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# Effect of Salicylic acid, Biofertilization and Sowing Dates on Peanut (*Arachis hypogaea* L.) Yield under Semi-arid Conditions

**Howaida A. Maamoun and A. M. Abd El Gawad***
*Plant Production Dept. and *Soil Fertility & Microbiology Dept., Desert Research Center, El- Matareya, Cairo, Egypt.*

TWO FIELD experiments were carried out in El-Kharga Experimental Farm of Desert Research Center, Al- Wadi Al- Gadeed Governorate in a sandy clay loam soil, during two summer seasons of 2010 and 2011 to study the effect of salicylic acid application, biofetilization and sowing dates on yield and its components, and the chemical composition of peanut (Giza, 6 cultivar).

The study included four levels of salicylic acid, *i.e.,* zero salicylic acid, 100, 150 and 200 ppm salicylic acid(SA), four different biofertilization treatments, *i.e.,* without biofertilization (Br), *Bacillus megatherium* (PDB),*Pseudomonas fluorescence* (PS) and mixed biofertilization treatment (PDB+PS), Rhizobia was applied as base treatment and three sowing dates: April 20*th*, May 15*th* and June 10*th* . The studied factors were arranged in a split- split design with four replications, where sowing date constituted the main plots, salicylic acid was arranged in the sub plots and biofertilizations were occupied sub-sub plots.

Based on yield and yield components data, it was concluded that the early sowing (April 20*th*) produced the highest significant parameters of peanut plants; plant height, weight of pods per plant, number of pods per plant, 100-seeds weight, pod and seed yields and protein and oil yields. On the reverse,the lowest values were obtained at late sown (June, 10*th*) throughout the studied two seasons (2010 and 2011). Early sown gave the chance of growing plant to complete all of its physiological processes (vegetative and reproductive processes) at proper time than that of late sown. Delaying of peanut sowing till (June, 10*th*) caused a decline in all of the studied parameters throughout the studied seasons. Increasing SA levels from 100 to 200 ppm increased significantly all the studied parameters as compared with control in the studied two seasons. Mixed biofertilization treatment had a significant effect on yield and its components as compared with the single biofertilization treatments. Also, biofertilization treatment resulted in higher values of soil microbiological properties, *i.e.* total microbial counts, counts of phosphate dissolving bacterial (PDB), *Pseudomonas* count and nodule characteristics.

**Keywords:** Sowing times, Salicylic acid, Biofertilization, Heat stress conditions, Peanut .

Desert land of the New Valley region offers opportunities for agricultural expansion. It represents 44% of the total area of Egypt covering about 3.3 million fad (Salem, 2008). However, the cultivated area does not exceed 9981 faddan, mainly occupied by field crops and depends on ground water irrigation. Peanut is a crop which offers potential for the area both for oil (40-50%) and stock feed (30-50% proteins) (Hatam & Abbasi, 1994). There is a need for optimization of the peanut production system in this desert land area particularly with respect to possible improvement of the microbiological environment.

A Significant increases in peanut yield can be achieved by early or late of planting (Baldwin, 2005), with a previous study indicating that early planting produced 20% to 50% greater pod yields than late planting (Naab *et al.,* 2004; Laurence, 1983: Mozingo *et al.,* 1991 and Bala *et al.,* 2011). The yields of plant components (pod and seeds) and their respective rates, as well as flower, peg and pod numbers were significantly affected by planting date (Kasai *et al.,* 1999). Frimpong (2004) reported that plant height, biomass, and pod yield were significantly affected by planting date and environmental factors.

Growth regulators are one of the most important factors for yield improvement in various field crops (Ali & Mahmoud, 2012). Salicylic acid, (SA) (2-hydroxybenzoic acid) as a natural plant hormone has many effects on physiological processes and growth plants (Khan *et al.,* 2003) and development and plays an active role in plant defense responses (Janda *et al*., 2007). Exogenously added SA also increased the heat tolerance of mustard (Dat *et al*., 2000). It occurs naturally in plants in low amounts and has been shown to promote nutrient uptake, chlorophyll synthesis, photosynthesis and protein synthesis (Khan *et al.,* 2003 and Sakhabutdinova *et al.,* 2003). Salicylic acid may be a prerequisite for the synthesis of auxin and / or cytokinin (Metwally *et al*., 2003). Furthermore, SA has an important role in tolerance of some environmental stresses such as heat, salts and drought stress (Khan *et al.,* 2003 and Hussein *et al.,* 2007). Foliar spray of salicylic acid as a 100 ppm concentration increased number of pod/plant, number of seed /pod, seed weight/plant and seed green gram yield/ ha (Sujatha, 2001). Naturally, most sandy soils are low in organic matter and nutrient content that means adding foliar fertilizers is much more essential to plants which will be cultivated in the last few decades, foliar fertilizers are used not only to give great yields or to improve the quality of crops but also to compensate the deficient soil nutrients, particularly in sandy soils due to the vertical expansion in agriculture (Ali & Mahmoud, 2012).

Biofertilizer, an alternative source of N-fertilizer, especially rhizobia in legume symbiosis is an established technology. Use of the biofertilizers can also prevent the depletion of the soil organic matter (Jeyabal & Kuppuswamy, 2001). Inoculation with bacterial biofertilizer may reduce the application of fertilizer-N by increasing N uptake by plants (Choudhury & Kennedy, 2004; Kennedy *et al.,* 2004 and Mia *et al.* 2005, 2007). Nitrogen fixation and plant growth enhancement by rhizosphere bacteria might be important factors for achieving a sustainable agriculture in the future (Baset Mia & Shamsuddin, 2010)

Soil microorganisms can fix atmospheric nitrogen, soluble phosphate, affect plant growth through synthesis of growth promoting substances and enhance the decomposition of plant residues to release vital nutrients and increase humic content in soils. Thus addition of these to cropping soils may be an environmentally benign approach for improved nutrient management and ecosystem function (Wu *et al*., 2005 and Kaci *et al*., 2005). Possible options for improving peanut nutrition include *Bradyrhizobium* (N nutrition) and *Pseudomonas* (P nutrition). Peanut *(Arachis hypogaea* L.*)*, Family Leguminosae is usually nodulated by rhizobia of the genus *Bradyrhizobium* as demonstrated by Van Rossum *et al*. (1995): Rhizobia are symbiotic bacteria which fix atmospheric nitrogen into ammonia. Phosphate solubilizing bacteria have the ability to increase the available phosphorous for plant through production of organic acids (Mehana & Farag, 2000). The microorganisms involved in P solubilisation can enhance plant growth by increasing the efficiency of biological nitrogen fixation, enhancing the availability of other trace elements and by production of plant growth promoting substances (Gyaneshwar *et al.,* 2002). Fluorescent *Pseudomonas* spp. strain 267 promoted growth of different plants under field conditions and enhanced symbiotic nitrogen fixation in clover (Marek-Kozaczuk & Skorupska, 1997).

Therefore, the present work aimed to extend investigate the existing information on the benefits of early sowing to study the effects of levels of salicylic acid and types of biofertilization and their interactions with sowing dates on yield, yield components and chemical composition of peanut plants grown under New Valley conditions of Egypt.

## Materials and Methods

Two field experiments were carried out at the Agricultural Experimental Farm of the Desert Research Center at El-Kharga Oasis, New Valley Governorate of Egypt. The major portion the El-Kharga Oasis site is between longitudes $28^{\circ}$ $48^{-}$ and $29^{\circ}$ 21-$^{-}$ E and latitudes $25^{\circ}$ $28^{-}$ and $25^{\circ}$ 44- N). The experiments were carried out during two successive summer seasons of 2010 and 2011 to study the response of peanut, cv., (Giza, 6) to sowing dates (April $20^{th}$, May $15^{th}$ and June $10^{th}$) and salicylic acid foliar application (zero salicylic acid, 100, 150 and 200 ppm) and four different biofetilization treatments (Bradyrhizobium as base for all treatments, *Bacillus megatherium* (PDB), *Pseudomonas fluorescence* (PS) and mixed biofertilization treatment (PDB+PS). The physical and chemical properties of the soil before cultivation are presented in Table 1 , chemical analysis of irrigation water in Table 2 and temperature of the site 2010 and 2011 according to Meteorological Station at New Valley in Egypt in Table 3.

**TABLE 1. Some Physical and Chemical characteristics of the studied soil .**

| Mechanical analysis | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sand** | | | **Clay** | | | **Silt** | | **Soil texture** | | |
| 51.5% | | | 30.4% | | | 18.1% | | Sandy clay loam | | |
| **Chemical analysis** | | | | | | | | | | |
| **pH** | **EC ds/ml** | **T.N** | **Cations (me/l)** | | | | **Anions (meq/l)** | | | |
| | | | **$Ca^{+2}$** | **$Mg^{+2}$** | **$K^{+}$** | **$Na^{+}$** | **$CO_3^{-2}$** | **$HCO^{-3}$** | **$Cl^{-}$** | **$SO_4^{-2}$** |
| 8.32 | 24.8 | 100ppm | 4.00 | 3.25 | 1.66 | 15.79 | 0.00 | 1.2 | 18.0 | 5.5 |
| **Trace elements (ppm)** | | | | | | | | | | |
| **Zn** | | **Mn** | | **Cu** | | **Fe** | | **B** | | |
| 5.97 | | 4.03 | | 1.79 | | 33.08 | | 0.56 | | |

**TABLE 2. The chemical analysis of irrigation water .**

| **pH** | **ECds/ml** | **Units** | **$Ca^{+2}$** | **$Mg^{+2}$** | **$Na^{+}$** | **$K^{+}$** |
|---|---|---|---|---|---|---|
| 7 | 676 | ppm | 31.89 | 10.80 | 1.33 | 19.40 |
| | | Units | $CO_3^{-2}$ | $HCO_3^{-}$ | $SO_4^{-2}$ | $Cl^{-}$. |
| | | ppm | 0.00 | 64.06 | 30.87 | 36.97 |

**TABLE 3. Temperature of the site 2010 and 2011(Meteorological Station at New Valley in Egypt) .**

| **Month** | **Mean temperatures (°C) 2010** | | | **Mean temperatures (°C) 2011** | | |
|---|---|---|---|---|---|---|
| | Max | Min | Mean | Max | Min | Mean |
| April 1st -10th | 34.71 | 18.41 | 26.52 | 30.23 | 13.49 | 22.53 |
| April 11-20th | 37.28 | 18.93 | 28.78 | 32.91 | 16.83 | 24.89 |
| April 21-30th | 34.65 | 18.85 | 27.17 | 34.59 | 18.20 | 26.81 |
| May 1st -10th | 37.58 | 18.31 | 28.99 | 36.90 | 20.28 | 28.93 |
| May 11-20th | 39.13 | 22.88 | 31.14 | 35.02 | 19.67 | 27.98 |
| May 21-31st | 38.16 | 23.56 | 30.29 | 39.97 | 24.66 | 32.77 |
| June 1st -10th | 40.34 | 24.59 | 33.16 | 39.64 | 26.78 | 33.22 |
| June 11-20th | 41.44 | 25.49 | 30.44 | 38.68 | 23.82 | 31.77 |
| June 21-30th | 42.98 | 26.29 | 35.32 | 38.95 | 24.35 | 32.02 |
| July | 40.47 | 26.56 | 34.28 | 42.02 | 25.87 | 34.56 |
| August | 42.14 | 26.33 | 35.14 | 40.63 | 24.58 | 33.31 |
| September | 39.39 | 24.59 | 31.88 | 37.83 | 21.38 | 30.51 |
| October | 37.22 | 21.69 | 29.53 | 33.28 | 19.99 | 26.38 |

*Assay of biochemical activities in vitro*

The ability of the tested microbial isolates to produce biochemical activities was evaluated under *in vitro* conditions, through determination of their efficiency to solubilize phosphate (Nautiyal, 1999), produce of growth regulators (Rizzolo *et al*., 1993), carry out nitrogen fixation (Scholhorn & Burris, 1967), produce enzymes (Barrow & Veltham, 1993), produce antibiotics (Jarlier *et al*., 1996) and produce total carbohydrate (Cherry, 1973).

Peanut *(Arachis hypogace* L.) cv., Giza 6 was inoculated just before sowing with the specific bacterial inoculants. Seeds of peanut were sown on three sowing dates (April, 20$^{th}$, May, 15$^{th}$ and June 10$^{th}$) with two successive seasons 2010 and 2011.

Seeds of peanut were washed and immersed for 30 min in liquid culture of the specific bacteria to be tested. Carboxymethyl cellulose (CMC 0.5%) was used as an adhesive agent. Seeds were then dried at room temperature for two hours. Fresh liquid cultures 48 hr old containing pure local strains of *Bradyrhizobium (*Br*), Bacillus megatherium var. phosphaticm* (PDB) and *Pseudomonas fluorescens* (PS), previously isolated from the rhizosphere of soils of New Valley region were used. These had been purified and identified according to Bergey's Manual (1984*).* They were used as biofertilizers in the form of single and mixed inoculations at the rate of ~$10^8$ cfu/ml.

Plants were sprayed with distilled water (control), 100, 150 and 200 ppm, of salicylic acid dissolved in distilled water. All solutions were sprayed to the shoots uniformly using a hard-pump sprayer.

Normal cultural practices for peanut were applied as recommended in the district. The experimental design was split-split plot with four replicates: three sowing dates were arranged in the main plots, salicylic acid as foliar application treatments were assigned in the sub plots and biofertilization treatments were allocated in the sub- sub plots. The plot area was 10.5 m$^2$ consisting of five rows (3.5 m length and 60 cm between rows). Plants were thinned to a single plant per hill and the distance between hills was 25 cm apart.

Foliar spraying with salicylic acid was done twice, firstly during the vegetative stage (35 days after sowing) and then at pod development (75 days after sowing) at the rate of 400 L / fad.

Peanut plants were harvested at mid September, first of October and end of October in the two studied growing seasons, respectively for the three sowing dates. Ten guarded and competitive plants of the middle two rows were taken randomly to determine the yield components as follows: - plant height (cm), weight of pods per plant (g), number of pod per plant, and 100-seed weight (g). Whole plant was uprooted and the pods were air dried to weigh and calculate seed yield per Faddan.

Seeds content of N was determined using the methods described by Chapman & Pratt (1978) and protein content calculated by multiplying N% by 6.25. Seed oil content was determined according to A.O.A.C. (1980).

Soil samples of the peanut rhizosphere were collected in both seasons and analyzed for microbial determinations. Nodulation was determined by nodule numbers and dry wt. of nodule. Total microbial counts were determined on Bunt and Rovira medium (Nautiyal, 1999) using the decimal plate method technique.

Counting the number of growing phosphate dissolving bacteria was carried out using Bunt and Rovira medium after addition of 5 ml sterile solution of 10 % of $K_2HPO_4$ and of 10 ml of sterile solution of 10 % $CaCl_2$ to each 100 ml of the medium. The most probable number (MPN) of *Pseudomonades* was determined after incubating the tubes at 30±2 ˚C for 48 hr on King's B medium (King *et al*, 1954). Estimates of number of pseudomonades by MPN technique were calculated using Cochran's table. Nodulation (nodule number and dry weight of nodule) was determined by the method of Wilson & Reisenauer (1963).

The data were subjected to analysis of variance of split- split plot designs according to the method described by Gomez & Gomez (1984). Least significant differences (LSD) at the 5% level were used to compare the means of tested treatments.

## Results and Discussion

*Biochemical activities of microbial isolates*

Table 4 shows the biochemical activities of the *Bradyrhizobium japonicum, Bacillus megatherium* and *Pseudomonas fluorescens* used in the trial for production of hormones, antibiotic, enzymes, phosphate solubilization, nitrogen fixation and total carbohydrates production. Hormonal activities, enzyme production and phosphate solubilization are common features of all the tested microorganisms. However, *B. megatherium* appeared to be superior to the other isolates in phosphate solubilization. Only *Bradyrhizobium* showed nitrogenase activity on other side *P. fluorescens and B. megatherium* showed antimicrobial activity. *Bradyrhizobium* showed highest indole acetic acid production (IAA) while *Pseudomonas* gave highest cytokinine production as expected the microorganisms exhibited the types of biochemical and hormonal activity *in vitro* that could result, in beneficial action in the field (Van Rossum *et al.* 1995; Vargas *et al.*, 2009; Verma *et al.*, 2010 and El- Saidy & Abd El-Hai, 2011).

**TABLE 4. Biochemical activities of microbial isolates .**

| **Isolate** | **Nitrogenase $\mu lC_2H_4H^{-1}l^{-1}$** | **Hormonal activity Quantitative (HPLC) / µg/ml** | | | **Enzyme activity*** | | | |
|---|---|---|---|---|---|---|---|---|
| | | **IAA** | **$GA_3$** | **Cytokinin** | **Amylase** | **Cellulase** | **Protease** | **Pectinase** |
| *B.japonicum* | 463 | 1.8 | 2.5 | 8.7 | + | + | + | + |
| *B.megatherium* | - | 0.24 | 1.32 | 10.2 | + | + | + | + |
| *P.fluorescens* | - | 0.91 | 2.19 | 14.15 | - | + | + | + |
| Isolate | **P.solubilizat-ion mg p/l** | **Antibiotic production (mm)** | | | **Total carbohydrates (mg/l)** | | | |
| | | ***E. coli*** | ***F. oxysporum*** | ***R. solani*** | **Mono** | **Di** | **Poly** | **Total** |
| *B.japonicum* | 2.85 | - | - | - | 257 | 114.68 | 12.2 | 383.7 |
| *B.megatherium* | 4.75 | 21 | 26 | 19 | 108 | 74.31 | 56.27 | 238.58 |
| *P. fluorescens* | 1.1 | 24 | 31 | 36 | 91 | 63.81 | 17.39 | 172.2 |

***** for enzyme activity; + indicates existence of activity, - indicates no activity.

*Effect of treatments on the yield of peanut and its components*

Table 5, indicates that in the two growing seasons, the yield of peanut and its attributes; *i.e.*, plant height(cm), weight of pods per plant (g), number of pods per plant, 100-seeds weight (g), pod and seed yields (kg/fad) and protein and oil yields (kg/fad), exhibited significant differences for different dates of sowing. The highest increases for all parameters were recorded for early sown (April 20$^{th}$), while, late sown (June 10$^{th}$) show the lowest values (Table 5). Among different rates of salicylic acid and biofetilization treatments there were significant variations at the level ($p< 0.05$). This may be due to the efficiency of the sink than the source under early sowing date. The results are in agreement with Ahmed *et al.* (2007) who reported that late sown crop failed to mature and yielded 15-25% production less than the early sowing. The late crop had a shorter period for the production of pods and also a slightly lower rate of pod production causing a reduction in seeds and weight of pod/plant was similar at two sowing. Laurence (1983), reported that late sowing reduced pod yield by 19% (from 5.02 to 4.21 ton/ha) and seeds yield by 18% (from 3.55 to 2.85 ton/ha) compared with early sowing. Bell (2001), reported that commercial pod yield being decreased by 28 and 31%, respectively, for the final sowing date (June 10$^{th}$).

Sowing peanut in 20$^{th}$ of April exerted percentage increase in seeds yield over these cultivated in 15$^{th}$ of May and 10$^{th}$ of June by 9.95 and 42.48 % in 2010 season, and by 7.69 and 44.27 % in 2011 season, respectively.

As respect to protein and oil yields (kg/fad.), of peanut seeds were decreased by delaying sowing date from April 20$^{th}$ to June 10$^{th}$ in both studied seasons. Delaying sowing date from April 20$^{th}$ to May 15$^{th}$ and June 10$^{th}$ decreased accumulative heat units by 0.72 and 13.21$^{\circ}$C in first season and by 13.96 and 25.08 $^{0}$C in the second season comparing with April 20$^{th}$, respectively (Table 3). Increasing protein and oil yields by sowing peanut seeds early may be due to environmental conditions in this period which seem to be suitable for translocation the nutrient to seed and consequently increasing 100-seed weight and seeds production as well as oil yields. (Wahid *et al.,* 2007 and Bala *et al.,* 2011).

Data presented in Table 5, clearly showed that salicylic acid treatments significantly ($p< 0.05$) increased all the studied parameters; *i.e.,* plant height(cm), weight of pods per plant (g), number of pods per plant, 100-seeds weight (g), pod and seed yields (kg/fad) and protein and oil yields (kg/fad) than untreated plants during 2010 and 2011. The data also indicated that the effect of SA at 200 ppm concentration was more pronounced than other concentrations as well as the control. The highest values of plant height (cm), 100-seed weight (g), seed, protein and oil yields (kg/fad) (41.5, 85.1, 473.6, 87.3 and 174.6 in the 2010) and (42.4, 85.8, 481.6, 99.9 and 181.5 in the 2011) respectively, were registered at concentration of 200 ppm salicylic acid. These results may be due to the role of SA in enhancing some physiological and biochemical aspects (Ali & Mahmoud, 2012). The stimulation effect of SA on yield and its components was confermed by El-Shraiy & Hegazi (2009) on pea plant and the beneficial effect of spraying with SA could be attributed to its vital role activity in the function of enzymes in various plants which led to increase in yield components (Khan *et al.,* 2003 and Shu & Hui, 2008) . In this concern Amutha *et al.* (2007) stated that foliar application with SA improved the productivity of crop plants under moderately high temperature. The associative action of salicylic acid led to a significant increase in oil yield as compared to salicylic alone.

**TABLE 5. Main effects of sowing date, salicylic acid and biofertilization on yield and its components of peanut in the two growing seasons .**

| Characters / Treatment | Plant height (cm) | Weight of pods/ plants (g) | No. of pods/ plants | 100-seeds weight (g) | Pod yield (kg/fad) | Seed yield (kg/fad) | Protein yield (kg/fad) | Oil yield (kg/fad) |
|---|---|---|---|---|---|---|---|---|
| **2010 Season** | | | | | | | | |
| **Sowing date** | | | | | | | | |
| 20th April | **43.34** | **40.01** | **29.10** | **88.62** | **845.17** | **445.42** | **90.3** | **177.7** |
| 15th May | 38.16 | 38.66 | 28.27 | 86.24 | 773.19 | 401.10 | 64.7 | 136.7 |
| 10th June | 34.83 | 37.22 | 26.50 | 69.37 | 562.10 | 256.17 | 40.0 | 74.3 |
| LSD5% | 0.22 | 0.18 | 0.31 | 0.15 | 2.95 | 4.08 | 0.06 | 0.11 |
| **Salicylic acid** | | | | | | | | |
| Control | 34.60 | 37.17 | 25.78 | 76.46 | 639.58 | 270.28 | 39.2 | 87.1 |
| 100ppm | 38.66 | 37.93 | 27.19 | 81.41 | 700.14 | 319.17 | 50.9 | 105.1 |
| 150ppm | 40.31 | 36.69 | 29.06 | 82.63 | 756.06 | 407.19 | 75.0 | 143.8 |
| 200ppm | **41.52** | **37.72** | **29.81** | **85.16** | **811.50** | **473.61** | **87.3** | **174.6** |
| LSD5% | 0.19 | 0.12 | 0.23 | 0.21 | 5.11 | 3.18 | 0.09 | 0.11 |
| **Biofertilization** | | | | | | | | |
| Control (Br) | 34.58 | 36.52 | 25.75 | 76.64 | 621.89 | 307.00 | 40.9 | 93.4 |
| PDB | 37.6 0 | 38.05 | 27.56 | 79.98 | 708.67 | 355.64 | 59.7 | 120.9 |
| PS | 40.29 | 39.32 | 28.67 | 83.16 | 745.25 | 382.50 | 71.6 | 136.2 |
| mix (PDB + BS) | **42.62** | **40.62** | **29.86** | **85.87** | **831.47** | **425.11** | **87.4** | **158.6** |
| LSD5% | 0.23 | 0.15 | 0.26 | 0.21 | 4.72 | 3.48 | 0.06 | 0.14 |
| **2011 Season** | | | | | | | | |
| **Sowing date** | | | | | | | | |
| 20th Abril | **44.05** | **40.96** | **29.73** | **89.39** | **881.38** | **471.58** | **96.6** | **199.4** |
| 15th May | 39.31 | 39.46 | 28.31 | 86.86 | 810.19 | 435.31 | 70.6 | 155.1 |
| 10th June | 35.72 | 37.62 | 26.75 | 69.75 | 580.67 | 262.81 | 41.5 | 77.1 |
| LSD5% | 0.23 | 0.14 | 0.28 | 0.44 | 18.17 | 2.86 | 0.18 | 0.22 |
| **Salicylic acid** | | | | | | | | |
| Control | 35.28 | 37.95 | 26.47 | 76.89 | 678.03 | 318.69 | 46.5 | 104.7 |
| 100ppm | 39.45 | 38.95 | 27.61 | 81.76 | 726.64 | 331.83 | 53.5 | 111.6 |
| 150ppm | 41.58 | 40.26 | 29.17 | 83.53 | 787.06 | 427.39 | 79.2 | 153.7 |
| 200ppm | **42.472** | **40.29** | **29.81** | **85.83** | **837.92** | **481.69** | **99.9** | **181.5** |
| LSD5% | 0.42 | 0.17 | 0.27 | 0.36 | 10.08 | 4.26 | 0.14 | 0.12 |
| **Biofertilization** | | | | | | | | |
| Control (Br) | 35.2 0 | 36.71 | 25.94 | 77.00 | 650.22 | 324.05 | 43.4 | 99.4 |
| PDB | 38.39 | 38.79 | 28.00 | 80.38 | 749.47 | 380.11 | 64.7 | 133.2 |
| PS | 41.45 | 40.32 | 28.86 | 83.79 | 772.58 | 405.97 | 76.4 | 147.6 |
| mix (PDB + BS) | **43.73** | **41.57** | **30.25** | **86.83** | **857.36** | **449.47** | **93.4** | **171.1** |
| LSD5% | 0.38 | 0.20 | 0.25 | 0.45 | 5.03 | 3.76 | 0.12 | 0.18 |

The maximum value of plant height (42.62 and 43.73 cm), weight of pods per plant( 10.62 and 11.57 g), number of pods per plant (9.86 and 10.25), 100-seeds weight ( 35.87 and 36.83 g), pod yields (831.47 and 857.36 kg/fad) and seed yields (425.11 and 449.47 kg/fad) protein combined yield ( 87.4 and 93.4 kg/fad) and oil yields (158.6 and 171.1 kg/fad) were obtained by biofertilized peanut plant with mixed biofertilization treatments (PDB + PS) through the first and second seasons, respectively. These results in accordance with Badawi *et al.* (2011), they reported that Co inoculation of Peanut with *Bradyrhizobium* and PGPRs significantly magnified the Peanut yield (41%) during two growing seasons, synergy inoculation between *Bradyrhizobium* and PGPRs led to further increases in all studied parameters and strengthened the stimulating effect of bacterial inoculation.

Regarding the effect of interaction between sowing date and biofertilization (Table 6), on plant height, weight of pods per plant, number of pods per plant, 100-seeds weight, pod and seed yields, protein and oil yields of peanut through 2010 and 2011seasons, data indicated significant increase of the previous mentioned parameters.

Above mentioned results may be due to the suitable temperature degrees which led to increase seeds yield from biofertilzed plant seed that sown on April $20^{th}$ with mix two type of bacteria at the period from flowering to harvest, this caused an increase in dry matter accumulation in plant organs which reflected on plant height, weight of pods per plant number of pods per plant, 100 seed weight.

The interaction effect of sowing date and salicylic acid foliar application reached the 5% level of significance for the yield of peanut and its attributes; *i.e.*, plant height (cm), weight of pods per plant (g), number of pods per plant, 100-seeds weight (g), pod and seed yields (kg/fad) and protein and oil yields (kg/fad), in both seasons (Table 7). It could be conclude that there was an opposite relation between delaying date of sowing peanut seeds and increasing of salicylic acid foliar application on the yield of peanut and its components characteristics through 2010 and 2011. It could be concluded that increasing rate of salicylic acid led to productive seeds than vegetative growth. However, the maximum value of seed yields protein and oil yields (kg/fad) (575.6, 132.9 and 251.5 in the 2010 and 598.1, 138.8 and 263.8 in 2011) respectively, were obtained from plants grown in the $20^{th}$ of April treated with 150 ppm salicylic acid. While in the second date May $15^{th}$ treated plant with 200 ppm salicylic acid. This is to be logic since the same interaction gained the highest values of yield components and consequently seed yield (kg/fad) (Metwally *et al*., 2003).

**TABLE 6 . Effect of interaction between sowing dates and biofetilization on yield and its components of peanut in the two growing seasons.**

| Characters / Treatments | | Plant height (cm) | Weight of pods/ plants (g) | No. of pods/ plants | 100-seeds weight (g) | Pod yield (kg/fad) | Seed yield (kg/fad) | Protein yield (kg/fad) | Oil yield (kg/fad) |
|---|---|---|---|---|---|---|---|---|---|
| **2010 Season** | | | | | | | | | |
| **D1** | B0 | 38.4 | 7.7 | 6.4 | ٣٢,٦ | ٦٨١,٧ | ٣٦٧,٤ | 50.3 | 123.1 |
| | B1 | ٤١,٧ | ٩,٥ | ٨,٧ | ٣٨,٠ | ٨٢٣,١ | ٤٣٢,٨ | 86.1 | 173.6 |
| | B2 | ٤٥,٠ | ١٠,٧ | ١٠,٠ | ٤٠,٦ | ٨٦٣,٣ | ٤٦١,١ | 104.2 | 201.0 |
| | B3 | **٤٨,٣** | **١٢,٢** | **١١,٥** | **٤٣,٤** | **١٠٠٩,٢** | **٥٢٠,٤** | **129.6** | **231.0** |
| **D2** | B0 | ٣٣,٢ | ٦,٣ | ٦,٠ | ٣٢,٤ | ٦٥٥,٢ | ٣٢٣,٠ | 42.9 | 97.5 |
| | B1 | ٣٧,٢ | ٨,٠ | ٧,٨ | ٣٤,١ | ٧٥١,٣ | ٣٨٢,٣ | 59.3 | 127.7 |
| | B2 | ٤٠,٠ | ٩,٣ | ٨,٩ | ٣٧,٨ | ٧٩٩,٧ | ٤٢١,٧ | 71.7 | 150.5 |
| | B3 | ٤٢,٢ | ١١,٠ | ١٠,٣ | ٤٠,٧ | ٨٨٦,٧ | ٤٧٧,٥ | 88.8 | 178.1 |
| **D3** | B0 | ٣٢,١ | ٥,٦ | ٤,٩ | ١٤,٩ | ٥٢٨,٨ | ٢٣٠,٦ | 30.2 | 63.6 |
| | B1 | ٣٣,٩ | ٦,٧ | ٦,٢ | ١٧,٨ | ٥٥١,٧ | ٢٥١,٩ | 37.5 | 72.0 |
| | B2 | ٣٥,٩ | ٧,٩ | ٧,١ | ٢١,٢ | 572.8 | ٢٦٤,٨ | 43.7 | 78.1 |
| | B3 | ٣٧,٤ | ٨,٧ | ٧,٧ | ٢٣,٦ | ٥٩٥,٢ | ٢٧٧,٤ | 50.2 | 84.1 |
| **LSD at 5%** | | ٠,٩ | ٠,٦ | ١,١ | ٠,٩ | ٢٠,١ | ١٤,٨ | ٠,٣ | ٠,٦ |
| **2011 Season** | | | | | | | | | |
| **D1** | B0 | ٣٨,٧ | ٧,٩ | ٦,٩ | ٣٣,٣ | ٧١٤,٥ | ٣٩٤,٤ | 54.4 | 132.5 |
| | B1 | ٤٢,٦ | ١٠,٢ | ٩,٧ | ٣٨,٤ | ٨٧٦,٠ | ٤٥٦,٩ | 91.8 | 184.6 |
| | B2 | 45.5 | ١١,٩ | ١٠,٣ | ٤١,٣ | ٨٩٣,٧ | ٤٨٤,٨ | 115.0 | 203.1 |
| | B3 | ٤٩,٣ | ١٣,٦ | ١٢,١ | ٤٤,٧ | ١٠٣٥,٦ | ٥٥٠,٣ | 139.2 | 246.5 |
| **D2** | B0 | ٣٣,٧ | ٦,٥ | ٥,٩ | ٣٢,٦ | ٦٧٩,٠ | ٣٤٠,٠ | 45.6 | 104.4 |
| | B1 | ٣٧,٩ | ٩,١ | ٧,٩ | ٣٤,٩ | ٧٩٧,١ | ٤٢٤,٠ | 66.6 | 152.2 |
| | B2 | ٤١,٩ | ١٠,٥ | ٩,٠ | ٣٨,٦ | ٨٣٣,٥ | ٤٦٢,٥ | 79.1 | 172.1 |
| | B3 | ٤٣,٢ | ١١,٨ | ١٠,٥ | ٤١,٦ | ٩٣١,٢ | ٥١٤,٨ | 96.3 | 198.7 |
| **D3** | BO | ٣٢,٥ | ٦,٠ | ٥,١ | ١٥,٢ | ٥٤٨,٠ | ٢٣٧,٧ | 31.6 | 65.8 |
| | B1 | ٣٤,٦ | ٧,١ | ٦,٤ | ١٨,١ | ٥٧٥,٣ | ٢٥٩,٧ | 39.7 | 74.8 |
| | B2 | ٣٧,٠ | ٨,٤ | ٧,٣ | ٢١,٥ | ٥٩٠,٦ | ٢٧٠,٧ | 44.9 | 81.2 |
| | B3 | ٣٨,٨ | ٩,٢ | ٨,١ | ٢٤,٢ | ٦٠٨,٨ | ٢٨٣,٤ | 51.9 | 87.3 |
| **LSD at 5%** | | ١,٦ | ٠,٩ | ١,١ | ١,٩ | ٢١,٤ | ١٦,٠ | ٠,٥ | ٠,٨ |

B0 = *Bradyrhizobium*, (control), B1 = *B. megatherium* var. *phosphaticum* (PDB), B2 = *Pseudomonas fluorescens* (PS), and B3 = mix between (PDB + PS) while, D1= 20$^{th}$ April, D2=15$^{th}$ May and D3= 10$^{th}$ June

**TABLE 7 . Effect of interaction between sowing date and salicylic acid on yield and its components of peanut in the two growing seasons .**

| Characters / Treatment | Plant height (cm) | Weight of pods/ plants (g) | No. of pods/ plants | 100-seeds weight (g) | Pod yield (kg/fad) | Seed yield (kg/fad) | Protein yield (kg/fad) | Oil yield (kg/fad) |
|---|---|---|---|---|---|---|---|---|
| | **2010 season** | | | | | | | |
| **D1** SA0 | 40.64 | ٧,٧٣ | ٦,٣٥ | ٣٥,٩٥ | ٧٤٢,٢٥ | 314.40 | 53.7 | 116.6 |
| SA1 | 42.35 | ٩,٢٠ | ٨,٢٥ | ٣٩,٣٣ | ٨٠٣,٧٥ | ٣٧٦,٦٠ | 73.8 | 143.5 |
| SA2 | **45.31** | **١٢,٣٠** | **١١,٣٥** | **٤١,٠٠** | **929.15** | **٥٧٥,٦٠** | **132.9** | **251.5** |
| SA3 | ٤٥,٠٨ | ١٠,٨٠ | ١٠,٥٠ | ٣٨,٢٠ | ٩٠٢,٠٨ | ٥١٥,٠٨ | 109.7 | 210.2 |
| **D2** SA0 | ٣٤,٣٣ | ٧,١٥ | 6.25 | ٣٢,١٥ | ٦٦٦,٣٣ | ٢٧٣,٤٣ | 36.6 | 86.4 |
| SA1 | ٣٧,٧٨ | ٧,٩٥ | ٧,٢٥ | ٣٥,٨٥ | ٧٢٨,٨٥ | ٣٥٠,٣٥ | 47.3 | 112.5 |
| SA2 | ٣٩,٢٠ | ٩,٣٠ | 8.55 | ٣٥,٨٨ | ٧٦٤,٩٣ | ٤٠٤,٢٥ | 64.3 | 133.8 |
| SA3 | **٤١,٢٨** | **١٠,٢٠** | **١١,٠٠** | **٤١,٠٣** | **٩٣٢,٦٨** | **٥٧٦,٤٣** | **120.5** | **228.8** |
| **D3** SA0 | ٢٨,٨٨ | ٦,٦٨ | ٤,٧٥ | ١١,٢٥ | ٥١٠,١٨ | ٢٢٣,٠٠ | 28.7 | 62.4 |
| SA1 | ٣٥,٨٥ | ٦,٨٠ | ٦,١٠ | ١٩,٠٣ | ٥٦٧,٨٣ | ٢٣٠,٥٨ | 32.5 | 66.2 |
| SA2 | ٣٦,٦٥ | ٧,٤٥ | ٧,١٨ | ٢٠,٩٨ | ٥٧٤,٠٨ | ٢٤١,٧٥ | 39.2 | 70.6 |
| SA3 | ٣٧,٩٠ | ٨,١٥ | ٧,٨٣ | ٢٦,٢٠ | ٥٩٦,٣٣ | ٣٢٩,٣٣ | 64.2 | 99.1 |
| **LSD at 5%** | ٠,٧٧١٣ | ٠,٤٨٨٦ | ٠,٩١٣١ | ٠,٨٣٩٧ | ٢٠,٦٣٦٢ | ١٢,٨٥١١ | 0.3604 | 0.1771 |
| **201١ season** | | | | | | | | |
| **D1** SA0 | 41.15 | ٨,٨٣ | ٧,٢٣ | ٣٦,٤٥ | ٧٥٤,٦٠ | ٣٦٨,٧٥ | 63.8 | 137.2 |
| SA1 | 42.74 | ١٠,٤٥ | ٨,٧٥ | ٣٩,٧٠ | ٨٣٤,١٨ | ٣٩٨,٤٠ | 79.7 | 152.2 |
| SA2 | **٤٦.2** | **١٢,٩٥** | **١١,٨٥** | **٤٢,١٠** | **٩٨٥,٨٥** | **٥٩٨,١٨** | **138.8** | **263.8** |
| SA3 | ٤٦,١٣ | ١١,٥٠ | ١١,٠٨ | ٣٩,٢٨ | ٩٤٥,١٨ | ٥٢١,٠٠ | 112.0 | 214.7 |
| **D2** SA0 | ٣٤,٧٥ | ٨,٠٣ | ٦,٦٥ | ٣٢,٦٨ | ٧١٧,٨٥ | ٣٥٤,٠٠ | 47.8 | 116.8 |
| SA1 | ٣٨,٨٨ | ٩,٠٨ | ٧,٦٨ | ٣٦,٦٠ | ٧٦٦,٨٥ | ٣٥٣,٩٣ | 47.8 | 119.9 |
| SA2 | ٤٠,٨٢ | ١٠,٠٠ | ٨,٣٣ | ٣٦,٩٣ | ٧٨٦,٩٠ | ٤٣٧,٢٥ | 69.9 | 149.9 |
| SA3 | **42.95** | **١٠,٧٨** | **١٠,٦٨** | **٤١,٤٨** | **٩٦٩,١٥** | **٥٨٨,٥٨** | **124.8** | **243.1** |
| **D3** SA0 | ٢٩,٩٣ | ٦,٨٥ | ٥,٥٣ | ١١,٤٣ | ٥٥٢,٥٠ | ٢٣٣,٣٥ | 30.6 | 66.3 |
| SA1 | ٣٦,٧٥ | ٧,٢٥ | ٦,٥٠ | ١٩,٢٨ | ٥٧٨,٩٣ | ٢٣٥,٦٥ | 33.5 | 68.1 |
| SA2 | ٣٧,٩٠ | ٨,١٠ | ٧,٢٥ | ٢١,٥٣ | ٥٨٨,٤٣ | ٢٤٦,٩٨ | 40.5 | 73.1 |
| SA3 | ٣٨,٣٥ | ٨,٥٣ | ٧,٦٥ | ٢٦,٧٥ | ٦٠٢,٨٣ | ٣٣٥,٥٣ | 65.7 | 102.3 |
| **LSD at 5%** | 1.2952 | ٠,٦٨٨٥ | ١,١٠٩٩ | ١,٤٧٤٧ | ٤٠,٧٢٠٧ | ١٧,١٩١٨ | 0.5737 | 0.4941 |

D1= 20th April, D2=15th May and D3= 10th June, While SA0= zero salicylic acid, SA1= 100ppm, SA2= 150ppm and SA3= 200 ppm

For the interaction effect between salicylic acid and biofertilization (Fig. 1a -1g) data shown significant effects on plant height, weight of pods per plant, number of pods per plant, 100-seed weight, pod and seed yields, protein and oil yields in both seasons. The obtained data showed that increasing salicylic acid rates from

100 to 200 ppm and biofertlized with mixture of *Bacillus megatherium* and *Pseudomonas fluoresce*nce (the two types of bacteria) in both seasons caused an increase in all aforementioned parameters. It may be due to that increasing both salicylic acid rates and mix biofertiliztion together led to an encouragement in seed formation owing to increasing the plant capacity in building metabolites and caused increases in seed and pod yields.

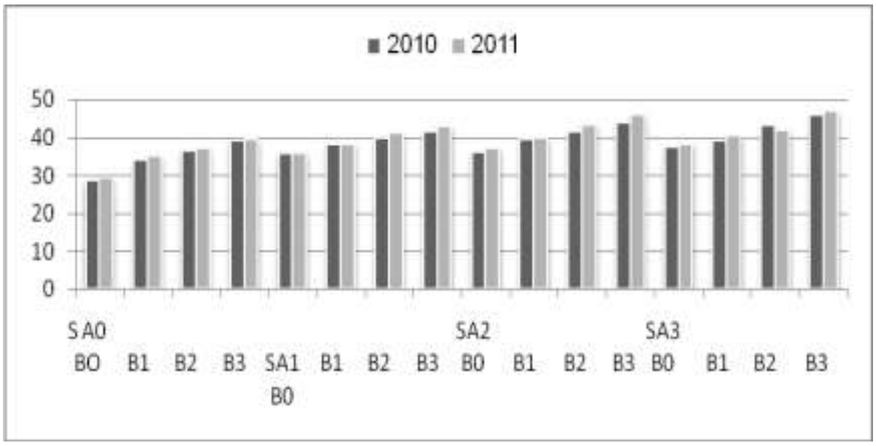


**Fig . 1a. Effect of interaction between salicylic acid and biofertlization on plant height (cm) of peanut in two growing seasons .**

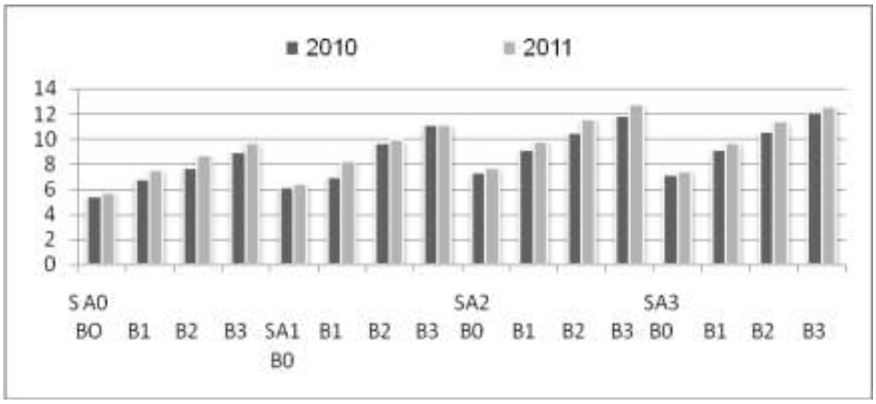


**Fig . 1b. Effect of interaction between salicylic acid and biofertlization on weight of pod (g) of peanut in two growing seasons .**

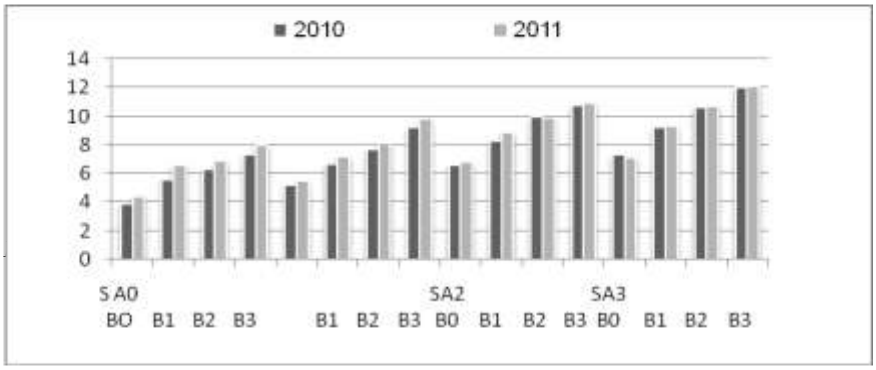

**Fig . 1c. Effect of interaction between salicylic acid and biofertlization on No. of pod/plant of peanut in two growing seasons .**

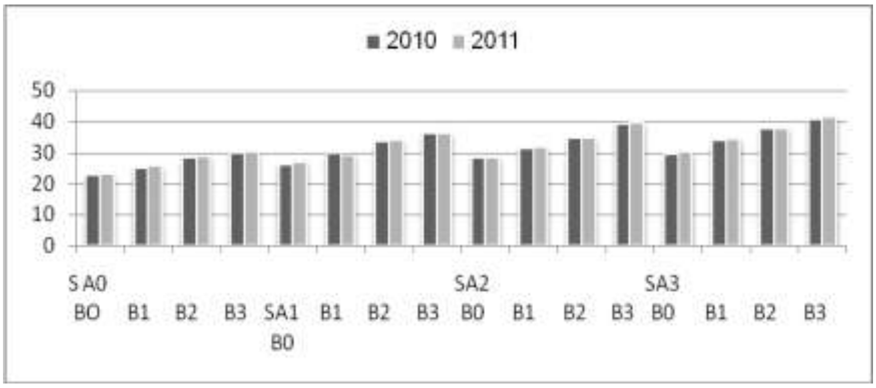


**Fig . 1d. Effect of interaction between salicylic acid and biofertlization on weight of 100 seed (g) of peanut in two growing seasons .**

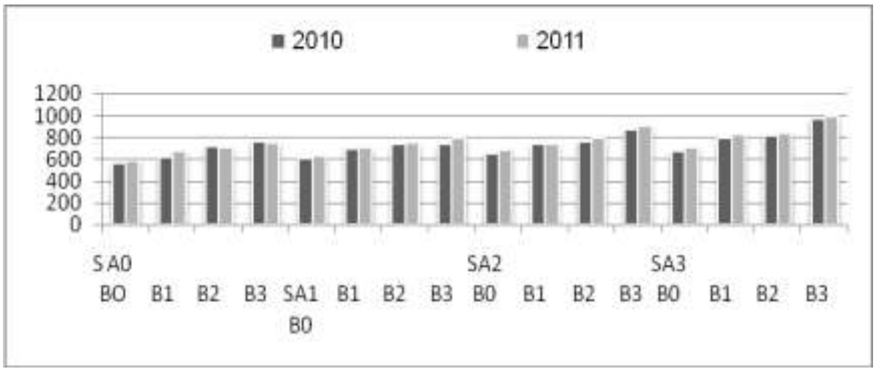


**Fig .1e. Effect of interaction between salicylic acid and biofertlization on pod yield (kg/fad) of peanut in two growing seasons .**

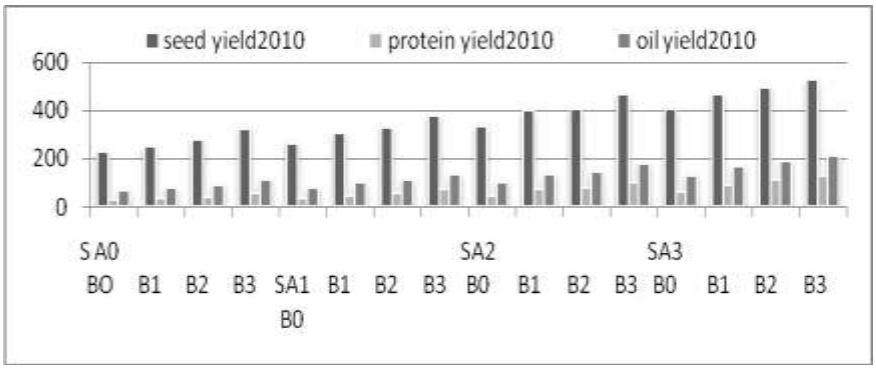

**Fig . 1f. Effect of interaction between salicylic acid and biofertlization on seed, protein and oil yields (kg/fad) of peanut in 2010 season.**

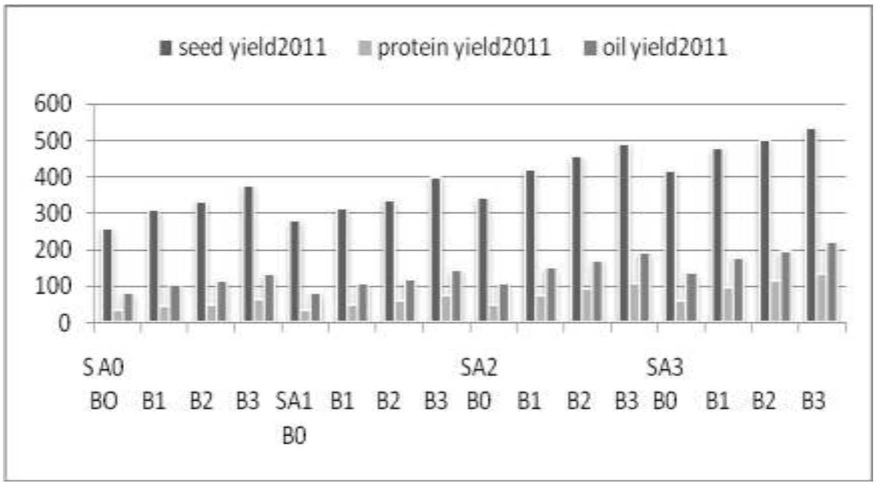


**Fig . 1g. Effect of interaction between salicylic acid and biofertlization on seed, protein and oil yields of peanut in 2011 season .**
SA0= zero salicylic acid, SA1= 100ppm, SA2= 150ppm and SA3= 200 ppm While B0 = *Bradyrhizobium*, (control), B1 = *B. megatherium* var. *phosphaticum* (PDB), B2 = *Pseudomonas fluorescens* (PS), and B3 = mix between (PDB + PS)

Applied biofertilization enhanced the utilization of applied salicylic acid could play a major role during the early stages of Bradyrhizobium-legume symbiosis. Nodulation factors produced by rhizobia, in response to legume produced flavonoids, affected SA content of the host plant during the early stages of nodulation. The maximum values of plant height, weight of pods per plant number of pod per plant, 100-seed weight, pod and seed yields, and protein and oil yields were obtained from plants sown on April 20*th* and supplied with 200 ppm salicylic acid and biofertilized with mix of two types of bacteria. This was true for the studied two seasons. Generally, the addition of biofertilizer with salicylic acid led to improvement the quantity and quality yield chacterization as compared to salicylic acid alone (Bai *et al.,* 2002).

The effect of interaction between salicylic acid foliar application, biofertilization and sowing dates was significant for yield and its components characteristics of peanut in both seasons (Tables 8a and 8b). The maximum value of plant height, weight of pods per plant number of pod per plant, 100-seed weight, pod and seed yields and protein and oil yields were obtained at growing seasons 2010 and 2011, from plants sown on April 20*th* and supplied with 150 ppm salicylic acid and mixed biofertilization treatments .

**TABLE 8a. Effect of interaction between salicylic acid and biofertilization and sowing date on yield and its components of peanut in 2010 season .**

| Characters / Treatments | | Plant height (cm) | Weight of pods/ plants (g) | No. of pods/ plants | 100-seeds weight (g) | Pod yield (kg/fad | Seed yield (kg/fad) | Protein yield (kg/fad) | Oil yield (kg/fad) |
|---|---|---|---|---|---|---|---|---|---|
| **D1 SA0** | B0 | ٣٦,٤ | ٥,٦ | ٤,٧ | ٣٠,٤ | ٦١٠,٣ | ٢٤٦,٣ | 31.3 | 78.6 |
| | B1 | ٣٨,٧ | ٧,٣ | ٥,٧ | ٣٣,٥ | ٧٠٢,٧ | ٢٨٨,٧ | 47.3 | 107.9 |
| | B2 | ٤١,٨ | ٨,٥ | ٦,٧ | ٣٩,٢ | ٧٨٣,٧ | ٣٢٦,٣ | 59.7 | 125.9 |
| | B3 | ٤٥,٧ | ٩,٥ | ٨,٣ | ٤٠,٧ | ٨٧٢,٣ | ٣٩٦,٣ | 82.8 | 160.5 |
| **SA1** | B0 | ٣٨,٥ | ٧,١ | ٥,٧ | ٣٢,٦ | ٦٥٦,٣ | ٢٨٩,٠ | 37.6 | 94.5 |
| | B1 | ٤٠,٤ | ٨,٢ | ٧,٣ | ٣٩,٥ | ٨٢٣,٠ | ٣٦٦,٧ | 70.4 | 141.5 |
| | B2 | ٤٣,٨ | ٩,٨ | ٨,٧ | ٤١,٧ | ٨٥٠,٠ | ٣٧٩,٧ | 84.3 | 149.2 |
| | B3 | ٤٦,٧ | ١١,٧ | ١١,٣ | ٤٣,٥ | ٨٨٥,٧ | ٤٧١,٠ | 112.6 | 195.9 |
| **SA2** | B0 | ٣٨,٣ | ٩,٦ | ٧,٧ | ٣٦,٠ | ٧٤٢,٠ | ٤٨٠,٧ | 70.7 | 172.6 |
| | B1 | ٤٤,٦ | ١١,٩ | ١١,٣ | ٤٠,٣ | ٨٨٣,٠ | ٥٧١,٧ | 129.2 | 248.1 |
| | B2 | ٤٦,٧ | ١٢,٨ | ١٢,٧ | ٤١,٣ | ٩١٣,٣ | ٦٠٤,٠ | 159.5 | 274.2 |
| | B3 | **٥٠,٧** | **١٤,٩** | **١٣,٧** | **٤٦,٤** | **١١٧٨,٣** | **٦٤٦,٠** | **185.4** | **323.0** |
| **SA3** | B0 | ٤٠,٥ | ٨,٣ | ٧,٣ | ٣١,٣ | ٧١٨,٠ | ٤٥٣,٧ | 65.3 | 151.9 |
| | B1 | ٤٢,٩ | ١٠,٤ | ١٠,٣ | ٣٨,٧ | ٨٨٣,٧ | ٥٠٤,٠ | 107.8 | 206.1 |
| | B2 | ٤٧,٨ | ١١,٧ | ١١,٧ | ٤٠,٠ | ٩٠٦,٣ | ٥٣٤,٣ | 124.5 | 232.4 |
| | B3 | ٥٠,٠ | ١٢,٨ | ١٢,٧ | ٤٢,٨ | ١١٠٠,٣ | ٥٦٨,٣ | 148.9 | 258.0 |
| **D2 SA0** | B0 | ٢٥,٩ | ٥,٥ | ٤,٠ | ٢٧,٧ | ٦٠٢,٠ | ٢٣١,٣ | 28.4 | 65.4 |
| | B1 | ٣٤,٧ | ٦,٦ | ٦,٣ | ٣٠,٦ | ٦٤٨,٣ | ٢٤٤,٠ | 31.2 | 75.2 |
| | B2 | ٣٧,٣ | ٧,٤ | ٧,٠ | ٣٣,٩ | ٦٩٠,٧ | ٢٧٨,٧ | 36.8 | 91.7 |
| | B3 | ٣٩,٤ | ٩,١ | ٧,٧ | ٣٦,٤ | ٧٢٤,٣ | ٣٣٩,٧ | 52.6 | 117.2 |
| **SA**1 | B0 | ٣٥,٢ | ٦,١ | ٥,٣ | ٣١,٨ | ٦٣٧,٧ | ٢٨٥,٠ | 35.6 | 80.4 |
| | B1 | ٣٧,٢ | ٧,٢ | ٧,٠ | ٣٣,٠ | ٦٩٧,٧ | ٣٢٢,٠ | 44.7 | 101.4 |
| | B2 | ٣٨,٨ | ٨,٥ | ٧,٧ | ٣٧,٧ | ٧٦٩,٣ | ٣٦٧,٧ | 53.6 | 123.9 |
| | B3 | ٣٩,٩ | ١٠,٠ | ٩,٠ | ٤٠,٩ | ٨١٠,٧ | ٤٢٦,٧ | 67.8 | 148.9 |
| **SA2** | B0 | ٣٥,٣ | ٦,٤ | ٦,٣ | ٣٢,٩ | ٦٦٦,٠ | ٢٩٤,٧ | 40.4 | 86.1 |
| | B1 | ٣٨,٤ | ٨,٥ | ٨,٣ | ٣٤,٢ | ٧٥٨,٠ | ٣٩٣,٣ | 61.4 | 128.6 |
| | B2 | ٤٠,٥ | ١٠,٧ | ٩,٣ | ٣٦,٧ | ٨٠٠,٠ | ٤٣٥,٠ | 72.2 | 150.1 |
| | B3 | ٤٢,٦ | ١١,٦ | ١٠,٣ | ٣٩,٧ | ٨٣٥,٧ | ٤٩٤,٠ | 87.9 | 177.3 |
| **SA3** | B0 | ٣٦,٣ | ٧,١ | ٨,٣ | ٣٧,١ | ٧١٥,٠ | ٤٨١,٠ | 70.2 | 167.9 |
| | B1 | ٣٨,٦ | ٩,٧ | ٩,٧ | ٣٨,٦ | ٩٠١,٠ | ٥٦٩,٧ | 112.2 | 218.8 |
| | B2 | ٤٣,٥ | ١٠,٧ | ١١,٧ | ٤٢,٧ | ٩٣٨,٧ | ٦٠٥,٣ | 145.3 | 251.2 |
| | B3 | **٤٦,٧** | **١٣,٣** | **١٤,٣** | **٤٥,٧** | **١١٧٦,٠** | **٦٤٩,٧** | **164.4** | **285.2** |
| **D3 SA0** | B0 | ٢٣,٥ | ٥,٠ | ٣,٠ | ١٠,٤ | ٤٦٠,٧ | ٢٠٥,٠ | 23.9 | 53.5 |
| | B1 | ٢٨,٨ | ٦,٤ | ٤,٧ | ١١,٠ | ٤٩٠,٣ | ٢١٥,٧ | 27.4 | 60.2 |
| | B2 | ٣٠,٨ | ٧,٣ | ٥,٣ | ١١,٦ | ٥٣٢,٠ | ٢٣٠,٣ | 30.2 | 66.3 |
| | B3 | ٣٢,٤ | ٨,٠ | ٦,٠ | ١٢,٠ | ٥٥٧,٧ | ٢٤١,٠ | 34.5 | 70.4 |
| **SA1** | B0 | ٣٣,٩ | ٥,٥ | ٤,٧ | ١٥,٠ | ٥٣٢,٣ | ٢١٥,٠ | 26.2 | 58.7 |
| | B1 | ٣٤,٨ | ٦,٢ | ٥,٧ | ١٧,٣ | ٥٦٤,٠ | ٢٢٧,٣ | 30.7 | 63.9 |
| | B2 | ٣٦,٩ | ٧,١ | ٦,٧ | ٢٠,٧ | ٥٧٧,٧ | ٢٣٨,٠ | 34.0 | 70.4 |
| | B3 | ٣٧,٨ | ٧,٦ | ٧,٣ | ٢٣,١ | ٥٩٧,٣ | ٢٤٢,٠ | 39.9 | 72.4 |
| **SA2** | B0 | ٣٥,١ | ٦,٠ | ٥,٧ | ١٤,٨ | ٥٥١,٣ | ٢٢٣,٠ | 29.6 | 63.3 |
| | B1 | ٣٥,٦ | ٧,٠ | ٦,٧ | ١٨,٨ | ٥٦٦,٧ | ٢٣٨,٧ | 35.5 | 68.5 |
| | B2 | ٣٧,٥ | ٧,٩ | ٨,٠ | ٢٢,٧ | ٥٧٦,٠ | ٢٤٨,٠ | 42.7 | 72.9 |
| | B3 | ٣٨,٤ | ٨,٩ | ٨,٣ | ٢٧,٦ | ٦٠٢,٣ | ٢٥٧,٣ | 49.9 | 77.9 |
| **SA3** | B0 | ٣٥,٨ | ٥,٩ | ٦,٣ | ١٩,٦ | ٥٧١,٠ | ٢٧٩,٣ | 44.4 | 80.4 |
| | B1 | ٣٦,٥ | ٧,٣ | ٧,٧ | ٢٤,١ | ٥٨٥,٧ | ٣٢٦,٠ | 61.3 | 96.2 |
| | B2 | ٣٨,٢ | ٩,٣ | ٨,٣ | ٢٩,٦ | ٦٠٥,٣ | ٣٤٢,٧ | 72.9 | 103.5 |
| | B3 | ٤١,١ | ١٠,١ | ٩,٠ | ٣١,٥ | ٦٢٣,٣ | ٣٦٩,٣ | 81.9 | 117.8 |
| **LSD at 5%** | | ٠,٩ | ٠,٦ | ٠,٩ | ٠,٨ | ١٧,٢ | ١٢,٧ | 0.2 | 0.5 |

**TABLE 8 b. Effect of interaction between salicylic acid and biofertilization and sowing date on yield and its components of peanut in 2011 season .**

| Characters / Treatments | | Plant height (cm) | Weight of pods/ plants (g) | No. of pods/ plants | 100- seeds weight (g) | Pod yield (kg/fad) | Seed yield (kg/fad) | Protein yield (kg/fad) | Oil yield (kg/fad) |
|---|---|---|---|---|---|---|---|---|---|
| **D1 SA0** | B0 | 36.0 | ٦,١ | ٥,٣ | ٣٠,٨ | 619.7 | 289.7 | 37.1 | 92.9 |
| | B1 | ٣٩,٩ | ٨,٥ | ٧,٣ | ٣٤,٣ | ٧٥٨,٧ | ٣٥٥,٠ | 58.3 | 133.5 |
| | B2 | ٤٢,٥ | ٩,٦ | ٧,٣ | ٣٩,٤ | ٧٧٤,٠ | ٣٧٨,٣ | 69.8 | 146.4 |
| | B3 | ٤٦,١ | ١١,١ | ٩,٠ | ٤٢,١ | ٨٦٦,٠ | ٤٥٢,٠ | 97.7 | 183.1 |
| **SA1** | B0 | ٣٨,٢ | ٧,٥ | ٥,٧ | ٣٣,٣ | ٦٨٩,٣ | ٣٢٢,٣ | 41.9 | 103.1 |
| | B1 | ٤١,٥ | ٩,٣ | ٨,٣ | ٣٩,٢ | ٨٥٠,٧ | ٣٧٢,٣ | 72.9 | 145.9 |
| | B2 | ٤٤,٠ | ١١,٨ | ٩,٣ | ٤٢,٤ | ٨٥٧,٠ | ٣٩٤,٧ | 89.9 | 155.5 |
| | B3 | ٤٧,٣ | ١٣,٢ | ١١,٧ | ٤٣,٩ | ٩٣٩,٧ | ٥٠٤,٣ | 124.1 | 212.3 |
| **SA2** | B0 | ٣٩,٦ | ٩,٦ | ٨,٧ | ٣٧,٠ | ٧٨٧,٠ | ٥٠٠,٧ | 73.6 | 180.3 |
| | B1 | ٤٤,٩ | ١٢,٢ | ١١,٧ | ٤٠,٦ | ٩٤٦,٧ | ٥٨٧,٠ | 133.2 | 257.1 |
| | B2 | ٤٧,٤ | ١٣,٩ | ١٢,٧ | ٤٢,٥ | ٩٨٧,٠ | ٦٣٣,٣ | 167.8 | 290.1 |
| | B3 | **٥٢,٩** | **١٦,١** | **١٤,٣** | **٤٨,٣** | **١٢٢٢,٧** | **٦٧١,٧** | **194.1** | **340.6** |
| **SA3** | B0 | ٤١,١ | ٨,٦ | ٧,٧ | ٣٢,٠ | ٧٦٢,٠ | ٤٦٥,٠ | 67.4 | 159.5 |
| | B1 | ٤٩,٣ | ١٠,٩ | ١١,٣ | ٣٩,٦ | ٩٤٨,٠ | ٥١٣,٣ | 111.9 | 210.5 |
| | B2 | ٤٨,٢ | ١٢,٦ | ١٢,٠ | ٤٠,٩ | ٩٥٦,٧ | ٥٣٢,٧ | 125.2 | 232.3 |
| | B3 | ٥٠,٩ | ١٣,٩ | ١٣,٣ | ٤٤,٦ | ١١١٤,٠ | ٥٧٣,٠ | 150.1 | 263.0 |
| **D2 SA0** | B0 | ٢٧,٤ | ٥,٨ | ٤,٣ | ٢٧,٩ | ٦١٨,٠ | 339.0 | 33.5 | 77.2 |
| | B1 | ٣٥,٤ | ٧,٤ | ٦,٧ | ٣١,٢ | ٦٨٤,٧ | ٣٤٤,٠ | 43.7 | 115.6 |
| | B2 | ٣٧,٤ | ٨,٩ | ٧,٣ | ٣٥,٢ | ٧٧٤,٧ | ٣٧٧,٣ | 50.2 | 129.8 |
| | B3 | ٣٨,٨ | ١٠,٠ | ٨,٣ | ٣٦,٤ | ٧٩٤,٠ | ٤٢٤,٧ | 65.8 | 150.3 |
| **SA**1 | B0 | ٣٥,٣ | ٦,١ | ٥,٧ | ٣١,٩ | ٦٤٧,٧ | ٢٩٤,٧ | 36.8 | 85.8 |
| | B1 | ٣٨,٠ | ٨,٧ | ٧,٧ | ٣٥,٢ | ٧٨٢,٣ | ٣٣٠,٧ | 45.6 | 114.4 |
| | B2 | ٤٠,٣ | ١٠,١ | ٨,٠ | ٣٨,٣ | ٧٩٥,٧ | ٣٧٥,٣ | 54.8 | 132.1 |
| | B3 | ٤١,٩ | ١١,٤ | ٩,٣ | ٤١,٠ | ٨٤١,٧ | ٤٤٥,٠ | 70.3 | 163.3 |
| **SA2** | B0 | ٣٦,٤ | ٦,٦ | ٦,٠ | ٣٢,٩ | ٦٨٠,٣ | ٣٠٢,٣ | 41.4 | 89.8 |
| | B1 | ٣٧,٩ | ٩,٧ | ٨,٠ | ٣٤,٣ | ٧٩٣,٠ | ٤٣٤,٠ | 69.0 | 151.5 |
| | B2 | ٤٤,٣ | ١١,٣ | ٩,٠ | ٣٨,٤ | ٨١٣,٣ | ٤٧٩,٧ | 80.1 | 171.3 |
| | B3 | ٤٤,٦ | ١٢,٤ | ١٠,٣ | ٤٢,١ | ٨٦١,٠ | ٥٣٣,٠ | 94.9 | 185.7 |
| **SA3** | B0 | ٣٨,٥ | ٧,٣ | ٧,٧ | ٣٧,٨ | ٧٧٠,٠ | ٤٩٣,٠ | 72.9 | 174.5 |
| | B1 | ٤٠,٣ | ١٠,٥ | ٩,٣ | ٣٨,٨ | ٩٢٨,٣ | ٥٨٧,٣ | 118.6 | 239.6 |
| | B2 | ٤٥,٤ | ١١,٨ | ١١,٧ | ٤٢,٥ | ٩٥٠,٣ | ٦١٧,٧ | 147.0 | 268.7 |
| | B3 | **٤٧,٦** | **١٣,٥** | **١٤,٠** | **٤٦,٨** | **١٢٢٨,٠** | **٦٥٦,٣** | **169.3** | **299.3** |
| **D3 SA0** | B0 | ٢٤,٤ | ٥,١ | ٣,٧ | ١٠,٤ | ٥٠٢,٧ | ٢١٤,٣ | 25.5 | 56.1 |
| | B1 | ٣٠,١ | ٦,٧ | ٥,٧ | ١١,٢ | ٥٥٢,٣ | ٢٢٩,٧ | 29.4 | 64.7 |
| | B2 | ٣١,٧ | ٧,٥ | ٦,٠ | ١١,٧ | ٥٧٥,٠ | ٢٤١,٧ | 31.9 | 71.1 |
| | B3 | ٣٣,٥ | ٨,١ | ٦,٧ | ١٢,٤ | ٥٨٠,٠ | ٢٤٧,٧ | 35.4 | 73.8 |
| **SA1** | B0 | ٣٤,٣ | ٥,٧ | ٥,٠ | ١٥,١ | ٥٥١,٠ | ٢٢٢,٣ | 27.1 | 60.7 |
| | B1 | ٣٥,٤ | ٦,٧ | ٥,٧ | ١٧,١ | ٥٧٤,٠ | ٢٣٢,٣ | 31.6 | 65.7 |
| | B2 | ٣٨,٢ | ٧,٨ | ٧,٠ | ٢١,٣ | ٥٨٧,٧ | ٢٤٠,٠ | 34.3 | 71.2 |
| | B3 | ٣٩,١ | ٨,٨ | ٨,٣ | ٢٣,٦ | ٦٠٣,٠ | ٢٤٨,٠ | 41.4 | 74.9 |
| **SA2** | B0 | ٣٦,٠ | ٦,٩ | ٥,٧ | ١٥,٠ | ٥٦٧,٠ | ٢٢٥,٣ | 30.4 | 63.9 |
| | B1 | ٣٦,٣ | ٧,٤ | ٧,٠ | ١٩,٦ | ٥٨٢,٧ | ٢٤١,٠ | 37.1 | 69.4 |
| | B2 | ٣٨,٦ | ٨,٥ | ٨,٠ | ٢٣,٣ | ٥٩٢,٧ | ٢٥٤,٣ | 43.9 | 77.1 |
| | B3 | ٤٠,٧ | ٩,٦ | ٨,٣ | ٢٨,٢ | ٦١١,٣ | ٢٦٧,٣ | 51.8 | 82.3 |
| **SA3** | B0 | ٣٥,٢ | ٦,٢ | ٦,٠ | ٢٠,٢ | ٥٧١,٣ | ٢٨٩,٠ | 42.8 | 83.8 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | B1 | ٣٦,٧ | ٧,٦ | ٧,٣ | ٢٤,٦ | ٥٩٢,٣ | ٣٣٥,٧ | 64.5 | 100.0 |
| | B2 | ٣٩,٦ | ٩,٩ | ٨,٣ | ٢٩,٧ | ٦٠٧,٠ | ٣٤٦,٧ | 74.2 | 106.1 |
| | B3 | ٤١,٩ | ١٠,٤ | ٩,٠ | ٣٢,٥ | ٦٤٠,٧ | ٣٧٠,٧ | 84.5 | 120.1 |
| **LSD at 5%** | | 1.4 | ٠,٧ | ٠,٩ | ١,٧ | ١٨,٤ | ١٣,٧ | 0.4 | 0. 7 |

*Effect of treatments on the microbial determinations*

Data in Table 9 showed that the total microbial counts at rhizosphere of inoculated plants were significantly higher in mixed treatments than in single inoculants. The highest significant increases was recorded with sowing date 20$^{th}$ April, salicylic acid concentration 200ppm and mixed inoculation treatment, (Rhizobia as base treatment, PDB+ Psudomonase, being 217× $10^5$ cfu /g dry soil) compared with control. These results in compatible with the finding of El-Wakeil & El-Sebai (2007) who reported that total microbial count was significantly higher in mixed inoculants' strains than in single inoculants at rhizosphere of inoculated faba bean plants.

**TABLE 9. Main effect of salicylic acid, biofertilization and sowing date, on some microbial characters in the two growing seasons.**

| Characters / Treatment | Microbial determinations | | | | | | Nodule characteristics | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Total microbial in soil** | | **PDB count in soil** | | ***Pseudomonas* count in soil** | | **No. of nodule / plant** | | **Nodule dry weight mg/plant** | |
| | **2010** | **2011** | **2010** | **2011** | **2010** | **2011** | **2010** | **2011** | **2010** | **2011** |
| **Sowing date** | | | | | | | | | | |
| 20$^{th}$ April | 161.9 | 177.2 | 57.9 | 70.6 | 25.9 | 34.3 | 20.2a | 21.4 | 71.8 | 73.7 |
| 15$^{th}$ May | 143.9 | 161.3 | 53.5 | 66.7 | 25.8 | 33.5 | 18.8a | 19.2 | 51.5 | 54.9 |
| 10$^{th}$ June | 133.6 | 148.7 | 42.3 | 49.2 | 25.8 | 31.6 | 13.6b | 14.3 | 36.4 | 39.9 |
| LSD5% | 5.1 | 2.1 | 1.7 | 2.6 | 0.9 | 1.4 | 3.6 | 1.6 | 5.4 | 5.2 |
| **Salicylic acid** | | | | | | | | | | |
| Control | 69.4 | 78.1 | 26.4 | 32.1 | 14.1 | 18.5 | 11.2 | 12.1 | 37.5 | 40.1 |
| 100ppm | 148.3 | 162.7 | 59.3 | 74.3 | 20.6 | 25.5 | 17.9 | 17.3 | 45.9 | 49.4 |
| 150ppm | 170.0 | 191.9 | 39.4 | 47.9 | 32.8 | 40.6 | 18.8 | 19.7 | 56.8 | 59.6 |
| 200ppm | 198.3 | 216.9 | 79.8 | 94.3 | 36.1 | 47.9 | 22.0 | 24.0 | 72.6 | 75.6 |
| LSD5% | 3.1 | 2.1 | 1.3 | 1.6 | 1.1 | 1.3 | 4.0 | 0.7 | 3.2 | 3.4 |
| **Biofertilization** | | | | | | | | | | |
| Control Br | 122.9 | 139.4 | 39.5 | 50.1 | 21.4 | 30.8 | 14.2 | 13.8 | 38.1 | 40.5 |
| PDB | 146.7 | 161.5 | 47.7 | 58.6 | 25.1 | 32.5 | 15.3 | 15.8 | 49.4 | 51.7 |
| PS | 154.6 | 170.9 | 57.4 | 69.5 | 27.9 | 33.1 | 19.6 | 21.6 | 55.8 | 59.9 |
| mix(PDB + BS) | 161.8 | 177.8 | 60.4 | 70.4 | 28.9 | 36.2 | 20.8 | 22.3 | 69.4 | 72.6 |
| LSD5% | 2.9 | 1.5 | 1.9 | 1.9 | 1.2 | 1.0 | 4.0 | 0.9 | 1.9 | 1.7 |

It was clear from the data represented in Table 8 that inoculation with rhizobia and PDB+ Pseudomonas stimulated the activity and growth of phosphate dissolving bacteria in rhizosphere area of inoculated plant. The highest density of PDB being 96.4×$10^2$ cfu /g dry soil recorded with mixed treatment *Bradyrhizobia* as base treatment, PDB+ *Psudomonase*. These results are in agreements with Gyanshwar *et al*. (2002) who confirmed that increase in PDB count leads to corresponding increase in the availability and mobility of phosphorous and other plant nutrients from soil to plant through production of organic acids. These effects were reflected on increasing of plant growth, crop production and oil yield

Also, mixed inoculation with rhizobia and PDB+ Pseudomonas stimulated the activity and growth of *Pseudomonas* in rhizosphere area of inoculated plants. The highest density of *Pseudomonas* being $49.3\times10^{2}$ cfu /g dry soil recorded with mixed treatment. These results are in agreement with Usha (2003) and El-shazly (2010) who reported that *Pseudomonas* strain may be helpful as plant growth promoting bacteria and bio-control agent. Also, *Pseudomonas* has tremendous importance due to its widespread distribution in soil. This may be due to utilizing a wide range of organic substances as carbon or nitrogen sources.

Application of biofertilizers is an acceptable approach for higher yield with good quality and safe for human consumption. Our results show that either single or mixed inoculates gave positive response to the studied parameters. This response was accompanied by significant increase in soil microbial determinations and nodule characteristics (Table 9) thus mixed inoculation treatment is the best compared with single inoculation treatment. These findings is on the same line with those obtained by Monibe *et al*. (1998 ) who found that single inoculation of rhizoidal performed lower in terms of $N_2$ fixation and N accumulation capacities as compared with the mixture of this strain with some other strains. Also, Moawad *et al.* (2004) mentioned that the rhizobia inoculation showed a positive response to inoculation in terms of nodule numbers and dry weight and also enhanced growth of *Phaseolus* bean and N values compared to control. The mixed inoculation treatment of rhizobia and PDB + *Pseudomonas* enhanced all tested parameters more than single inoculation treatment with PDB or *Pseudomonas* compared with control. This inspection was confirmed by Moawad & Abd El-Rahim (2002) who reported that biofertilizers treatments applied increased growth parameters and NPK contents

In respect to effect of interaction of sowing date and salicylic acid on microbial determinations (Fig. 2a, 2b and 2c) represented data showed that sowing date at April 20*th* recorded highest microbial counts (Total, PDB and *Pseudomonas* counts) followed by 2*nd* sowing date. Also, salicylic acid concentrations exhibited pronounced effect on microbial counts, SA3 (200ppm) recorded highest microbial counts compared to other concentrations.

Regarding to effect of interaction of sowing date and biofertilizations on microbial determinations (Fig. 3a, 3b and 3c) represented data showed that sowing date at April 20*th* recorded highest microbial counts (Total microbial, PDB and *Pseudomonas* counts) followed by 2*nd* sowing date. Also, mixed biofertilization treatments had a stimulatory effect on microbial counts, which recorded highest microbial counts compared to other biofertilization treatments.

In order to study the effect of interaction between salicylic acid concentrations and biofertilization on microbial counts in peanut rhizosphere, obtained data representd in Fig. 4a, 4b and 4c revealed that SA3 (200ppm) recorded highest microbial counts compared to other concentrations. Also, mixed biofertilization treatments had a stimulatory effect on microbial counts , which recorded highest microbial counts compared to other biofertilization treatments.

The effect of interaction between salicylic acid foliar application, biofertilization and sowing date was significant for microbial determination and nodule characteristics (Table 10). The maximum value of Total microbial counts, PDB counts , *Psedomonas* counts, Number of Nodule /plant and nodule dry weight mg/plant were obtained at growing seasons 2010 and 2011, from plants sown on April 20$^{th}$ and supplied with 200 ppm salicylic acid and mixed biofertilization treatments

It could be concluded that sowing of peanut cv., Giza, 6 may be completed from April 20$^{th}$ to May 15$^{th}$ with foliar spraying by salicylic acid at rate 150-200 ppm and mix two types of biofertilization (PDB + *Pseudomonas*) in order to raise a healthy and good peanut crop and ultimately get highest yield.

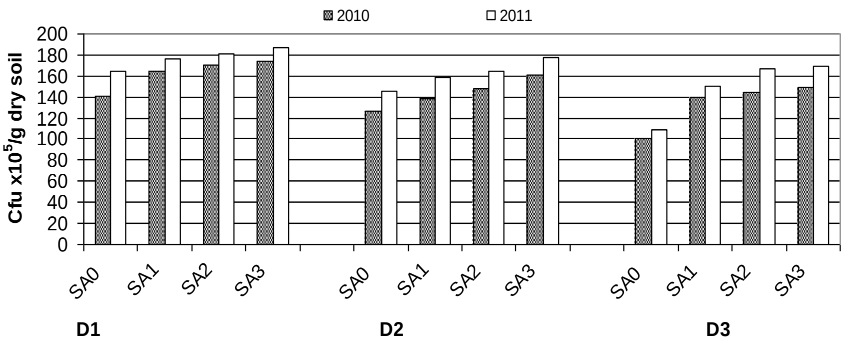


**Fig. 2a. Interaction sowing date and salicylic acid on total microbial counts at two growing seasons.**

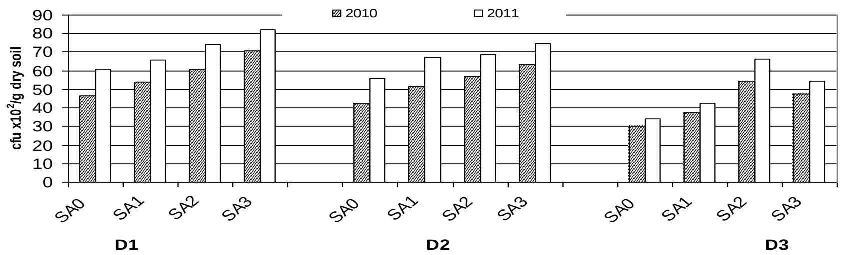


**Fig. 2b. Interaction sowing date and salicylic acid on PDB at two growing seasons .**

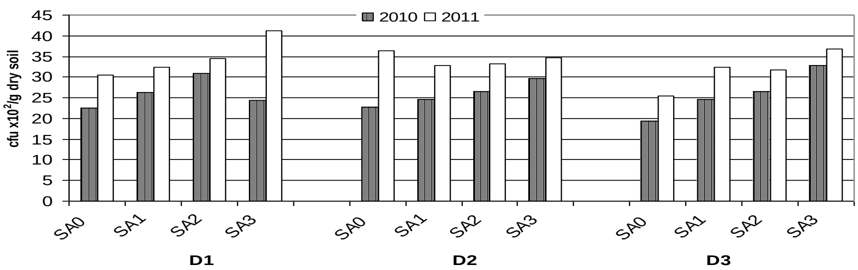


**Fig. 2c. Interaction sowing date and salicylic acid on *Pseudomonas* counts at two growing seasons .**

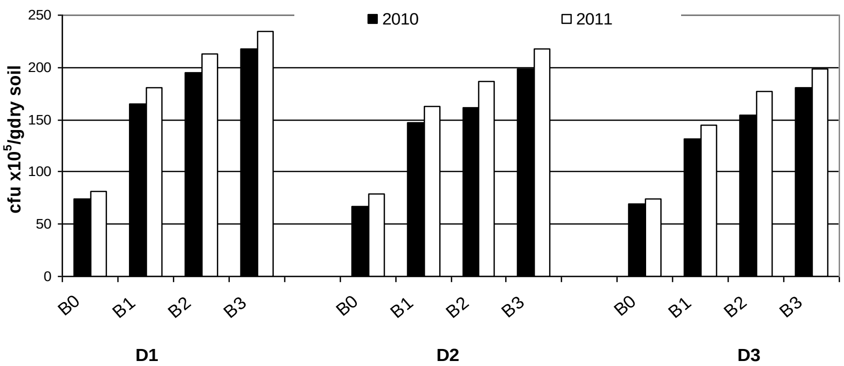


**Fig. 3 a. Interaction sowing date and biofertilization on total microbial counts at two growing seasons .**

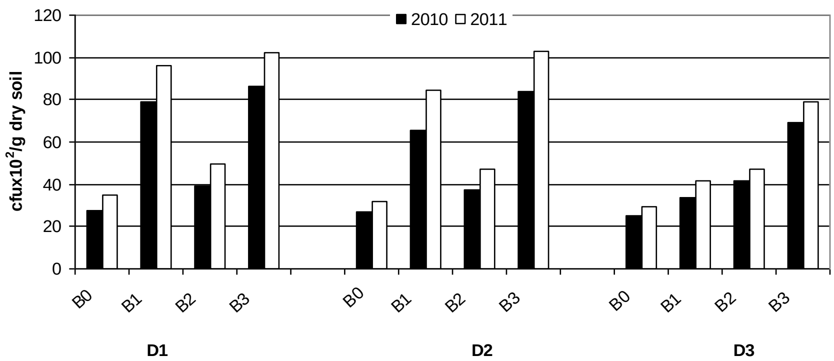


**Fig. 3 b. Interaction sowing date and biofertilization on PDB at two growing seasons .**

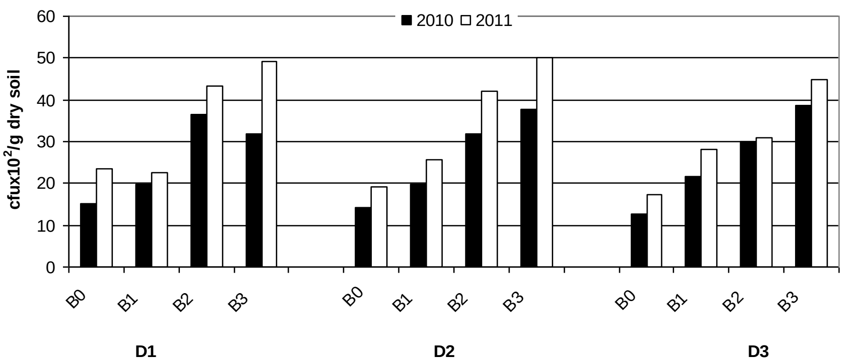


**Fig. 3c. Interaction sowing date and biofertilization on *Pseudomonas* counts at two growing seasons .**

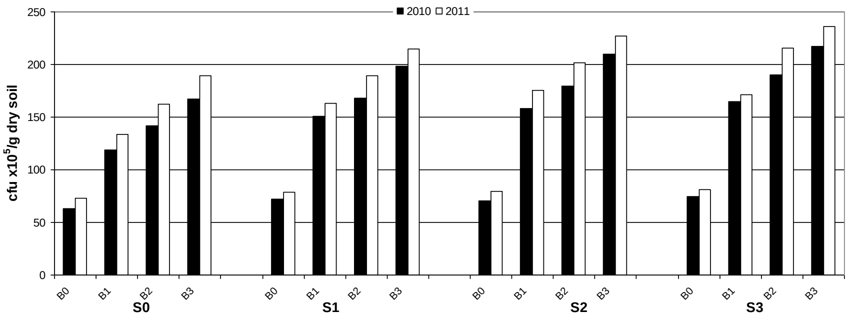


**Fig.4a. Effect of interaction between salicylic acid and biofetilization on total microbial counts at two growing seasons .**

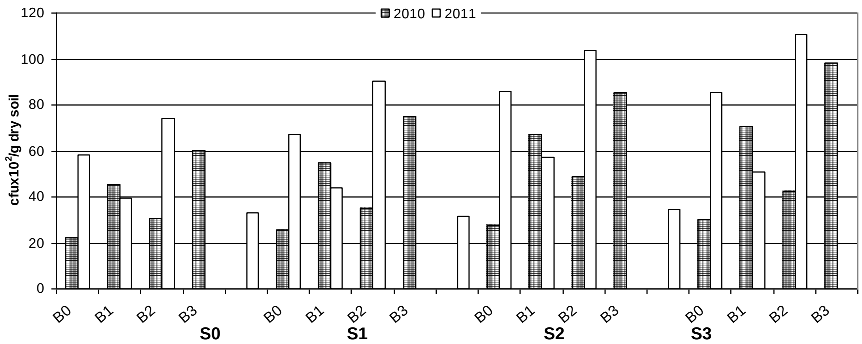


**Fig. 4b. Effect of interaction between salicylic acid and biofetilization on PDB at two growing seasons .**

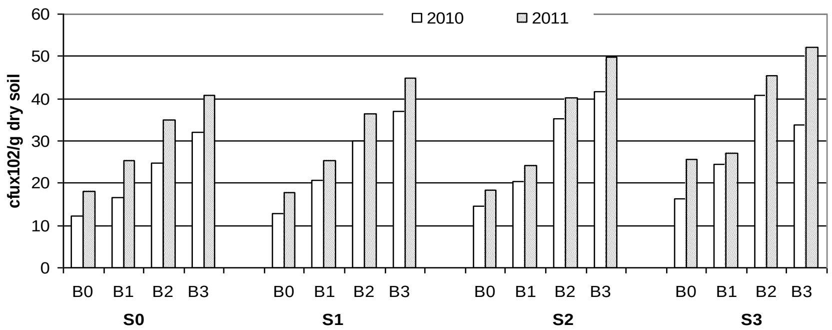


**Fig. 4c. Effect of interaction between salicylic acid and biofetilization on *Pseudomonas* counts at two growing seasons .**

TC= Total microbial in soil, PDB= PDB count in soil and Ps= *Pseudomonas* count in soil.

SA0= Zero salicylic acid, SA1, SA2 and SA3= 100, 150 and 200 ppm salicylic acid B0= Br, B1=PDB bacteria, B2= PS bacteria and B3= mix (PDB + BS) and D1= 20$^{th}$ April, D2=15$^{th}$ May and D3= 10$^{th}$ Jun

**TABLE 10.Effect of interaction between salicylic acid and biofertilization and sowing date on microbial determinations and nodule characteristics of peanut at two growing seasons**

| Characters / Treatments | | | Microbial determinations | | | | | | Nodule characteristics | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | T.microbial | | PDB | | *Pseudomonas* | | No.of nodule / plant | | Nodule dry weight mg/plant | |
| | | | 2010 | 2011 | 2010 | 2011 | 2010 | 2011 | 2010 | 2011 | 2010 | 2011 |
| **D1** | SA0 | B0 | 66.3 | 77.0 | 24.3 | 32.0 | 13.0 | 17.7 | 9.7 | 11.0 | 29.6 | 30.7 |
| | | B1 | 142.0 | 158.0 | 58.0 | 79.0 | 16.0 | 20.7 | 13.0 | 14.0 | 36.6 | 37.8 |
| | | B2 | 164.3 | 193.3 | 32.3 | 44.7 | 27.7 | 39.7 | 13.3 | 15.7 | 48.2 | 49.7 |
| | | B3 | 193.0 | 227.7 | 71.0 | 87.3 | 32.7 | 44.0 | 16.0 | 18.0 | 62.6 | 63.9 |
| | SA1 | B0 | 79.3 | 81.7 | 26.3 | 35.0 | 14.0 | 17.7 | 9.7 | 11.4 | 35.1 | 36.5 |
| | | B1 | 168.7 | 184.0 | 72.0 | 88.7 | 19.7 | 22.0 | 14.0 | 16.0 | 49.5 | 51.8 |
| | | B2 | 194.7 | 214.0 | 38.7 | 46.7 | 33.0 | 41.7 | 15.7 | 16.0 | 52.2 | 54.0 |
| | | B3 | 213.3 | 223.3 | 79.0 | 93.0 | 38.0 | 47.7 | 20.3 | 21.7 | 77.3 | 78.2 |
| | SA2 | B0 | 72.7 | 81.3 | 28.7 | 35.3 | 16.7 | 19.3 | 18.7 | 18.7 | 44.5 | 49.2 |
| | | B1 | 179.3 | 188.0 | 87.3 | 103.3 | 21.7 | 24.3 | 26.3 | 26.7 | 73.9 | 76.3 |
| | | B2 | 207.7 | 219.0 | 39.0 | 50.3 | 39.7 | 43.3 | 27.3 | 30.3 | 85.5 | 87.2 |
| | | B3 | 223.0 | 237.7 | 87.7 | 108.0 | 45.7 | 50.7 | 37.7 | 38.7 | 113.4 | 115.4 |
| | SA3 | B0 | 87.0 | 83.3 | 30.3 | 38.3 | 18.3 | 39.0 | 16.3 | 16.0 | 66.0 | 67.9 |
| | | B1 | 171.7 | 194.0 | 98.7 | 114.7 | 22.3 | 23.3 | 21.0 | 24.3 | 112.3 | 114.1 |
| | | B2 | 217.0 | 223.7 | 46.7 | 55.3 | 45.3 | 48.3 | 26.3 | 27.0 | 119.2 | 120.9 |
| | | B3 | 234.7 | 248.7 | 107.3 | 120.0 | 11.7 | 54.7 | 35.3 | 37.0 | 142.3 | 146.0 |
| **D2** | SA0 | B0 | 61.3 | 74.7 | 20.7 | 28.3 | 14.3 | 23.0 | 9.3 | 10.3 | 29.1 | 30.2 |
| | | B1 | 131.3 | 145.3 | 50.7 | 67.3 | 21.3 | 34.3 | 12.3 | 13.7 | 38.1 | 39.6 |
| | | B2 | 143.0 | 168.0 | 29.3 | 41.3 | 24.3 | 42.3 | 16.3 | 16.0 | 42.7 | 51.7 |
| | | B3 | 171.7 | 193.3 | 69.3 | 86.3 | 30.7 | 45.7 | 18.3 | 18.0 | 47.3 | 55.7 |
| | SA1 | B0 | 67.0 | 79.7 | 27.3 | 35.7 | 13.3 | 17.7 | 10.0 | 11.3 | 37.8 | 40.1 |
| | | B1 | 144.3 | 161.0 | 61.7 | 81.0 | 17.7 | 22.3 | 15.0 | 17.3 | 43.6 | 45.6 |
| | | B2 | 152.0 | 177.7 | 36.7 | 49.3 | 31.0 | 41.0 | 15.7 | 20.0 | 54.3 | 57.5 |
| | | B3 | 191.3 | 213.7 | 79.7 | 103.0 | 36.3 | 50.7 | 19.7 | 24.3 | 62.2 | 64.0 |
| | SA2 | B0 | 69.0 | 80.0 | 28.3 | 29.7 | 13.3 | 17.3 | 10.3 | 12.3 | 39.3 | 42.0 |
| | | B1 | 152.3 | 170.7 | 68.7 | 88.0 | 19.7 | 23.3 | 17.0 | 21.3 | 42.8 | 43.0 |
| | | B2 | 163.3 | 184.3 | 40.7 | 47.0 | 33.7 | 41.3 | 20.0 | 23.7 | 56.3 | 59.3 |
| | | B3 | 209.3 | 224.3 | 90.3 | 110.0 | 39.0 | 50.7 | 19.7 | 27.0 | 71.3 | 73.2 |
| | SA3 | B0 | 72.7 | 81.0 | 30.3 | 33.7 | 15.3 | 18.7 | 11.7 | 13.3 | 48.3 | 50.2 |
| | | B1 | 162.3 | 173.7 | 82.0 | 101.7 | 21.0 | 23.3 | 21.7 | 24.0 | 63.0 | 64.6 |
| | | B2 | 188.0 | 215.0 | 43.0 | 51.3 | 38.3 | 44.3 | 21.3 | 24.3 | 68.0 | 72.9 |
| | | B3 | 223.0 | 238.3 | 97.0 | 113.0 | 44.3 | 53.0 | 28.3 | 30.3 | 78.6 | 85.9 |
| **D3** | SA0 | B0 | 63.3 | 67.7 | 21.7 | 26.7 | 9.0 | 13.3 | 8.0 | 8.3 | 21.5 | 22.4 |
| | | B1 | 83.7 | 97.0 | 28.0 | 29.0 | 12.7 | 21.3 | 9.7 | 9.3 | 29.7 | 31.3 |
| | | B2 | 118.7 | 124.3 | 30.3 | 33.0 | 22.7 | 29.7 | 11.0 | 8.7 | 30.5 | 32.7 |
| | | B3 | 137.0 | 146.3 | 40.0 | 48.0 | 32.7 | 37.7 | 13.3 | 15.3 | 33.6 | 35.1 |
| | SA1 | B0 | 70.0 | 74.7 | 23.0 | 29.0 | 11.3 | 18.3 | 9.7 | 9.3 | 29.6 | 34.0 |
| | | B1 | 140.7 | 144.0 | 30.0 | 31.3 | 24.3 | 31.3 | 11.0 | 11.3 | 31.8 | 37.6 |
| | | B2 | 157.3 | 176.3 | 30.3 | 35.3 | 26.3 | 35.7 | 13.7 | 14.3 | 35.1 | 46.8 |
| | | B3 | 190.3 | 207.7 | 67.3 | 75.3 | 36.7 | 44.3 | 16.3 | 16.7 | 42.2 | 44.1 |
| | SA2 | B0 | 69.3 | 78.0 | 26.7 | 29.7 | 14.3 | 18.3 | 10.3 | 7.7 | 37.8 | 42.0 |
| | | B1 | 143.3 | 166.7 | 45.7 | 67.0 | 20.0 | 25.0 | 13.3 | 13.7 | 32.0 | 34.8 |
| | | B2 | 167.7 | 200.7 | 67.3 | 74.7 | 32.0 | 36.3 | 16.3 | 17.0 | 36.3 | 40.3 |
| | | B3 | 198.3 | 219.7 | 78.0 | 93.0 | 40.0 | 47.7 | 18.7 | 19.3 | 48.3 | 51.9 |
| | SA3 | B0 | 73.0 | 78.0 | 29.3 | 31.7 | 15.7 | 19.3 | 11.0 | 9.3 | 38.8 | 40.5 |
| | | B1 | 159.3 | 169.7 | 31.3 | 40.0 | 30.3 | 34.7 | 15.7 | 16.3 | 39.4 | 40.1 |
| | | B2 | 171.3 | 207.0 | 38.3 | 46.3 | 39.3 | 44.0 | 18.7 | 20.0 | 42.3 | 47.3 |
| | | B3 | 195.0 | 221.7 | 91.0 | 99.0 | 45.7 | 49.0 | 20.3 | 21.7 | 53.0 | 57.0 |
| **L.S.D at 5%** | | | 11.271 | 7.5071 | 4.795 | 5.8584 | 4.112 | 4.6718 | n.s | 2.5171 | 7.0076 | 6.1204 |

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## تاثير الرش بحامض السالسيلك والتسميد الحيوي ومواعيد الزراعة على محصول الفول السودانى تحت الظروف شبة الجافة

**هوايدا احمد مامون و عمرو محمود عبد الجواد***
قسم الانتاج النباتى و*قسم خصوبة وميكروبيولوجيا الأراضى – مركز بحوث الصحراء– القاهرة – مصر .

تم اجراء تجربتين حقليتين بالمزرعة البحثية بالخارجة التابعة لمركز بحوث الصحراء بمحافظة الوادى الجديد بمصر خلال الموسمين الصيفيين ٢٠١٠ و٢٠١١ لدراسة تاثير الرش الورقى بثلاث مستويات من حامض السالسيلك (١٠٠ و ١٥٠ و ٢٠٠ جزء فى المليون ) وذلك بالمقارنة مع معاملة بدون رش بالاضافة إلى نوعين من البكتريا (التلقيح ببكتريا المذيبة للفوسفات و التلقيح ببكتريا *السيدوموناس* وخليط بين بكتريا المذيبة للفوسفات + بكتريا *السيدوموناس* ) بالمقارنة مع معاملة بدون تلقيح من خلال ثلاثة مواعيد زراعة ( ٢٠ ابريل و ١٥ مايو و ١٠ يونيو) وذلك على محصول الفول السودانى صنف جيزة ٦ ومكوناته والتركيب الكيمياوى وقد اوضحت الدراسة النتائج التالية:-

١- الحصول على اعلى قيم لمكونات محصول الفول السوانى {ارتفاع النبات – وزن القرون بالنبات- وعدد القرون بالنبات- ووزن المائة بذرة- ووزن محصول القرون والبذور (كجم/الفدان) بالاضافة إلى محصول البروتين والزيت (كجم/فدان)} وذلك بزراعتة فى الميعاد الاول ( ٢٠ ابريل ) خلال موسمى النمو .

٢- ادى رش نباتات الفول السودانى بحامض السالسيلك بتركيز ٢٠٠ جزء فى المليون إلى زيادة معنوية فى كل صفات المحصول ومكوناتة {ارتفاع النبات – وزن القرون بالنبات- وعدد القرون بالنبات- ووزن المائة بذرة- ووزن محصول القرون والبذور (كجم/الفدان) بالاضافة إلى محصول البروتين والزيت (كجم/فدان)} خلال موسمى النمو .

٣- ادت معاملة الخلط بين التسميد الحيوى البكتريا المذيبة للفوسفات وبكتريا *السيدوموناس* الى الحصول على اعلى قيم للصفات {ارتفاع النبات – وزن القرون بالنبات- وعدد القرون بالنبات- ووزن المائة بذرة- ووزن محصول القرون والبذور (كجم/الفدان) بالاضافة إلى محصول البروتين والزيت (كجم/فدان)} بالمقارنة مع معاملة كل بكتريا بمفردها.

٤- امكن الحصول على اقصى قيم للمحصول ومكوناتة بزراعة نباتات الفول السودانى بالخارجة محافظة الوادى الجديد بمصر فى ميعاد ٢٠ ابريل ورشة بحامض السالسيلك بمعد ل ١٥٠ جزء فى المليون بالمقارنة بالميعاد التالى ١٥ مايو فيجب الرش بحامض السالسيلك بمعدل ٢٠٠ جزء فى المليون وهذا بالنسبة لمعاملة التفاعل بين ميعاد الزراعة والرش بحامض السالسيلك فى كلا الموسميين.

٥- وقد اظهرت النتائج تفوق واضح للمعاملات الحيوية مع الرش بحامض السالسيلك كما اتضح ان استخدام مخلوط من البكتريا سجل اعلى قيم للاعداد الكلية للميكروبات وايضا فى اعداد كلا من البكتريا المذيبة للفوسفات وبكتريا *السيدوموناس* .

٦- من خلال نتائج البحث امكن الحصول على اقصى قيم لمحصول بذور الفول السودانى ومحصول القرون ومحصول الزيت ومحصول البروتين بزراعة بذور الفول السودانى صنف جيزة ٦ فى منطقة الخارجة بمحافظة الوادى الجديد فى ٢٠ ابريل ورش نباتاتة بتركيز ١٥٠ جزء فى المليون بحامض السالسيلك وتسميدة حيويا بخلط البكتريا المذيبة للفوسفات مع بكتريا *السيدوموناس* وهذا فى الموسمين ٢٠١٠ و ٢٠١١ وعند تاخير الزراعة حتى منتصف مايو يكون الرش بحامض السالسيلك بمعدل ٢٠٠ جزء فى المليون وايضا مع معاملة الخلط بين نوعى البكتريا المذيبة للفوسفات وبكتريا *السيدوموناس*.