.63 | 2.25 | 2.55 |
| | $T_2$ | 57.70 | 48.27 | 2.39 | 2.20 |
| | $T_3$ | 59.30 | 51.90 | 2.83 | 2.37 |
| | $T_4$ | 68.57 | 59.57 | 2.84 | 2.81 |
| | $T_5$ | 71.57 | 70.60 | 2.94 | 2.83 |
| | $T_6$ | 51.20 | 46.73 | 2.07 | 2.10 |
| Rhizobacteren | $T_1$ | 51.17 | 48.03 | 2.15 | 2.34 |
| | $T_2$ | 47.60 | 45.50 | 2.36 | 2.49 |
| | $T_3$ | 50.50 | 52.27 | 2.62 | 2.52 |
| | $T_4$ | 59.97 | 61.73 | 2.70 | 2.53 |
| | $T_5$ | 62.57 | 62.73 | 2.68 | 2.58 |
| | $T_6$ | 48.07 | 45.63 | 1.97 | 2.09 |
| Phosphorine | $T_1$ | 28.40 | 35.97 | 1.73 | 1.81 |
| | $T_2$ | 25.93 | 33.03 | 1.58 | 1.87 |
| | $T_3$ | 32.63 | 33.33 | 1.78 | 1.87 |
| | $T_4$ | 32.87 | 36.17 | 1.70 | 2.41 |
| | $T_5$ | 34.87 | 40.03 | 1.89 | 2.05 |
| | $T_6$ | 25.57 | 29.23 | 1.63 | 1.65 |
| Unfertilized | $T_1$ | 22.77 | 31.20 | 1.16 | 1.43 |
| | $T_2$ | 21.03 | 29.17 | 1.16 | 1.37 |
| | $T_3$ | 24.13 | 26.73 | 1.20 | 1.21 |
| | $T_4$ | 24.33 | 30.73 | 1.23 | 1.17 |
| | $T_5$ | 26.50 | 31.10 | 1.28 | 1.23 |
| | $T_6$ | 18.47 | 24.73 | 0.94 | 1.10 |
| L.S.D. at $_{0.05}$ | | NS | 3.94 | 0.12 | 0.18 |

Weeds control treatments increased plant height, number of branches plant$^{-1}$, number of pods plant$^{-1}$, weight of pods plant$^{-1}$, number of seeds pod$^{-1}$ , weight of seeds pod$^{-1}$ ,weight of seeds plant$^{-1}$, seeds index, and seeds yield fed$^{-1}$ in both growing seasons. Furthermore, hand hoeing three times(22.39 and 22.36), hand hoeing twice (20.60 and 19.31) and fluazifop-butyl + bentazon (18.42 and 18.59) gave the highest values of seed index compared to uncontrolled treatment (15.26 and 17.77) in both growing seasons, respectively. Also, seeds yield ha$^{-1}$ for hoeing three times (5.0 and 5.26), hand hoeing twice (4.57 and 4.76) and fluazifop-butyl + bentazon (4.36 and 4.52) were the highest among other treatments in both growing seasons, respectively compared to uncontrolled treatment (3.24 and 3.36 kg/ha.). Table (8) showed that all interactions between biofertilizers and weeds control treatments affect significantly number of seeds pod$^{-1}$, weight of seeds pod$^{-1}$, seeds index and seeds yield ha$^{-1}$ in both growing seasons**.** Hand hoeing three times and hand hoeing twice gave the highest values of number of seeds pod$^{-1}$, weight of seeds pod$^{-1}$, seeds index and seeds yield fed$^{-1}$ under fertilization by microbin in both growing seasons.

**Table 7. Effect of biofertilizers and weeds control treatments on plant height, number of branches, pods, seeds pod$^{-1}$, weight of pods and seeds pod$^{-1}$ 2013 and 2014 seasons.**

| Treatments | Plant height cm | | Number of branches plant$^{-1}$ | | Number of pods plant$^{-1}$ | | Weight of pods plant$^{-1}$ g | | Number of seed pod$^{1}$ | | Weight of seeds pod$^{-1}$g | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 |
| Biofertilizers | | | | | | | | | | | | |
| Microbin | 89.43 | 93.05 | 2.30 | 2.44 | 84.29 | 75.54 | 99.88 | 92.64 | 2.60 | 2.51 | 1.51 | 1.35 |
| Rhizobacteren | 98.33 | 91.61 | 2.34 | 2.41 | 65.30 | 59.05 | 80.75 | 72.99 | 2.11 | 2.12 | 1.20 | 1.14 |
| Phosphorine | 80.03 | 89.68 | 1.83 | 1.57 | 57.89 | 52.27 | 74.68 | 66.40 | 2.11 | 1.95 | 1.10 | 1.03 |
| Unfertilized | 76.42 | 76.60 | 1.57 | 1.19 | 47.80 | 42.75 | 67.64 | 58.73 | 1.92 | 1.86 | 1.03 | 0.95 |
| L.S.D. at $_{0.05}$ | 7.78 | 8.61 | 0.22 | 0.16 | 6.75 | 4.41 | 6.22 | 8.12 | 0.12 | 0.08 | 0.03 | 0.09 |
| Weeds control treatments | | | | | | | | | | | | |
| Fluazifop-p-butyl | 83.45 | 78.72 | 1.91 | 1.94 | 56.50 | 51.23 | 72.40 | 65.07 | 2.11 | 1.96 | 1.19 | 1.01 |
| Bentazon | 80.46 | 78.22 | 2.12 | 1.93 | 56.15 | 48.39 | 73.67 | 65.12 | 2.08 | 1.79 | 1.18 | 1.09 |
| F+ B | 85.89 | 94.58 | 2.02 | 2.03 | 66.12 | 58.68 | 81.38 | 72.07 | 2.12 | 2.10 | 1.19 | 1.14 |
| Hand hoeing twice | 88.62 | 93.59 | 2.00 | 2.07 | 70.10 | 61.10 | 88.77 | 81.16 | 2.38 | 2.46 | 1.27 | 1.20 |
| Hand hoeing three | 93.11 | 103.33 | 2.14 | 1.77 | 81.76 | 73.29 | 100.66 | 91.77 | 2.75 | 2.81 | 1.39 | 1.25 |
| Un-weeded | 71.28 | 77.97 | 1.72 | 1.69 | 52.30 | 51.72 | 67.54 | 60.77 | 1.66 | 1.55 | 1.03 | 1.02 |
| L.S.D. at $_{0.05}$ | 7.10 | 6.22 | 0.18 | 0.10 | 6.71 | 6.69 | 5.83 | 7.14 | 0.14 | 0.13 | 0.04 | 0.08 |

***F+B= Fluazifop-p-butyl + Bentazon**

**Table 8. Effect of interaction between biofertilizers and weeds control treatments on number of seeds pod$^{-1}$, weight of seeds pod$^{-1}$, seed index and seeds yield ha$^{-1}$ in 2013 and 2014 seasons.**

| Biofertilization | Weeds control treatments | Number of seeds pod$^{-1}$ | | Weight of seeds plant$^{-1}$g | | Seeds index | | yield ha$^{-1}$ (ton) | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 |
| Microbin | $T_1$ | 2.46 | 2.30 | 78.73 | 67.60 | 22.17 | 19.10 | 5.79 | 6.05 |
| | $T_2$ | 2.45 | 2.32 | 73.50 | 63.37 | 20.43 | 19.10 | 6.26 | 6.52 |
| | $T_3$ | 2.67 | 2.45 | 49.27 | 66.20 | 22.07 | 19.50 | 6.05 | 6.31 |
| | $T_4$ | 2.91 | 2.80 | 81.20 | 68.10 | 21.47 | 22.00 | 6.02 | 6.33 |
| | $T_5$ | 3.30 | 3.20 | 96.27 | 88.87 | 26.53 | 26.93 | 6.76 | 6.98 |
| | $T_6$ | 1.81 | 2.00 | 64.87 | 56.40 | 16.73 | 18.37 | 5.29 | 5.31 |
| Rhizobacteren | $T_1$ | 2.14 | 2.20 | 54.13 | 47.80 | 18.57 | 18.43 | 4.60 | 4.88 |
| | $T_2$ | 2.07 | 1.60 | 50.60 | 44.77 | 18.37 | 19.90 | 4.38 | 4.60 |
| | $T_3$ | 2.26 | 2.10 | 62.90 | 53.67 | 19.10 | 19.83 | 4.86 | 4.88 |
| | $T_4$ | 2.45 | 2.27 | 68.07 | 59.67 | 21.97 | 20.87 | 5.19 | 5.10 |
| | $T_5$ | 2.22 | 3.00 | 76.97 | 70.67 | 22.40 | 24.27 | 5.36 | 5.55 |
| | $T_6$ | 1.53 | 1.63 | 45.67 | 39.03 | 16.03 | 17.03 | 3.67 | 3.88 |
| Phosphorine | $T_1$ | 1.97 | 1.83 | 45.90 | 44.10 | 17.97 | 18.37 | 2.88 | 3.00 |
| | $T_2$ | 1.88 | 1.77 | 46.60 | 39.80 | 18.30 | 18.50 | 3.64 | 3.95 |
| | $T_3$ | 1.63 | 1.97 | 53.47 | 47.90 | 15.00 | 19.00 | 3.95 | 4.19 |
| | $T_4$ | 1.93 | 2.47 | 65.27 | 59.13 | 19.10 | 19.60 | 3.88 | 4.10 |
| | $T_5$ | 2.45 | 2.40 | 75.30 | 68.00 | 20.20 | 21.37 | 4.55 | 4.83 |
| | $T_6$ | 1.66 | 1.27 | 38.80 | 31.87 | 13.90 | 18.30 | 2.52 | 2.64 |
| Unfertilized | $T_1$ | 1.84 | 1.53 | 38.87 | 33.40 | 17.63 | 14.80 | 2.21 | 2.48 |
| | $T_2$ | 1.94 | 1.47 | 37.50 | 35.20 | 18.90 | 17.87 | 1.95 | 2.24 |
| | $T_3$ | 1.94 | 1.93 | 53.83 | 44.63 | 17.53 | 16.47 | 2.60 | 2.74 |
| | $T_4$ | 2.24 | 2.30 | 57.70 | 46.63 | 19.87 | 16.07 | 3.19 | 3.45 |
| | $T_5$ | 3.05 | 2.63 | 69.17 | 62.00 | 20.43 | 18.03 | 3.38 | 3.67 |
| | $T_6$ | 2.46 | 2.30 | 78.73 | 67.60 | 14.37 | 14.33 | 1.45 | 1.64 |
| L.S.D. at $_{0.05}$ | | 0.23 | 0.15 | 0.26 | 0.13 | 0.15 | 1.78 | 0.30 | 0.31 |

**Effect of biofertilizers and weed treatments on yield quality**

The results in Table (9) showed that inoculation of soybean seeds by microbin, rhizobecteren and phosophorine caused significant increase in the seed oil content compared with unfertilized in both growing seasons. Oil content increased by 10.38 and 17.90% for microbin, by 3.89 and 10.00 % for rhizobecteren and by 0.15 and 3.71% for phosophorine in both growing seasons, respectively, compared to unfertilized treatment. Weed control treatments increased significantly oil content of soybean seeds in both growing seasons. Oil content increased by 36.56 and 22.21%, for hoeing three times, by 21.00 and 14.26% for hand hoeing twice and by 13.17 and 4.59% for fluazifop-butyl + bentazon in both growing seasons, respectively compared to uncontrolled treatment. The interaction between biofertlizers and weeds control treatments showed no significant increase in oil content in both growing seasons.

The protein content of treated and untreated soybean seeds were analyzed and the data presented in Table (9). The data showed that the inoculation of soybean seeds by microbin, rhizobecteren and phosophorine biofertilizers caused significant increase in the protein content compared with unfertilized treatment in both growing seasons. Protein content increased by 9.98 and 21.49% for microbin, by 6.11 and 10.38 % for rhizobecteren and by 1.67 and 7.43% for phosphorine, in both growing seasons, respectively compared to unfertilized treatment. Also the weeds control treatments significantly increased the protein content in both growing seasons. Protein content increased by 14.62 and 19.05% for hand hoeing three times, and by 10.42 and 12.35% for hand hoeing twice while fluazifop-butyl + bentazon increased by 8.13 and 11.09% in first and second seasons, respectively compared to uncontrolled treatment. The interaction between biofertilizers and weeds control treatments had no noticeable effect on protein content in both growing seasons.

Data presented in Table (9) showed that the nitrate reductase activity in soybean leaves affected by microbin, rhizobecteren and phosphorine inoculation. The results revealed that the inoculation with microbin, rhizobecteren led to an increase in nitrate reductase activity in soybean leaves compared with those of the non-inoculated plants with values of 14.01 and11.80 as well as 12.80 and 10.89 in both growing seasons, respectively compared to unfertilized treatment. Also, weeds control treatments increased nitrate reductase activity (NRA) in the leaves in both growing seasons. Hand hoeing three times, hand hoeing twice and fluazifop-butyl + bentazon were the most effective treatments for induction of nitrate reductase activity in soybean leaves by 13.02 and 11.56%, 12.14 and 10.95% as well as 11.57 and 10.42% in first and second seasons, respectively compared with uncontrolled treatment (10.00 and 9.30%).

**Table 9. Effect of biofertilizers and weed control treatments on weight of seeds pod$^{-1}$, weight of seeds plant$^{-1}$, seed index, seed yield ha$^{-1}$, oil%, protein% and nitrate reductase activity in 2013 and 2014 seasons**

| Treatments | Weight of seeds plant$^{-1g}$ | | Seeds Index | | yield ha$^{-1}$ (ton) | | Oil % | | Protein% | | NRA* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 |
| Biofertilizers | | | | | | | | | | | | |
| Microbin | 78.97 | 68.42 | 21.57 | 20.83 | 6.02 | 6.24 | 22.43 | 21.60 | 37.59 | 34.65 | 14.01 | 12.80 |
| Rhizobacteren | 59.72 | 52.60 | 19.40 | 19.89 | 4.67 | 4.81 | 21.11 | 20.15 | 36.27 | 31.48 | 11.80 | 10.89 |
| Phosphorine | 54.22 | 48.47 | 17.41 | 19.19 | 3.57 | 3.79 | 20.35 | 19.00 | 34.75 | 30.64 | 10.31 | 9.39 |
| Unfertilized | 48.86 | 42.19 | 18.12 | 16.36 | 2.48 | 2.69 | 20.32 | 18.32 | 34.18 | 28.52 | 9.28 | 8.26 |
| L.S.D. at $_{0.05}$ | 6.20 | 5.19 | 0.88 | 1.44 | 0.17 | 0.20 | 1.29 | 0.80 | 1.58 | 1.55 | 0.29 | 0.51 |
| Weeds control treatments | | | | | | | | | | | | |
| Fluazifop-p-butyl | 54.41 | 48.22 | 19.08 | 17.83 | 3.88 | 4.10 | 19.46 | 19.02 | 34.84 | 30.35 | 10.42 | 9.52 |
| Bentazon | 52.05 | 45.78 | 19.00 | 18.59 | 4.07 | 4.31 | 20.11 | 18.89 | 35.11 | 31.47 | 10.96 | 9.97 |
| F+B | 62.37 | 53.10 | 18.42 | 18.59 | 4.36 | 4.52 | 20.80 | 19.14 | 36.00 | 31.66 | 11.57 | 10.42 |
| Hand hoeing twice | 68.06 | 58.38 | 20.60 | 19.31 | 4.57 | 4.76 | 22.44 | 20.91 | 36.78 | 32.02 | 12.14 | 10.95 |
| Hand hoeing three | 79.42 | 72.38 | 22.39 | 22.36 | 5.00 | 5.26 | 25.10 | 22.34 | 38.15 | 33.93 | 13.02 | 11.56 |
| Un-weeded | 46.36 | 39.64 | 15.26 | 17.77 | 3.24 | 3.36 | 18.38 | 18.30 | 33.31 | 28.50 | 10.00 | 9.30 |
| L.S.D. at $_{0.05}$ | 6.45 | 6.14 | 0.95 | 1.10 | 0.15 | 0.15 | 1.34 | 1.42 | 1.79 | 2.24 | 0.44 | 0.45 |

***NRA = Nitrate reductase activity**

The results in Table (10) showed that inoculation of soybean seeds by microbin, rhizobecteren and phosphorine significantly increase the N, P and K contents in leaves and seeds of soybean compared to unfertilized treatment in both growing seasons.

Microbin and rhizobecteren gave the highest values of N, P and K contents in leaves and seeds of soybean compared to phosphorine and unfertilized treatment in both growing seasons. Also, weeds control treatments increased the mean value of N, P and K contents of leaves and seeds in both growing seasons. Hand hoeing three times, hand hoeing twice and fluazifop-butyl + bentazon gave the highest values of N, P and K contents in leaves and seeds of soybean in both growing seasons. Weeding control by either mechanically or chemically may increase the amount of nutrients absorbed by the roots which resulted in increased N, P and K contents in both soybean seeds and leaves. The interaction between biofertilizers and weeds control treatments had no noticeable effect on N, P and K contents of leaves and seeds in both growing seasons.

**Table 10. Effect of biofertilization and weeds control treatments on weight of leaves and seed contents% (N, P and K) in 2013 and 2014 seasons.**

| Treatments | Leaves contents % | | | | | | Seeds contents % | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | | P | | K | | N | | P | | K | |
| | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 |
| Biofertilizers | | | | | | | | | | | | |
| Microbin | 4.841 | 4.850 | 0.339 | 0.390 | 3.074 | 0.342 | 6.029 | 6.829 | 0.620 | 0.663 | 0.312 | 0.340 |
| Rhizobacteren | 4.225 | 4.349 | 0.318 | 0.352 | 2.649 | 0.306 | 5.206 | 5.703 | 0.532 | 0.563 | 0.289 | 0.306 |
| Phosphorine | 3.644 | 3.768 | 0.284 | 0.328 | 2.401 | 0.237 | 4.925 | 5.446 | 0.496 | 0.518 | 0.226 | 0.236 |
| Unfertilized | 3.348 | 3.555 | 0.243 | 0.295 | 2.262 | 0.202 | 4.389 | 4.891 | 0.422 | 0.432 | 0.196 | 0.213 |
| L.S.D. at $_{0.05}$ | 0.017 | 0.20 | 0.02 | 0.01 | 0.07 | 0.01 | 0.20 | 0.25 | 0.01 | 0.01 | 0.01 | 0.01 |
| Weeds control treatments | | | | | | | | | | | | |
| Fluazifop-p-butyl | 3.944 | 4.070 | 0.300 | 0.351 | 2.607 | 0.264 | 5.217 | 5.712 | 0.512 | 0.540 | 0.247 | 0.268 |
| Bentazon | 3.752 | 4.402 | 0.303 | 0.354 | 2.648 | 0.266 | 5.373 | 5.875 | 0.508 | 0.536 | 0.247 | 0.267 |
| F+ B | 4.057 | 4.158 | 0.302 | 0.352 | 2.692 | 0.285 | 5.295 | 5.796 | 0.524 | 0.552 | 0.268 | 0.285 |
| Hand hoeing twice | 4.301 | 3.867 | 0.315 | 0.367 | 2.700 | 0.282 | 5.310 | 5.840 | 0.532 | 0.561 | 0.263 | 0.280 |
| Hand hoeing three | 4.886 | 5.010 | 0.334 | 0.350 | 2.761 | 0.296 | 5.579 | 6.070 | 0.547 | 0.575 | 0.278 | 0.294 |
| Un-weeded | 3.148 | 3.278 | 0.220 | 0.275 | 2.171 | 0.239 | 4.050 | 5.028 | 0.484 | 0.500 | 0.223 | 0.250 |
| L.S.D. at $_{0.05}$ | 0.17 | 0.16 | 0.01 | 0.03 | 0.19 | 0.01 | 0.17 | 0.26 | 0.01 | 0.02 | 0.01 | 0.01 |

## DISCUSSION

Biofertilizers generally improve crop growth and yield but we should evaluate its effect on associated weeds also. The used biofertilizers in this study significantly reduced the dry weight of the controlled weeds grown in soybean fields and this is might be due to increasing the vegetative growth of soybean plants treated by biofertilizers which subsequently inhibit the weeds growth and dry weight (Saberali and Mohammadi 2015). Manipulation of crop fertilization with biofertilizers is a promising agronomic practice in reducing weeds interference in soybean. The possible effect of biofertilizers on nutrient and water availability appeared to be responsible for improved soybean competitiveness with associated weeds and this would make the competition of associated weeds very week and reduced its growth and dry weight compared to soybean (Saberali and Mohammadi 2015). Therefore, the application of biofertilizers favors the soybean over the weeds. Furthermore, the tested weeding treatments (hand weeding and herbicides) significantly reduced the dry weight of total weeds compared to untreated treatment. Similar results were obtained by Pramod *et al*. (2001), Chauhan *et al*. (2002), Pandya *et al*. (2004) and Tiwari *et al*. (2006).

The effect of biofertilizers and control treatments of weeds on nodulation of soybean roots considered one of the key factors in soybean production and quality. In our study the inoculation of soybean seeds by the used biofertilizers caused significant increase in the nodules number, fresh weight of nodules and inactive nodules compared with unfertilized seeds in both growing seasons. This increase in number and fresh weight of nodules were due to inoculation effect, which caused more atmospheric nitrogen fixation that required for crop growth. This role of microorganisms' activity in the soil led to increase the production of organic compounds. Many investigators confirmed these results (Soliman *et al*. 1995; Raut *et al*. 2004 ; Agha *et al.* 2004).

Also, the used control treatments caused significant increase in the nodules number, fresh weight of nodules and inactive nodules compared with unfertilized seeds in both growing seasons. The used post emergence herbicides in this study did not reduce on the number and dry weight of root nodules as reported earlier by Kishinevsky *et al.* (1998). Moreover, Na-acifluorfen and imazethapyr significantly increased the number and dry weight of nodules as compared to untreated. Furthermore, combined utilization of clodinafop-propargyl + Na-acifluorfen showed marked increase in the nodule dry weight which may be due to stimulation effect of these herbicides on synthesis of nodular tissue (Billore *et al.* 2001).

It is essential to note that the development soybean growth and yield gave by biofertilizers was evidently identified with enhanced root improvement and upgraded nodulation, which led good uptake capacity and increased nitrogen supply. Improved nodulation is presumably because of *Bacillus* sp abilities to deliver gibberellins (Gutiérrez-Mañero *et al.* 2001). Several investigators have been reported the beneficial effect of soybean co-inoculation with *B. japonicum* and Phosphorus-solubilizing bacteria and/or rhizobacterin (*A. lipoferum*) for improving soybean nodulation (El-Dsouky *et al.* 2003). The results are also in a good agreement with those obtained by Agha *et al.* (2004) and Tilak *et al.* (2006). Moreover, the interactions between biofertilizers and weeds control treatments indicated the formation of more active nodules; this appeared clearly in counting the number of nodules and fresh weight of nodules in both growing seasons. Therefore, these enhancements that observed in response to co-inoculation may be attributed to the increase in the number of root hairs and infection sites available for nodulation with rhizobium (*B. japonicum*).

Nutrients management is a standout amongst the most important components in effective cultivation of crops. Biofertilizers can influence the quality and amount of yield. The data in this study showed that biofertilizers increased yield of soybean crop. This is may be due to that the application of these treatments accelerated the vegetative growth, enhances the photosynthetic activity which eventually forms the carbohydrate pools which lead to increase yield and yield components subsequently (Kazemi *et al.* (2005). The results are also in agreement with those obtained by Chandra (1996), Sharma and Namdeo (1999), Agha *et al.* (2004), and Raut *et al.* (2004). Kazemi *et al.* (2005) expressed that the inoculation of soybean seed by rhizobial microorganisms fundamentally increase the yield number of seeds per plant, grain weights and lastly the yield of soybean. Additionally, the raise in seeds yield in cultivar got biofertilizers principally due to the impact of microorganisms that can play important role in making accessible supplements of these nutrients for plants. Since microorganism can degraded organic and inorganic compounds in soil to make these elements available for soybean plants. The good roots system in soybean and high absorption of elements in soybean seeds inoculated by biofertilizers led to marked increase in seed yield. Then again, increase of photosynthesis by these microorganisms may increase seeds yield, besides increasing vegetative growth. Likely, enhance of plant nutrition has prompted adequate photoassimilate being transmitted to seeds in the grain filling stage and seeds have more weight in soybean plants (Saleh 2005). Bacteria found in biofertlizes formulation showed marked increase in the yield of soybean seeds by supplying macro and micro nutrients that needed for plant growth, production of stimulate material, improve of root system and anti-pathogenic effects (Jat and Ahlawat 2006). Mehasen and Saeed (2005) examined the impacts of bacterial inoculation and mineral and organic fertilizers on the yield and yield quality of soybean (Giza 22 and Giza 111 cultivars). They reasoned that there is a high impact for the interaction between soybean cultivars and fertilizers on seed yield. The increase in seeds yield as soybean plants that got biofertilizers principally ascribed to the positive impact of biofertilizers application to the soil which enhanced its physical and biological properties bringing about more arrival of accessible supplements to plant root. These outcomes are in agreement with Hussein *et al.* (2006) who reported a critical impact on 100 seed weight in both seasons because of the interaction between soybean cultivars and used fertilizers. Soybean inoculation by bradyrhizobium bacteria and phosphate solubilizing bacteria increased the seeds yield (Singh 1994; Jat and Ahlawat 2006). Phosphate solubilizing bacteria increased the absorption of other elements via enhancing its ability to uptake phosphorus and thereby improve crop yield (Mahfouz and Sharaf-Eldin 2007).

Priority of fertilizer phosphorine than rhizobecteren fertilizer in all measured characters was probably because phosphate-solubilizing bacteria had positive effect on activities of nitrogen stabilizer bacteria due to provision of phosphorus and other nutrients. Furthermore, the higher efficacy of microbin than phosphorine and rhizobecteren biofertlizers may be due to that mirobin is a mixture of phosphate-solubilizing bacteria and nitrogen fixing bacteria.

The increased of seeds index due to the increased in seeds yield since Shirastava *et al.* (2001) and Narne *et al.* (2002) reported that in soybean, harvest index has highly correlated with grain yield. The data in this study showed that weeds control treatments and increased yield of soybean crop. The results indicated that weeds control treatments favors the growth of soybean plants. Superiority of these treatments is correlated with their efficiency for controlling soybean associated weeds. This finding could be due the limiting weeds infestation and minimizing weed competition. Similar conclusions were obtained by Chavan *et al.* (2000), Tiwari and Mathew (2002), Bhattacharya *et al*. (2004) and Pandya *et al*. (2005). Similar conclusions were obtained by Huda (2009).

The effect of biofertilizers and weeds control treatments on quality of soybean crop such as oil, protein and nutrients content considered one of the key factors for evaluation. The data in this study showed that biofertilizers application increased oil content of soybean seeds. The increase in oil content due to application of herbicides may be attributed to increasing phospholipids formation which is considered one of oil constituents. Similar conclusions were obtained by El-Quesni (1993).. The increase in protein content in soybean treated with biofertlizers may be due to that biofertilizers application enhance protein biosynthesis by either direct nitrogen supply (through $N_2$-fixation) or indirectly by enhancing the uptake of soil nitrogen and enhancing the photosynthetic process. Similar conclusions were obtained by Huda (2009). Sugiyama *et al.* (1984) found that the soluble proteins are raised with good nitrogen supply and better growth conditions. The high N-rate increases the amino acids synthesis in the leaves, and this stimulates the accumulation of protein in the seeds rather than oil content. Furthermore, biofertilizers application increased nitrate reductase activity in soybean which may be due to improving minerals nutrition (N, P and K) in addition to release plant promoting substances such as indole acetic acid (IAA), gibberellins and cytokinin-like substances (Tilak *et al*. 2006). The data in this study showed that weeds control treatments increased nitrate reductase activity in soybean. The enhanced NRA may be due to weeding control which consequently increased nitrogen contents which simulate nitrate reductase activity and synthesis. Similar conclusions were obtained by interaction between inoculation and other treatments which caused induction of nitrate reductase activity in soybean plants in both growing seasons.

The nutrients content (N, P and K) in soybean leaves and seeds significantly increased as results of application of biofertilizers and weeds control treatments. It is clear that, the nitrogen contents in leaves and seeds increased in inoculated plants compared to that uninoculated. The obtained results may be attributed to the $N_2$-fixing bacteria which increase the available content of nitrogen in the soil (Abd Allah *et al*. 2001). Inoculation with phosphorin caused an increase in phosphorus content in leaves and seeds. The positive effect of phosphorin may due to it is contain *Azotobacter* and *Bacillus* microorganisms that lead to produced adequate amounts of growth regulators

(Patten& Glick 1996), which increased the surface area per unit root length and responsible for root hair branching with an eventual increase in uptake of nutrients from the soil (Jagnow *et al.* 1991). Moreover, the increase of nutrients content (N, P and K) in soybean leaves and seeds probably resulted in a better absorption of water and nutrients from the soil (Egamberdiyeva and Höflich 2004). Weeds control treatments LSO increased the mean value of N,P and K contents of leaves and seeds in both growing seasons. Weeding control by either mechanically or chemically reduced the competition between weeds and soybean which may increase amount of nutrients absorbed by the roots of soybean which resulted in increased N, P and K contents in both soybean seeds and leaves. The interaction between biofertilizers and weeds control treatments had no noticeable effect on N, P and K contents of leaves and seeds of soybean in both growing seasons.

## CONCLUSIONS

Biofertilizers can play an important role in enhancing soybean growth, nodulation and productivity. Weeds treatments significantly controlled soybean associated weeds and improve soybean yield and quality. Interaction between weed treatments and biofertilizers increased soybean yield and quality.

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## تأثير الاسمدة الحيوية ومعاملات مكافحة الحشائش علي العقد البكتيرية والمحصول ومكوناته والحشائش المصاحبه في محصول فول الصويا

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أجريت هذه التجربة في صيف موسمي ٢٠١٣ و ٢٠١٤ وفى مزرعة محطة البحوث الزراعية بسخا. بهدف دراسة تأثير التسميد الحيوي (ميكروبين- ريزوبكتيرين -فوسفورين) وبعض معاملات مقاومة الحشائش (فيوزليد سوبر بمعدل ٣.٥٧ لتر هكتار$^{-١}$، بازجران بمعدل ٢.٣٨ لتر هكتار$^{-١}$، فيوزليد سوبر+ بازجران ، عزيق بعد ٣٠و٤٥ يوم من الزراعه،عزيق بعد ١٥و٣٠و٤٥ يوم من الزراعه) على محصول فول الصويا ومكوناته والعقد البكتيريه والحشائش المصاحبة وأظهرت النتائج مايلى:- أدت معامله بذور فول الصويا بالاسمدة الحيويه الي حدوث حفض معنوي في الوزن الجاف للحشائش الضيقه والعريضه والكلية. أعطت المعاملة بالا سمده الحيوية إلي زيادة عدد ووزن العقد البكتيرية النشطة لكل نبات وإنقاص عدد العقد البكتيرية الميتة. كما أدت إلي زيادة عدد ووزن القرون لكل نبات وعدد ووزن البذور فى القرن و محصول الفدان من البذور ونسبه البروتين والزيت وزياده نشاط انزيم اختزال النترات وكذلك زيادة محتوي الاوراق والبذور من النيتروجين والفسفور والبوتاسيوم في كلا الموسمين مقارنه بمعامله عدم التسميد وكانت المعاملة بالميكروبين قد ادت إلي الحصول علي افضل النتائج في جميع الصفات. أدت معاملات مقاومة الحشائش الي تقليل الوزن الجاف للحشائش الضيقه والعريضه الاوراق والكليه في الموسمين. كما أدت المعاملة بمبيدات الحشائش فيوزليد سوبر وبازجران إلي عدم زيادة عدد العقد البكتيرية النشطة علي جذور نباتات فول الصويا في الموسمين زيادة معنوية مقارنة بمعاملة العزيق والكنترول وكذلك زيادة عدد ووزن القرون نبات$^{-١}$ وعدد ووزن البذور قرن$^{-١}$ و محصول الفدان من البذور ونسبه البروتين والزيت وزياده نشاط انزيم اختزال النترات وكذلك زيادة محتوي الاوراق والبذور من النيتروجين والفسفور والبوتاسيوم مقارنه بمعامله المقارنة .. كانت أفضل المعاملات علي الاطلاق العزيق بعد ١٥-٣٠-٤٥ يوم من الزراعة و استخدام مبيد فيوزليد سوبر بمعدل٣.٥٧ لتر /هكتار + بازجران٢.٣٨ لتر/هكتار بعد شهر من الزراعة حيث أعطت أفضل مقاومة للحشائش .