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 .

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 .

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

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.

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) .**

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.

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.

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

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

(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,

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)

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 .

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.

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) .

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 .

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 .