EFFECT OF BIOFERTILIZER AND MICRO NUTRIENTS ON SOME CHICKPEA VARIETIES

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CONTENTS

INTRODUCTION

INTRODUCTION

Chickpea *(Cicer arietinum, L.)* is one of the most important seed legume in the world .In Egypt, chickpea is the third important leguminous crop raised for seed production. Its seeds not only provide a cheap source of protein, but also a food of high calorific and nutritive value. The seeds are used either green or dry as human diet, moreover, these seeds are used in sweets and baby food blend. It is generally known that N_2 fixation by Rhizobium is enhanced in host plants. It can grow successfully in different soil types and it increases soil fertility.

Mostly concentrated in upper Egypt (about 90%).Farmers of Beheira, Sharkia, Ismailia, Assuit, Sohag and Qena Governorates used to grew chickpea for seed production, hence it is considered as a useful cash crop with numerous uses.

The total area of chickpea in Egypt is about 10859 faddan in 2007/2008 season. The average yield reached 5.85 ardabs/faddan in 2007/2008 season.* It is not easy to increase the cultivated area of chickpea due to the limitation in the land and competition with other winter cash crops. However, in the future, it may be grown as a winter crop in the newly reclaimed land as a leguminous soil building crop. Therefore, it is of vital importance to increase the total production by increasing the yield per unit area. This could be reached through developing

* Agricultural statistics, Economic (2007) winter crop. Affairs sector, Ministry of Agricultural and land Reclamation, Arab republic of Egypt, December vol.1pp 54-59 (In Arabic).

high yielding new varieties and the application of best agronomic practices. Now, there is a tendency to use high seeding rate than before.

This tendency is the result of some recent research work showing that the leguminous protein –rich plant depend completely on soil fertilizers for providing its high requirements of nitrogen and phosphorus.

Special attention should be paid to fertilization due to the contradictory investigation results. The present study aimes to investigate the effect of biofertilizer and micronutrients on some varieties of chickpea (*Cicer arietinum, L.*). To contribute some information concerning fertilization requirements in addition to decrease environmental pollution.

Review of Literature

REVIEW OF LITERATURE

Micronutrients are considered ones of the very important elements which have adistinct influence on most biosynthesis reactions as well as play an important role not only as a catalyst but also as co-enzyme for many chemical reactions.

Biofertilizer is a natural organic fertilizer known that helps to provide all the nutrients required by the plants and help to increase the content of the soil with natural microorganisms. Biofertilizers are the most advanced biotechnology necessary to support developing organic agriculture, sustainable agriculture, green agriculture and non-pollution agriculture. This Bioorganic fertilizer can increase the output, improve the quality and it is responsible for agriculture environment. Today, it has been widely used with excellent results in all kinds of plants and several countries.

Kale *et al.* (1982) studied the effect of seed boifertilization with a mixed culture of Rhizobium and Azotobacter on yield of gram (*Cicer arietinum,L.*).They found that inoculation resulted in a significant increase in seed yield .

Hernandez and Hill (1983) emphasized that biofertilizer of chickpea seeds with Rhizobium sp.Strain cc 1192 increased seed yield by 29 % with significant increase in pod numbers.

Kalyan *et al.* (1983)found that Rhizobium inoculation of gram. (*Cicer arietinum,L.*) significantly increased the growth, yield and quality but phosphobacterin had no significant influence of them.

Ram *et al.* (1984) treated 30 g of chickpea seeds with dithan alone or with dithan followed by Rhizobium or Rhizobium followed by dithan or left untreated before sowing.Seed yield was higher after treatment with Rhizobium followed by dithan in other treatments.

Gangwar and Singh (1986) manganese and zinc application using single method or more than one method techniques in lentil was found to increase vegetative growth, flowering, number of branches/plant, number of pods ,number of seed, seed yield, straw yield, protein percentage in seeds and protein yield .

Santos and Estefanel (1986) found that on soybean seeds coating as a fertilization technique was used beside other application methods i.e. (soil application or foliar application) as well, whereas, seed coating with Zn at 0,0 0.1 and 0.2% followed by foliar spray of Zn SO_4 at 15+30 and 15+45 days after emergence resulted in higher number of branches/plant, pods/plant and seeds/pod and increased 1000-seed wt, grain yield /plant, harvest index and seed yield/ ha.

Subba-Rao *et al.* (1986) mentioned that seed biofertilization with Rhizobium and soil biofertilization with Glomus fasciculatum increased yield of chickpea var BG 12.

Tellawi *et al.* (1986) found that biofertilization of chickpea plants with three different Rhizobium strains resulted in a significant increase in seed yield .The average increase due to biofertilization was 110 % over the unbiofertilized control.

Kabesh *et at.* (1987) stated that use of biofertilizer significantly increase soybean plant growth, in terms of height, number of leaves and dry weight.

Maurya *et al.*(1987)studied the effect of chickpea seeds biofertilization with two Rhizobium strains alone and with two Azotobacter strains (with and without soil application of 50 kg P_2O_5 /ha.) and pseudomonas strata (P solubilizer) on seed yield .All treatments increased seed yield from 1.34 to 1.48- 1.9 t/ha. Biofertilization with Rhizobium strain BGI+Azotobacter strai B 5 + P striata gave the highest yield.

Khune *et al.* (1989) found that seed biofertilization with Rhizobium increased average seed yield of chickpea by 29%.

Sharma *et al.* (1989) showed that (*cicer arietinum, L.*) grown inoculated and uninoculated seeds gave seed yields of 1.76 and 1.47 t/h, respectively.

Hussein *et al.* (1991) studied the effect of biofertilizer application (as bacterial inoculation) on *faba bean* and reported that seed yield was increased by 1.48 tons per hectare (39.8%) due to biofertilization. Also, straw yield increased by 3.14 tons/hectare (44.9%).

Hegazy *et al.* (1992) using faba bean observed that inoculation with Azospirillum and Rhizobia significantly increased seed index.

Tippannavar *et al.* (1992) reported that seed yield of *(Cicer arietinum*, cv. A- From the following inoculation (seed or soil) treatments were: Rhizobium (Rh),1.53 t/h; a Aspergillus awamori (Aa) 1.53 t; pseudomonas striata (Ps). 1.62 t,Rh+ Aa, 1.44t; Rh+ ps.1.4 t; Aa+ 12.5 kg N and 25 kg P_2O_5 /ha (NP)

,152t; ps+NP, 1.49 t; compared with 1.50 t with NP and 1.33 from the uninoculated control .Treatment inoculated with P. striata only had the highest nodule dry weight,number of pods and pod dry weight.

Yanni (1992) reported that chickpeas, lentils and Lupins albus grown in pots where soil inoculated with Rhizobium meliloti, R.Leguminosarum biovar viceae and Bradyrhizobium sp.,respectively with or without 30 or 60 ppm N. plants were also given 3 ppm Mo, 2 p.p.m. CO_2 1 ppm B , or no trace elements. Nodulation, dry weight plant and seed yield were increased by inoculation. nodulation in chickpeas and L. albus was decreased but seed yield increased by 60 ppm N compared with 30 ppm N .

Abd-El-Gawad *et al.* (1993), in Egypt, reported that chick pea cv.Giza 2 were given 15.5, 31.0 or 46.5 kg P_2O_5 kg/fad. as calcium superphosphate and foliar application of 25 or 50 ppm Zn as zinc sulfate, Mn as manganese sulfate, Mo as ammonium molybdate or Fe as iron sulfate. The highest seed yield of 0.95 t/fad. was obtained with application of 15.5 kg P_2O_5 + 50 p.p.m.Zn or 31 kg P_2O_5 + 25 ppm Zn. Data on yield components are tabulated [1 faddan =0.42 ha].

Azad *et al.* (1993), in Indian Punjab, soil application of 12.5 kg $ZnSO_4$/ha gave the highest seed yield of 956 kg/ha compared with soil application of 6.25 or 25 kg $ZnSO_4$, or foliar application of Zn. Cu:Zn, Fe:Zn and Mn:Zn ratios in seed and straw were decreased by Zn application, except that of Fe : Zn in straw on lentil.

El-Awag *et al.*(1993) reported that phosphobacterin caused significant increase in soybean seed and straw yields as compared with the control treatment.

Hegazy *et al.* (1993), in Egypt, found that seed coating with Zn at 00.2 % and basal application of zinc sulphate at 10 kg Zn/ha, resulted in increasing seed yield, straw and biological yields/plant. Yield attributes (number of branches/plant, pods/plant, seed/pod, and 1000-seed wt) were also higher than the control when Zn was applied as a seed coating on seeds at rate of 0.2% Zn. Maximum harvest index was recorded from foliar sprays of Zn at 15 and 45 days after emergence and seed coating with Zn 0.1% .

Kosgey *et al.* (1993) indicated that on loam soil with 0, 15, 45 or 90 kgN/ha and Rhizobium seed inoculation at 0,1 or 2 times the recommended rate were applied in chickpea. Maximum dry matter yield which averaged 10.35 t /ha. was not influenced by either Rhizobium inoculation or N rate .Neither inoculation or N affected seed yield ,which averaged 2.87 t / ha with a harvest index of 0-40.

Arf *et al.*(1994) reported that P. vulgaris cv.carioca seeds were untreated, pelleted with a commercial trace element formulation and /or inoculated with Rhizobium leguminosarum .N fertilizer at 25 kg/ha was applied to the soil either 1/3 at sowing and 2/3 about 21 days after emergence (DAE) or all at 21 DAE, or 1-3 foliar applications of 300 litres/ha of 5 % urea were given .Inoculation and N fertilizer had no significant effects, but trace elements increased dry matter yield.

Enania *et al.* (1994) in a field trial at Udaipur, Rajasthan in rabi [winter] 1991/92, DM yield/plant of chickpeas cv.C-235 increased with increasing p (0-50 kg p_2o_5/ha) and Zn (0- 7.5 kg Zn/ha) rate. Plant height and branching were not significantly affected by fertilizers. P uptake was increased by increasing P rate and decreased by 7.5 kg Zn/ha, while Zn uptake increased with increasing Zn rate and with 25 kg p_2o_5/ha.

Gangwar and Singh (1994) showed that in a field experiment on sandy loam soil (containing 0.72-0.85 ppm) extractable Zn) at pantnagar, Uttar Pradesh, lentils cv.pant L 406 received Zn through seed coating (as Zn O), or soil or foliar application as Zn SO4. Seed yields from the three application methods were in the order seed coating > foliar application > soil application. The highest seed yield of 2.4 t/ha was obtained from coating seeds with 0.1 % Zn O. Zn application increased N uptake in all the treatments, while increase in P uptake was only noted in treatments where seeds were coated with Zn O , and foliar spraying with Zn SO_4 decreased P uptake .

Monib *et al.* (1994) concluded that, faba bean seed treatment with microbial inoculants i.e. specific Rhizobiam strains could supply the plants with apart of nitrogen rewired during different growth stages and increase seed yield and its components, as well as seed protein content.

Chandra (1995) found that *Cicer arietinum* cv Pant G-114 seed were inoculated with Rhizobium or not inoculated before sowing and given 0-60 kg P_2O_5 or 20 kg Zn SO_4 /ha . Average seed yield was unaffected by inoculation or Zn treatments.

Gautam *et al.* (1995) inoculated 9 *Cicer arietinum*, cultivars seeds with Rhizobium or not inoculated and given 0 , or 25 kg N –ha. Seed inoculation +25 kg N gave the highest mean seed yield of 2.14 t/ha. the high yield cultivars were phule G-5 (2.05 t /ha), IG-5-14 (1.91 t) and JG – 226 (1.90 t).

Islam *et al.* (1995) in Bogra Bangladesh, showed that chickpeas cv.Nabin was given 20 kg N+60 kg P+40kg K +5 kg Zn + 1 kg B +1 kg Mo/ha (complete fertilizer package,CFP) with or without an additional 1kg. B/ha,NPKS alone or with 5 t cattle manure/ha or 7 other treatments .They found CFP + 1 kg B/ha gave 37 % higher yields than with CFP alone .In the following year application of 2 kg B + 1 kg Mo/ha gave the optimum *C . arietinum* yield which was 514 % higher than that obtained from 2 kg B alone .

Mahmoud (1995) mentioned that inoculated faba bean seeds with Rhizobia in the progressive plant stages increased number of nodules and nodule dry weight /plant, that reflect on yield and its componts, as well as soil fertility.

Roy *et al.* (1995) showed that *Cicer arietinum*, cv.Nabin and local were given 20 kg N/ha and/or inoculation with Rhizobium strain RCa-220. Nodulation and dry matter yield were similar in the 2 genotypes, but Rhizobium inoculation increased nodule number/ plant and gave the highest harvest index and 1000-seed weight, while total dry matter yield was highest when inoculation was combined with N application .

Tomar and Raghumanshi (1995) reported that Rhizobium inoculation and application of 20 kg N/ha, both

singly and in combination, increased chickpea seed yield and net returns compared with the control.

Gupta and Namdeo (1996) found that 10 *Cicer arietinum* cultivars were inoculated with Rhizobium strin JGRS-60. Number and dry weight of nodules increased with inoculation and were highest in cv. BG 244. Seed yield in both years was highest in cv. BG 244 (1.06 t/ha) followed by cv. ICCC 43 (1.00 t). Seed protein content increased from 29% without inoculation to 21.55% with inoculation and it was highest in cv. ICCC 43 (22.35%) followed by cv. ICCC 42 (22.26%).

Krishnareddy and Ahlawat (1996), in India, in a field experiment on a sandy loam soil *Lens culinaris* cv. JL 1 and Lens 4076 were not inoculated or seed inoculated with *Rhizobium leguminosarum* and/or *Glomus fasciculatum* and were given 0 or 17.2 kg P/ha as rock phosphate (RP) or 17.2 kg P as RP or single superphosphate (SSP) + 5 kg Zn as zinc sulfate. LAI, root nodulation, number of pods/plant, seeds number/pod and seed yield and harvest index were higher in JL 1 whereas plant height and 1000-seed weight were higher in Lens 4076. Application of 17.2 kg P as SSP + 5 kg Zn produced the highest seed yield, but this was not significantly different from the treatment receiving 17.2 kg P as RP + 5 kg Zn. Seed inoculation increased seed yields. Seed yield was highest where both the inoculants were applied together.

Peksen and Gulumser (1996) evaluated the response of chickpeas cv.ILC 482 to inoculation with Rhizobium strains,given N fertilizer or untreated .They found that seed

inoculation had no significant effects on seed yield or seed protein content when compared with uninoculated controls.

Sattar *et al.* (1996) tested three treatments: control (no nitrogen and no inoculation), rhizobial inoculation. and urea at 50 kg N/ ha for chickpea (*Cicer arietinum,L.*). They indicated that inoculation increased the effective nodules and nodule mass. The application of urea had little effect on nodule formation and most characters .Increases in yield due to inoculation ranged from 15-30 % in cowpea to 75-200 % in soyabean.

Tomar *et al.* (1996) in a field trial in India, (*Cicer arietinum, L.*) was indicated that with 10 g phosphate-solubilizing bacteria/ kg or uninoculated, and received 0,20,40 or 60kg P_2O_5/ha as diammonium phosphate, single superphosphat, rock phosphate or rock phosphate + pyrite . Results indicated that inoculation increased mean seed yield from 2.23 to 2.46 t /ha. Yield was 2.40, 2.93, 3.12 and 3.38 t/ha at the 4 P. rates and was highest (mean 3.44 t) with P applied as rock phosphate+ pyrite .

Bahr (1997) found that biofertilizer with phosphorus significantly increased plant height, number of branches and leaves/plant, seed index ,weight of seeds and pods /plant and seed and biological yield/fed.of chickpea.

Pawar *et al.* (1997) found that seeds of *Cicer ariteinum*, cv.Pule G-12 were inoculated with 19 different strains of Rhizobium or not inoculated and sown at 30 X 10 cm spacing. The non- inoculated plots were given 0 or 30 kg N /ha .Abasal dose of 40 kg P_2O_5 /ha was applied to all plots. Compared with non-inoculated controls given no N, seed inoculation increased

the number of nodules/plant nodule dry weight/ plant and seed yields .the highest seed yields were obtained with seed inoculation with Rhizobium strains co-Be-12 (4.06 t/ha) SG-8-87 (4.01 t/ha) and sG-3- 87 (3.84 t /ha) Non-inoculated controls gave seed yields of 3.52 t /ha with N fertilizer and 3.18 t /ha with no N.

Sharma and Parmar (1997) evaluated the influence of various combination of phosphorus solubilizing bacteria (PSB), farmyard manure(FYM), agricultural grade pyrites (PY), rock phosphate (PR) and single superphosphate on productivity and nutrient uptake by rainfed soybean cv.JS 81-1498 and gram chickpea cv. IG 218 grown in sequence on black clay soils. They showed that seed yield of gram was not significantly different between the different treatments.

Yadav and Shrivastava (1997) showed that chickpea cv.JG-315 were given 0, 20, 40, 60 kg P_2O_5/ha.with and without seed inoculation with phosphate solubilizing bacteria (PSB).The results indicated that seed yield of untreated controls was 1.10 t/ha, while the highest yield was given by 60 kg P_2O_5 /ha+PSB (2.67 t/ha), followed by 60 kg P2O5 alone (2.51 t) .

Abd El-Lateef *et al.* (1998) in Egypt, mentioned that the biofertilization increased seed yield of soybean by 20.4 % over the control treatment.

Bhuiyan *et al.* (1998) reported that Rhizobium seed inoculation with 1 kg Mo and 1 kg B/ha increased nodule number, shoot weight, straw and seed yield compared with the control in soybean seeds. Seed yield was 107% and 148% higher than control in two consecutive growth seasons. Economic

evaluation of the crop suggested that treatment of PKMOB+ Rhizobium is optimum for higher seed yield and PKB+Rhizobium for higher chickpea gross margin .However Rhizobium was suitable from an economic point of view in obtaining marginal rates of return as high as 15567% in1993 and 12400% in 1994.

Braga and Vieira (1998) showed that *C.arietinum* cv .IAC Marrocos and IAC India-4 were seed inoculated with bradyrhizobium or not inoculated, and given 0 or 30kg N/ha, 0 or 40 g Mo/ha and 0 or 40 kg micronutrients/ha (Zn, B, Cu Fe, Mn and Mo). Inoculation gave the greatest yield increase of both cultivars compared with controls, followed by N fertilizer. Micronutrients had a height positive effect in IAC Marrocos.

Gupta (1998) showed that the effects of B, Zn, Cu, Fe, Mn and Mo on chickpea root pathogens (*Sclerotium rolfsii* [*Corticium rolfsii*], *Fusarium oxysporum* f.sp. *ciceris* and *Rhizoctonia bataticola* [*Macrophomina phaseolina*]) were investigated *in vitro*, and the results are tabulated.

El-Awag (1998) noticed that Rhizobial inoculation enhanced both numbers nodules and nodule dry weight/plant on broad bean yield.

Negm *et al.* (1998) found that, total nitrogen percentage and uptake of both seed and straw of soybean plant were significantly increased with Rhizobial inoculation over that uninoculated plots. Protein content in seeds which expressed by total nitrogen determination, was significantly increased with Rhizobium inoculation over that uninoculated plots.

Reddy and Ahlawat (1998) reported that on a sandy loam soil low in available N and P, application of 18 kg N + 46 kg P2O5 + 5.25 kg zn /ha increased growth and yield attributes, seed and straw yields of chickpea cv. BG 261 .Dual inoculation gave the highest bacterial count in rhizophere and net return than other fertilizer treatment .

Rodelas *et al.* (1998) studied the effect of inoculation with biofertilizers on faba bean plants and they found that, the positive effect of Azotobcter and Rhizobia may refer to the improvement of root development, an increase in the rate of water and mineral uptake by roots, execration of phytohormones and vitamins especially the group B as well as biological N2-fixation.

Abd-EL-Aziz and Anton (1999) found that application of coating method or micronutrients mixture of (Fe+ Zn+ Mn+ Mo) on faba bean significantly increased all growth characters yield, its components and crud protein of seeds. Whereas total carbohydrates content was decreased.

Abdel-Wahab *et al.* (1999) reported that biofertilization of soybean plants with microbien containing phosphate solubilizer increased seed and straw yields/fed Also, number of pods/plant, 100-seed weight and seed yield/plant were increased.

El-Hadi and El-Sheikh (1999) in Sudan, inculated clay loam, chickpea cv.plants with one of three Rhizobium sp. (*Cicer arietinum, L.*) strains (TAL 480 'TAL 620 and TAL 1148) or given 50 kg N/ha. Results indicated the absence of infective Rhizobium strains for chickpea in the soil- Rhizobium inoculation or fertilizer application significantly increased total

nodul number per plant and 100-seed weight. Inoculation with Rhizobium strain TAL 1148 increased yield by 70-72% .While 50 kg N /ha increased yield 69 – 70 %. The amounts of protein accumulated (kg/ha) due to Rhizobium inoculation were comparable to that due to application of 50 kg N /ha.

El-Kalla *et al.* (1999) found that application of biophosphate fertilizer (phosphorien) resulted in an increase in number of pods/plant, 100-seed weight, seed yield/plant, plant height and seed yield/fed. The results indicated that highest P rate (45 kg P_2O_5/fed) and phosphorien increased seed protein percentage, of faba bean.

El-Karamany and Bahr (1999) studied the response of two Chickpea cultivars Giza-2 and Giza-531 to microbien biofertilizer, compost and chemical fertilizer (NPK) under newly reclaimed sandy soil conditions. They indicated that chickpea cultivar Giza -531 surpassed Giza-2 in seed yield /plant or faddan .Organic manure gave the highest seed yield /plant or faddan and all yield attributes followed by biofertilizaters and chemical fertilizaters.

Hafiz (1999) in Egypt, showed that of some chickpea Giza 1 variety exhibited little increases in the yield of seed, straw and biological per fad. as compared with Giza 88 and Giza 195.

Hussein *et al.* (1999) mentioned to the promotive effect of Rhizobial inoculation on the quantity of nodules in the legume crops. They reported that treatment increased both number of nodules and the dry weight of nodules/plant, which had positive effect on plant growth and soil fertility.

Jain *et al.* (1999) studied the inoculation of seed chickpeas CV.JG 315 with Rhizobium and/or phosphorus solubilizing bacteria (PSB) and given 30,45 or 60 kg P2O5 /ha .They found that P application markedly increased nodulation, pods/plant, seed and stover yield .Seed inoculation with Rhizobium and PSB increased seed yield by 15% and 10 % respectively compared with no inoculation. Combined inoculation of Rhizobium and PSB + 60 kg P2O5 produced the highest mean seed yield of 1.63 t /ha and the highest net returns.

Hamissa *et al.* (2000) mentioned that application of phosphate solubilizing bacteria (phosphorien) significantly increased top dry weight/plant and seed yield/fed of faba bean.

Mahmoud and El-Far (2000) found that protein percentage in seeds was significantly influenced by inoculation of peanut with bradyrhizobium sp.

Neweigy *et al.* (2000) revealed that biofertilization by a mixture of *Bacillus megaterium* var. *phosphaticum* and *Rhizobium leguminosarum* and 30 kg N/feddan on broad bean significantly increased the nitrogenase activity and nodulation, particularly on the 70th day after sowing. Data also showed that inoculation of seeds and application of 30 kg N/feddan was better than inoculation of seeds without inorganic N fertilizer application. [1 faddan=0.42 ha].

Saleh *et al.* (2000) conducted field trials in old land and sandy soil on faba bean which was inoculated with Rhizobium as biofertilizer. They found that in the old land, inoculation of faba bean with biofertilizer gave significant increase in seed yield. In

the sandy soil inoculation increased seed yield by 0.067 ton/ha (13.6%) compared with the check.

Smith *et al.* (2000) showed that the plants were given foliar applications of B or B + Mg. B and B + Mg increased yields of plants not infected with SCN. Yield decreased with increasing soybean cyst nematode (SCN, Heterdera glycines) population, but was not affected by B or B +Mg.

Abo-Shetaia and Mokhtar (2001), in Egypt, investigated 20 and 40 ppm of micronutrients (Mo, Zn or Mn). Foliar spraying with Zn significantly increased the number of pods per plant, weight of pods per plant and seed index, followed by Mo and Mn respectively. Mo, Zn or Mn at 20 or 40 ppm increased seed and straw yields/faddan. The highest value for pod length was obtained by spraying Mo or Zn at 40 ppm. The effect of the interaction between phosphorus and micronutrients on number of pods per plant, number of seeds per pod, pod length, weight of pods and seeds per plant was not significant. The highest values for seed and straw yields were obtained by supplying chickpea plants with 40 kg P_2O_5/feddan and 20 or 40 ppm Zn.

Meena (2001), in India, studied the response of chickpea cv. RSG-44 to P fertilizer (0, 20, 40 and 60 P_2O_5/ha) and to *Rhizobium* and phosphate-solubilizing bacteria (PSB) inoculation, either singly or in combination. *Rhizobium*+PSB inoculation significantly increased the number of seeds per pod and pods per plant as well as the seed and straw yields. The yield obtained with this treatment was higher with that produced by *Rhizobium* inoculation, but was at par with the yield obtained with PSB inoculation.

Sawires (2001) in Egypt, reported that foliar spraying with Zinc caused on chickpea. Significant increase in number of pods /plant, weight of pods/plant and seed index. Adding, Fe, Mo, Zn and Mn at the rate of 15 or 30 ppm caused an increase in seed and straw yields/fed., compared with the untreated (control).

Yakout *et al.* (2001) found that application of biofertilizer (microbien) to faba bean significantly increased seed yield.

Zeidan *et al.* (2001) treated faba bean plants (cvs. Giza 2 and Reina Blanka) with biofertilizer (microbien) and organic fertilizer. The results indicated that number of pods/plant, seed yield/plant, and seed and straw yields/fed were significantly increased. Seed yield/fed for Giza 2 and Reina Blanka was 2.55 and 3.08 tons, respectively.

Abdalla (2002) showed that treating faba bean plants with biofertilizer (phosphorien) markedly increased number of pods/ plant and seed yield.

Misra *et al.* (2002) showed that in chickpea, pea and lentil, the application of 20 mg Zn/kg significantly increased dry weight (by 37.9, 50.8 and 127.3%) and N content (by 26, 50 and 53%) and total plant weight (by 52.9, 44.6 and 71.2%).

Nassar *et al.* (2002) reported that on faba bean cv. Giza 2. Micronutrient treatments increased plant height, number of leaves and branches, the dry matter of plant organs, photosynthetic pigments (chlorophylls and b, and carotene) and micronutrient contents. The highest values for these parameters were obtained with the simultaneous application of the 3 micronutrients. Fe produced the highest photosynthetic pigment

content in plants, followed by Zn, while the lowest content was obtained with Mn.

Sapatnekar *et al.* (2002) conducted on experiment to study the interactions among different P sources and P solubilizers along with N-fixed and their effects on chickpea cv. PG-5 cultivation treatment combinations comprised: 100% P_2O_5 in the form of either single superphosphate (SSP) or rock phosphate (RP), two P solubilizers (fungal culture, *Aspergillus awamori* and a bacterial culture, *Pseudomonas striata*) along with N-fixer *Rhizobium loti*. Among all treatment combinations, 100% SSP + *A. awamori* + *R. loti* recorded the highest yield (14.9 kg/ha), Chickpea responded positively to application of P sources with P solubilizers alone and in combination with *R. loti*. Based on the results, fungal P solubilizers were superior over bacterial strains, and SSP was superior over RP.

Ulukan *et al.* (2002) showed that the response of faba bean cultivar (Filiz 99) and inbred lines (PN 55 K.No. 584-066 Reine Blance and PN 54 K.No. 7954x964-12B) to zinc fertilizer rates (0.0, 2.5, 5.0 and 7.5 kg/ha) was studied in Ankara. Generally, the increase in zinc rate enhanced plant height, biological yield and grain yield, but reduced first pod height, number of pods per plant and number of seeds per pod. The effects of zinc fertilizer on pod length, 100-seed weight and seed protein content were not significant. The performance of the cultivars varied with year and fertilizer rate.

Zaghloul *et al.* (2002) in Egypt, they found that growth characters were significantly increased in the case of dual inoculation compared to individual inoculation and this was true

in the two growing seasons. Also, mung bean growth characters were improved with zinc application either at 10 or 20 ppm compared with no zinc application. The highest records of macro- (N, P and K) and micronutrient (Fe, Zn and Cu) contents in mung bean shoots were observed with dual inoculation and zinc application at 20 ppm. Also, macro- and micronutrient contents were higher during flowering stage than during vegetative stage. Dual inoculation gave the highest seed yield, biological yield and yield components as well as protein yield of mung bean plants and this was obvious with zinc application at 20 ppm.

Ahmed *et al.* (2003) in Egypt, reported that the application of biofertilizer (phosphorine) + chemical fertilizer (nitrogen, phosphorus and potassium) resulted in the highest increases in the characters. The increases estimated in the yield and yield components of faba bean, chickpea and lupin plants from the control were, more or less, the same for plants treated with chemical fertilizer, biofertilizer, organic fertilizer, or their combinations. Treatment with biofertilizer + chemical fertilizer resulted in the highest increases in 100-seed weight, weight of pods per plant, weight of seeds per plant, weight of straw per plant, 100-seed weight, seed yield, straw yield and seed protein yield.

Hamed (2003) found that inoculating faba been seeds with phosphate dissolving bacteria (phosphoren) surpassed the uninoculated in plant high, pods and seeds weight/ plant,100-seed weight, seed and protein yields/fed.

Jain *and Singh* (2003) investigated the effect of the biofertilizer treatment on chickpea in a sandy clay loam soil. These treatment were: control; Rhizobium sp.(Rz); phosphate solubilizing bacteria (PSB);and Rz+PSB. The P (P2O5) fertilizer was applied at 0(control), 12.5, 25, 37.5 and 50 kg/ha. They found that seed treatment with Rz+PSB showed 8.33, 24.75 and 13.07 % higher in plant height, dry matter accumulation and number of branches per plant, respectively, compared to the control. Rz+ PSB and P at 50% kg/ha. also increased nutrient content and uptake. Rz+PSB increased the soil N availability after harvest. Rz+PSB application significantly increased P availability in the soil after harvest.

Meena *et al.* (2003) studied the effects of soil moisture conservation practices (bunded field,bunded field+ 10 t farmyard manure / ha, and bunded field + dhaincha and, P rates (0 , 30 and 60 kg P_2O_5 /ha) with or without phosphobacterin (pseudomonas striata) seed inoculation on the yield and nutrient uptake by chickpea cv.pusa 256.They revealed that among the soil conservation practices, bunded field+ farmyard manure recorded the greatest straw yield (35.89 quintal /ha, 1 quintal= 100 kg), and N (109.96 kg/ ha), P (18.01 kg /ha) and K (95.01 kg /ha) uptake. Grain and straw yields, harvest index, and N, P and K levels increased by 15.42, 7.32, 3.66, 13.70, 1.97 and 4.81 % with phosphbacterin inoculation over inoculation.

Mehasen and El-Ghozoli (2003) reported that all growth characters, yield and yield components as well as chemical composition of soybean seeds in both seasons were significantly increased by application of rock-phosphate (RP) + phosphate

dissolving bacteria (PDB) or inoculation with PDB alone except number of branches /plant and oil percentage in the second season only.

Menaria *et al.* (2003) found that inoculation faba bean plants with Rhizobium, solubilizing bacteria (PSB) and Rhizobium + (PSB) significantly increased the growth parameters (plant height, dry matter accumulation and leaf area index) and yield over control.

Pathak (2003) in India, showed that the effects of biofertilizers, diammonium phosphate (DAP) and $ZnSO_4$ on the growth and yield of chickpea cv. JG-315. Plant height, branches per plant, root nodulation, pods per plant, grains pod, 1000-grain weight and grain yield were highest at 69 kg P_2O_5/ha through DAP. Phosphate solubilizing bacteria (PSB) + 10 t farmyard manure (FYM)/ha and 12.5 kg $ZnSO_4$/ha proved to be the most beneficial treatment. The additional net return due to P_2O_5 (69 kg/ha), PSB + FYM and $ZnSO_4$ was Rs. 8564, 6457 and 846/ha, respectively, over their respective controls. The combined influence of these inputs further augmented the net return. The seed protein and protein yield/ha were also highest in these treatments.

Pramanik and Singh (2003), in India, reported that the treatments comprised 4 levels of biofertilizer inoculation (no inoculation, phosphate solubilizing bacteria (PSB), vesicular arbuscular mycorrhiza (VAM) and PSB+VAM), 3 P levels (0, 30 and 60 kg/ha) and 2 modes of P application on chickpea . Inoculation of biofertilizers increased the yield and nutrient (N, P and K) uptake. The inoculation of PSB+VAM recorded higher

yield and nutrient uptake over PSB and VAM individual applications.

Sunder *et al.* (2003) showed that in faba bean cv. RGC 936. Zinc at 5.0 kg/ha significantly increased the dry matter accumulation over the control and 2.5 kg Zn/ha treatments. Application of Zn beyond 5.0 kg/ha resulted in the decrease in dry matter yield. A similar trend was noted for nitrogen, phosphorus and zinc content and uptake. Protein and gm content also showed a similar pattern of response to Zn except that application of 7.5 kg Zn/ha was at par with application of 5 kg Zn/ha.

El-Gizawy and Mehasen (2004) studied the effect of phosphate dissolving bacteria (B.Megatherium) inoculation i.e.phosphoren (with or without) three phosphorus fertilizer levels (0, 15 and 30 kg P_2O_5 /fed.) and two spraying treatments with Fe (tap water and 0.5 gil as chelated iron, 14 % Fe-EDTA). Results showed that phosphoren treatments,inoculating chickpea seeds with phosphate dissolving bacteria (Bacillus megatherium) significantly surpassed those of superphosphate in seed yield / plant, seed, straw, biological as well as protein yields/ fed.,N and P uptake /fed. while the lowest values for forenamed trails were obtained in the unfertilized plots .

Hafiz (2004) found that a field experiment was carried out in Ismailia, Egypt, to study the effects of the biofertilizer Phosphorin (phosphate-dissolving bacteria), 3 levels of N + P_2O_5 (25+16, 45+32, and 65+48 kg/faddan), and foliar spraying of chelated Zn (0, 400 or 800 ppm as 14% Zn EDTA) on the yield, yield components and quality of chickpea (cv. Giza 195) grown

on new reclaimed sandy soil. The application of Phosphorin significantly enhanced the evaluated parameters, except the number of seeds per pod.. The foliar application of chelated Zn up to 800 ppm significantly improved the yield attributes; seed, biological and straw yields/feddan; and quality. The interaction between N + P_2O_5 fertilizers and spraying of Zn had significant effects on weight of seeds per plant, seed yield/feddan and biological yield/feddan. The interaction biofertilizer x foliar spraying of Zn had significant effects on the seed protein content. [1 faddan=0.42 ha].

Knany *et al.* (2004) concluded that inoculating faba bean seeds by P dissolving bacteria significantly increased seed yield as well as P in the soil.

Agrawal and Sharma (2005) in India, investigated the effect of *Rhizobium* and P-solubilizing bacteria (PSB) as composite inoculants with S and Mo on chickpea three levels of S (0, 20 and 40 kg/ha) and 3 levels of Mo as sodium molybdate (0, 2.5 and 5.0 kg/ha) were integrated with dual inoculation of *Rhizobium*+PSB and an uninoculated control. The highest grain yield (29.32 q/ha) and straw yield (31.30 q/ha) were recorded under 40 kg S/ha + 5.0 kg Mo/ha with dual inoculation of *Rhizobium*+PSB. The increases in grain and straw yields, in response to dual inoculation, were in the ranges 4.66-12.76 and 7.47-14.65%, respectively. The lowest yield of 24.27 q/ha was recorded in the absolute control.

Hossain and Suman (2005) reported that of Azotobacter, Rhizoboium and different levels of urea N on growth, yield and N-uptake of lentil results indicated that treatments of

Azotobacter plus Rhizobium inoculation had significant effect on nodule formation, plant height, number of seeds, seed and stover yields, compared to uninoculated controls. The highest seed yield was recorded for the treatment (Azotobacter+Rhizobium) that was statistically similar to that of Rhizobium with the corresponding yields of 1533 and 1458 kg/ha, respectively. The dual inoculation of Azotobacter and Rhizobium significantly influenced all the crop characters including N contents, N uptake by seeds and shoot as well as protein content of seeds.

Johnson *et al.* (2005) showed that soil deficiencies of zinc (Zn) and boron (B) limit crop production in Nepal. Improving the micronutrient status of plants would increase yield and increase micronutrient content of the seeds, leading to better nutrition of the progeny crop and to improved human micronutrient nutrition. Micronutrient treatments were evaluated for their effect on grain yield and grain micronutrient content. Soil B fertilization increased B content of the grain of lentil (*Lens culinaris*), chickpea (*Cicer arietinum,L.*), and wheat by a factor of two to five, while increasing the yield of chickpea only. Soil fertilization with Zn had no effect on yield of any crop .During the first season, the primed chickpea seeds failed to emerge at either site, causing complete yield loss, but this negative effect was not observed in the second season with similar priming treatments at nearby sites, and no effect of priming on yield was observed with any other crop in either season.

Kedar *et al.* (2005) in India, studied the effect of farmyard manure (FYM; at 10 t/ha) and *Rhizobium* culture as

seed inoculation under different levels (0, 60, 80 and 100% of the recommended dose of 150 kg/ha) of diammonium phosphate (DAP) on the yield and economics of chickpea cv. KPG-59. *Rhizobium* culture improved the seed yield by 2.44 q/ha (12.55%) over the control.

Khanal *et al.* (2005) showed that chickpea, mung beans, in the Terai and hills of Nepal. Soil analysis showed that the soils were low to medium in boron and zinc with moderately acidic reactions. In chickpeas, soil application of borax at 20 kg ha-1 and zinc sulfate at 14 kg ha-1 gave significantly higher yields over the control treatment.

Rao *et al.* (2005) showed that the effects of mepiquat chloride, potassium nitrate, borax and triacontanol, applied alone or in combination, on flower abortion, pod setting and yield of chickpea were determined in a field experiment conducted in Andhra Pradesh, India. Application of 50 ppm mepiquat chloride, 1.25 ppm triacontanol, 0.2% borax and 1% potassium nitrate resulted in the highest flowers setting, 100-seed weight, biomass at harvest, seed yield and harvest index, and lowest number of aborted flowers.

Ajay *et al.* (2006) reported that seed inoculation and P fertilizer rate (0, 30, 60 or 90 kg P_2O_5/ha through single superphosphate) on the performance of V. mungo cultivars (Pant-U 19, UG 218 and Type 9) were studied in Kangra, Himachal Pradesh, India, they found the biofertilizer inoculation generally improved the yield components. Pooled data showed that biofertilizer inoculation increased the seed yield by 5.5%,

total N uptake by 13.6%, and total P uptake by 16.3% over the control (no inoculation).

Jain *et al.* (2006) conducted that a field experiment in Udaipur, Rajasthan, India, to evaluate the effect of biofertilizers (*Rhizobium* and phosphorus solubilizing bacteria [phosphate solubilizing bacteria], alone and in combination) and P (0, 12.5, 25.0, 37.5 and 50.0 kg P/ha) on chickpea. *Rhizobium* + phosphorus solubilizing bacteria + 50.0 kg P/ha gave the highest grain yield (28.51 q/ha) and straw yield (59.58 q/ha).

Rizk *et al.* (2006) showed that the effect of organic manure, bio- and mineral fertilizers as a total or partial replacement of mineral fertilizers on yield and yield components of faba bean (Vicia faba). Three levels of organic manure (garbage compost) i.e., 0,20 and 40 m^3/fad and six treatments of bio- and mineral fertilizer i.e., zero nitrogen + 15.5 P_2O_5 + 12 K_2O, 15 N + 15.5 P_2O_5 +12 K_2O, zero nitrogen + 7.75 P_2O_5+6 K_2O, 15 N + 7.75 P_2O_5+6 K_2O, phosphorin (biofertilizer) and phosphorin + 12 K_2O, were investigated. The results were obtained by using biofertilizer (phosphorin) as well as the combination of 15 N + 15.5 P_2O_5+12 K_2O/fad.

Singh *et al.* (2006) studied the effect of biofertilizers (*Rhizobium* and/or vesicular arbuscular mycorrhiza (VAM)), NPK fertilizers (75, 100 and 125%) and herbicide application (1 kg a.i. pendimethalin/ha with or without hoeing 40 days after sowing) on the growth and yield of chickpea cv. KPG 59 were determined in a field experiment conducted in Uttar Pradesh, India during the rabi season of 2000-02. The combined application of *Rhizobium* and VAM resulted in the highest

number of pods per plant (25.2), seed yield per plant (6.9 g), test weight (151.7 g) seed yield (1.57), straw yield (3.56), protein content (22%) and net returns (Rs. 11 830). The values of the parameters measured increased with increasing rates of NPK .

Srivastava *et al.* (2006) conducted that in a greenhouse experiment on French bean (cv. Contender-3) inoculated with Rhizobium leguminosarum bv. phaseoli (strain-9R) on nodulation at 40 days after sowing (DAS), shoot and root dry weights, seed and straw yields at maturity, nutrient concentration and uptake at both 40 DAS and maturity. Zinc application, especially at lower and medium N levels, Zn application increased total dry matter, seed yields and average seed weight. Seed yield was significantly affected by N x Zn interaction and the highest seed yield was recorded with 40 mg N + 5 mg Zn/kg treatment combination. Zinc application increased the N concentration and uptake in shoots at 40 DAS and in seed and straw at maturity. Nitrogen application, especially at medium and high rates, decreased Zn concentration and uptake in shoots at 40 DAS and Zn concentration in seeds at maturity.

Jain *et al.* (2007) in India, reported that the effects of Rhizobium leguminosarum, phosphorus at 40 kg/ha and micronutrients, i.e. Zn at 4 kg, Mo at 0.6 kg and B at 0.1 kg/ha, in different combinations, on mung bean cultivars Pusa 105 and Pusa Vishal. The R. leguminosarum inoculation along with application of phosphorus, Zn, Mo and B was found optimum for better enhancement of grain yield and yield attributes (number of pods per plant, pod length and number of grains per pod) of Pusa Vishal compared to Pusa 105 .

Ram *et al.* (2007) reported that application of three biofertilizers viz., phosphate solubilizing bacteria PSB, *Rhizobium* and vesicular arbuscular mycorrhiza (VAM) were tested with five doses of phosphorus viz., 0, 20, 40, 60 and 80 kg/ha. on chickpea. Result showed that VAM produced better growth, yield attributes and yield over rest of the biofertilizers. In terms of margin, VAM gave 7.32 g and 3.58 g more dry matter, 5.70 and 4.43 higher seeds per plant and 1.64 q/ha (9.58%) and 1.42 q/ha (8.19%) higher grain yield than PSB and *Rhizobium*, respectively.

Materials and Methods

MATERIALS AND METHODS

The present investigation was conducted at the Farm of Faculty of Agriculture,AL-Azhar University at Nasr City, Cairo Governorate during the two successive seasons of 2007/2008 and 2008/2009 to study the effect of Biofertilizer and Micro nutrients on growth yield and yield components of some chickpea cultivars (*Cicer arietinum, L.*).

Table (1):Mechanical and chemical analysis of soil at experimental site 2007/2008 and 2008/2009 seasons.

Mechanical analysis	2007/2008 season	2008/2009 season
Sand %	60.4	58.60
Silt %	8.0	7.95
Clay %	31.6	33.45
Textural grade	Sandy loam	Sandy loam
Chemical analysis		
pH	7.8	7.5
E.C. (ds/m)	1.6	1.5
O.M.%	0.90	0.88
AvailableN (mg/kg.soil)	0.96	0.98
Available P (mg/kg.soil)	1.00	0.91
Available K (mg/kg.soil)	0.296	0.298
Available Zn (mg/kg.soil)	0.43	0.60
Available B (mg/kg.soil)	0.42	0.46
Available Fe (mg/kg.soil)	7.6	7.8

The preceding crop was wheat and chickpea followed by fallow in the first and second season ,.Each experiment included 30 treatments, which were the combinations of 2 cultivars,3 treatments of biofertilizer and 5 treatments of micronutrients :

Studied Factors:

A:Cultivars:

1- Giza 1 (big seed)

2- Giza 2 (small seed)

Seeds of two chickpea cultivars were obtained from the Agricultural Research Center at Giza .

B-Biofertilizer treatments:

1- 0.0 biofertilizer.

2- Phosphoren at the rate of 500 gm /fad.

3- Biogen at the rate of 300 gm /fad.

Biogen and/or Phosphoren were mixed with seed at sowing.

Phosphoren and Biogen were obtained from The Unit of Biofertilizer Agric. Res. Center, Giza – Egypt.

C- Micro nutrient treatments:

1-0.0 micro nutrient.

2-100 ppm concentration of Zn as $ZnSO_4$.

3-200 ppm concentration of Zn as $ZnSO_4$.

4-100 ppm concentration of B as $Na_2B_4O_7$.

5-200 ppm concentration of B as $Na_2B_4O_7$.

Micro nutrients treatments were applied as foliar spray after 40 and 60 days from sowing.

The two experiments were planted on Nov.20 in the first season and Nov.15 in the second season .The recommended seed rate of 24 kg/fad was used .Nitrogen fertilizer was added before sowing at the rate of 20 kg N/fad. in the form of ammonium nitrate (33.5% N).Phosphorus was applied before sowing at the rate of 31 kg P_2O_5 /fad., in the form of calcium superphosphate (15.5% P_2O_5). Other normal cultural practices of growing chickpea were followed.

The design of the experiment was a randomized complete block design with three replications. The plot area was 6.0 m^2 and included 4 ridges, which were 2.5 m length and 60 cm width.

Studied attributes:

A- **Growth characters** :

Five plants were randomly selected from inter two ridges of each plot and carefully with rooted at 75 and 105 days after sowing(DAS). From these samples the following data were recorded:

1- Plant height (cm)
2- Number of branches / plant
3- Dry weight of leaves per plant (gm)
4- Dry weight of branches per plant (gm)
5- Total dry weight per plant (gm)
6- Flowering date: Number of days from sowing to 50 % flowering.

B- Yield components :

At harvest (150 days from sowing) five plants were randomly selected from each plot to estimate the following characters.

1- Plant height (cm).
2- Total dry weight per plant (gm).
3- Number of pods per plant.
4- Seed weight per plant (gm).
5- Seed index (Weight of 100- seed, in gm).

C- **Yield per faddan :**

Plants of each plot were harvested, air dried and weighted and calculated per fad. ($4200m^2$) to determine the following characters:

1- Seed yield /fad (kg).
2- Biological yield/fad (kg).
3- Harvest index %.

The harvest index was determind as follows

$$\text{Harvest index \%} = \frac{\text{Seed yield per fad.}}{\text{Biological yield per fad.}} \times 100$$

D- Chemical characters:

1- Seed protein percentage: Nitrogen was determined using the improved Kjeldahps methods of the **A.O.A.C (1970)** modified by distilling the ammonia in to boric acid .protein percentage was calculated by multiplying the nitrogen in the seed by 6.25 for chickpea.

2- Seed carbohydrates % were determined using the colorimetric method described by **Herbert *et al.* (1971).**

Statistical analysis:

Values of L.S.D were obtaimed whenever, the calculated "F" values were significant at 5 % level of probability according to **Snedecor and Cochran (1980).**

Results and Discussion

RESULTS AND DISCUSSION

A. Growth characters:

A. 1. The differences between cultivars:

Results in Table (2) present the average values of plant height (cm.), number of branches per plant, dry weight of branches and leaves per plant, total dry weight per plant at 75 and 105 days after sowing DAS as well as number of days from sowing to 50 % flowering for chick pea cultivars.

All studied characters showed significant differences between chickpea cultivars at 75 and 105 days after sowing DAS, except plant height, dry weight of leaves in the first season ,number and dry weight of branches and total dry weight per plant in the second season at 75 DAS while dry weight of leaves in the second season, total dry weight per plant in both season at 105 DAS. Were insignificant.

The highest value of plant height was recorded by Giza 1 in the second season at 75 and 105 DAS after sowing being 43.28 and 57.77 cm., respectively .

The greatest number of branches per plant was recorded by Giza 1 at 75 and 105 days, being 9.25 and 14.75 cm in the first season , respectively and with Giza 2 being 25.71 cm at 105 DAS in the second season .

The highest mean values for dry weight of leaves /plant was recorded for Giza 2 being 2.31(gm) in the second season at 75DAS and by Giza 1 being 7.09(gm) in the first season at 105 DAS .

Table (2) Growth characters of chickpea cultivars in 2007/2008 and 2008/2009 seasons.

Cultivars	Plant height (cm)		No. of branches/ plant		Dry weight of leaves/plant (gm)		Dry weight of branches/plant (gm)		Total dry weight/plant (gm)		No.of days from sowing to 50%flowering	
	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
	At 75 days from sowing											
Giza 1	33.89	**43.28**	**9.25**	15.73	2.84	2.29	**3.29**	4.36	**6.13**	6.65	**72.40**	**70.93**
Giza 2	34.35	42.06	8.49	15.10	2.52	**2.31**	2.65	4.05	5.17	6.36	74.47	71.13
L.S.D.	N.S	*	*	N.S	N.S	*	*	N.S	*	N.S	*	*
At 105 days from sowing												
Giza 1	54.25	**57.77**	**14.75**	23.15	**7.09**	**7.33**	5.01	**8.95**	12.10	16.28		
Giza 2	**54.91**	56.06	12.79	**25.71**	6.66	6.83	**5.12**	8.77	11.78	15.60		
L.S.D.	*	*	*	*	*	N.S	*	*	N.S	N.S		

S1 : 2007/2008 season . **S2: 2008/2009 season .**

For dry weight of branches per plant, the highest values were achieved by Giza 1 (3.29, gm) at 75DAS and by Giza 2 (5.12 ,gm)at 105 DAS in the first season , and by Giza 1 being 8.95(gm) at 105 DAS in the second season.

Concerning total dry weight per plant, the highest mean values were obtained by Giza 1 being 6.13(gm) at 75 DAS in the first season.

Giza 1 erlier than Giza 2 in flowering being 72.4 and 70.93 day in the first and second seasons, respectively .

Generally, Giza 1 produced greater growth characters than Giza 2. These differences may be due to genetical differences between the two cultivars .These results are in harmony with those obtained by **El-Karamany and Bahr (1999), Hafiz (1999).Yanni et al .(1992),Hegazy et al.(1993).**

A.2. The effect of biofertilizers :

Results presented in Table (3) show the average values of plant height (cm.), number of branches per plant, dry weight of branches and leaves per plant and total dry weight per plant at 75 and 105 days after sowing DAS as well as number of days from sowing to 50 % flowering for chick pea cultivars as affected by biofertilizer treatments in both seasons.

These results indicate that significant differences due to the biofertilizer treatments at 75 and 105 DAS for all growth characters except number of branches / plant at 75 days in the second season , number of branches / plant in both seasons and dry weight of branches per plant in the second season at 105 DAS .

Table (3) Growth characters of chickpea cultivars as affected by biofertilizer treatments in 2007/2008 and 2008/2009 seasons.

Biofertilizer treatment	Plant height (cm)		No.of branches/ plant		Dry weight of leaves/plant (gm)		Dry weight of branches/plant (gm)		Total dry weight/plant (gm)		No.of days from sowing to 50% flowering	
	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
	At 75 days from sowing											
Zero biofert.	33.44	41.07	8.44	14.77	2.39	2.18	2.62	3.82	5.01	6.00	74.33	72.90
Phosphoren	**34.64**	43.03	8.97	15.98	**3.05**	**2.57**	**3.33**	**4.51**	**6.38**	**7.08**	**72.36**	**69.50**
Biogen	34.27	**43.92**	**9.19**	15.49	2.61	2.16	2.98	4.27	5.59	6.43	73.60	70.70
L.S.D.	0.78	1.07	0.45	N.S	0.45	0.19	0.42	0.45	0.5	0.53	1.18	1.18
	At 105 days from sowing											
Zero biofert.	53.67	54.13	13.85	23.83	6.26	6.26	4.89	8.37	11.15	14.63		
Phosphoren	**55.77**	57.50	14.18	25.56	**7.32**	**7.50**	**5.51**	8.86	**12.83**	16.36		
Biogen	54.30	**59.13**	13.29	23.90	7.05	7.49	4.79	9.34	11.84	**16.83**		
L.S.D.	1.66	1.24	N.S	N.S	0.5	0.70	0.59	N.S	0.64	1.16		

biofert. refer to Biofertilizer

S1 : 2007/2008 season . S2: 2008/2009 season

Results indicate that the tallest chickpea plants were recorded by phosphoren being 34.64 (cm.) in the first season and by biogen being 43.92(cm.) in the second season, at 75 DAS. Also the tallest plants were recorded by phosphoren being 55.77(cm) in the first season and with biogen being 59.13(cm.) in the second season at 105 DAS .

The greatest number of branches per plant was recorded by biogen being 9.19, and without significant differences phosphoren at 75 days in the first season .

The highest dry weight of leaves /plant were 3.05 and 2.57 (gm) at 75 DAS and 7.32 and 7.50 (gm) at 105 DAS in the first and second seasons, respectively which were obtained by phosphoren .

Regarding dry weight of branches per plant, phosphoren gave the highest value 3.33 and 4.51(gm) at 75 days in the first and second seasons, respectively, as well as 5.51 (gm) at 105 days in the first season.

For total dry weight per plant ,the highest response were achieved by phosphoren being 6.38 and 7.08 at 75 DAS in the first and second seasons, respectively, and with phosphoren (12.83) and biogen (16.83) at 105 DAS in the first and second seasons, respectively.

In general, it can be concluded that applying biofertilizers,especially phosphoren positively enhanced chickpea growth and that is clear in all studied characters, due to their effect on increasing the capacity of chickpea plants to accumulate dry matter and favors cell division and expansion .These results are in harmony with those obtained by **Rodalas et al. (1998),**

Kabesh et al. (1987), Mehasen and El-Ghozoli (2003), Menaria et al. (2003) and Ram et al. (2007) they found that VAM produced better growth, yield attributes and yield over rest of the biofertilizers. In terms of margin.

The lowest number of days after sowing was recorded by phosphoren being 72.36 and 69.50 in the first and second seasons, respectively .

A.3. The effect of micronutrients:

Table (4) present the average values of plant height (cm.), number of branches, dry weight of branches and leaves per plant (gm), total dry weight per plant(gm) at 75 and 105 DAS as well as number of days from sowing to 50 % flowering as affected by micronutrient treatments in both seasons.

All studied characters showed significant differences due to micronutrients treatments at 75 and 105 DAS for all growth characters except dry weight of branches per plant at 75 DAS in the second season and at 105 DAS in both seasons and total dry weight per plant in the second season at 105 days.

From Table (4) it is clear that the tallest plant at 75 DAS was recorded by 200 ppm boron in the first season and with 100 ppm Zn in the second season.

At 105 DAS the tallest plant was obtained by 100 ppm boron in the first season (56.58 cm) and by 200 ppm Zn (58.88 cm) in the second season.

Concerning number of branches per plant, 100 ppm Zn gave the highest value at 75 and 105 DAS in the first season. In the second season results indicate that adding 200 ppm boron and

Table (4) Growth characters of chickpea cultivars as affected by micronutrient in 2007/2008 and 2008/2009 seasons.

Micro nutrient treatment (ppm)	Plant height (cm)		No.of branches/ plant		Dry weight of leaves/plant (gm)		Dry weight of branches/plant (gm)		Total dry weight/ plant (gm)		No.of days from sowing to 50% flowering	
	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
	At 75 days from sowing											
Zero Micro.	33.79	41.18	8.38	12.98	2.67	1.97	2.35	4.06	5.02	6.03	76.4	72.33
100 Zn	34.02	**43.90**	**9.46**	16.94	2.70	**2.74**	3.18	4.68	5.88	**7.42**	71.44	68.66
200 Zn	32.98	43.31	8.88	14.06	**2.87**	2.05	2.93	3.86	5.80	5.91	**70.50**	**68.00**
100 boron	34.86	41.84	9.04	15.71	2.62	2.17	**3.61**	4.15	**6.23**	6.32	74.83	73.00
200 boron	**34.93**	43.14	8.57	**17.36**	2.54	2.56	2.80	4.25	5.34	6.81	74.00	73.16
L.S.D.	1.01	1.38	0.59	1.69	0.32	0.25	0.53	N.S	0.67	0.7	1.52	1.52
	At 105 days from sowing											
Zero Micro.	53.05	55.22	11.96	21.38	5.73	6.95	4.41	8.05	10.14	15.00		
100 Zn	55.92	58.55	**15.22**	24.05	**7.42**	**7.53**	5.34	9.52	**12.76**	17.05		
200 Zn	53.61	**58.88**	13.40	23.88	7.08	7.03	5.08	8.86	12.16	15.89		
100 boron	**56.68**	58.11	14.25	26.55	7.35	7.18	5.39	9.13	12.74	16.31		
200 boron	55.14	53.83	14.02	**26.27**	6.80	6.73	5.08	8.73	11.88	15.46		
L.S.D.	2.14	1.6	1.29	2.79	0.67	0.79	N.S	N.S	0.85	N.S		

Micro. refer to Micronutrient

S1: 2007/2008 season . S2: 2008/2009 season

100 ppm significantly increased the number of branches per plant at 75 and 105 DAS respectively .

Regarding dry weight of leaves/plant, results indicate that Zn 100 ppm gave the highest values at 75 DAS in the second season, and at 105 DAS in both seasons. While in the first season at 75 DAS, Zn 200 ppm gave the highest value.

The highest mean values for dry weight of branches /plant was recorded by boron 100 ppm at 75 DAS in the first season.

For total dry weight per plant, the highest response were achieved by Zn 100 ppm at 75 DAS in the second season and at 105 DAS in the first season. While, at 75 DAS in the first season, boron 100 ppm gave the highest value without significant difference from those of Zn 100 ppm.

The lowest number of days after sowing was recorded by Zn 200 ppm being 70.5 and 68.0 in the first and second seasons, respectively.

The observed increase in plant growth of chickpea due to Zn and boron application is possibly because Zn is essential for photosynthetic pigments formation, while boron application is possibly because it is essential for building up protoplasm and proteins which induce cell division and initiate meristematic activity. This effect resulted in an increase in number size of cell with an overall increase in plant growth.

The good effect of micronutrients on plant height my be due to the important function of Zn and Boron in plant metabolism especially in chlorophyll synthesis, photosynthesis, activation of different enzymes and finally in phytohormone regulation. These results are confirmed with those obtained **by Abd-El-Aziz and**

Anton (1999) and Nassar et al. (2002) they found The highest values for these parameters were obtained with the simultaneous application of the 3 micronutrients. Fe produced the highest photosynthetic pigment content in plants, followed by Zn, while the lowest content was obtained with Mn.

A.4.Interaction effects:

A.4.1. Interaction effect between cultivars and biofertilizer treatments:

Results present in Table (5) show the average values of plant height, number of branches, dry weight of branches and leaves per plant , total dry weight per plant at 75 and 105 DAS as well as number of days from sowing to 50 % flowering as affected by interaction between chick pea cultivars and biofertilizer treatments .

These results indicate that significant differences due to the interaction effect between chickpea cultivars and biofertilizers at 75 and 105 DAS on growth characters , except plant height in the first season and number of branches/ plant in the second season at 75 DAS and number of days from sowing to 50 % flowering in both seasons where average dry weight of branches/ plant at 105 DAS in the first season.

The tallest plant (44.10, cm) recorded by Giza 2 with biogen without significant difference from those of Giza 1 with phosphoren (43.88) at 75 DAS in the second season . At 105 DAS, Giza 2 with phosphoren and Giza 1 with biogen recorded the highest values in first and second seasons, respectively.

Table (5) Growth characters affected by the interaction effect between cultivars and biofertilizers in 2007/2008 and 2008/2009 seasons.

Cultiv. X Bio.		Plant height(cm)		No.of branches/plant		Dry weight of leaves/plant (gm)		Dry weight of branches/ plant (gm)		Total dry weight/plant (gm)		No.of days from sowing to 50%flowering	
		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
		At 75 days from sowing											
Giza1	Zero biofert.	33.53	42.23	8.77	15.41	2.42	2.01	2.92	3.68	5.34	5.69	73.86	72.20
	Phospho.	34.08	43.88	9.02	15.12	2.94	**2.72**	3.31	**5.41**	6.25	**8.13**	71.33	70.20
	Biogen	34.07	43.74	**9.95**	15.18	**3.16**	2.12	3.64	3.98	**6.80**	6.1	72.00	70.40
Giza2	Zero biofert.	33.42	39.92	8.11	14.14	2.06	2.34	2.32	3.95	4.38	6.29	74.80	73.60
	Phospho.	35.21	42.18	8.92	15.30	3.15	2.41	**3.33**	3.61	6.48	6.02	73.00	68.80
	Biogen	34.47	**44.10**	8.44	15.86	2.35	2.19	2.31	4.56	4.66	6.75	75.20	71.00
L.S.D.		N.S	1.52	0.64	N.S	0.64	0.28	0.59	0.64	0.73	0.76	N.S	N.S
		At 105 days from sowing											
Giza1	Zero biofert.	53.38	55.13	13.92	23.8	6.03	6.33	4.95	8.49	10.99	14.82		
	Phospho.	**54.75**	55.73	**15.36**	22.26	7.29	7.19	5.03	7.92	12.32	15.11		
	Biogen	54.62	**62.46**	14.97	23.40	**7.96**	**8.47**	5.04	**10.43**	13.00	**18.92**		
Giza2	Zero biofert.	53.95	53.13	12.65	24.00	6.14	6.19	4.54	8.26	10.68	14.45		
	Phospho.	56.78	59.26	13.00	**28.86**	7.35	7.81	5.98	9.80	**13.34**	17.61		
	Biogen	53.99	55.80	12.72	24.26	6.50	6.50	4.83	8.25	11.33	14.75		
L.S.D.		2.34	1.74	1.41	3.07	0.73	1.01	N.S	1.13	0.93	1.64		

Cultiv. refer to cultivar
S1 : 2007/2008 season .

biofert. refer to Biofertilizer.
S2: 2008/2009 season

The results suggest that biofertilizers had an stimulating influence on elongation as well as cell division which in turn increased plant height.

For number of branches per plant ,the highest response values (9.95) were achieved by Giza 1 with biogen and without significant superiovity than those of Giza 1 with phosphoren (9.02) at 75 DAS in the first season, whereas the highest response were recorded by Giza 1 X phosphoren (15.36) and Giza 2 with phosphoren (28.86) at 105 days in the first and second seasons, respectively .

Concerning dry weight of leaves per plant , in the first season Giza 1 X biogen gave the highest values 3.16 and 7.96 gm at 75 and 105 DAS while in the second season, Giza 1 X phosphoren 2.72 gm at 75 DAS and Giza 1 X biogen 8.47 gm at 105 DAS produced the highest value .

As to the dry weight of branches per plant, Giza 1 with biogen and phosphoren at 75 DAS had the highest value in the first and second seasons, respectively .At 105 DAS Giza 1 with biogen recorded the highest values in the second season.

For total dry weight per plant, the highest values were achieved by Giza 1 with biogen (6.80) and phosphoren (8.13) at 75 days in the first and second seasons, respectively. At 105 DAS Giza 2 with phosphoren (13.34) and Giza 1 with biogen (18.92) gave the highest total dry weight in the first and second seasons,respectively.

In conclusion, Giza 1 variety showed higher response to biofertilizer than Giza 2 .It was also evident that biofertilizer may

be essential for building up plant organs in chickpea grown under Egyptian condition.

A.4.2.Interaction between cultivars and micronutrients treatments:

Results in Table (6) present the average values of plant height (cm.), number of branches, dry weight of branches and leaves per plant (gm) , total dry weight per plant(gm) at 75 and 105 DAS as well as number of days from sowing to 50 % flowering as affected by interaction between chick pea cultivars and micronutrient treatments .

All studied growth characters showed significant differences due to the interaction effect between chickpea cultivars and micronutrients at 75 and 105 DAS except dry weight of leaves and branches per plant in both seasons and total dry weight per plant in the first season at 75 DAS as well as dry weight of branches per plant at 105 DAS in the second season.

With regard to plant height, Giza 2 with boron 100 ppm (35.62, cm) and Giza 1 with Zn 100 ppm (44.26,cm) at 75 DAS gave the highest values in the first and second seasons, respectively. Whereas Giza 1 with Zn 100 ppm and Zn 200 ppm at 105 DAS gave the highest values (58.97cm) and (60.33, cm) in the first and second seasons, respectively .

The good effect of micronutrients on plant height my be due to the important function of Zn and Boron in plant metabolism especially in chlorophyll synthesis ,photosynthesis ,activation of different enzymes and finally in phytohormone regulation .These results are in harmony with those obtained by **Abd-El Gawad et al. (1993) and Misra et al. (2002) .**

Table (6) Growth characters affected by the interaction effects between cultivars and micronutrients in 2007/2008 and 2008/2009 seasons.

Cultiv.XMicro.(ppm)		Plant height(cm)		No.of branches/plant		Dry weight of leaves/ plant (gm)		Dry weight of branches/plant (gm)		Total dry weight/plant (gm)		No.of days from sowing to 50%flowering	
		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
		At 75 days from sowing											
Giza1	Zero Micro.	33.20	41.13	8.33	12.15	2.57	2.07	2.24	3.77	4.81	5.84	75.77	72.00
	100 Zn	34.86	44.26	10.75	19.41	3.09	2.75	3.66	4.83	6.75	7.58	71.22	68.66
	200 Zn	32.97	44.07	9.52	13.74	3.33	1.95	3.51	4.41	6.84	6.36	70.33	67.66
	100 boron	34.10	43.84	8.90	15.90	2.48	2.26	3.81	4.55	6.29	6.82	73.66	73.33
	200 boron	34.33	43.12	8.74	17.44	2.75	2.41	3.25	4.23	6.00	6.64	71.00	73.00
Giza2	Zero Micro.	34.38	42.55	8.44	13.82	2.77	1.86	2.47	3.71	5.24	5.57	77.0	72.66
	100 Zn	33.18	43.53	8.07	14.47	2.31	2.74	2.70	4.53	5.10	7.27	71.66	68.66
	200 Zn	33.00	42.55	8.16	14.38	2.42	2.16	2.35	3.95	4.77	6.12	70.66	68.33
	100 boron	35.62	38.53	8.24	15.53	2.76	2.08	3.41	3.74	6.17	5.82	76.00	72.66
	200 boron	35.53	43.16	8.41	17.28	2.33	2.72	2.34	4.28	5.34	7.02	77.00	73.33
L.S.D.		1.43	1.97	0.81	2.39	N.S	N.S	N.S	N.S	0.95	N.S	2.14	2.17
		At 105 days from sowing											
Giza1	Zero Micro.	52.92	54.66	12.31	22.77	5.15	7.65	4.14	8.64	9.29	16.29		
	100 Zn	58.97	59.88	17.87	25.33	7.50	8.56	5.72	10.07	13.22	18.63		
	200 Zn	50.96	60.33	14.64	23.44	8.25	7.11	5.12	9.40	13.38	16.51		
	100 boron	54.97	57.33	15.47	23.77	7.48	6.90	5.13	8.72	12.61	15.62		
	200 boron	53.42	56.66	13.46	19.44	7.09	6.45	4.93	7.92	12.03	14.37		
Giza2	Zero Micro.	53.19	53.77	11.62	23.77	6.31	6.25	4.68	8.18	10.99	14.43		
	100 Zn	52.87	57.22	12.57	24.33	7.34	6.49	4.97	8.97	12.31	15.46		
	200 Zn	53.22	57.44	12.15	29.33	5.92	6.96	5.05	8.33	10.98	15.29		
	100 boron	58.40	58.88	13.03	28.77	7.22	7.46	5.67	9.55	12.89	17.01		
	200 boron	56.86	53.00	14.57	23.33	6.52	7.01	5.23	8.82	11.75	15.83		
L.S.D.		3.04	2.25	1.83	2.95	0.96	1.29	1.1	N.S	1.21	2.05		

Cultiv. refer to cultivar
S1 : 2007/2008 season .
Micro. refer to Micronutrient
S2: 2008/2009 season

For number of branches per plant ,the highest values 10.75 and 19.41 were achieved by Giza 1 with Zn 100 ppm at 75 DAS in the first and second seasons ,respectively. While Giza 1 X Zn 100 ppm and Giza 2 X Zn 200 ppm recorded the highest values,(17.87) and (29.33) at 105 DAS in the first and second seasons .respectively .

The highest mean values for dry weight of leaves /plant was recorded by Giza 1 with Zn 100 ppm and 200 ppm being (3.33, gm) and (2.75,gm) at 75 DAS in the first and second seasons, respectively. At 105 DAS Giza 1 with Zn 100ppm and 200 ppm gave the highest values being (8.25,gm) and (8.56,gm) in the first and second seasons respectively.

Giza 1 with Zn 100 ppm had the highest value for dry weight of branches per plant (5.72 gm) at 105 DAS in the first season .

For total dry weight per plant ,the highest value achieved by Giza 1 with Zn 200 ppm and 100 ppm were 6.84 and 7.58 gm at 75 DAS in the first and second seasons, respectively. At 105 DAS Giza 1 with Zn 200 ppm and 100 ppm had the highest total dry weight per plant were 13.38 and 18.63 gm in the first and second seasons, respectively .

The lowest number of days from sowing to 50 % flowering was recorded by Giza 1 with Zn 200 ppm being 70.33 and 67.66 in the first and second seasons, respectively.

Generally, it could be concluded that under the conditions of the experiments, Giza 1 cultivar showed higher response to microelements compared with Giza 2.

A.4.3. Interaction between biofertilizers and micronutrient treatments:

I. At 75 days after sowing:

Results present in Table (7) show the average values of plant height, number of branches/ plant , dry weight of branches and leaves per plant , total dry weight per plant as well as number of days from sowing to 50 % flowering at 75 DAS as affected by interaction between biofertilizer and micronutrients.

These results indicate that significant differences due to the interaction between the two factors at 75 DAS for all growth characters ,except number of days from sowing to 50 % flowering in both seasons .

The tallest plant was 36.00 and 47.13 cm due to biogen with boron 100 ppm and zero micronutrients in the first and second seasons ,respectively .

For number of branches per plant ,the highest values 10.55 and 20.60 were achieved by phosphoren with zero micro in the first and second seasons ,respectively.

As to the dry weight of leaves /plant, phosphoren with zero micro produced the highest weight (3.91 and 3.59 gm in the first and second seasons respectively. The highest mean values for dry weight of branches / plant (3.82 gm) was recorded by phosphoren with Zn (200 ppm) in the first season and by phosphoren with zero micronutrient (5.70 gm) in the second season.

For total dry weight per plant, the highest values were achieved by phosphoren with zero micronutrient being 7.55 and 9.29 in the first and second seasons, respectively.

Table (7) Growth characters affected by the interaction between biofertilizers and micronutrients at 75 days from sowing in 2007/2008 and 2008/2009 seasons.

Biofert. X Micro.(ppm)		Plant height(cm)		No.of branches/plant		Dry weight of leaves/plant (gm)		Dry weight of branches/plant (gm)		Total dry weight/ plant (gm)		No.of days from sowing to 50%flowering	
		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
Phospho.	Zero micro.	34.60	47.13	10.55	20.60	3.91	3.59	3.64	5.70	7.55	9.29	70.83	66.50
	100 Zn	32.46	39.46	8.83	11.58	2.96	1.84	3.32	2.84	6.29	4.68	69.50	65.50
	200 Zn	35.40	41.20	8.55	16.58	2.75	2.26	3.82	4.89	6.57	7.15	73.50	72.00
	100 boron	35.73	42.78	8.2	18.83	3.02	3.23	3.11	4.31	6.13	7.54	72.50	72.50
	200 boron	35.03	44.58	8.73	12.31	2.60	1.91	2.72	4.81	5.33	6.72	75.50	71.00
Biogen	Zero micro.	34.00	44.48	9.45	16.98	1.69	2.21	3.09	4.02	4.79	6.23	71.00	69.50
	100 Zn	33.60	44.55	9.18	16.78	2.83	2.20	2.51	4.75	5.34	6.95	71.00	68.50
	200 Zn	33.31	41.88	8.65	13.28	2.14	2.03	3.6	3.60	5.74	5.63	76.50	72.50
	100 boron	36.00	42.90	9.23	13.43	2.87	1.99	3.03	3.93	5.90	5.92	74.50	72.50
	200 boron	34.45	45.81	9.47	16.96	3.53	2.35	2.65	5.05	6.18	7.40	75.00	70.50
Zero biofert.	Zero micro.	33.48	40.08	8.38	13.25	2.50	2.43	2.82	4.31	5.32	6.74	72.50	70.00
	100 Zn	32.90	45.93	8.63	13.83	2.83	2.13	2.95	4.00	5.78	6.13	71.00	70.00
	200 Zn	35.86	40.48	9.93	17.28	2.98	2.24	3.40	3.96	6.38	6.20	74.50	74.50
	100 boron	33.06	43.75	8.3	19.83	1.74	2.46	2.24	4.51	3.98	6.97	75.00	74.50
	200 boron	31.9	35.13	6.97	9.68	1.88	1.64	1.68	2.31	3.56	3.95	78.66	75.50
L.S.D.		1.74	2.42	1.01	2.93	1.01	0.45	096	1.04	1.18	1.21	N.S	N.S

Micro. refer to Micronutrient biofert. refer to Biofertilizer

S1 : 2007/2008 season . S2: 2008/2009 season

II At 105 days after sowing:

Table (8) show that the average values of plant height, number of branches/plant, dry weight of branches and leaves per plant, total dry weight per plant as affected by interaction between biofertilizer and micronutrients treatments at 105 DAS in both seasons.

All studied characters showed significant differences due to the interaction effect between the two factors at 105 DAS in both seasons, except dry weight of branches/plant in the first season.

The tallest plant (59.26 and 65.33 cm) recorded by adding zero biofert. with Zn 200 ppm in the first season and biogen with zero micronutrient in the second season, respectively.

For number of branches per plant, the highest values were achieved by zero biofertilizer with zero micro.in the first season (17.15) and with Zn 200 ppm (30.66) in the second season.

With regard to in the first season the highest mean value for dry weight of leaves /plant, was recorded by phosphoren with Zn 200 ppm followed by phosphoren with boron 100 ppm being 7.86 gm, while in the second season biogen with Zn 100 ppm gave the highest value 8.79 gm .

With regard to dry weight of branches /plant, the highest value (10.58 gm) was obtained by adding biogen with zero micronutrient in the second season.

For total dry weight per plant, the highest values were achieved by phosphoren with zero micronutrient (14.25gm) and by biogen with boron 200 ppm (19.01) in the first and second seasons, respectively.

Table (8) Growth characters affected by the interaction effect between biofertilizers and micro nutrients at 105 days from sowing in 2007/2008 and 2008/2009 seasons.

Biofert. X Micro.(ppm)		Plant height(cm)		No.of branches/plant		Dry weight of leaves/plant (gm)		Dry weight of branches/plant (gm)		Total dry weight/ plant (gm)	
		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
Phospho.	Zero micro.	**58.76**	60.33	**16.23**	28.66	7.78	7.74	6.47	9.51	**14.25**	17.25
	100 Zn	51.78	54.66	14.66	20.66	7.51	6.18	4.91	7.63	12.42	13.81
	200 Zn	55.26	59.83	14.21	27.16	**7.86**	8.05	5.45	9.27	13.31	18.32
	100 boron	56.01	53.33	12.90	30.33	**7.86**	8.37	5.34	10.4	13.20	18.77
	200 boron	57.01	59.33	12.90	21.00	5.60	7.17	5.38	7.5	10.98	14.67
Biogen	Zero micro.	54.70	**65.33**	12.30	22.83	6.83	8.31	4.34	**10.58**	11.17	**18.89**
	100 Zn	50.16	59.33	12.60	26.50	7.15	**8.79**	5.16	9.4	12.31	18.19
	200 Zn	55.53	58.83	13.51	21.83	7.40	5.78	5.15	9.28	12.55	15.06
	100 boron	55.46	51.83	15.33	21.33	6.74	5.82	5.19	7.17	11.93	12.99
	200 boron	55.66	60.33	12.70	26.66	7.12	8.73	4.11	10.28	11.23	19.01
Zero biofert.	Zero micro.	54.31	50.00	17.15	20.66	7.64	6.54	5.22	8.47	12.86	15.01
	100 Zn	54.33	62.66	12.93	24.50	6.60	6.13	5.19	9.56	11.79	15.69
	200 Zn	59.26	55.66	15.03	**30.66**	6.78	7.70	5.60	8.86	12.38	16.56
	100 boron	53.95	56.33	13.83	27.16	5.81	5.99	4.70	8.57	10.51	14.56
	200 boron	46.48	46.00	10.30	16.50	4.48	4.96	3.74	6.42	8.22	11.38
L.S.D.		3.72	2.76	2.23	4.85	1.16	1.60	N.S	1.8	1.5	2.59

biofert. refer to Biofertilizer
S1 : 2007/2008 season .

Micro. refer to Micronutrient
S2: 2008/2009 season .

It could be concluded that the interaction between biofertilizer and microelements at 75 DAS indicated that phosphoren acted independently on affecting growth characters .In other words, the effect of biofertilizer was not influenced by microelement. Also, it is clear that no definite trend could be detected for the effect of interaction between biofertilizers and microelements at 105 DAS.

A.4.4. Interaction between cultivars, biofertilizers and micronutrients treatments:

I. At 75 days after sowing:

Results in Table (9) present the average values of plant height, number of branches/plant, dry weight of branches and leaves per plant, total dry weight per plant as well as number of days from sowing to 50 % flowering as affected by interaction among cultivar, biofertilizers and micronutrient treatments :

These results indicate that significant differences due to the interaction between the three factors at 75 DAS in both seasons, except plant height, number of branches/ plant and number of days from sowing to 50 % flowering in the first season.

As for plant height, Giza 1 with phosphoren under Zn 100 ppm had the highest value in the second season which was 49.10 cm.

The highest number of branches per plant produced by Giza 1 with phosphoren under Zn 100 ppm which was 22.86 in the second season.

With respect to dry weight of leaves /plant Giza 2 with phosphoren under Zn 100ppm gave the highest weights which

Table (9) Interaction between cultivars, biofertilizers and micronutrients at 75 days from sowing in 2007/2008 and 2008/2009 seasons.

Cultiv. x Biofert .x Micro.(ppm)			Plant height(cm)		No.of branches/plant		Dry weight of leaves/plant(gm)		Dry weight of branches/plant(gm)		Total dry weight/plant(gm)		No.of days from sowing to 50%flowering	
			S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
Giza 1	Phospho	Zero micro.	32.73	44.26	7.9	12.76	2.18	2.36	1.80	6.83	3.98	9.19	75.00	71.00
		100 Zn	35.13	49.10	11.86	22.86	3.85	3.48	3.87	5.74	7.72	9.22	70.66	67.00
		200 Zn	32.53	41.26	9.46	12.83	3.92	1.68	4.18	2.68	8.11	4.37	70.00	66.00
		100boron	34.73	42.60	7.8	16.13	2.08	2.42	3.42	6.38	5.50	8.81	73.0	74.00
		200 boron	35.26	42.20	8.03	18.7	2.67	3.66	3.30	5.43	5.97	9.10	68.00	73.00
	Biogen	Zero micro.	35.13	44.36	9.8	13.86	3.31	2.23	3.22	4.10	6.53	6.33	74.00	70.00
		100 Zn	34.93	44.53	10.6	20.7	2.32	2.80	3.43	4.91	5.75	7.71	70.00	69.00
		200 Zn	33.33	45.86	9.9	15.36	3.69	2.36	3.38	5.00	7.07	7.36	69.0	68.00
		100 boron	32.30	44.43	9.5	11.56	2.63	1.73	3.99	2.96	7.63	4.70	76.00	72.00
		200boron	34.66	39.53	9.9	14.1	3.86	1.50	4.18	2.93	8.04	4.43	71.00	73.00
	Zero biofert.	Zero micro.	31.73	34.76	7.2	9.83	2.2	1.6	1.70	2.30	3. 9	3.90	78.33	75.0
		100 Zn	34.53	39.16	9.8	14.66	3.11	1.96	3.67	3.83	6.79	5.80	73.00	70.00
		200 Zn	33.06	45.10	9.2	13.03	2.37	1.80	2.97	3.63	5.34	5.43	72.00	69.00
		100 boron	35.26	44.50	9.4	20.00	2.69	2.64	4.02	4.32	6.71	6.96	72.00	74.00
		200 boron	33.06	47.63	8.26	19.53	1.73	2.06	2.27	4.33	4.00	6.40	74.00	73.00
Giza 2	Phospho.	Zero micro.	37.33	44.9	9.5	11.86	3.03	1.46	3.65	2.80	6.68	4.27	76.0	71.00
		100 Zn	34.06	45.16	9.23	18.33	3.98	3.70	3.40	5.66	7.39	9.36	71.00	66.00
		200 Zn	32.40	37.66	8.2	10.33	2.00	2.00	2.46	3.0	4.47	5.00	69.0	65.00
		100 boron	36.06	39.80	9.30	17.03	3.38	2.10	4.23	3.40	7.62	5.50	74.00	70.00
		200boron	36.20	43.36	8.36	18.96	3.36	2.80	2.93	3.20	6.30	6.00	77.00	72.00
	Biogen	Zero micro.	33.76	47.26	9.10	20.07	3.76	2.46	2.08	6.00	5.84	8.46	76.0	71.00
		100 Zn	33.06	44.43	8.30	13.26	1.07	1.63	2.75	3.13	3.82	4.76	72.00	70.00
		200 Zn	33.86	43.23	8.46	18.20	1.96	2.03	1.64	4.50	3.60	6.53	73.00	69.00
		100 boron	34.33	39.33	7.80	15.00	1.64	2.33	3.23	4.24	4.87	6.57	77.00	73.00
		200 boron	37.33	46.26	8.53	12.76	1.88	2.49	1.89	4.94	3.77	7.45	78.0	72.00
	Zero biofert.	Zero micro.	32.06	35.50	6.73	9.53	1.54	1.67	1.67	2.33	3.21	4.00	79.00	76.00
		100 Zn	32.43	41.00	6.96	11.83	1.90	2.90	1.96	4.80	3.86	7.70	72.00	70.0
		200 Zn	32.73	46.76	8.06	14.63	3.29	2.46	2.94	4.36	6.24	6.83	70.0	71.00
		100 boron	36.46	36.46	10.46	14.56	3.27	1.83	2.77	3.60	6.05	5.43	77.0	75.00
		200 boron	33.06	39.86	8.33	20.13	1.75	2.86	2.22	4.70	3.97	7.56	76.00	76.00
L.S.D.			N.S	3.41	N.S	4.14	1.43	0.64	1.35	1.49	1.66	1.72	N.S	3.78

Cultiv. refer to cultivar
S1 : 2007/2008 season .

biofert. refer to Biofertilizer Micro. refer to Micronutrient
S2: 2008/2009 season

were 3.98 and 3.70 gm, in the first and second seasons, respectively.

The highest values of dry weight of branches /plant were recorded by Giza 2 under phosphoren and boron 100 ppm (4.23 gm) in the first season and by Giza 1 with phosphoren under zero micronutrient (6.83 gm) in the second season.

For total dry weight per plant, the highest values were achieved by Giza 1 with phosphoren under Zn 200 ppm (8.11 gm) and by Giza 2 with phosphoren with Zn 100 ppm (9.36 gm) in the first and second seasons ,respectively.

The lowest number of days after sowing to 50 % flowering was recorded by Giza 2 with phosphoren under Zn 200 ppm being 65.00 in the second season.

II. At 105 days after sowing:

Results in Table (10) present the average values of plant height (cm), number of branches/plant, dry weight of branches and leaves per plant, total dry weight per plant at 105 days as affected by interaction between the three factors.

All studied characters showed significant differences due to the interaction effect among cultivars, biofertilizer and micronutrient treatments at 105 days in both seasons, except plant height in the first season and dry weight of branches/plant in both seasons.

The highest plant height recorded by Giza 1 with biogen under Zn 200 ppm (68.66 cm) or boron 100 ppm (67.00cm.) followed by Giza 2 under phosphoren with boron 100 ppm

Table (10) Interaction effect between cultivars, biofertilizers and micronutrients at 105 days from sowing in 2007/2008 and 2008/2009 seasons.

Cultiv. x Biofert.x Micro.(ppm)			Plant height(cm)		No.of branches/plant		Dry weight of leaves/plant(gm)		Dry weight of branches/plant(gm)		Total dry weight/plant(gm)	
			S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
Giza1	Phospho.	Zero micro.	56.23	60.33	13.20	18.00	4.25	7.09	4.73	6.94	8.98	14.03
		100 Zn	61.86	61.00	19.60	28.00	7.19	7.64	6.86	7.95	14.05	15.59
		200 Zn	51.23	52.00	15.66	19.00	9.42	5.89	4.80	7.19	14.22	13.08
		100 boron	51.13	52.00	15.96	23.33	7.78	7.41	4.58	8.02	12.36	15.43
		200boron	53.30	53.33	12.40	23.00	7.83	7.92	4.20	9.52	12.03	17.44
	Biogen	Zero micro.	55.50	63.66	13.33	24.66	7.30	11.03	4.21	10.89	11.51	21.93
		100 Zn	57.53	64.33	13.93	25.66	7.17	11.04	4.09	13.34	11.26	24.38
		200 Zn	51.20	68.66	14.20	25.33	8.90	8.94	5.55	11.21	14.45	20.15
		100 boron	55.33	67.00	14.36	20.00	8.16	5.14	5.47	9.43	13.63	14.57
		200 boron	53.53	48.66	13.80	21.33	8.26	7.22	5.90	7.30	14.16	14.52
	Zero biofert.	Zero micro.	47.03	46.00	10.40	15.66	3.90	4.83	3.48	5.92	7.38	10.75
		100 Zn	57.53	50.00	20.10	22.33	8.15	6.99	6.23	8.92	14.38	15.91
		200 Zn	50.46	64.66	14.06	26.00	6.42	6.51	5.02	9.80	11.44	16.31
		100 born	58.46	53.00	16.10	28.00	6.50	8.14	5.33	8.71	11.83	16.85
		200 born	53.43	62.00	14.20	27.00	5.17	5.20	4.69	9.10	9.86	14.30
Gizaa 2	Phospho	Zero micro.	57.80	58.33	12.60	24.00	6.95	7.25	6.03	7.97	12.98	15.22
		100 Zn	55.66	59.66	12.86	29.33	8.37	7.83	6.08	11.08	14.45	18.91
		200 Zn	52.33	57.33	13.66	22.33	5.61	6.48	5.02	8.08	10.63	14.56
		100 boron	59.40	67.66	12.46	31.00	7.95	8.69	6.31	10.52	14.26	19.21
		200 boron	58.73	53.33	13.40	37.66	7.89	8.82	6.48	11.35	14.37	20.17
	Biogen	Zero micro.	55.83	57.00	12.06	28.66	6.94	6.43	4.03	9.67	10.97	16.10
		100 Zn	51.86	62.00	10.66	20.00	6.50	5.58	4.6	7.82	11.10	13.40
		200 Zn	49.13	54.33	11.00	27.66	5.39	8.65	4.77	7.58	10.17	16.23
		100 born	55.73	50.66	12.66	23.66	6.64	6.42	4.83	9.14	11.47	15.56
		200 born	57.40	55.0	16.86	21.33	5.22	5.42	4.49	7.05	9.71	12.47
	Zero biofert.	Zero micro.	45.93	46.00	10.20	17.33	5.06	5.08	4.00	6.91	9.06	11.99
		100 Zn	51.10	50.00	14.20	19.00	7.14	6.08	5.36	8.01	12.5	14.10
		200 Zn	58.20	60.66	11.80	23.0	6.78	5.74	5.87	9.33	12.65	15.07
		100 boron	60.06	58.33	13.96	33.33	7.07	7.26	4.73	9.00	11.80	16.26
		200 boron	54.46	50.66	13.46	27.33	6.45	6.79	4.72	8.05	11.17	14.84
L.S.D.			N.S	3.92	3.16	6.88	1.66	2.48	N.S	N.S	2.12	3.67

Cultiv. refer to cultivar biofert. refer to Biofertilizer Micro. refer to Micronutrient
S1 : 2007/2008 season . S2: 2008/2009 season

(67.66cm.) in the second season , but the differences between these treatments were not significant .

For number of branches per plant, in the first season the highest value was achieved by Giza 1 with zero biofertilizer. Under Zn 100 ppm (20.10), followed by Giza 1 under phosphoren with Zn 100 ppm (19.60), both values were statistically the same: In the second season, Giza 2 under phosphoren with boron 200 ppm recorded the highest value (37.66).

The highest mean values for dry weight of leaves /plant was recorded by Giza 1 with phosphoren under Zn 200ppm (9.42 gm) and by Giza 1 with biogen under Zn 100ppm (11.04 gm) in the first and second seasons respectively.

For total dry weight per plant, the highest values were achieved by Giza 1 under biogen with Zn 200 ppm followed by Giza 2 under phosphoren with Zn 100 ppm (14.45 gm) in the first season , while Giza 1 under biogen with Zn 100 ppm recorded the highest value (24.38 gm) in the second season .

In general, it was clear that the interaction among cultivars X biofertilizer X Micronutrient has no definite trend to ward chickpea plants stimulation. Two important points can be concluded: first, biofertilizers addition to the seed enables the plants to grow well and absorb more nutrients from the soil: Second, application of Zn and Boron is required to obtain the best growth, strong and healthy plants.

B. Yield and its components:

B.1.The differences between cultivars:

Results given in Table (11) show the average values of yield and its components for two chickpea cultivars under during the two growing seasons. The differences between cultivars reached the significant level for all studied characters except number of pods / plant in the second season and biological yield / fad. in the first season . Giza 1 recorded the highest values of plant height (66.79 and 70.45 cm), total dry weight per plant (26.26 and 25.74 gm), seed yield per plant (12.82 and 10.90 gm), seed index (26.87 and 23.72 gm) and seed yield per faddan (586.35 and 629.23 kg) in both seasons, respectively. Also, Giza 1 significantly surpassed Giza 2 in straw and biological yield per faddan in the second season, harvest index in the first season. The increase in seed yield of Giza 1 is mainly due to the increase in seed yield per plant and seed index .

B.2.The effect of biofertilizers:

Results in Table (12) show the average values of yield and its components for chickpea cultivars as affected by the biofertilizer treatments in both seasons.

Results indicated that all studied characters were significantly affected by biofertilizer treatments during the two seasons.

Phosphoren produced the tallest plants (68.26 and 71.56 cm), highest values of total dry weight per plant (25.86 and 25.70 gm), number of pods per plant (42.19 and 46.34 pod), seed yield per plant (11.94 and 11.09 gm) and seed index (24.66 and 23.24 gm) in the first and second seasons, respectively. Also,

Table (11) Yield and its components of two chickpea cultivars in 2007/2008 and 2008/2009 seasons.

Cultiv.	Plant height(cm)		Total dry weight/plant (gm)		No.of pods/plant		Seed yield/plant (gm)		Seed index(gm)		Seed yield/fad(kg)		straw yield/fad (kg)		Biological yield/fad		H . index	
	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
Giza 1	66.79	70.45	26.26	25.74	40.23	43.46	12.82	10.90	26.87	23.72	586.35	629.23	1153.94	1413.60	1738.25	2052.12	34.17	31.27
Giza 2	63.64	67.39	23.84	24.18	40.65	44.07	9.47	9.57	20.31	20.58	556.03	592.22	1171.26	1187.93	1686.99	1780.15	32.61	34.14
L.S.D.	*	*	*	*	*	N.S	*	*	*	*	*	*	N.S	*	N.S	*	*	*

Cultiv. refer to cultivar
S1 : 2007/2008 season .
S2: 2008/2009 season

Table (12) Yield and its components of two chickpea cultivars in 2007/2008 and 2008/2009 seasons.

Biofertilizer treatments	Plant height(cm)		Total dry weight/plant (gm)		No.of pods/plant		Seed yield/plant (gm)		Seed index(gm)		Seed yield/fad(kg)		Straw yield/fad (kg)		Biological yield/fad		H. index	
	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
Zero biofer.	63.21	67.10	24.08	23.88	39.55	42.47	10.85	9.63	22.89	21.38	521.37	573.92	1092.92	1264.95	1614.37	1838.88	32.98	31.92
Phosphoren	68.26	71.56	25.86	25.70	42.19	46.34	11.94	11.09	24.66	23.24	577.22	632.06	1179.12	1364.57	1756.38	2010.57	33.68	32.51
Biogen	64.17	68.10	25.21	25.31	39.58	42.49	10.65	9.97	23.23	21.84	614.98	626.20	1215.75	1272.77	1767.10	1898.96	33.81	33.68
L.S.D.	0.90	1.09	0.73	0.70	1.01	1.35	0.62	0.54	0.53	0.67	16.04	21.57	61.32	64.72	100.75	59.13	1.41	1.91

Cultiv. refer to cultivar
S1 : 2007/2008 season .
S2: 2008/2009 season

phosphoren produced the highest values of seed, straw and biological yields per faddan being 632.06,1364.57 and 2010.57 kg in the second season, respectively.

Concerning harvest index, the maximum values (33.81 and 33.68) were produced by adding biogen in the first and second seasons, respectively.

This result is expected since biofertilizer plays an important role in chickpea plants and affects most of physiological processes. These results are in harmony with those obtained by **Bahr (1997), Sharma and Parmar (1997), Abd-El-Lateef et al. (1998), Hamissa et al. (2000), Neweigy (2000), Ahmed et al.(2003), Kanany et al. (2004), Hossain and Suman (2005).**

B.3. The effect of micronutrient

Results in Table (13) present the means of chickpea yield and its components as affected by microelement applications during the two growing seasons.

Results indicated that seed yield and yield components were significantly affected by microelement applications, except straw yield in the first season and seed index in the second season wherever did not exhibit significance with these applications.

The highest value of plant height was recorded by applying Zn 200 ppm (67.53 and 72.88 cm) in the two seasons.

With respect to total dry weight per plant, the highest value was obtained by applying boron 100 ppm (26.47 gm) ,but the difference between this treatments and Zn 200 ppm (26.06 gm)

Table (13) Effect of micronutrients on yield and its components of chickpea in 2007/2008 and 2008/2009 seasons.

Micronutrients treatments (ppm)	Plant height(cm)		Total dry weight/plant (gm)		No.of pods/plant		Seed yield/plant (gm)		Seed index(gm)		Seed yield/fad(kg)		straw yield/fad (kg)		Biological yield/fad		H. index	
	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
Zero micro.	63.61	67.05	22.35	22.97	39.05	40.41	9.24	9.29	22.81	21.40	518.49	565.99	1197.96	1234.21	1710.35	1800.19	30.71	32.91
100 Zn	65.42	70.44	25.74	26.15	42.18	43.70	11.44	10.20	24.32	22.24	656.80	691.88	1180.05	1405.84	1836.96	2097.73	35.98	33.31
200 Zn	67.53	72.88	26.06	25.16	41.10	44.41	11.61	10.65	23.87	22.08	549.28	553.94	1101.70	1036.87	1551.06	1615.71	33.90	34.93
100 boron	64.87	67.50	26.47	25.31	40.97	45.22	11.56	10.96	23.64	22.52	588.49	579.36	1174.32	1409.26	1762.84	1986.95	34.13	30.00
200 boron	64.61	66.22	24.63	25.21	38.91	45.09	11.88	10.05	23.32	22.52	542.88	662.45	1158.95	1417.65	1701.89	2080.10	32.21	32.35
L.S.D	1.18	1.43	0.93	0.90	1.29	1.75	0.56	0.71	0.67	N.S	20.72	27.83	N.S	83.52	130.05	76.33	1.83	1.75

S1 : 2007/2008 season . S2: 2008/2009 season . Micro. refer to Micronutrient

was not significant in the first season. While, in the second season the highest values were (26.15 and 25.31gm) obtained by adding Zn 100 ppm and boron 100 pm, respectively. However , the differences between them were not significance.

The highest value of number of pods per plants was obtained by Zn 100 ppm (42.18 pod) without significant difference with Zn 200 ppm (41.10) and boron 100 ppm (40.97) in the first season.

As regarding seed yield per plant, the highest value was obtained by applying boron 200 ppm (11.88 gm), but without superiority over Zn 200 ppm ,boron 100 ppm and Zn 100 ppm in the first season. While, in the second season, the highest value (10.96 gm) was obtained by boron 100 ppm without significant difference with Zn 200 ppm (10.65 gm).

The highest average of seed index (24.32 gm) was obtained by applying Zn 100 ppm in the first season.

Concerning seed yield/fad. , results showed that the highest seed yield/fad. was recorded by adding Zn 100 ppm (656.80 and 691.88 kg/fad.) in the two successive seasons, respectively .

It is obvious that the increase in the seed yield/fad. was primarily due to the increase in number of pods per plant, seed yield per plant and seed index . In other words, this increase may be due to the ability of chickpea to respond better to microelements under study, especially Zn. Similar results were reported by **Santos and Estefanel (1986), Hegazy et al. (1993), Islam et al. (1995)and Sawires (2001).**

The highest average of straw yield per faddan was (1417.65 kg) obtained when appling boron 200 ppm, but with no

significant superiority over boron 100 ppm and Zn 100 ppm in the second season.

Concerning biological yield /fad. the highest values were (1836.96 and 2097.73 kg) in the first and second seasons, respectively obtained from adding Zn 100 ppm.

The highest average of harvest index were (35.98 and 34.93%) obtained when applying Zn 100 ppm in the first season and Zn 200 ppm in the second season , respectively. Similar results were reported by **Reddy and Ahlawat (1998) and Abd-Elaziz and Anton (1999).**

B.4.Interaction effect:

B.4.1. Interaction between cultivars and biofertilizers:

Means of chickpea yield and yield components as affected by the interaction between cultivars and biofertilizers during the two growing seasons are shown in Table (14).

Results in Table (14) revealed that the effect of interaction between cultivars and biofertilizers on plant height (cm) were non significant in both seasons.

Results indicate that total dry weight per plant, number of pods per plant, seed yield per plant and seed index were significantly affected by the interaction between cultivars and biofertilizers in one season out of two.

In the first season, the highest value of total dry weight per plant (28.05 gm) produced by Giza 1 cultivar with adding of biogen.

In the second season, the highest number of pods per plant (46.85 obtained by Giza 1 with adding of phosphoren .

Table (14) Effect of interaction between cultivars and biofertilizers on yield and its components of chickpea in 2007/2008 and 2008/2009 seasons.

Cultiv. X Biofert.		Plant height(cm)		Total dry weight/plant		No.of pods/plant		Seed yield/plant		Seed index(gm)		Seed yield/fad(kg)		straw yield (kg)		Biological yield/fad		H . index	
		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
Giza 1	Zero biofrt.	64.51	68.36	25.10	24.98	39.06	42.65	12.60	10.10	26.37	23.10	531.63	577.99	1135.80	1403.48	1667.47	1981.48	32.50	29.97
	Phospho.	69.46	72.66	25.62	26.36	41.63	46.85	13.50	12.14	27.52	25.12	583.42	692.90	1065.65	1617.30	1649.09	2338.08	35.66	29.92
	Biogen	66.36	70.33	28.05	25.90	40.02	40.89	12.36	10.45	26.52	22.94	644.0	616.80	1260.36	1220.01	1898.47	1836.81	34.34	33.90
Giza 2	Zero biofrt.	61.90	65.83	23.06	22.78	40.05	42.30	9.11	9.16	19.41	19.65	511.11	569.84	1050.05	1126.43	1561.28	1696.27	33.47	33.87
	Phospho.	67.05	70.46	26.10	25.04	42.76	45.84	10.37	10.05	21.59	21.36	571.0	571.22	1292.58	1111.84	1863.68	1683.06	31.07	35.10
	Biogen	61.97	65.86	22.38	24.72	39.14	44.08	8.94	9.49	19.94	20.74	585.96	635.59	1171.14	1325.53	1636.02	1961.12	33.28	33.47
L.S.D.		N.S	N.S	1.04	N.S	N.S	1.92	0.84	N.S	0.73	N.S	22.61	20.51	87.36	91.50	142.49	83.64	2.0	1.91

Cultiv. refer to cultivar biofert. refer to Biofertilizer

S1 : 2007/2008 season . S2: 2008/2009 season

Whereas, the highest value of seed yield per plant (13.50 gm) and seed index (27.52 gm) were recorded by Giza 1 with applying of phosphoren in the first season.

Results in Table (14) revealed that the effect of interaction between cultivars and biofertilizers on seed, straw and biological yields per faddan and harvest index were significant in both seasons.

The highest mean values for seed yield / fad. were recorded from Giza1 when received biogen (644.0 kg /fad.) or phosphoren (692.9 kg/fad.) in the first and second seasons, respectively .

For straw yield /fad. the highest response values were recorded by Giza 2 with (1292.58 kg) or Giza 1 (1617.30 kg) applying phosphoren in the first and second seasons, respectively .

The highest values of biological yield / fad., which obtained by Giza 1 with biogen (1898.47 kg) or with phosphoren (2338.08 kg) in the first and second seasons, respectively .

Concerning harvest index, the maximum values were recorded by Giza 1 (35.66) in the first season or with Giza 2 (35.10) in the second season with adding of phosphoren.

It was clear that Giza 1 showed higher response than Giza 2 to biofertilizer , especially phosphoren . This results is mainly due to the different characters of the two studied cultivars . Similar results were reported by **Roy et al. (1995), Gupta and Namdeo, (1996), El-Karamany and Bahr (1999) and Zeidan et al. (2001) .**

B.4.2. Interaction between cultivars and microelements:

With the exception of seed yield / plant and seed index in the first season, all studied characters showed significant differences due to the interaction effect between cultivars and microelements during the two growing seasons.(Table 15).

The tallest plants (68.07 and 77.94 cm) were recorded by Giza 1 cultivar with Zn 200 ppm in the first and second seasons, respectively.

The greatest total dry weight per plant (28.60 and 26.96 gm) was obtained by Giza 1 with Zn 200 and 100 ppm in the first and second seasons.

Concerning number of pods per plant, the highest values (43.02 and 45.83) were recorded by Giza 1 with Zn 100 ppm in the first season and by Giza 2 with Zn 200 ppm in the second season, respectively .

The highest value of seed yield per plant (11.42 gm) and seed index (24.70 gm) were achieved by Giza 1 with Zn 200 ppm and with Zn 100 ppm ,respectively in the second season .

For seed yield per faddan, the highest mean values which obtained by Giza 1 with Zn 100 ppm (677.30 kg) and with boron 200 ppm (733.34kg) in the first and second seasons, respectively.

It could be concluded that applying microelements, especially Zn favorably affected seed yield of Giza 1 cultivar. The superiority of Giza 1 cultivar in seed yield under Zn might be ascribed to some components of yield, especially seed index , seed yield / plant and number of pods / plant.

Table (15) The interaction between cultivars and micronutrients on yield and yield components of chickpea in 2007/2008 and 2008/2009 seasons.

Cultiv.XMicro. (ppm)		Plant height(cm)		Total dry weight/plant (gm)		No.of pods/plant		Seed yield/plant (gm)		Seed Index(gm)		Seed yield/fad(kg)		straw yield/fad (kg)		Biological yield/fad(kg)		H. Index	
		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
Giza1	Zero Micro.	65.06	68.11	22.88	24.18	39.91	41.98	10.36	10.0	26.14	22.84	556.01	581.74	1139.12	1341.11	1684.70	1922.85	33.41	31.36
	100 Zn	66.35	70.44	26.76	26.96	43.02	42.31	13.19	10.90	27.90	24.70	677.30	682.75	1128.01	1327.08	1805.30	2009.83	37.70	34.08
	200 Zn	68.07	77.94	28.60	25.58	40.67	42.99	13.49	11.42	27.58	22.91	547.25	555.45	1149.30	1077.28	1696.80	1682.53	33.14	33.62
	100 boron	67.30	67.88	27.46	26.68	39.63	45.01	13.02	11.35	26.47	24.51	633.56	591.88	1258.79	1637.42	1892.35	2226.97	34.35	26.91
	200 boron	67.02	67.88	25.57	25.31	37.94	45.01	13.94	10.80	26.28	23.65	517.64	733.34	1094.30	1685.08	1612.02	2418.42	32.24	30.35
Giza2	Zero Micro.	62.16	66.00	21.82	21.76	38.18	38.83	8.13	8.57	19.49	19.96	480.90	550.23	1256.80	1127.31	1736.0	1677.54	28.02	34.51
	100 Zn	64.50	70.44	24.72	25.33	41.35	45.10	9.59	9.51	20.74	19.78	636.30	701.02	1232.10	1484.60	1868.53	2185.62	34.27	32.54
	200 Zn	66.90	67.83	23.52	24.73	41.52	45.83	9.72	9.88	20.16	21.25	551.30	552.44	1054.02	996.45	1405.33	1549.89	34.65	36.23
	100 boron	62.36	67.11	25.48	23.94	42.31	45.43	10.10	10.56	20.82	20.54	543.42	565.84	1089.86	1181.09	1633.33	1746.92	33.92	33.09
	200 boron	62.20	65.55	23.68	25.12	39.87	45.17	9.83	9.31	20.36	21.38	568.12	591.56	1223.51	1150.22	1791.77	1741.79	32.17	34.35
L.S.D.		1.66	2.03	1.33	1.32	1.86	2.5	N.S	0.98	N.S	1.24	29.30	39.36	112.8	118.15	183.94	187.97	1.83	2.48

Cultiv. refer to cultivar
S1 : 2007/2008 season .

Micro. refer to Micronutrient
S2: 2008/2009 season

These results are in harmony with those obtained by **Abd-Elgawad et al. (1993), Ulukan et al. (2002), Hafiz (2004) and Johnson et al. (2005).**

The effect of interaction between cultivars and microelements on straw and biological yield / fad . indicated that the superiority of Giza 1 on Giza 2 in both season was significantly evident under boron . Giza 1 X boron 100 ppm recorded the maximum values of the above mentioned characters (1258.79 and 1892.35 kg / fad.) in the first season, respectively. While in the second season, Giza 1 had the maximum values (1685.08 and 2418.42 kg/fad.) under boron 200 ppm, respectively .

Concerning harvest index, Giza 1 cultivar recorded the highest value (37.70%) with Zn100 ppm in the first season. While, the highest value of the above mentioned trait (36.23%) was obtained from Giza 2 under Zn 200 ppm in the second season.

B.4.3.Interaction between biofertilizers and micronutrients:

The effect of the interaction between biofertilizers and micronutrients was significant on all characters of yield and its components of chickpea in both seasons (Table 16).

Results in Table (16) show that, in the first season applying phosphoren with Zn both levels(100 and 200 ppm) performed well, and recorded the tallest plant (71.25 cm) with Zn 200 ppm and highest total dry weight / plant (27.23 gm) maximum number of pods / plant (47.34, highest seed yield / plant (14.11 gm) and highest seed index (26.58 gm) with Zn (100 ppm) .

Table (16) Interaction effect between biofertilizers and micronutrients on yield and yield components of chickpea in 2007/2008 and 2008/2009 seasons.

Biofert. X Micro.(ppm)		Plant height(cm)		Total dry weight/plant (gm)		No.of pods/plant		Seed yield/plant (gm)		Seed index(gm)		Seed yield/fad(kg)		straw yield/fad (kg)		Biological yield/fad(kg)		H . index	
		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
Zero biofert..	Zero micro.	60.25	58.50	20.80	20.80	35.23	35.88	9.12	8.58	21.46	19.90	444.49	477.44	1428.63	1015.25	1873.20	1492.70	23.90	32.80
	100ppm Zn	63.0	64.75	25.55	25.41	39.85	42.88	10.26	9.01	23.45	21.82	607.72	602.30	994.10	1072.99	1601.93	1676.29	38.04	35.96
	200ppm Zn	67.15	75.16	25.10	24.95	39.55	43.91	10.37	9.76	23.28	19.98	522.08	572.47	1188.60	1304.07	1710.80	1876.55	31.16	30.66
	100 ppm boron	62.76	68.66	26.15	24.46	43.25	45.50	12.46	11.13	22.87	23.25	522.20	599.80	868.72	1615.74	1390.93	2215.54	37.62	27.23
	200 ppm boron	62.88	68.41	22.80	23.76	39.90	44.20	120.6	9.66	23.40	21.92	510.36	617.57	984.58	1316.72	1495.02	1934.29	34.20	32.96
Phospho.	Zero micro.	65.76	71.00	23.18	23.16	38.36	40.03	9.33	9.85	23.68	22.13	500.76	569.09	1026.69	1251.20	1527.45	1820.29	33.11	34.01
	100 ppmZn	69.81	78.83	27.23	27.20	47.31	46.22	14.11	12.28	26.58	23.91	633.00	783.15	1312.91	1667.52	1946.00	2450.67	32.63	31.98
	200ppm Zn	71.25	73.41	26.23	24.73	45.63	47.43	13.26	11.75	25.39	24.26	512.50	550.26	865.08	1001.57	1377.60	1626.53	37.48	34.00
	100ppmboron	67.58	67.66	26.50	26.76	40.31	47.65	9.68	11.00	24.61	22.50	649.32	579.18	1333.02	1344.25	1982.40	1918.42	32.97	32.02
	200ppmboron	66.88	66.91	26.18	26.18	39.35	50.38	13.30	10.60	23.03	23.41	590.49	678.61	1357.89	1558.32	1948.47	2236.94	30.63	30.54
Biogen	Zero micro.	64.83	71.66	23.08	24.51	43.55	45.31	9.28	9.45	23.0	22.17	610.23	651.42	1138.57	1436.18	1730.40	2087.59	35.14	32.00
	100ppm Zn	63.46	67.65	24.45	25.83	39.40	42.01	9.95	9.32	22.94	20.98	729.68	690.20	1233.15	1477.01	1962.95	2167.22	37.28	31.99
	200ppm Zn	64.20	70.08	26.85	25.80	38.11	41.90	11.20	10.45	22.93	22.00	613.25	539.10	1251.43	804.95	1564.80	1344.05	33.05	40.13
	100 ppm boron	64.28	66.16	26.78	24.71	39.35	42.52	12.54	10.75	23.45	21.82	593.95	559.10	1321.24	1267.78	1915.20	1826.88	31.81	30.75
	200 ppmborn	64.06	64.83	24.91	25.70	37.48	40.70	10.29	9.90	23.53	22.23	527.79	691.17	1134.38	1377.91	1662.19	2069.08	31.80	33.56
L.S.D.		2.05	2.5	1.63	1.6	2.28	3.07	1.41	1.21	1.18	1.55	25.89	48.22	138.15	144.69	225.28	132.25	3.15	3.04

Cultiv. refer to cultivar Bio. refer to Biofertilizer Micro. refer to Micronutrient

S1 : 2007/2008 season . S2: 2008/2009 season

While in the second season, the highest values of the above mentioned traits were obtained from applying phosphoren with different microelements under study which are (78.83 cm) with Zn 100 ppm for plant height, (27.20 gm) with Zn 100 ppm for total dry weight /plant, (50.38) with boron 200 ppm for number of pods /plant, (12.28 gm) with Zn 100 ppm for seed yield /plant and (24.26 gm) with Zn 200 ppm for seed index .

For seed yield per faddan, the highest mean values which obtained by adding Zn 100 ppm with biogen (729.08 kg /faddan) and with phosphoren (783.15 kg/faddan) in the first and second seasons, respectively .

The effect of interaction between biofertilizers and microelements on straw and biological yield /fad. showed the surperioity of phosphoren with different microelements under study in both seasons .

In the first season, phosphoren with boron 200 or 100 ppm recorded the maximum values of the above mentioned character (1357.89 and 1982.40 kg/fad.), respectively.

While in the second season, phosphoren had the maximum values (1667.52 and 2450.67 kg/fad.) under Zn 100 ppm, respectively .

As to the harvest index, zero biofertilizer with Zn 100 ppm recorded the highest value (38.04) in the first season. While the highest value in the second season (40.13) was obtained from biogen under Zn 200 ppm.

In conclusion, the interaction between biofertilizer and microelements on chickpea yield and its components indicated that the effect of phosphoren was influenced by microelements ,

especially Zn. Similar results were reported **by Chandra (1995) and Jain et al. (2007).**

B.4.4.Interaction between cultivars, biofertilizer and micronutrients:

With the exception of biological yield / fad. and harvest index in the first season and total dry weight /plant , seed yield/plant and seed index in the second season, all other studied characters showed significant differences due to the interaction effect among cultivars, biofertilizers and microelements (Table 17).

The tallest plants was recorded by Giza 1 with phosphoren and Zn (200 and 100 ppm) (72.66 and 80.33 cm) in the first and second seasons, respectively .

The greatest total dry weight / plant was obtained by Giza 1 with biogen and Zn 200 ppm being (31.20 gm), but the difference between this treatment and phosphoren with Zn 200 ppm or biogen with boron 100 ppm both with Giza 1 were not significant, in the first season.

The highest value of number of pods/plant was obtained by Giza 2 with phosphoren and Zn 100 ppm being (48.90 pod) without significant difference with zero biofertilizer X boron 100 ppm and phosphoren X Zn 200 ppm both with Giza 2 as well as Giza 1 X phosphoren X Zn 100ppm, in the first season .While, Giza 1 X phosphoren X boron 200 ppm being (52.9 pod) without significant difference with Giza 1 X phosphoren X boron 100 ppm and Giza 2 X phosphoren X Zn 100 ppm in the second season .

Table (17) Interaction effect between cultivars , biofertilizers and microelements on yield and yield components of chickpea in 2007/2008 and 2008/2009 seasons.

Cultiv. X Biofert. X Micro.(ppm)			Plant height(cm)		Total dry weight/plant (gm)		No.of pods/plant		Seed yield/plant (gm)		Seed index(gm)		Seed yield/fad(kg)		straw yield (kg)		Biological yield/fad(kg)		H . index	
			S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
Giza1	Zero biofert.	Zero micro.	62.90	58.00	21.76	21.53	36.36	37.63	10.75	9.40	24.45	22.02	472.20	486.83	1409.38	1115.02	1881.60	1601.85	25.14	31.83
		100 ppm Zn	64.1	66.00	28.86	27.40	40.93	43.73	12.49	9.63	27.16	25.46	635.26	599.81	955.79	1092.36	1591.06	1692.17	39.95	35.45
		200 ppm Zn	64.23	76.66	25.53	25.03	39.63	42.28	11.28	10.00	28.05	20.86	522.47	578.24	1375.70	1359.12	1898.40	1937.36	28.03	30.11
		100ppm boro	65.20	66.66	25.96	26.93	39.50	44.60	14.24	11.73	25.06	24.85	523.26	597.73	931.39	1789.76	1454.66	2387.50	35.98	25.02
		200ppm boro	66.13	74.5	23.36	24.00	38.86	45.00	14.22	9.76	27.15	22.34	504.96	627.38	1006.75	1661.13	1511.65	2288.51	33.41	27.46
	Phospho	Zero micro.	65.63	71.33	21.96	25.06	39.70	43.40	10.34	11.50	28.17	23.90	493.69	629.68	881.21	1805.88	1374.90	2435.56	35.98	25.90
		100 ppm Zn	69.93	80.33	26.10	27.46	45.73	42.71	15.96	13.33	29.58	25.72	702.68	793.29	1223.70	1586.16	1926.40	2379.44	36.60	33.32
		200 ppm Zn	72.66	78.5	29.06	25.80	44.83	46.43	15.06	12.46	28.63	25.22	508.70	579.04	852.09	1026.87	1360.80	1755.29	37.93	33.19
		100ppm boron	70.80	65.66	25.50	27.00	41.30	48.80	11.19	11.33	27.38	25.36	688.35	671.09	1249.24	1881.65	1937.60	2542.74	35.78	26.28
		200ppm boron	68.30	67.5	25.50	26.46	36.60	52.90	14.98	12.06	24.88	25.41	523.71	791.40	1122.02	1785.95	1645.75	2577.36	32.02	30.92
	Biogen	Zero micro.	66.66	75.00	24.93	25.96	43.66	44.93	9.98	9.15	25.80	22.62	702.13	628.73	1126.78	1102.43	1797.60	1731.14	39.12	36.36
		100 ppm Zn	65.03	65.00	25.33	26.03	42.40	40.50	11.44	9.75	26.96	22.92	693.95	655.16	1204.54	1302.72	1898.70	1957.89	36.55	33.48
		200 ppm Zn	67.33	78.66	31.20	25.93	37.56	4.26	14.15	11.80	26.05	22.66	610.60	509.07	1220.36	845.87	1831.20	1354.95	33.48	37.57
		100ppm boron	66.16	71.33	30.93	26.13	38.10	41.65	13.64	11.00	26.97	23.13	689.06	509.83	1595.74	1240.85	2284.80	1750.69	31.29	29.43
		200ppm boron	66.63	61.67	27.86	25.46	38.36	37.13	12.62	10.56	26.81	23.21	524.25	781.24	1154.39	1608.17	1678.66	2389.40	31.30	32.68
Giza2	Zero biofert.	Zero micro.	57.60	59.00	19.83	20.06	34.10	34.13	7.48	7.76	18.48	17.79	416.79	468.06	1447.88	915.48	1864.80	1383.55	22.66	33.78
		100 ppm Zn	61.90	63.5	22.23	23.43	38.76	42.03	8.03	8.40	19.74	18.19	580.18	604.80	1032.41	1053.62	1612.80	1658.42	36.14	36.47
		200 ppm Zn	70.06	73.66	24.66	24.86	39.46	45.55	9.46	9.53	18.51	19.11	521.69	566.71	1001.50	1249.03	1523.20	1815.74	34.30	31.20
		100ppm boron	60.33	70.66	26.33	22.00	47.00	46.40	10.68	10.53	20.68	21.66	521.14	601.87	806.05	1441.71	1327.20	2043.58	39.26	29.43
		200ppm boron	59.63	62.33	22.23	23.53	40.93	43.40	9.90	9.56	19.66	21.50	515.76	607.76	962.41	972.31	1478.40	1580.08	34.99	38.46
	Phospho	Zero micro.	65.90	70.66	24.40	23.06	37.03	36.66	8.33	8.20	19.19	20.37	507.83	674.11	1172.17	696.52	1680.00	1205.03	30.23	42.12
		100 ppm Zn	69.70	77.33	28.36	25.63	48.90	49.73	12.26	11.23	23.58	22.10	563.31	725.24	1402.12	1748.88	1965.60	2521.90	28.67	30.65
		200 ppm Zn	69.83	68.33	23.40	25.66	46.43	48.43	11.47	11.03	22.16	23.30	516.31	569.13	878.07	976.28	1394.40	1497.77	37.03	34.81
		100ppm boron	64.36	69.66	27.50	23.30	39.33	46.50	8.18	10.66	21.84	19.65	610.29	608.38	1416.79	806.85	2027.20	1294.10	30.17	37.76
		200ppm boron	65.46	66.33	26.86	25.93	42.10	47.86	11.63	9.13	21.18	21.40	657.28	601.11	1593.75	1330.70	2251.20	1896.52	29.24	30.16
	Biogen	Zero micro.	63.00	68.33	21.23	20.06	43.43	45.70	8.58	9.75	20.79	21.72	518.34	468.06	1150.35	1769.92	1663.20	2444.04	31.16	27.64
		100 ppm Zn	61.90	70.5	23.56	23.43	36.40	43.53	8.47	8.90	18.92	19.04	765.41	604.80	1261.76	1651.31	2027.20	2376.55	38.01	30.51
		200 ppm Zn	61.06	61.5	22.50	24.86	38.66	43.53	8.25	9.10	19.81	21.35	615.90	566.71	1282.50	764.04	1298.40	1333.16	32.63	42.70
		100ppm boron	62.40	61.00	22.63	22.00	40.60	43.40	11.44	10.50	19.93	20.33	498.84	601.87	1046.74	1294.71	1545.60	1903.08	32.33	32.07
		200ppm boron	61.50	68.00	21.96	23.53	36.60	44.26	7.97	9.23	20.24	21.24	531.33	607.76	1114.38	1147.66	1645.72	1748.77	32.29	34.43
L.S.D.			2.9	3.55	2.34	N.S	3.21	4.34	2.0	N.S	1.69	N.S	50.76	68.21	195.36	204.64	N S	187.02	N.S	4.31

As regarding seed yield /plant and seed index, the highest values (15.96 gm and 29.58 gm) were obtained by Giza 1 with phosphoren and Zn 100 ppm in the first season , respectively .

Concerning seed yield /fad., Giza 2 with biogen and Zn 100 ppm produced the highest value (765.41 kg/fad.) in the first season.While, in the second season, Giza1 with phosphoren and Zn 100 ppm produced the greatest value (793.29 kg/fad.). Generally, the results indicated that no definite trend could be detected for the effect of interaction among the three experimental factors on chickpea seed yield /fad. Similar results were reported **by Hafiz (2004).**

The highest average of straw yield per faddan was obtained by Giza 1 under biogen with boron 100 ppm being (1595.74 kg) and phosphoren (1881.65 kg) in the first and second seasons , respectively .

Biological yield /fad.of Giza 1 showed the highest value when applying phosphoren with boron 200 ppm being (2577.36 kg/fad.),only in the second season. Also, in that season Giza 2 recorded the highest average harvest index (42.70) by adding biogen and Zn 200 ppm .

C.Seed quality:

C.1.The differences between cultivars :

Table (18) revealed that the two chickpea cultivars significantly differed in protein % and carbohydrate % in one season out of two.

Giza 1 produced higher protein and carbohydrate (20.45 and 57.84%) in the first season, respectively.

Table (18) Protein and carbohydrate % for two chickpea cultivars in 2007/2008 and 2008/2009 seasons.

Cultiv.	Protein%		Carbohydrate%	
	S1	S2	S1	S2
Giza 1	**20.45**	20.33	**57.84**	58.43
Giza 2	20.35	20.58	57.69	57.99
L.S.D.	*	N.S	*	N.S

Cultiv. refer to cultivar

S1 : 2007/2008 season . S2: 2008/2009 season .

C.2.The effect of biofertilizers :

The mean values of protein and carbohydrate % as affected by biofertilizers in both seasons are presented in Table (19) .

The differences between the mean values of protein and carbohydrate percentage as affected by biofertilizer treatments were significant in the two seasons.

Biogen gaved the highest percentage of protein was (20.91) and (21.15%) in the first and second seasons, respectively. While, the maximum percentage of carbohydrate recorded by applying phosphoren (57.96 %) in the first season and biogen (59.94 %) in the second season. No significant difference was observed between phosphoren and biogen in the percentage of the two characters of seed quality under study.

These results are in feel agreement with those obtained by **Monib et al. (1994) and Negm et al. (1998).**

Table (19) Protein and carbohydrate % as affected by biofertilizers in 2007/2008 and 2008/2009 seasons.

Biofertilizer treatments	Protein%		Carbohydrate%	
	S1	S2	S1	S2
Zero biofert.	19.88	19.39	57.42	57.37
Phosphoren	20.42	20.82	**57.96**	58.30
Biogen	**20.91**	**21.15**	57.82	**58.94**
L.S.D.	0.77	0.6	0.50	0.65

Biofert. refer to Biofertilizer

S1 : 2007/2008 season . S2: 2008/2009 season .

C.3.The effect of micronutrients:

Results in Table (20), show that protein and carbohydrate percentages were significantly increased by microelements in one season out of two. Appling Zn 100 ppm recorded the highest percentage of protein 21.13 and carbohydrate 58.08% .

The increase in protein and carbohydrate% by Zn application might be attributed to the essential role of this element to activate several enzymes which are important for producing dry matter and storing it in seed .These results are in feel agreement with those obtained by **Abd-El-Aziz and Anton (1999), Zaghloul et al. (2002), Sunder et al. (2003) and Stivastava et al. (2006).**

Table (20) Protein and carbohydrate % as affected by micronutriens in 2007/2008 and 2008/2009 seasons.

Micronutrient treatments (ppm)	Protein%		Carbohydrate%	
	S1	S2	S1	S2
Zero micro.	19.90	20.55	56.93	58.21
100 Zn	20.74	**21.13**	**58.68**	58.73
200 Zn	20.48	20.58	58.23	57.93
100 boron	20.32	19.90	57.69	57.95
200 boron	20.58	20.11	57.30	58.19
L.S.D	N.S	0.76	0.85	N.S

Micro. refer to Micronutrient
S1 : 2007/2008 season . S2: 2008/2009 season .

C.4. Interaction effect:

C.4.1. Interaction between cultivars and biofertilizers:

Results in Table (21) showed significant interaction between the cultivars and biofertilizers applications in the two seasons.

Giza 2 cultivar with biogen had the highest values for protein (20.95% and 21.73%) in the first and second season,respectively. but the difference between the above mentioned treatment and all the other treatments was not significant except Giza 2 X zero biofertilizer in the first season.

While, in the second season the difference was not significant only with Giza 1 X phosphoren.

Respecting carbohydrate percentage , Giza 1 X phosphoren produced the maximum value (58.22%) but the difference between this treatment and all the others treatments is not significant except Giza 2 X zero biofertilizer in the first season.While, Giza 2 X biogen recorded the highest value (59.30%) without significant difference with Giza 1 X phosphoren in the second season .

Table (21) Protein and carbohydrate % as affected by interaction between cultivars and biofertilizers in 2007/2008 and 2008/2009 seasons.

Cultiv. X Biofert.		Protein%		Carbohydrate%	
		S1	S2	S1	S2
Giza 1	Zero biofert.	20.13	19.24	57.60	57.53
	Phospho.	**20.35**	**21.17**	**58.22**	**59.17**
	Biogen	20.87	20.58	57.90	58.60
Giza 2	Zero biofert.	19.64	19.55	57.45	57.21
	Phospho.	**20.48**	**20.46**	57.90	57.43
	Biogen	**20.95**	**21.73**	57.73	**59.30**
L.S.D.		0.93	0.85	0.73	0.90

Cultiv. refer to cultivar Bio. refer to Biofertilizer.
S1 : 2007/2008 season . S2: 2008/2009 season .

C.4.2. Interaction between cultivars and micronutrients:

The effect of interaction between cultivars and micronutrients on protein and carbohydrate percentage was significant in one season out of two (Table 22) .

Giza 2 with Zn 100 ppm produced the maximum protein (21.16 %) and carbohydrate (58.84 %) percentage in chickpea seed in the second and first season, respectively).

Table (22)Protein and carbohydrate % as affected by interaction between cultivars and micronutrients in 2007/2008 and 2008/2009 seasons.

Cultiv.XMicro.(ppm)		Protein%		Carbohydrate%	
		S1	S2	S1	S2
Giza1	Zero micro.	19.51	19.93	56.96	57.71
	100 Zn	21.09	21.09	58.53	58.84
	200 Zn	20.64	20.58	58.18	58.58
	100 boron	20.77	20.18	57.86	58.31
	200 boron	20.25	19.86	57.65	58.71
Giza2	Zero micro.	20.27	20.92	56.90	57.72
	100 Zn	20.38	**21.16**	**58.84**	58.63
	200 Zn	20.32	20.58	58.27	57.28
	100 boron	19.88	19.88	57.52	57.60
	200 boron	20.91	20.36	56.94	58.67
L.S.D.		N.S	1.1	1.21	N.S

Cultiv. refer to cultivar Micro. refer to Micronutrient
S1 : 2007/2008 season . S2: 2008/2009 season .

C.4.3. Interaction between biofertilizers and micronutrients :

Results in Table (23) indicate that protein and carbohydrate percentage were significantly affected by the interaction between biofertilizers and micronutrients in one season only . Phosphoren with zero microelements produced the maximum protein% (21.37%) in the first season.While, the highest percentage of carbohydrate per seed was 60.79 % in the second season, due to applying biogen with boron 200 ppm .

Generally ,the results indicated that no definite differences in protein and carbohydrate % due to the interaction between the two factors .These results are in agreement with that obtained by **Satajit et al. (2003), Hafiz (2004), Pathak (2003) and Mut and Gulumser (2005).**

C.4.4.Interaction between cultivars, biofertilizers and micronutrients:

The differences between the average values of protein and carbohydrate percentage were significant due to the interaction effect among the three experimental factors (Table 24).

The highest mean value of protein % was obtained by Giza 1 with phosphoren and Zn 100 ppm (22.05 and 22.40 %) in the first and second seasons, respectively.

For carbohydrate percentage, the highest mean value was obtained by Giza 1 with biogen and Zn 100 ppm (59.43%) in the first season and with zero microelements (62.25%) in the second season .These results are in agreement with that obtained by **Krishnareddy and Ahlawat (1996).**

Table (23) Protein and carbohydrate% as affected by interaction between biofertilizers and micronutrients in 2007/2008 and 2008/2009 seasons.

Biofert. X Micro.(ppm)		Protein%		Carbohydrate%	
		S1	S2	S1	S2
Phospho	Zero micro.	**21.37**	22.16	**59.13**	**59.62**
	100 Zn	20.32	20.56	57.96	59.05
	200 Zn	19.66	20.25	57.35	58.01
	100 boron	20.69	20.18	57.83	57.52
	200 boron	20.04	20.95	57.53	57.30
Biogen	Zero micro.	21.00	21.67	59.10	59.36
	100 Zn	20.79	21.25	58.05	57.55
	200 Zn	21.00	20.03	57.96	58.13
	100 boron	20.91	20.90	56.96	58.89
	200 boron	20.85	21.91	57.01	**60.79**
Zero biofert.	Zero micro.	18.78	18.79	56.25	56.55
	100 Zn	19.85	19.55	57.83	57.22
	200 Zn	20.34	19.93	58.68	57.19
	100 boron	20.32	19.44	57.76	57.72
	200 boron	20.12	19.25	57.10	58.17
L.S.D.		1.5	N.S	N.S	1.46

Biofert. refer to Biofertilizer Micro. refer to Micronutrient

S1 : 2007/2008 season . S2: 2008/2009 season .

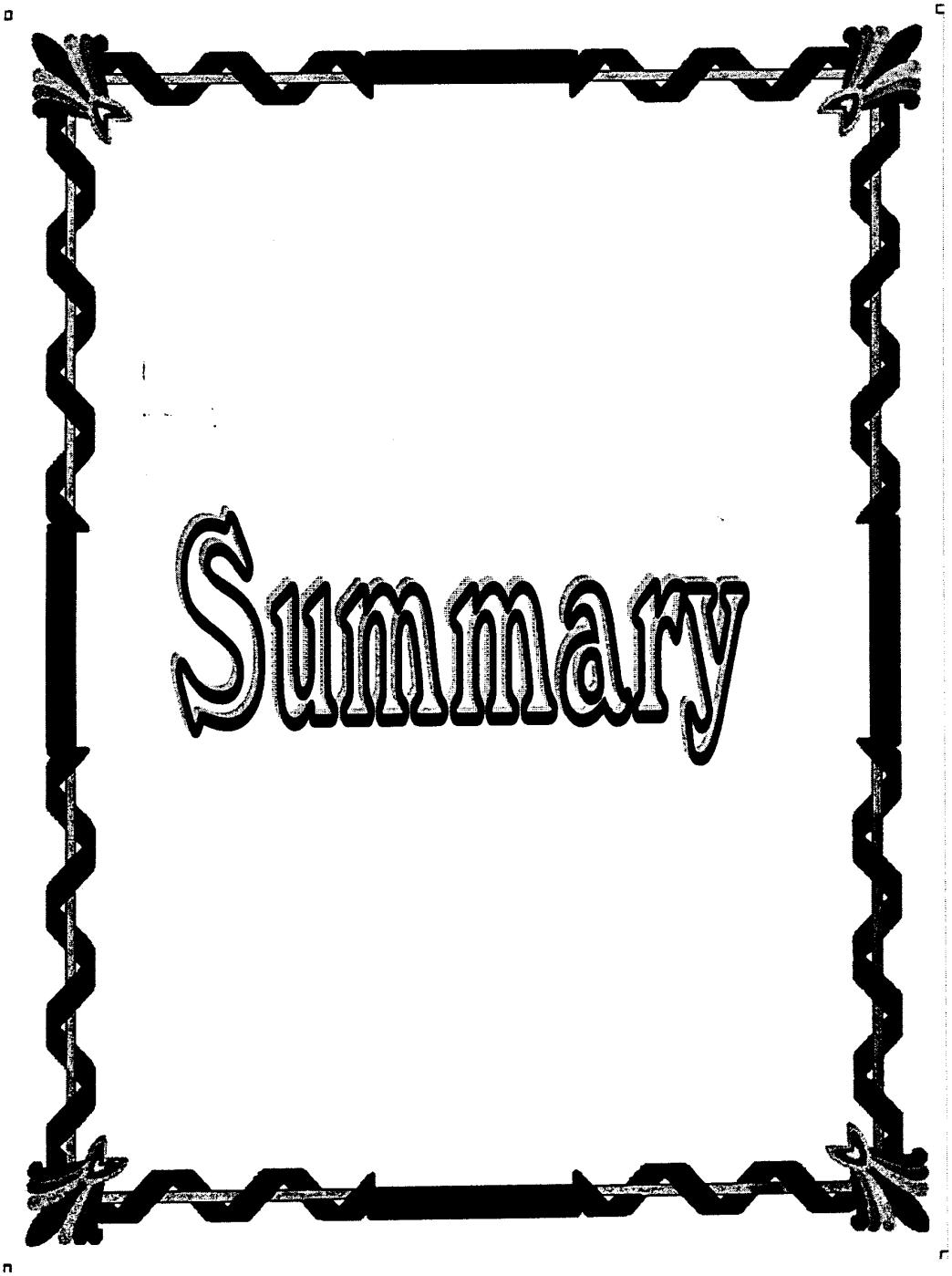
Table (24) Protein and carbohydrate % as affected by interaction between cultivars, biofertilizers and micronutrients in 2007/2008 and 2008/2009 seasons.

Cultiv. X Biofert.XMicro.(ppm)			Protein%		Carbohydrate %	
			S1	S2	S1	S2
Giza1	Phospho.	Zero micro.	19.17	20.56	57.63	57.40
		100 Zn	**22.05**	**22.40**	**59.26**	**61.00**
		200 Zn	20.69	21.52	58.70	60.42
		100 boron	19.95	20.81	56.96	58.72
		200 boron	19.92	20.59	57.53	58.31
	Biogen	Zero micro.	20.59	21.43	56.96	**62.25**
		100 Zn	21.30	21.47	**59.43**	57.87
		200 Zn	20.69	20.12	56.70	57.76
		100 boron	21.08	19.77	58.93	57.52
		200 boron	20.69	20.11	57.50	57.57
	Zero biofert.	Zero micro.	18.78	18.55	56.30	56.49
		100 Zn	19.94	19.41	56.90	57.65
		200 Zn	20.53	20.12	59.16	57.56
		100 boron	21.27	19.21	57.70	58.70
		200 boron	20.14	18.89	57.93	57.26
Giza2	Phospho.	Zero micro.	20.92	21.34	57.43	57.20
		100 Zn	20.69	21.93	59.00	58.24
		200 Zn	19.94	19.60	57.23	57.68
		100 boron	19.37	19.68	57.73	57.3
		200 boron	21.46	19.77	58.13	56.73
	Biogen	Zero micro.	21.11	22.39	57.06	59.34
		100 Zn	20.70	21.87	58.76	60.85
		200 Zn	20.89	22.39	59.40	57.35
		100 boron	20.91	20.29	57.00	58.74
		200 boron	21.14	21.70	56.43	60.21
	Zero biofert.	Zero micro.	18.78	19.02	56.20	56.62
		100 Zn	19.75	19.69	58.76	56.79
		200 Zn	20.14	19.74	58.20	56.81
		100 boron	19.37	19.66	57.83	56.75
		200 boron	20.14	19.61	56.26	59.07
L.S.D.			2.12	1.88	2.12	2.06

Cultiv. refer to cultivar

Bio. refer to Biofertilizer Micro. refer to Micronutrient

S1 : 2007/2008 season . S2: 2008/2009 season .



SUMMARY

Two field experiments were carried out at the Farm of Faculty of Agriculture,AL-Azhar University at Nasr City, Cairo Governorate during the two successive seasons of 2007/2008 and 2008/2009 to study the effect of Biofertilizer and Micronutrients on growth, yield and yield components of some chickpea cultivars (*Cicer arietinum, L.*).

Each experiment included 30 treatments, which were the combination of 2 cultivars, 3 treatments of biofertilizer and 5 treatments of micronutrients.

Studied Factors:

A:Cultivars

1- Giza 1

2- Giza 2

B-Biofertilizer treatments :

1-0.0 biofertilizer.

2-Phosphoren at the rate of 500 gm /fad.

3-Biogen at the rate of 300 gm /fad.

Phosphoren and Biogen were obtained from The Unit of Biofertilizer Agric. Res. Center, Giza – Egypt.

C-Micronutrient treatments :

1-0.0 micro nutrient.

2-100 ppm concentration of Zn as $ZnSO_4$.

3-200 ppm concentration of Zn as $ZnSO_4$.

4-100 ppm concentration of B as $Na_2B_4O_7$.

5-200 ppm concentration of B as $Na_2B_4O_7$.

The soil of experiment was clay loam with 7.7PH and 0.89% organic matter content .

A randomized complete block design was used with three replication.

Data on growth characters (at 75 and 105 days after sowing), flowering date, yield and yield components were recorded.

Results could be summarized as follows:

A.Growth characters:

A.1. The differences between of cultivars :

1.After 75 days from sowing :

Chickpea cultivars showed significant differences in all studied characters at 75 days after sowing (DAS), except plant height , dry weight of leaves in the first season ,number of branches/plant and dry weigh of branches/plant and total dry weight / plant in the second season .

Giza 1 recorded the highest values of No. of branches /plant (9.25), dry weight of branches/plant (3.29 gm) and total dry weight /plant (6.13 gm) in the first season as well as the highest value of plant height (43.28 cm) in the second season and, no. of days from sowing to 50% flowering by (70.93 day) in the second season. Giza 2 gave the maximum value of dry weight of leaves/plant (2.31 gm) in the second season.

2.After 105 days from sowing:

Chickpea cultivars showed significant differences in all studied characters at 105 days after sowing (DAS), except dry weight of leaves in the second season and total dry weight per plant in the two seasons .

Giza 1 gave the highest values of plant height (57.77 cm) and dry weight of branches/plant (8.95 gm) in the second season as well as dry weight of leaves /plant (7.09 gm) in the first season. Giza 2 was recorded the highest values of No. of branches /plant (25.71) in the second season .

A.2. The effect of biofertilizers:

1.After 75 days from sowing:

Biofertilizer treatments indicate that significant differences in all growth characters at 75 days after sowing DAS, except number of branches / plant in the second season .

Results indicate that the phosphoren fertilizer gave the highest values for dry weight of leaves/plant (3.05 gm), in the first season as well as dry weight of branches /plant (4.51 gm), total dry weight /plant (7.08 gm) and lowest days of no. of days from sowing (69.50 day) in the second season .

Biogen fertilizer gave tallest plants (43.92 cm) in the second season and No. of branches /plant (9.19) in the first season.

2.After 105 days from sowing :

Biofertilizers treatments indicate that significant differences in all growth characters at 105 days after sowing DAS, except number of branches / plant in the two seasons and dry weight of branches per plant in the second season .

Phosphoren gave the highest values of dry weight of leaves/plant (7.50 gm) in the second season and dry weight of branches per plant (5.51 gm) in the first season and Biogen gave the tallest plants (59.13 cm) and total dry weight /plant (16.83 gm) in the second season.

A.3. The effect of micronutrient:

1.After 75 days from sowing :

All studied characters showed significant differences due to micronutrient treatments at 75 (DAS), except dry weight of branches per plant in the second season .

Application of Zn 100 ppm significantly increased plant height (43.90 cm) and total dry weight /plant (7.42 gm) in the second season. Zn 200 ppm gave the highest values of dry weight of leaves/plant (2.87 gm) in the first season and no. of days from sowing (68.00 day) in the second season.

Application of boron 100 ppm gave the highest value for dry weight of branches per plant (3.61 gm) in the first season, and no. of branches / plant (17.36) in the second season.

2.After 105 days from sowing:

All studied characters showed significant differences due to micronutrient treatments at 105 (DAS) for all growth characters, except dry weight of branches per plant in the two seasons and total dry weight per plant in the second season .

Application of Zn 100 ppm gave greatest values for dry weight of leaves/plant (7.53 gm) and total dry weight per plant (12.76 gm) in the first season. Application of Zn concentration

200 ppm recorded the highest values of plant height (58.88 cm) in the second season.

Application of Zn 200 ppm produced the highest values for no. of branches / plant (26.55) in the second season .

A.4.Interaction effects :

A.4.1. Interaction effect between cultivars and biofertilizers treatments :

1.After 75 days from sowing :

Results indicate that significant differences due to the interaction effect between chickpea cultivars and biofertilizers at 75 on growth characters except plant height per plant in the first season, number of branches/ plant in the second season and number of days from sowing to 50 % flowering in both seasons.

Giza 1 with phosphoren gave the highest values for dry weight branches/plant (5.41 gm) and total dry weight /plant (8.13 gm) in the second season .

Giza 1 with biogen gave greatest values for no. of branches (9.95) and dry weight of leaves/plant (3.16 gm) in the first season.

Giza 2 with biogen gave the highest value for plant height (44.10 cm) in the second season.

2.After 105 days from sowing :

Results indicate that significant differences due to the interaction effects between chickpea cultivars and biofertilizers at 105 were obtained on growth characters, except dry weight of branches/ plant in the first season.

Giza 1 with biogen recorded the highest values for plant height (62.46 cm), dry weight of branches/plant (10.43 gm) and total dry weight /plant (18.92 gm) in the second season, as well as dry weight of leaves/plant (7.96 gm) in the first season .

Giza 2 with phosphoren recorded the highest values for no. of branches per plant (28.86) in the second season.

A.4.2 Interaction between cultivars and micronutrients:

1.After 75 days from sowing:

All studied growth characters showed significant differences due to the interaction effect between chickpea cultivars and micronutrient at 75 (DAS), except dry weight of leaves and branches per plant in both seasons and total dry weight per plant in the second season.

Application of Giza 1 with Zn 100 ppm significantly increased plant height (44.26 cm) in the second season, number of branches per plant (19.41) in second season, and total dry weight per plant (6.75 gm) in the first season.

Giza 1 with Zn 200 ppm gave the highest value no.of days from sowing 50% flowering (67.66 day) in second season .

2.After 105 days from sowing:

All studied growth characters showed significant differences due to the interaction effect between chickpea cultivars and micronutrients at 105 (DAS), except dry weight of branches per plant in the second season .

Giza 1 with Zn 200 ppm gave the highest values for plant height (58.97 cm), number of branches per plant (17.87), and dry weight of branches per plant (5.72 gm) in the first season, dry

weight of leaves per plant (8.25 gm) and total dry weight per plant (18.63 gm) in the second season. Giza 1 with Zn 200 ppm gave the tallest plants (60.33 cm) in the second season.

Giza 2 with Zn concentration 200 ppm recorded the height value for no.of branches /plant (29.33) in the second season .

A.4.3.Interaction effect between biofertilizers and micronutrients:

1. At 75 days after sowing:

Results indicate that significant differences due to the interaction effects between the two factors at 75 (DAS) for all growth characters, except number of days from sowing to 50 % flowering in both seasons.

The tallest plant recorded with phosphoren and zero micro nutrients by (47.3 cm), no. of branches/plant (20.60), dry weight of branches / plant (5.70 gm) and total dry weight per plant (9.29 gm) in the second season, as well as dry weight of leaves per plant (3.91gm) in the first season.

II.At 105 days after sowing :

All studied characters showed significant differences due to the interaction effect between the two factors at 105 (DAS) in both seasons, except dry weight of branches/plant in the first season.

Biogen with zero micro nutrients recorded the highest values for plant height (65.33cm), dry weight of branches/plant (10.58 gm) and total dry weight per plant (18.89 gm) in the second season.

Biogen with Zn 100 ppm gave the highest values for dry weight of leaves / plant (8.79 gm) in the second season.

Appling zero biofertilizers with Zn 200 ppm gave the highest value for no. of branches /r plant (30.66) in the second season .

A.4.4. Interaction effect between cultivars, biofertilizers and micronutrient treatments:

1. At 75 days after sowing:

Results indicate that significant differences due to the interaction effect between the three factors at 75 (DAS) in both seasons. except plant height, number of branches and number of days from sowing to 50 % flowering in the first season.

As for plant height, Giza 1 with phosphoren and Zn 100 ppm had the highest value (49.10 cm), no. of branches / plant (22.86) and total dry weight per plant (9.22 gm) in the second season .

Giza 1 with zero micronutrient gave the highest value for dry weight of branches /plant (6.83 gm) in the second season. Giza 2 with phosphoren and Zn 100 ppm gave the highest dry weight of leaves /plant (3.98 gm) in the first season.

Giza 2 with phosphoren and Zn 200 ppm gave the lowest value for number of days from sowing to 50 % flowering (65 day) in the second season.

I.At 105 days after sowing :

All studied characters showed significant differences due to the interaction effect among cultivar, biofertilizer and micronutrient treatments at 105 days in both seasons, except

plant height in the first season and dry weight of branches in both seasons .

The highest dry weight of leaves/plant recorded by Giza 1 with biogen and Zn 100 ppm (11.04 gm) and total dry weight /plant (24.38 gm) in the second season .Giza 1 with Biogen and Zn 200ppm gave the highest mean values for plant height (68.66 cm) in the second season. Giza 2 with phosphoren and boron 200 ppm gave the highest for number of branches /plant (37.66) in the second season.

II. yield and its components :

II.1.The differences between cultivars :

The differences between cultivars reached the significance level for all studied characters, except number of pods / plant in the second season and biological yield / fad. in the first season .

Giza 1 cultivar gave the highest values of plant height (70.45 cm), seed yield per fad. (629.23 kg), straw and biological yields per fad.(1413.60 and 2052.12 kg/fad.) in the second season, as well as total dry weight per plant (26.26 gm), seed yield per plant (12.82 gm) and seed index (26.87 gm) in the first season.

Giza 2 cultivar gave the highest value for number of pods/plant (40.65 pod) in the first season.

II.2.Effect of biofertilizers:

All studied characters were significantly affected by biofertilizers treatments during the two seasons.

Phosphoren treatment gave the tallest plants (71.56 cm), number of pods per plant (46.34 pod), seed, straw and biological

yields per fad. (632.06, 1364.57 and 2010.57 kg/fad.) in the second season, as well as total dry weight per plant (25.86 gm), seed yield per plant (11.94 gm) and seed index (24.66 gm) in the first season. Biogen treatment gave the maximum values for harvest index (33.81) in the first season.

II.3. Effect of micronutrients :

Results indicated that for effect of micronutrient under studied characters during two seasons, except seed index in the second season and straw yield in the first season.

Treatment Zn 100 ppm give the highest values for seed index (24.32 gm) and harvest index (35.98 %) in the first season , as well as seed yield/fad. (691.88 kg) and biological yield /fad.(2097.73 kg) in the second season .Treatment Zn 200 ppm gave the highest value of plant height (72.88 cm) in the second season.

Boron 100 ppm treatment give the highest value of total dry weight per plant (26.47gm) in the first season and no. of pods per plants (45.22 pod) in the second season.

Treatment boron 200 ppm gave the highest value of seed yield per plant (11.88 gm) in the first season and straw yield per fad. (1417.65 kg) in the second season.

II.4.Interaction effect :

II.4.1. Interaction between cultivar and biofertilizer :

Results indicate that total dry weight per plant, number of pods per plant, seed yield per plant and seed index were significantly affected by the interaction between cultivar and

biofertilizer in one season out of two, except plant height in the two seasons .

Giza 1 cultivar with phosphoren gave the height values for number of pods per plant (46.85 pod), seed yield/fad. (692.90 kg), straw yield / fad.(1617.30 kg) and biological yield (2338.08 kg) in the second season as well as seed yield/ plant (13.50 gm), seed index (27.52 gm) and harvest index (35.66 %) in the first season. While, Giza 1 cultivar with biogen gave greatest values for total dry weight per plant (28.05 gm) in the first season.

II.4. 2. Interaction effect between cultivar and micronutrient:

With the exception of seed yield / plant and seed index in the first season, all studied characters showed significant differences due to the interaction effect between cultivars and micronutrient during the two growing seasons.

Giza 1 cultivar with Zn 100 ppm gave greatest values for seed index (24.70 gm) in the second season and harvest index (37.70 %) in the first season.

Giza 1 cultivar with Zn 200 ppm gave greatest values for plant height (77.94cm) in the second season, total dry weight/plant (28.60 gm) in the first season and seed yield/plant (11.42 gm) in the second season. Also, Giza 1 cultivar with boron (200 ppm) gave greatest values for seed yield/fad. (733.34 kg), straw yield/fad. (1685.08 kg) and biological yield /fad. (2418.42 kg) in the second season.

Giza 2 cultivar with Zn 200 ppm gave the highest value for number of pods /plant (45.83 pod) in the second season .

II.4.3.Interaction effect between biofertilizers and micronutrient:

Results indicate that all traits were significantly affected by the interaction between biofertilizers and micronutrient in the two seasons.

Results show that, applying phosphoren with Zn 100 ppm recorded the highest value for plant height (78.83 cm), straw yield /fad.(1667.52 kg) and biological yield /fad.(2450.67 kg) in the second season as well as total dry weight (27.23 gm), seed yield /plant (26.58 gm) and seed index (26.58 gm) in the first season .

Phosphoren with boron 200 ppm gave the highest value for No.of pods/plant (50.38 pod) in the second season. Biogen treatment with Zn 200 ppm gave the highest value of harvest index (40.13%) in the second season .

II.4.4. Interaction effect between cultivars, biofertilizer and micronutrient :

With the exception of biological yield/fad. and harvest index in the first season ,total dry weight /plant ,seed yield /plant ,seed index in the second season all studied characters showed significant.

Giza 1 cultivar with phosphoren and Zn 100 ppm gave the highest values for plant height (80.33 cm), seed yield /fad. (793.29 kg) in the second season and seed yield /plant (15.96 gm), seed index (29.58 gm) in the first season.

Giza 1 cultivar with phosphoren and boron 100 ppm gave the highest value for straw yield/fad. (1881.65 kg) in the second season .

Giza 1 cultivar with phosphoren and boron 200ppm showed the highest values for number of pods /plant (52.90 pod) and biological yield /fad.(2577.36 kg) in the second season .

Giza 1 cultivar with biogen and Zn 200 ppm recorded the highest value for total dry weight /plant (31.20 gm) in the first season. Giza 2 cultivar with biogen and Zn 200 ppm gave the highest value for harvest index (42.70%) in the second season .

C.Chemical seeds contents:

C.1. The differences between cultivar :

Cultivars significantly differed in the first season, Giza 1 produced higher protein and carbohydrate percentage (20.45 and 57.84%) than Giza 2.

C.2. Effect of biofertilizer:

The differences between biofertilizer treatments planting during were significant in the both seasons.

Biogen treatment gave the highest percentage of protein was (21.15%) in the second season .While, the maximum percentage of carbohydrate recorded by applying Biogen (58.94%) in the second season.

C.3. Effect of micronutrients:

Appling of Zn (100 ppm) recorded the highest percentage of protein (21.13%) in the second season and carbohydrate (58.68%) in the first season.

C.4. Interaction effect :

C.4.1. Interaction effect between cultivars and biofertilizers:

Results showed significant interaction effect between cultivars and biofertilizer applications in the two seasons.

Giza 2 cultivar with biogen gave the highest values for protein (21.73%) and carbohydrate (59.30%).

C.4.2. Interaction effect between cultivars and micronutrient:

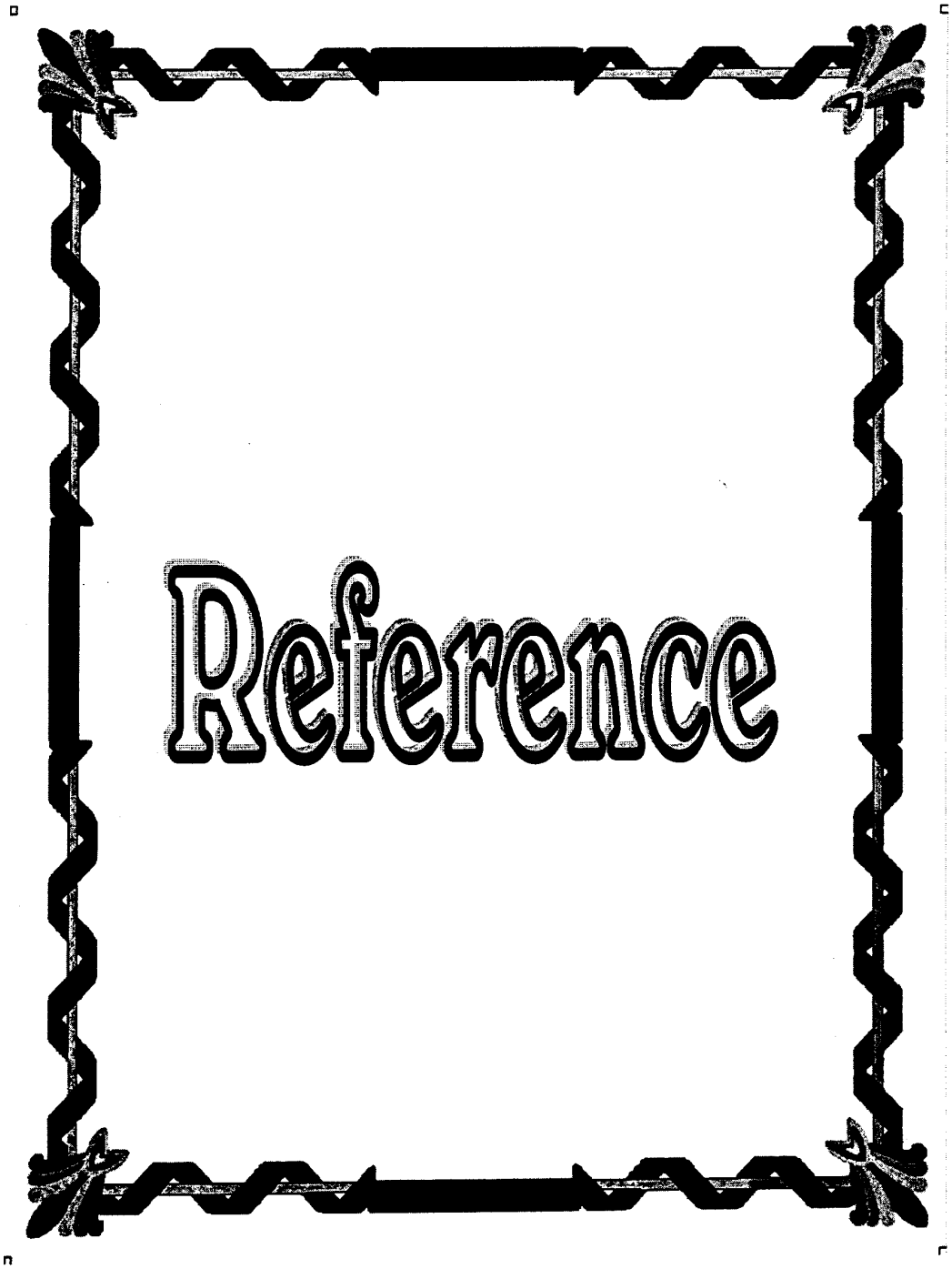
Giza 2 cultivar with Zn 100 ppm gave the maximum for protein percentage (21.16) in the second season and carbohydrate (58.84 %)in the first season.

C.4.3.Interaction effect between biofertilizers and micronutrients:

Phosphoren with zero micronutrient produced the maximum for protein % (21.37%) in the first season. While, biogen with boron 200 ppm gave the highest percentage of carbohydrate (60.79 %) in the second season .

C.4.4.Interaction effect between cultivars ,biofertilizers and micronutrients:

Giza 1 cultivar with phosphoren and Zn 100 ppm gave the highest mean value of protein % (22.40 %) in the second season. While, Giza 1 cultivar with biogen and zero micronutrients gave recorded the highest mean value for carbohydrate (62.25 %) in the second season.



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Arabic Summary

الملخص العربي

تأثير التسميد الحيوي والمعدني للعناصر الصغرى علي بعض أصناف الحمص

أقيمت تجربتان حقليتان بمزرعة كلية الزراعة –جامعة الأزهر – مدينة نصر ، محافظة القاهرة . خلال موسمي ٢٠٠٧/٢٠٠٨ ، ٢٠٠٨/٢٠٠٩ م .

وذلك لدراسة تأثير المعاملات المختلفة من السماد الحيوي والسماد المعدني للعناصر الصغرى علي صفات النمو والمحصول ومكوناته وبعض المكونات الكيماوية في البذور لصنفي الحمص جيزة ١ ، جيزة ٢ .

عوامل الدراسة :

اشتملت التجربة على ثلاثة عوامل للدراسة هي:

أولا :الأصناف :

أستخدم الصنفان جيزة ١ ، جيزة ٢ .

جيزة ١ : بذوره كبيرة الحجم ويصلح لصناعة الحلوى .

جيزة ٢ : بذوره صغيرة الحجم ويصلح لأغراض الحمص المجوهر وأغراض الطهي .

ثانيا : الأسمدة الحيوية :

١- بدون تسميد حيوي .

٢-الفوسفورين بمعدل ٥٠٠ جم / فدان .

٣-البيوجين بمعدل ٣٠٠ جم / فدان .

وقد تمت إضافة كل منهما خلطا مع البذور عند الزراعة .

ثالثا : العناصر الصغرى :

وكانت المعاملات كما يلي :

١-مقارنة (بدون إضافة عناصر صغرى) .

٢-الزنك بمعدل ١٠٠جزء في المليون .

٣-الزنك بمعدل ٢٠٠جزء في المليون.

٤-البورون بمعدل ١٠٠جزء في المليون.

٥-البورون بمعدل ٢٠٠جزء في المليون .

وقد أستخدم الزنك في صورة كبريتات زنك و أستخدم البورون في صورة بورات صوديوم .

وقد تم رش عنصري الزنك والبورون علي النباتات بعد ٤٠ ، ٥٥ يوم من الزراعة .

وقد اشتملت كل تجربة علي ٣٠ معاملة عبارة عن التوافق بين الصنفين وثلاث معاملات من السماد الحيوي وخمس معاملات من العناصر الصغرى .

وكانت التربة التي زرعت بها التجربتان صفراء ورقم الحموضة ٧,٦٥ ومحتوي التربة من المادة العضوية ٠,٨٨% .

وقد أستخدم تصميم القطاعات الكاملة العشوائية في ثلاث مكررات .

*** الصفات المدروسة :**

أولا : صفات النمو :

تم أخذ خمسة نباتات عشوائيا من كل قطعة عند عمر ٧٥ ، ١٠٥ يوم بعد الزراعة لدراسة الصفات التالية :

١. طول النبات (سم) .

٢. عدد الأفرع / نبات .

٣. الوزن الجاف لأوراق النبات بالجرام .

٤. الوزن الجاف للأفرع بالجرام .

٥. الوزن الجاف الكلى للنبات بالجرام .

٦- وتم حساب عدد الأيام من الزراعة حتى أزهار ٥٠ % من النباتات .

ثانيا : مكونات المحصول :

عند الحصاد تم أخذ خمسة نباتات عشوائيا من كل قطعة لدراسة الصفات التالية :

١. طول النبات بالسم .

٢. الوزن الجاف الكلي للنبات بالجرام .

٣. عدد قرون النبات .

٤. وزن بذور النبات بالجرام .

٥. وزن ال ١٠٠ بذرة بالجرام .

ثالثا : المحصول :

تم حصد نباتات القطعة (٢,٥ x ٢,٤م) ٦,٠م٢ ووزنت ثم نسبت للفدان لدراسة الصفات التالية :

١. محصول البذور للفدان (كجم) .

٢. محصول القش للفدان (كجم) .

٣. المحصول البيولوجي للفدان (كجم) .

٤. دليل الحصاد = $\frac{\text{محصول البذور للفدان}}{\text{المحصول البيولوجي للفدان}} \times ١٠٠$

رابعا :المكونات الكيماوية :

- % للبروتين .
- % للكربوهيدرات .

** وفيما يلي ملخصا لأهم النتائج المتحصل عليها :

١- صفات النمو:

أولا : الاختلافات بين الأصناف :

١- بعد ٧٥ يوم من الزراعة :

اختلفت الأصناف معنويا في صفات النمو المدروسة باستثناء طول النبات و الوزن الجاف للأوراق في الموسم الأول وعدد الفروع للنبات والوزن الجاف للأفرع والوزن الجاف الكلي للنبات في الموسم الثاني .

- أعطي الصنف جيزة ١ أعلي القيم لكل من طول النبات (٤٣,٢٨ سم) في الموسم الثاني وأقل عدد من الأيام حتى ٥٠ % تزهير (٧٠,٩٣ ، ٧٢,٤٠ يوم) في الموسم الثاني ، عدد الفروع/ نبات (٩,٢٥ فرع) والوزن الجاف للفروع (٣,٢٩ جم) والوزن الجاف الكلي للنبات (٦,١٣جم) في الموسم الأول
- كما أعطي الصنف جيزة ٢ أعلي قيمة للوزن الجاف للأوراق (٢,٣١ جم) في الموسم الثاني .

٢ - بعد ١٠٥ يوم من الزراعة :

اختلفت الأصناف معنويا في الصفات المدروسة باستثناء الوزن الجاف للأوراق في الموسم الثاني ، والوزن الجاف الكلي للنبات في الموسمين .

أعطي الصنف جيزة ١ أعلي القيم لكل من طول النبات (٥٧,٧٧ سم) والوزن الجاف للأفرع (٨,٩٥ جم) في الموسم الثاني و الوزن الجاف للأوراق (٧,٠٩ جم) في الموسم الأول - كما أعطي الصنف جيزة ٢ أعلي قيمة لعدد قرون النبات (٢٥,٧١ قرن) في الموسم الثاني .

ثانيا : تأثير الأسمدة الحيوية :

١-بعد ٧٥ يوم من الزراعة :

- أوضحت النتائج أن معاملات الأسمدة الحيوية المستخدمة كان لها تأثيرا معنويا علي الصفات المدروسة باستثناء عدد الفروع للنبات في الموسم الثاني .
- أدت المعاملة بالفوسفورين إلي زيادة معنوية لكل من الوزن الجاف للأوراق (٣,٠٥ ٧ جم) ، والوزن الجاف للفروع (٤,٥١ جم) ، والوزن الجاف الكلي للنبات (٧,٠٨ جم) بينما قل عدد الأيام من الزراعة حتى أزهار ٥٠ % من النباتات (٦٩,٥٠ يوم) في الموسم الأول .
- أعطت معاملة البيوجين اعلي القيم لكل من طول النبات (٤٣,٩٢ سم) في الموسم الثاني ، عدد فروع النبات (٩,١٩ فرع) في الموسم الأول .

٢- بعد ١٠٥ يوم من الزراعة :

- أوضحت النتائج أن معاملات الأسمدة الحيوية المستخدمة كان لها تأثيرا معنويا علي الصفات المدروسة باستثناء عدد الفروع للنبات في الموسمين ، والوزن الجاف للفروع في الموسم الثاني.
- أعطت معاملة الفوسفورين أعلي القيم لكل من الوزن الجاف للأوراق (٧,٥٠جم) في الموسم الثاني والوزن الجاف للفروع (٥,٥١ جم) في الموسم الأول .
- وقد أعطت معاملة البيوجين أعلي القيم لطول النبات (٥٩,١٣ سم) ، الوزن الجاف الكلي للنبات (١٦,٨٣ جم) في الموسم الثاني .

ثالثا : تأثير التسميد بالعناصر الصغرى:

١- بعد ٧٥ يوم من الزراعة :

- أوضحت معاملات التسميد بالعناصر الصغرى إلي وجود تأثيرا معنويا لها علي معظم الصفات المدروسة فيما عدا الوزن الجاف لفروع النبات في الموسم الثاني .

- أعطت معاملة الرش بتركيز ١٠٠ جزء في المليون زنك أعلي القيم لطول النبات (٤٣,٩٠ سم) ، والوزن الجاف الكلي للنبات (٧,٤٢ جم) في الموسم الثاني .
- وقد أعطي الرش بتركيز ٢٠٠ جزء في المليون زنك أعلي القيم للوزن الجاف للأوراق (٢,٨٧ جم) في الموسم الأول وأقل عدد من الأيام حتى تزهير ٥٠ % من النباتات (٦٨,٠ يوم) في الموسم الثاني .
- أعطت معاملة الرش بتركيز ١٠٠ جزء في المليون بورون أعلي قيمة للوزن الجاف للفروع (٣,٦١ جم) في الموسم الأول .
- أزداد عدد فروع النبات بالرش بتركيز ٢٠٠ جزء في المليون بورون (١٧,٣٦ فرع) في الموسم الثاني .

٢- بعد ١٠٥ يوم من الزراعة :

- أوضحت النتائج وجود فروق معنوية بين معاملات العناصر الصغرى المستخدمة في تأثيرها علي الصفات المدروسة فيما عدا الوزن الجاف للفروع في الموسمين ، والوزن الجاف الكلي للنبات في الموسم الثاني .
- سجلت معاملة الرش بتركيز ١٠٠ جزء في المليون زنك أعلي قيمة لكل من الوزن الجاف للأوراق للنبات (٧,٥٣ جم) في الموسم الثاني ، الوزن الجاف الكلي للنبات (١٢,٧٦ جم) في الموسم الأول.
- أعطت معاملة الرش بتركيز ٢٠٠ جزء في المليون زنك أعلي القيم لطول النبات (٥٨,٨٨ سم) في الموسم الثاني .
- بينما أعطت معاملة الرش بتركيز ١٠٠ جزء في المليون بورون أعلي قيمة لعدد فروع النبات (٢٦,٥٥ فرع) في الموسم الثاني .

رابعا : تأثير التفاعل :

أ- تأثير التفاعل بين الأصناف و الأسمدة الحيوية .

١- بعد ٧٥ يوم من الزراعة :

- أوضحت النتائج وجود تأثير معنوي لهذا التفاعل علي الصفات المدروسة فيما عدا طول النبات في الموسم الأول ، عدد الفروع في الموسم الثاني ، وعدد أيام التزهير في الموسمين .
- أعطت معاملة الصنف جيزة ١ بالفوسفورين أعلي قيمة لكل من الوزن الجاف للفروع (٥,٤١ جم) و الوزن الجاف الكلي للنبات (٨,١٣ جم) في الموسم الثاني.
- كما أعطت معاملة الصنف جيزة ١ بالبيوجين أعلي قيمة لكل من عدد الفروع/نبات (٩,٩٥ فرع) ،و الوزن الجاف للأوراق (٣,١٦ جم) في الموسم الأول.
- وقد أعطي الصنف جيزة ٢ مع معاملة البيوجين أعلي قيمة لطول النبات (٤٤,١٠ سم) في الموسم الثاني .

٢-بعد ١٠٥ يوم من الزراعة :

- أوضحت النتائج وجود تأثير معنوي لهذا التفاعل علي الصفات المدروسة فيما عدا الوزن الجاف للفروع في الموسم الأول .
- سجلت معاملة الصنف جيزة ١ بالبيوجين أعلي قيمة لطول النبات (٦٢,٤٦سم)، والوزن الجاف للفروع (١٠,٤٣ جم) ، والوزن الجاف الكلي للنبات (١٨,٢٢جم) في الموسم الثاني ، والوزن الجاف للأوراق (٧,٩٦ جم) في الموسم الأول.
- أعطت معاملة الصنف جيزة٢ بالفوسفورين اعلي قيمة لعدد الفروع/نبات (٢٨,٨٦ فرع) في الموسم الثاني .

ب- تأثير التفاعل بين الأصناف والعناصر الصغرى

١- بعد ٧٥ يوم من الزراعة :

- بينت نتائج الدراسة وجود اختلافات معنوية لتأثير التفاعل بين الأصناف والعناصر الصغرى علي الصفات المدروسة فيما عدا الوزن الجاف للأوراق والوزن الجاف للأفرع في الموسمين ، والوزن الجاف الكلي للنبات في الموسم الثاني .
- أعطت معاملة الصنف جيزة ١ بالرش بتركيز ١٠٠ جزء في المليون زنك أعلي القيم لطول النبات (٤٤,٢٦ سم) وعدد الفروع للنبات (١٩,٤١ فرع) في الموسم الثاني ، و الوزن الجاف الكلي للنبات (٦,٧٥ جم) في الموسم الأول .
- كما سجلت معاملة الصنف جيزة ١ بالرش بتركيز ٢٠٠ جزء في المليون زنك أقل عدد من الأيام حتي تزهير ٥٠ % من النباتات (٦٧,٦٦ يوم) في الموسم الثاني .

٢- بعد ١٠٥ يوم من الزراعة :

- أوضحت نتائج الدراسة وجود تأثير معنوي لهذا التفاعل علي الصفات المدروسة فيما عدا الوزن الجاف للأفرع في الموسم الثاني .
- أعطي الصنف جيزة ١ بالرش بتركيز ١٠٠ جزء في المليون زنك أعلي القيم للوزن الجاف للأوراق (٨,٥٦ جم)، والوزن الجاف الكلي للنبات (١٨,٦٣ جم) في الموسم الثاني ، والوزن الجاف للفروع (٥,٧٢ جم) في الموسم الأول. وأيضا أعطي هذا الصنف مع الرش بتركيز ٢٠٠ جزء في المليون زنك أعلي طول للنبات (٦٠,٣٣ سم) في الموسم الثاني.
- بينما سجل الصنف جيزة ٢ بالرش بتركيز ٢٠٠ جزء في المليون زنك أعلي قيمة لعدد فروع النبات (٢٩,٣٣ فرع) في الموسم الثاني .

ج- تأثير التفاعل بين الأسمدة الحيوية والعناصر الصغرى :

١- بعد ٧٥ يوم من الزراعة :

- بينت نتائج الدراسة وجود اختلافات معنوية لتأثير التفاعل بين الأسمدة الحيوية والعناصر الصغرى علي الصفات المدروسة فيما عدا صفة عدد الأيام من الزراعة حتي تزهير ٥٠ % من النباتات في الموسمين .
- أعطي الفوسفورين بدون إضافة عناصر صغري أعلي قيمة لكل من طول النبات (٤٧,٣ سم) ، و عدد فروع النبات (٢٠,٦٠ فرع) ، والوزن الجاف لفروع النبات (٥,٧٠ جم) و الوزن الجاف الكلي للنبات (٩,٢٩ جم) في الموسم الثاني، والوزن الجاف للأوراق (٣,٩١ ، ٣,٥٩ جم) في الموسم الأول .

٢- بعد ١٠٥ يوم من الزراعة :

- بينت نتائج الدراسة وجود اختلافات معنوية لتأثير التفاعل بين الأسمدة الحيوية والعناصر الصغرى علي الصفات المدروسة فيما عدا الوزن الجاف للأفرع في الموسم الأول.
- سجلت المعاملة بالبيوجين بدون إضافة عناصر صغري اعلي قيمة لطول النبات (٦٥,٣٣ سم) ، والوزن الجاف للأفرع (١٠,٥٨ جم) ، والوزن الجاف الكلي للنبات (١٨,٨٩ جم) في الموسم الثاني .
- أعطت معاملة البيوجين مع الرش بتركيز ١٠٠ جزء في المليون زنك أعلي قيمة للوزن الجاف للأوراق (٨,٧٩ جم) في الموسم الثاني .
- أدي الرش بتركيز ٢٠٠ جزء في المليون زنك بدون إضافة سماد حيوي أعلي قيمة لعدد فروع النبات (٣٠,٦٦ فرع) في الموسم الثاني .

د – تأثير التفاعل بين الأصناف و الأسمدة الحيوية والعناصر الصغرى .

١ – بعد ٧٥ يوم من الزراعة :

- أوضحت النتائج وجود فروق معنوية لتأثير التفاعل بين الأصناف والأسمدة الحيوية والعناصر الصغرى علي الصفات المدروسة فيما عدا طول النبات وعدد الفروع وعدد أيام التزهير في الموسم الأول .
- أعطي الصنف جيزة ١ مع الفوسفورين والرش بتركيز ١٠٠ جزء في المليون زنك أعلي قيمة لكل من طول النبات (٤٩,١٠ سم) ، وعدد فروع النبات (٢٢,٨٦ فرع) ، والوزن الجاف الكلي للنبات (٩,٢٢ جم) في الموسم الثاني. ومن ناحية أخري أعطي الصنف جيزة ١ مع الفوسفورين بدون إضافة عناصر صغري أعلي قيمة للوزن الجاف للفروع (٦,٨٣ جم) في هذا الموسم .
- أعطي الصنف جيزة ٢ مع الفوسفورين والرش بتركيز ١٠٠ جزء في المليون زنك اعلي قيمة للوزن الجاف للأوراق (٣,٩٨ جم) في الموسم الأول . و الرش بتركيز ٢٠٠ جزء في المليون زنك اقل عدد أيام من الزراعة حتى تزهير ٥٠ % من النباتات (٦٥ يوم) في الموسم الثاني.

٢ – بعد ١٠٥ يوم من الزراعة :

- أوضحت نتائج الدراسة وجود فروق معنوية لتأثير التفاعل بين الأصناف والأسمدة الحيوية والعناصر الصغرى علي الصفات المدروسة فيما عدا طول النبات في الموسم الأول والوزن الجاف للأفرع في الموسمين.
- أعطت معاملة الصنف جيزة ١ مع البيوجين والرش بتركيز ١٠٠ جزء في المليون زنك أعلي قيمة للوزن الجاف للأوراق (١١,٠٤جم) والوزن الجاف الكلي للنبات (٢٤,٣٨ جم) في الموسم الثاني .و أعطى الصنف جيزة ١ مع البيوجين والرش بتركيز ٢٠٠ جزء في المليون زنك اعلي قيمة لطول النبات (٦٨,٦٦ سم) في الموسم الثاني.

- أعطت معاملة الصنف جيزة ٢ بالفوسفورين مع الرش بتركيز ٢٠٠ جزء في المليون بورون اعلي قيمة لعدد فروع النبات (٣٧,٦٦ فرع) في الموسم الثاني .

٢- المحصول ومكوناته :

II - ١- الاختلافات بين الأصناف :

- اختلفت الأصناف معنويا في الصفات المدروسة فيما عدا عدد القرون للنبات في الموسم الثاني والمحصول البيولوجي في الموسم الأول .
- وقد أعطي الصنف جيزة ١ أعلي قيمة لكل من طول النبات (٧٠,٤٥ سم) ومحصول البذور للفدان (٦٢٩,٢٣ كجم) و محصولي القش (١٤١٣,٦٠ كجم/ف) والبيولوجي (٢٠٥٢,١٢ كجم/ف) في الموسم الثاني ، والوزن الجاف الكلي للنبات (٢٦,٢٦ جم)، ومحصول بذور النبات (١٢,٨٢ جم) ودليل البذرة (٢٦,٨٧ جم) و دليل الحصاد(٣٤,١٧ %) في الموسم الأول .
- و أعطي الصنف جيزة ٢ أفضل القيم لعدد القرون/نبات(٤٠,٦٥ قرن) في الموسم الأول .

II -٢- تأثير الأسمدة الحيوية :

- اختلف تأثير الأسمدة الحيوية معنويا علي جميع الصفات المدروسة ،و أعطت معاملة الفوسفورين أفضل القيم لكل من طول النبات (٧١,٥٦ سم) والوزن الجاف الكلي للنبات (٢٥,٧٠ جم) و عدد قرون /النبات (٤٦,٣٤ قرن) ومحصول البذور / فدان (٦٣٢,٠٦ كجم) ومحصول القش /فدان (١٣٦٤,٥٧كجم) والمحصول البيولوجي / فدان (٢٠١٠,٥٧ كجم) في الموسم الثاني ، ووزن بذور النبات (١١,٩٤ جم) ودليل البذرة (٢٤,٦٦ جم) في الموسم الأول.
- أعطت معاملة البيوجين أفضل القيم لدليل الحصاد (٣٣,٨١%) في الموسم الأول.

II -٣- تأثير العناصر الصغرى :

- أوضحت النتائج وجود اختلافات معنوية لتأثير العناصر الصغرى المستخدمة علي الصفات تحت الدراسة خلال موسمي الزراعة فيما عدا دليل البذرة في الموسم الثاني ومحصول القش في الموسم الأول .
- أعطت المعاملة بالزنك بتركيز ١٠٠ جزء في المليون أعلي القيم لكل من
- دليل البذرة (٢٤,٣٢ جم) ودليل الحصاد (٣٥,٩٨ %) في الموسم الأول، ومحصول البذور /فدان (٦٩١,٨٨ كجم) والمحصول البيولوجي (٢٠٩٧,٧٣ كجم) في الموسم الثاني .
- أعطت المعاملة بالزنك بتركيز ٢٠٠ جزء في المليون أفضل القيم لطول النبات (٧٢,٨٨ سم) في الموسم الثاني.
- أعطت معاملة النباتات بالبورون بتركيز ١٠٠ جزء في المليون أفضل القيم للوزن الجاف الكلي للنبات (٢٦,٤٧ جم) في الموسم الأول وعدد القرون للنبات (٤٥,٢٢ قرن) في الموسم الثاني .
- أعطت معاملة النباتات بالبورون بتركيز ٢٠٠ جزء في المليون أفضل القيم لمحصول البذور/نبات (١١,٨٨ جم)في الموسم الأول ، محصول القش (١٤١٧,٦٥ كجم/ف) في الموسم الثاني .

II - ٤ - تأثير التفاعل :

٤- أ - تأثير التفاعل بين الأصناف والأسمدة الحيوية .

- أوضحت النتائج وجود تأثير معنوي للتفاعل بين الأصناف والأسمدة الحيوية المستخدمة علي الصفات تحت الدراسة فيما عدا طول النبات في الموسمين و الوزن الجاف الكلي للنبات ، محصول البذور للنبات ، دليل البذرة في الموسم الثاني وعدد القرون في الموسم الأول .

- أعطت معاملة الصنف جيزة ١ بالفوسفورين اعلي القيم لكل عدد قـرون النبـات (٤٦,٨٥ قرن) ومحـصول البـذور /فـدان (٦٩٢,٩٠ كجـم) ومحـصول القش/فدان (١٦١٧,٣٠ كجم) والمحصول البيولوجي /فدان (٢٣٣٨,٠٨ كجم) في الموسم الثاني . ومحصول البذور للنبات (١٣,٥٠ جـم) ، ودليـل البـذرة (٢٧,٥٢جم) ودليل الحصاد (٣٥,٦٦ %) في الموسم الأول .
- سجل الصنف جيزة ١ مع المعاملة بالبيوجين أفضل قيمة للوزن الجاف الكلـي لنبات (٢٨,٠٥ جم) في الموسم الأول .

II - ٤ – ب – تأثير التفاعل بين الأصناف والعناصر الصغرى .

- باستثناء محصول البذرة للنبات ودليل البذرة في الموسم الأول كان تـأثير هـذا التفاعل علي كل الصفات المدروسة معنويا خلال موسمي الزراعة .
- أعطي الصنف جيزة ١ مع الرش بتركيز ١٠٠ جزء في المليون زنك أفضل القيم لدليل البذرة (٢٤,٧٠ جم) في الموسم الثاني، ودليـل الحـصاد (٣٧,٧٠ %) في الموسم الأول .
- أعطي الصنف جيزة ١ مع الرش بتركيز ٢٠٠ جزء في المليون زنك أفضل القيم لكل من طول النبات (٧٧,٩٤ سم) ومحصول بذور/ النبات (١١,٤٢ جـم) في الموسم الثاني والوزن الجاف الكلي للنبات (٢٨,٦٠ جم) فـي الموسـم الأول.
- أعطي الصنف جيزة ١ مع الرش بتركيز ٢٠٠ جزء في المليون بورون أفـضل القيم لكل من محصول البذور للفدان (٧٣٣,٣٤ كجم) ومحصول القش /فـدان (١٦٨٥,٠٨ كجم) والمحصول البيولوجي /فـدان (٢٤١٨,٤٢ كجـم) فـي الموسم الثاني .
- أعطي الصنف جيزة ٢ مع الرش بتركيز ٢٠٠ جزء في المليون زنك اعلي قيمة لعدد قرون النبات (٤٥,٨٣) في الموسم الثاني .

I – ٤ – ج- تأثير التفاعل بين الأسمدة الحيوية والعناصر الصغرى :

- كان تأثير هذا التفاعل معنويا علي كل الصفات المدروسة خلال موسمي الزراعة.

- أعطي الفوسفورين مع الرش بالزنك بتركيز ١٠٠ جزء في المليون اعلي القيم لكل من طول النبات (٧٨,٨٣ سم)، ومحصول البذور للفدان(٧٨٣,١٥ كجم) ، ومحصول القش / فدان (١٦٦٧,٥٢ كجم) والمحصول البيولوجي / فدان (٢٤٥٠,٦٧ كجم) في الموسم الثاني ، والوزن الجاف الكلي للنبات (٢٧,٢٣ جم) ووزن بذور النبات (١٤,١١ جم) ودليل البذرة (٢٦,٥٨) في الموسم الأول.ومع الرش بالبورون تركيز ٢٠٠ جزء في المليون اعلي قيمة لعدد القرون /نبات (٥٠,٣٨) في الموسم الثاني.

- وقد أعط البيوجين مع الرش بالزنك بتركيز ٢٠٠ جزء في المليون اعلي قيمة لدليل الحصاد (٤٠,١٣ %) في الموسم الثاني .

II ٤ – د – تأثير التفاعل بين الأصناف و الأسمدة الحيوية والعناصر الصغرى .

- باستثناء المحصول البيولوجي ودليل الحصاد في الموسم الأول والوزن الكلي الجاف للنبات ومحصول بذور النبات ودليل البذرة في الموسم الثاني كان تأثير هذا التفاعل علي كل الصفات المدروسة معنويا .

- أعطت معاملة الصنف جيزة ١ بكل من الفوسفورين والرش بالزنك بتركيز ١٠٠ جزء في المليون أعلي القيم لكل من طول النبات (٨٠,٣٣ سم) ومحصول البذور /فدان (٧٩٣,٢٩ كجم) في الموسم الثاني.، ومحصول البذور / نبات (١٥,٩٦ جم) ودليل البذرة (٢٩,٥٨ جم) في الموسم الأول.

- أعطت معاملة الصنف جيزة ١ بكل من الفوسفورين والرش بالبورون بتركيز ١٠٠ جزء في المليون أعلي قيمة لمحصول القش /فدان (١٨٨١,٦٥ كجم) في الموسم الثاني.وكذلك مع الرش بالبورون بتركيز ٢٠٠ جزء في المليون

أعلي القيم لعدد قرون النبات (٥٢,٩٠ قرن) والمحصول البيولوجي (٢٥٧٧,٣٦ كجم) في الموسم الثاني.

- أعطت معاملة الصنف جيزة ١ بكل من البيوجين والرش بالزنك بتركيز ٢٠٠ جزء في المليون أعلي القيم لكل من الوزن الجاف الكلي للنبات (٣١,٢٠ جم) في الموسم الأول.

- – أعطت معاملة الصنف جيزة ٢ بالبيوجين مع الرش بالزنك بتركيز ٢٠٠ جزء في المليون اعلي قيمة لدليل الحصاد (٤٢,٧٠ %) في الموسم الثاني.

٣- **المكونات الكيماوية للبذور :**

١- **الاختلاف بين الأصناف :**

- اختلفت الأصناف فيما بينها معنويا في الموسم الأول فقط ،وقد أعطي الصنف جيزة ١ أعلي نسبة لكل من البروتين(٢٠,٤٥%) والكربوهيدرات (٥٧,٨٤ %) .

٢- **تأثير الأسمدة الحيوية :**

- اختلف تأثير الأسمدة الحيوية معنويا خلال موسمي الزراعة وأعطت معاملة البيوجين اعلي نسبة للبروتين (٢١,١٥ %) و للكربوهيدرات (٥٨,٩٤ %) في الموسم الثاني.

٣- **تأثير العناصر الصغرى :**

– اختلفت تأثير العناصر الصغرى معنويا فيما بينها خلال موسمي الزراعة و أعطت معاملة ١٠٠ جزء في المليون زنك اعلي نسبه مئوية للبروتين (٢١,١٣ %) في الموسم الثاني و للكربوهيدرات (٥٨,٦٨ %)في الموسم الأول.

٤- تأثير التفاعل :

أ- تأثير التفاعل بين الأصناف و الأسمدة الحيوية.

- كان تأثير التفاعل بين الأصناف والأسمدة الحيوية معنويا في الموسمين وقد أعطي التفاعل بين الصنف جيزة ٢ والبيوجين أفضل القيم لكل من البروتين (٢١,٧٣%) والكربوهيدرات (٥٩,٣٠ %) في الموسم الثاني .

ب- تأثير التفاعل بين الأصناف والعناصر الصغرى .

- كان تأثير التفاعل بين الأصناف والعناصر الصغرى معنويا في الموسم الثاني للبروتين ، والكربوهيدرات في الموسم الأول .
- أعطت معاملة الصنف جيزة ٢ بالزنك ١٠٠جزء في المليون أعلي القيم للبروتين (٢١,١٦%) في الموسم الثاني و للكربوهيدرات (٥٨,٨٤%) في الموسم الأول.

ج- تأثير التفاعل بين الأسمدة الحيوية والعناصر الصغرى .

- كان تأثير التفاعل بين الأسمدة الحيوية والعناصر الصغرى معنويا في الموسم الأول للبروتين وفي الموسم الثاني للكربوهيدرات .
- أعطت معاملة التسميد بالفوسفورين بدون عناصر صغري اعلي نسبة للبروتين في البذور (٢١,٣٧ %)في الموسم الأول ، و أعطت معاملة ٢٠٠ جزء في المليون بورون مع البيوجين اعلي نسبة للكربوهيدرات (٦٠,٧٩ %) في الموسم الثاني .

د- تأثير التفاعل بين الأصناف و الأسمدة الحيوية والعناصر الصغرى.

- كان تأثير التفاعل بين الأصناف والأسمدة الحيوية والعناصر الصغرى معنويا في الموسمين.
- أعطت معاملة الصنف جيزة ١ بالفوسفورين مع ١٠٠ جزء في المليون زنك اعلي نسبة للبروتين (٢٢,٤٠ %) ، وأعطي الصنف جيزة ١ مع البيوجين

وبدون عناصر صغري اعلي نسبة كربوهيدرات (٦٢,٢٥ %) في الموسم الثاني .

التوصيـــــة

- من النتائج المتحصل عليها تحت ظروف التجربة يمكن التوصية بإضافة العناصر الصغرى رشا علي نباتات الحمص بتركيز ١٠٠ جزء في المليون زنك للحصول علي أعلي حاصل من البذور والناتج البيولوجي للفدان . و إضافة الفوسفورين مع الصنف جيزة ١ للحصول علي أعلي حاصل من البذور والقش و البيولوجي للفدان .
- زراعة الصنف جيزة ١ مع استخدام الفوسفورين والرش ١٠٠جزء في المليون زنك للحصول علي أعلي حاصل من البذور ، والرش ٢٠٠جزء في المليون للحصول علي أعلي حاصل من القش والمحصول البيولوجي للفدان.

الإهداء

✿إلي والدى ووالدتي اللذان قدما كل تضحية وحب في سبيل تفرغي للعملي العلمي.

✿إلي زوجتي

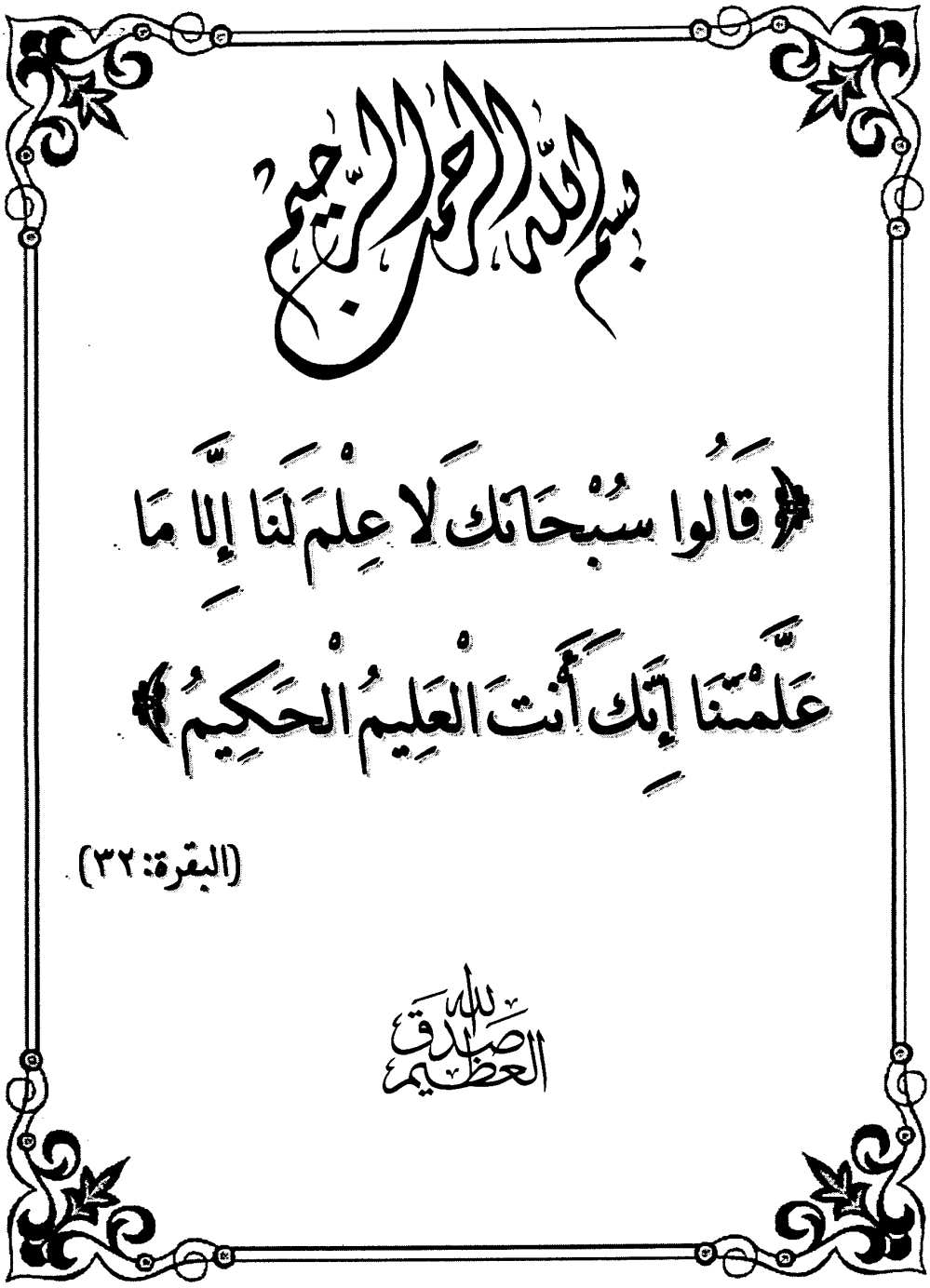
✿إلي ابنائى ﴿مؤمن – فتحي - فاطمة﴾

✿إلي أخواتى وإخوتى

أهدي إليهم جميعا هذا العمل واعياً من الله أن يجعل فيما يحويه ما يفيد أجيالا جديدة من الباحثين يستفيدون من هذا العمل العظيم.

الباحث

محمد فتحي



تأثير التسميد الحيوي والمعدني للعناصر الصغرى علي بعض أصناف الحمص

رسالة مقدمة من

محمد فتحي أمين محمد

بكالوريوس في العلوم التعاونية الزراعية المعهد العالي للتعاون الزراعي (١٩٩٨)

استكمال شعبة المحاصيل – كلية الزراعة بمشتهر – جامعة الزقازيق (فرع بنها) ٢٠٠٢

ماجستير العلوم الزراعية (محاصيل)– كية الزراعة بمشتهر– جامعة بنها ٢٠٠٥

و قد تمت مناقشة الرسالة والموافقة عليها

أجازهـــا:

أ.د/ السيد عبد الرحيم علي محمد .....

أستاذ المحاصيل– كلية الزراعة بالإسماعيلية – جامعة قناة السويس

أ.د/ صديق عبد العزيز صديق محيسن .....

أستاذ المحاصيل– كلية الزراعة بمشتهر – جامعة بنها

أ.د/ علي عبد المقصود الحصري .....

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أستاذ المحاصيل– كلية الزراعة بمشتهر – جامعة بنها

تاريخ المناقشة: ٢١ / ٣ /٢٠١٠ م

تأثير التسميد الحيوي والمعدني للعناصر الصغرى علي بعض أصناف الحمص

رسالة مقدمة من

محمد فتحي أمين محمد

بكالوريوس في العلوم التعاونية الزراعية المعهد العالي للتعاون الزراعي (١٩٩٨)

استكمال شعبة المحاصيل – كلية الزراعة بمشتهر – جامعة الزقازيق (فرع بنها) ٢٠٠٢

ماجستير العلوم الزراعية (محاصيل)– كية الزراعة بمشتهر– جامعة بنها ٢٠٠٥

للحصول على درجة دكتوراه الفلسفة في العلوم الزراعية

(محاصيل)

لجنة الإشراف العلمي:

أ.د/ علي عبد المقصود الحصري .....

أستاذ تربية المحاصيل المتفرغ – كلية الزراعة بمشتهر – جامعة بنها

أ.د/ محمد السيد رياض جمعه .....

أستاذ المحاصيل– كلية الزراعة بمشتهر – جامعة بنها

أ.د/ الغريب عبد الله الغريب .....

أستاذ ورئيس قسم المحاصيل- كلية الزراعة بالقاهرة – جامعة الأزهر

قسم المحاصيل

كلية الزراعة بمشتهر

جامعة بنها

١٤٣١هـ

٢٠١٠م

تأثير التسميد الحيوي والمعدني للعناصر الصغرى علي بعض أصناف الحمص

رسالة مقدمة من

محمد فتحي أمين محمد

بكالوريوس في العلوم التعاونية الزراعية المعهد العالي للتعاون الزراعي (١٩٩٨)
استكمال شعبة المحاصيل – كلية الزراعة بمشتهر – جامعة الزقازيق (فرع بنها) ٢٠٠٢
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للحصول على درجة دكتوراه الفلسفة في العلوم الزراعية

(محاصيل)

قسم المحاصيل

كلية الزراعة بمشتهر

جامعـــــــة بنهـــا

١٤٣١هـ

٢٠١٠م