RESULTS AND DISCUSSION

A. Growth characters:

A.1. Effect of nitrogen treatments:

Results in Table (2) show the average values of plant height, number of branches and leaves per plant, dry weight of branches and leaves per plant and total dry weight per plant at 60 and 90 days after sowing (DAS) as well as number of days from sowing to 50 % flowering as affected by nitrogen treatments in both seasons as well as in the combined analysis. With the exception of plant height at 60 DAS and number of days from sowing to 50 % flowering all studied characters were significantly affected by nitrogen treatments in the combined analysis.

Results indicate that nitrogen treatments significantly affected plant height only at 90 days in both seasons and the combined analysis. The tallest plants were obtained by adding nitrogen at 15 kg/feddan which were almost significantly taller than those plants produced by the three other treatments .In the combined analysis, the application of 15 kg N/feddan increased plant height by 7.51, 5.12,and 4.72 % compared with zero (control),Biogen and Nitroben, respectively. It could be concluded that application of 15 kg N / feddan positively increased plant height at 90 days probably due to the stimulating influence on cell division and elongation which in turn increased plant height.

Concerning number of branches /plant in the combined analysis, Biogen application produced the highest branches number of per plant followed by adding 15 kg N / feddan at 60 days. The difference between these two treatments was not significant .At 90 DAS, the average of two seasons indicates a good illustration of the results where adding nitrogen at 15 kg / feddan surpassed zero nitrogen(control),Biogen and Nitroben in an effecting number of branches per plant by 24.01,8.73 and 6.32 % respectively. All these increases were significant. This results indicate specific effect of nitrogen fertilization on this trait.

Results in the combined analysis show that, the application of 15 kg N / feddan recorded the highest number of leaves per plant at 60 days which significantly surpassed that recorded by Biogen, Nitroben and zero (control) by 3.87, 2.39 and 4.04 % respectively. Number of leaves could be arranged in

descending order as affected by nitrogen fertilizer as follows: Biogen , 15 kg N / fed., Nitroben and control (Zero) at DAS. It could be concluded that application of 15 kg N or Biogen encouraged leaf production in chickpea. This results is expected since these treatments significantly increased number of branches/ plant and that in trun increased leaf number. With respect to the dry weight of leaves per plant, the greatest value was observed at 60 days in combined analysis when 15 kg N / fed was applied .This treatment outweighed zero control, Biogen and Nitroben by 9.95, 10.45 and 3.40 % respectively. Whereas Biogen produced higher values of this trait at 90 days with nonsignificant differences between adding 15 kg N and Nitroben. In this concern, biofertilizers additives proved to be an efficient tool in increasing available nutrients in soil. This is likely to be due to N_2 – fixed and production of growth promoting substances by Azospirilla (Raso, 1996 and Hamdi and El-Komy, 1998).

Concerning dry weight of branches / plant, the maximum values were observed at the two different stages, i.e.60 and 90 DAS of growth over the two seasons when 15 kg N / feddan was applied and recorded 1.97 g and 3.49 g, respectively.

Data show also that, application of nitrogen fertilizer at the rate of 15 kg N / feddan recorded the highest total dry weight / plant at the two different stages i.e, 60 and 90 DAS of growth, which were 4.41 g and 7.02 g, respectively. The effect of nitrogen rate (15 kg N / feddan) on total dry weight per plant is a result of its effect on number and dry weight of branches and leaves / plant.

In general, it can be concluded that applying 15 kg N / feddan or Biogen 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 favours cell division and expansion. These results are in

harmony with those obtained by Matiwade and Sheelavantar (1992),Verma (1994)and Reddy and Ahlawat (1998) on the contrang Kosgey et al (1993) who concluded that neither additional N nor Rizobium inoculation are necessary for maximum dry matter yield a loam soil to high fertile under.Table (2) shows that the effect of the interaction between nitrogen treatments and seasons which three was a significant effect for; no. of leaves / plant, dry weight of leaves / plant and total dry weight /plant at 60 DAS. Plant height, no. of branches/plant,no.of leaves /plant , dry weight of leaves ,branches and total dry weight plant at 90 DAS, indicating that the effect of nitrogen treatments differed from season to another. However, the revers was true for the remained traits.

A.2. Effect of phosphorus treatments:

Data reported in (table 3) indicate the effect of mineral and bio phosphorus fertilizers on the growth of chickpea at both stages i.e. 60 and 90 DAS. The majority of growth criteria were significantly affected by adding either mineral or bio- phosphorus fertilizer. Maximum No. of leaves /plant, dry wT. of branches/plant and total dry weight /plant at 60 DAS (in the first season and combined data of both seasons) and at 90 DAS in both grossing seasons and combined data of them) as well as dry wt . of leaves / plant were obtained by adding Phosphoren or 31 kg P_2O_5 .

These results indicate that adding bio or mineral phosphorus fertilizers were similar on the growth of chickpea plants.

Concerning the number of leaves per plant, results in the combined analysis show that, the differences between the effect of phosphorus treatments for this trait were significant. These results holds true for this trait at the two investigated growth stages .i.e. 60 and 90 DAS .Maximum values of this trait at 60 DAS were achieved at 15.5 kg P_2O_5 / feddan and phosphren i.e. were 86.90 and 86.81 leaves / plant, respectively. These two treatments did not differ significantly in this trait. At 90 DAS, phosphren significantly surpassed the other treatments on number of leaves per plant and produced the highest number of leaves being 133.87.

The dry weight of leaves per plant significantly affected by phosphorus treatments in the combined analysis only at 90 DAS. The application of 31 kg P_2O_5 / feddan led to an increase this trait as compared with other treatments. This treatment also outweighed zero, 15.5 kg P_2O_5 and phosphren by 17.64, 18.75 and 2.42 %, respectively.

Regarding dry weight of branches per plant, results indicated that phosphorus treatments significantly affected this trait at the two investigated growth stage. At 60 DAS results showed that 15.5 kg P_2O_5 / feddan. produced the highest dry weight of branches being 1.95gm followed by 31 kg P_2O_5 (1.94 gm) and phosphren (1.91 gm) .These three treatments did not differ significantly in this trait. The lowest dry weight of branches per plant was obtained without adding phosphorus being 1.79 gm.

Maximum value of this trait was obtained by treating chickpea with each mineral phosphorus treatment or Phosphoren at 90 DAS .The differences were insignificant .The lowest value of this trait was 2.89 g which was recorded with zero phosphorus.

With regards to total dry weight / plant, data indicated that phosphorus treatments led to significant influence on this trait at the two growth stage in the combined data .Total dry weight of plant at 60 DAS were represented by 4.04, 4.32, 4.26 and 4.20 gm / plant for 0, 15.5, 31 kg P_2O_5/ feddan and Phosphren respectively .At 90 DAS, there was significant difference on total dry weight / plant owing to P_2O_5 treatments. Maximum value of this trait was achieved at 31 kg P_2O_5 / feddan (7.09 gm) followed by phosphren (6.83 gm).This result may explain the role of Phosphoren as a dissolver for phosphorus and micro-elements which activate soil microbes that provide plants with available nutrients.

The total dry weight per plant was significantly increased by P application particularly with advanced plant growth. This result is expected

since P increased dry weight of branches and leaves per plant. This result ensures the role of P as an important nutritive element for chickpea. Similar results were also obtained by Verma (1994), Reddy and Ahlawat (1998),Jain et al (2003),Satyajit (2003)and El-Gizawy and Mehasen (2004) .The effect of interaction between phosphorus treatments and season was significant for all trait at both stages except plant height, No. of branches/plant and dry weight of branches/plant at 60 DAS and flowering date (Table 3) .The result indicate that the effect of phosphorus treatments differed from season to another .For the exceptional traits, insignificant effects of these interaction was detected, indicating that the effect of phosphorus treatments were constant from season to another.

A.3. Interaction effects:

A.3.1. Effect of interaction between nitrogen and

phosphorus treatments at 60 DAS.

Table(4)includes data of growth characters investigated, namly, plant height, number of leaves / plant, dry weight of leaves / plant, dry weight of branches / plant and total dry weight / plant which were significantly affected by interaction effect of nitrogen and phosphorus treatements.Whereas,the other characters were not affected due to the interaction effect N and P treatments.

Data indicate that the tallest chickpea plants were obtained at zero nitrogen + 15.5 kg P_2O_5 / fed.(33.21 cm) and shortest plant were at zero nitrogen + zero kg P_2O_5 / fed.(28.03 cm).The difference between these treatments was 5.18 cm or 18.48 % .

Concerning number of leaves / plant, the interaction between the studied factors showed significant effects on this trait. The highest number of leaves per plant was 93.27 which was recorded with application Biogen + 15.5 kg P_2O_5 / feddan, and the lowest number was only 72.98 obtained from application zero kg N + zero kg P_2O_5 / feddan. The difference between both treatments was 27.8 % .

With respect to dry weight of leaves per plant, the highest value of this trait was 2.58 gm. obtained from application Nitroben + 31 kg P_2O_5 / feddan, whereas, application of Biogen + zero kg P_2O_5/ feddan gave the lowest value of dry weight of leaves per plant (2.0 gm).

Concerning dry weight of branches per plant, the maximum value of this trait was 2.21 gm obtained from supplying 15 kg N + 31 kg P_2O_5 / feddan, whereas the minimum one (1.52 gm) was detected from zero N kg + zero kg P_2O_5 / feddan.The difference between these treatments was 0.69 gm or 45.39 % .

The highest total dry weight / plant was 4.70 gm which was recorded with Nitroben + 31 kg P_2O_5 / feddan, and the lowest weight was only 3.68 gm which was obtained with zero kg N + zero kg P_2O_5 / feddan.

In general, it was clear that the application of N stimulated chickpea plants to utilize the applied P .In conclusion, nitrogen and phosphorus are essential elements for the vegetative growth of chickpea .These results agree with those obtained by Verma,1994 (on chickpea),Reddy and Ahlawat,1998 (on chickpea) and Mehasen and El-Ghozoli,2003(on soybean) who found that application of N, P_2O_5 or N + P_2O_5 improved both growth and yield attributes , seed and straw yields .

A.3.2. Effect of interaction between nitrogen and phosphorus treatments at 90 DAS:

The effect of the interaction of nitrogen and phosphorus treatments was significant on plant height, number of leaves / plant, dry weight of leaves / plant, dry weight of branches / plant, total dry weight / plant and number of branches/ plant in the combined analysis of the two growing seasons as shown in Table (5). Whereas, the others characters of growth under study were not significantly affected by the interaction between (N and P) treatments.

It is clear from the table that the tallest chickpea plants (55.89 cm) were those of 15 kg N + 31 kg P_2O_5 / feddan and the shortest plants (44.38 cm) were those of Biogen + zero kg P_2O_5 / fed. The difference between these treatments was 11.51 cm or 25.9 %.

With respect to number of leaves per plant, the highest number of leaves per plant was 140.57 which was recorded with adding Nitroben + Phosphoren and the lowest number was only 112.4 obtained from zero kg N + 15.5 kg P_2O_5 / feddan.

With regard to number of branches per plant, results showed that the maximum value of this trait (28.41)was obtained from applying 15 kg N + 31

kg P_2O_5 / feddan, whereas the minimum (18.70) one was detected from zero kg N + zero kg P_2O_5 / feddan.

The interaction effect between the experimental treatments had significant effects on dry weight of leaves / plant at the second stage (90 DAS).The highest dry weight of leaves per plant was 4.47 gm which was

recorded with adding Nitroben + Phosphoren and the lowest weight was only 2.59 gm which was obtained with Nitroben + 15.5 kg P_2O_5/ feddan.

Results in the combined analysis show that the interaction effects on dry weight of branches / plant were significant .The highest value of this trait was 4.41 gm which was recorded with 15 kg N + 31 kg P_2O_5 / feddan,and the lowest value was 2.65 gm obtained by adding zero kg N + 15.5 kg P_2O_5 / feddan.

Concerning total dry weight per plant, the highest dry weight / plant (8.29 gm) was achieved at 15 kg N + 31 kg P_2O_5 / feddan. and the lowest dry weight(5.52 gm) was obtained at Nitroben + 15.5 kg P_2O_5 per feddan.It was also clear that the effects of nitrogen and phosphorus on dry weight per plant are the results of these effects on number and dry weight of leaves and branches per plant. In conclusion, nitrogen and phosphorus are fundamentally needed for a good and vigorous growth as well as for dry matter production .These results are in harmony with those obtained by Verma (1994) and Reddy and Ahlawat (1998) .

B. Yield and its components:

B.1. Effect of nitrogen treatments:

Table (6) shows the combined analysis of the two seasons for plant height, total weight per plant,number of pods per plant , weight of seeds per plant,seed index ,seed yield per feddan, biological yield per feddan and harvest index % .

Data reveal that the differences between the averages of all characters under study were significant due to nitrogen treatments in the combined analysis. and the majority of the previous traits in both seasons.

In the first , second seasons and combined data of them , maximum seed yield / fed. as well as biological yield / fed. in the second season and combined data were obtained by adding 15 kg mineral N fertilizer / fed. Coinciding with the other traits i.e. plant height , total WT/ plant No of pods / plant , seed yield / plant , seed index and harvest index of the second season and the combined data low dase of nitrogen i.e. 15 kg / fed. acts as an active starter for the growth of Rizobium sp . before beginning to fix nitrogen process which in turn initiates growth and yield of chickpea plant.

Concerning total weight per plant,nitrogen significantly increased this trait at harvest. The application of 15 kg N and Nitroben significantly increased total weight per plant over untreated plants (Zero) by 1.33 and 0.77 g , respectively . All these increases were significant. In conclusion , nitrogen is fundamently needed for a good and vigorous growth as well as for dry matter production .

Results in the combined analysis show that nitrogen application significantly increased number of pods per plant . Increases in number of pods / plant were 2.94 , 2.26 and 3.27 pods for the nitrogen treatments 15 kg N , Biogen and Nitroben , respectively , over unfertilized plants. Differences between fertilized treatments were not significant.The application of nitrogen at all treatments used worked positively on number of pods / plant, indicating that nitrogen is an important element for fruiting and seed formation. This effect of nitrogen was a results of its effect on number and dry weight of branches and leaves / plant.

Data on mean seed yield per plant as affected by nitrogen treatments in the combined analysis are shown in Table (6) . Significant increase was obtained when nitrogen was applied at 15 kg / fed. Increases of 0.93, 0.20 and 0.27 g were obtained over untreated plants for the nitrogen treatments 15 kg N , Biogen and Nitroben , respectively. That was mainly due to the positive effects of nitrogen on growth characters and yield components.

Concerning seed index, in the combined analysis nitrogen significantly increased it . Significant response of this trait to nitrogen application was shown with fertilized treatments . These three treatments (15 kg N, Biogen and Nitroben) increased seed index over untreated plants by 0.63 , 0.40 and 0.56 g , respectively . The differences between fertilized treatments in the combined average were below the level of significance . Results indicated also to the important role of nitrogen on seed plumpness in chickpea .

Increases in seed yield amounted to 111.73 (18.65 %) , 24.51 (4.09 %) and 27.74 (4.63 %) kg / fed. were obtained over unfertilized plots for adding nitrogen at a rate of 15 kg N , Biogen and Nitroben , respectively . The increase in seed yield at the 15 kg N / feddan treatment was highly significant . The effect of nitrogen is mainly due to its positive effects on all growth characters and yield components . It could be concluded that under the condition of the experiment chickpea must be supplied with nitrogen for producing high seed yield . These results were similar with those reported by Babar et al (1991), Verma and Pandya (1993) , Kurhade et al (1994), Verma (1994), Peksen and Gulumser (1996) and Saini and Faroda (1998) who found that N fertilizer significantly increased seed yield and yield attributes. Also,Kurhade et al (1994) found that seed yield or protein content were not affected by increasing N rate to 50 kg/ha. On the other hand , Kosgey et al (1993), singh et al (1994 a) ,Kurhade and Nagre (1995) , Man et al (1997) and Takankhar et al, (1998) indicated that seed yield was not significantly affected by N fertilizers.

The application of 15 kg N , Biogen and Nitroben increased biological yield / feddan by 7.14 , 1.88 and 4.13 % , respectively , over untreated plots. Differences between (15 kg N and Nitroben) were not significant.. This effect was due to the role of nitrogen on plant growth and dry matter production . The results were in line with those reported by Reddy and Ahlawat (1998).

With respect to harvest index, the results showed that the effect of nitrogen treatments on this trait was significant in the combined analysis . The application of 15 kg N , Biogen and Nitroben increased harvest index values by 2.92 % , 0.59 % and 0.11 % , respectively , over untreated treatment . In general , the highest value 29.63 % was recorded by adding 15 kg N/ feddan , being in the combined analysis .

Table (6) shows that the effect of the interaction between nitrogen treatments and seasons was significant effects for all traits except seed index and harvest index, indicating that the effect of nitrogen treatments differed from season to another.

B.2. Effect of phosphorus treatments :

With exception of seed index in the second season ,the mean values of plant height, total weight per plant, number of pods per plant,weight of seeds per plant , seed index , seed yield per feddan, biological yield per feddan and harvest index % as affected by phosphorus treatments in both seasons as well as combined analysis of the two seasons are presented in Table(7) .indicating that .

phosphorus had significant effect on them .

Concerning plant height at harvest , phosphorus showed a significant effect on it . Application of 15.5 kg P_2O_5 and 31 kg P_2O_5 per feddan and phosphren increased plant height over untreated plants by 1.96 , 2.10 and 2.63 cm , respectively . Differences between all fertilized treatments were not significant .

This results might be attributed to the favouarble effect of phosphorus on the vegetative growth of chickpea . These results are in general agreement

with these obtained by Matiwade and Sheelavantar (1992) and Reddy and Ahlawat (1998).

Total weight per plant was significantly increased by phosphorus application . The effect of phosphorus on total weight per plant was similar to that on total dry weight per plant at the two growth stage . The application of 15.5 kg P_2O_5 , 31 kg P_2O_5 and phosphoren per fed. significantly increased total weight of plant over unfertilized plants by 1.14 , 2.07 and 1.59 g , respectively . It could be concluded that phosphorus is an essential element for building up plant organs and inducing total weight of chickpea plants . Results reported by Matiwade and Sheelavantar (1992), Verma (1994),Reddy and Ahlawat (1998), Jain et al (2003).confirm these results .

With regards to the number of pods per plant , results show that phosphorus treatments led to significant influence on this trait. Application of 15.5 kg P_2O_5 and 31 kg P_2O_5 per feddan and phosphoren produced 7.36 , 8.29 and 5.05 pods / plant over untreated plants . Results also demonstrated clearly that P is essential for fruiting and seed formation in chickpea . This result is expected since P had positive effects on dry matter production in chickpea .

Phosphorus treatments significantly increased seed yield / plant . The application of 15.5 kg P_2O_5 , 31 kg P_2O_5 per fed. and phosphoren increased seed yield / plant over untreated plots by 0.31 , 0.34 and 0.64 gm , respectively .The highest seed yield / plant(5.66 gm) was obtained by adding phosphren. Such results may explain the synergistic effect of phosphate solubilizing bacteria.This result is in accordance with El-Gamal (1996) and Mahendran and Chandramani (1998),They reported that dual inoculation with Azospirillum and phosphate solubilizing bacteria increased soil N and P availability as well as improved potato yield. It was clear that P is essential for a good chickpea yield . This effect is based on the positive effects of this

element on number and dry weight of leaves and branches per plant as well as number of pods and seeds per plant .

Results indicate that phosphorus treatments significantly influenced seed index . Application of 15.5 kg P_2O_5 , 31 kg P_2O_5 per feddan and phosphren significantly increased seed index values over untreated plants by 0.14 , 0.38 and 0.72 gm , respectively . The highest seed index was 15.35 gm , obtained by adding phosphren followed by 31 kg P_2O_5 treatment (15.01 gm) . The difference between these two treatments which was(0.34 gm) failed to reach the level of significance .

Treating chickpea with Phosphoren exerterd maximum yield of seeds per fed. in the first , second and combined data . These values significantly surpassed those of the other treatments , i.e. 15.5 , 31 of phosphorus mineral fertilizer as well as the control treatment (Zero P_2O_5) . Similar pattern of change was obtained on biological yield per fed. by adding both bio or mineral phosphorus fertilizers. The application of 15.5 kg P_2O_5 , 31 kg P_2O_5 per fed. and phosphoren increased seed yield over untreated plots by 37.98 (6.34 %) , 48.25 (8.06 %) and 77.5 (12.95 %) kg / fed. , respectively. The increase in seed yield due to phosphoren application is a result of increased plant height , total weight of plant , seed yield per plant and seed index . Similar results were also reported by Hamed ,2003 (on faba bean) Mehasen and El-Ghozoli,2003 (on soybean) and El-Gizawy and Mehasen,2004 (on chickpea), whereas Sharma and Parmar (1997) found that seed yield of chickpea was not significantly different between the different treatments of P fertilizer,including the biological fertilization .

It could be concluded that fertilizing chickpea with mineral phosphorus fertilizers were promising in addition to phosphoren which was move effective on seed and biological yield . The effect of phosphorus on seed yield was also reported by Singh et al (1994b),Tomar and Reghuwanshi (1995),Man et al (

1997),Takankhar et al (1998) and Sotyjit et al (2003).On the other hand , Kurhade etal (1994) and Maliwal et al (1998)showed that P application did not increase seed yield .

Concering phosphoren on biological yield per fed. it was increased by 77.5 kg or 12.95% compared with untreated treatment (control). These results may be due to the effect of phosphorus on plant height , fresh and dry weight per plant and seed yield per fed .

The highest harvest index was 28.72 % , obtained by adding phosphoren and the lowest index was achieved by adding 31kg P_2O_5 , being 26.76 % . These results might be due to the positive effect of P on number of pods and weight of seeds per plant .

The effect of interaction between phosphorus treatments and seasons was significant for all traits except total yield/plant, seed index and biological yield/fed,(Table 7).The result indicate that the effect of phosphorus differed from season to another.

B.3. Interaction effect :

Table (8) show that the effect of interaction between nitrogen and phosphorus treatments in the combined analysis was statistically significant for plant height , total weight per plant , number of pods per plant , weight of seeds per plant , seed index , seed and biological yields per feddan as well as harvest index % .

The interaction N and P had significant effects on plant height at harvest. The application of N stimulated plant response to P.Tallest chickpea plants(69.72 cm)were obtained at 15 kg N + phosphoren/ fed. and shortest (60.48 cm).plants were obtained at zero kg N + zero kg P_2O_5 / fed. The difference between these two extremes which was 9.24 cm or 15.27 % reach the level of significance.

Concerning total weight per plant , effects of interaction on this trait was significant. Nitrogen application stimulated the response of chickpea plants to phosphorous application , and phosphorous induced nitrogen utilization by chickpea plants. The highest weight per plant (21.42 gm) was achieved at 15 kg N + Phosphoren and the lowest weight (16.61 gm) was obtained at Biogen + zero kg P_2O_5.

Interaction between the studied factors showed also significant effects on the number of pods per plant. Application of

nitrogen induced the response of chickpea plants to phosphorus . On the other hand, increase in pod number due to nitrogen application was more evident at the higher phosphorus treatment . The highest number of pods /plant was at Nitroben + 31 kg $P_2O_{5/\ fed.}$ (43.15 pods). The lowest pod number / plant was obtained were no fertilizer was applied.

The interaction between nitrogen and phosphorus had also a significant effect on seed yield per plant . In addition, the effect of phosphorus on seed yield per plant was greatly influenced by nitrogen treatments. It is worth noting here that higher seed yield per plant(6.69 gm) was obtained by adding 15 kg N + Phosphoren per fed. The lowest yield(4.74 gm) was obtained at zero kg N + 31 kg P_2O_5 per fed . As for the interaction effects on seed index , it was clear that all interaction between the two studied factors were significant. Also the response of seed index to phosphorous was affected by the nitrogen treatments . The highest value of seed index was recorded by adding Nitroben + 31 kg P_2O_5 per fed. being 16.18 gm and the lowest seed index was 13.4 gm

which was produced at zero kg N + 15.5 kg P_2O_5 per fed .With respect to seed yield per fed , results indicated that all effects of the interaction between the experimental factors on this trait were significant . In general, the highest seed yield per fed. was 802.25 kg which was produced by adding 15 kg N with Phosphoren per fed . The positive effects of this treatment were also observed with some other growth and yield component characters such as plant height at harvest , total weight per plant and seed yield per plant . The lowest yield was obtained by adding Nitroben under zero kg P_2O_5 per feddan being 568.83 kg .The difference between these two extremes which was 233.42 kg or 41.04 % reached the level of significance .The results revealed also that the interactions between the studied factors significantly influenced biological yield per feddan . The highest biological yield per feddan was 2570.78 kg which was recorded with 15 N combined with Phosphren , and the lowest biological yield was obtained by Biogen with zero kg P_2O_5 per feddan , being 1992.86 kg .

Concerning harvest index ,N and P interaction had a significant effect on this trait . In general , the highest values of harvest index were 31.53 and 31.46 % which were recorded by adding 15 kg N with 15.5 kg P_2O_5 or Phosphoren , respectively . The lowest value of this trait was obtained by zero kg N + 31 kg P_2O_5 per fed. being 24.6 % .The effect of interaction between N and P and seasons was significant for all traits (Table 8).The results indicated that the effect of interaction between N and P differed from season to season.

It could be concluded that present of each nitrogen and phosphorus in the Rhizosphere of chickpea was positive to the growth and yield of the plant.

C. Economic evaluation :

1- Effect of N and P fertilizer on the total costs of chickpea production:

Total costs include values of production tools and requirements such as land preparation, seed, irrigation, fertilizer, man power and other expenses or miscellaneous costs as well as land rent (average of 2002/2003 and 2003/2004 seasons) are shown in table (9) and the costs of the different N and P fertilizer treatments included in the study are given in table (10) .

Table (9):Costs of production for chickpea (average of 2002/2003 and 2003/2004 seasons)

Treatment	Costs Per Fed.In L. e.
Land Preparation	64
Seeding and Planting	191
Irrigation	81
Fertilization:	
15 kg N/fed.as area (46.5 %)	25.8
Biogen 500 gm/fed.	2.0
Nitroben 500 gm/fed.	2.0

15.5 kg P_2O_5/fed. as calcium super phosphate (15.5 % P_2O_5)	50.0
31 kg P_2O_5/fed.	100.0
Phosphoren 300gm/fed.	2.0
Weeding	87.0
Pest Control	62.0
Harvesting	123.0
Transportation	29.0
Other Expenses	69.0
Land rent	733.0

The price of one kg nitrogen in the form of urea (46.5 % N) was 0.80 L. E. The price of one kg calcium super phosphate (15.5 % P_2O_5) was 0.50 L.E . The price per packet for Nitroben, Biogen and Phosphoren was 2.0 L.E. The price of one kg chickpea seed (Giza 3) was 6.25. L.E.

Table (10) : Costs of different N and P fertilizer treatments included in the study (in L.E. / fed .) (average of 2002/2003 and 2003/2004 seasons).

Treatments	**Phosphorus**			
	Zero P_2O_5	15.5kgP_2O_5	31 kgP_2O_5	phosphoren
Nitrogen				
Zero N	————	50.0	100.0	2.0

15 kg N	25.8	75.8	125.8	27.8
Biogen	2.0	52.0	102.0	4.0
Nitroben	2.0	52.0	102.0	4.0

It is evident from Table (10) that the highest values of the costs were those of the treatment including 15 kg N / fed. combined with applying 31 kg P_2O_5 kg /fed, being 125.8 L.E. per fed .

Table (11) :The total costs of chickpea production(in L.E.per fed.) as affected by the different N and P fertilizer treatments (average of 2002/2003 and 2003/2004 seasons).

Treatments	**Phosphorus**			
	Zero P_2O_5	15.5kgP_2O_5	31 kgP_2O_5	phosphoren
Nitrogen				
Zero N	1459.0	1509.0	1559.0	1461.0
15 kg N	1484.8	1534.8	1584.8	1486.8
Biogen	1461.0	1511.0	1561.0	1463.0
Nitroben	1461.0	1511.0	1561.0	1463.0

From Table (11) it is clear that the minimum total costs was that of Zero kg N/fed. combined with zero kg P_2O_5/fed.,being 1459.0 L.E. and the maximum total cost was that of 15 kg N/fed. combined with 31 kg P_2O_5/fed. Which was 1584.8 L.E.

2- Value of chickpea seed and straw yield as affected by the different N and P fertilizer treatments.

Table (12) shows the value of chickpea seed and straw yield as well as total revenue in L.E. per fed. as affected by the different treatments (average of two seasons). In this estimation the average farmgate price of chickpea seed was 350.6 L.E./ardab and 24.9 L.E./local unit (250 K.G.) for chickpea straw as given by Extension Service information. From results it is clear that the highest value was 2051.23 L.E./fed .for 15 kg N/fed.X phosphoren .

Table (12) : Value of chickpea seed and straw yield (in L.E./fed.) as affected by the different N and P fertilizer (average of 2002/2003 and 2003/2004 seasons).

Treatments	Seed and straw yield values							
	Phosphorus							
Nitrogen	Zero P_2O_5	15.5 kg P_2O_5	31 kg P_2O_5	phosphoren	zero P_2O_5	15.5 kg P_2O_5	31 kg P_2O_5	phosphren
Zero N	1356.59 / 151.4	1403.76 / 163.7	1358.29 / 174.0	1482.31 / 164.1	1507.99	1567.46	1532.29	1646.41
15 kg N	1519.73 / 162.9	1629.36 / 155.2	1621.29 / 178.2	1875.13 / 176.1	1682.63	1784.56	1799.49	2051.23
Biogen	1388.66 / 139.3	1547.90 / 169.7	1398.54 / 177.7	1494.96 / 173.6	1527.96	1717.60	1576.24	1668.56
Nitroben	1329.55 / 172.0	1396.56 / 175.1	1667.45 / 175.0	1466.68 / 156.8	1501.55	1571.66	1842.45	1623.48

Where:* Numerator : Seed yield.

*Denominator : Straw yield value.

On the other hand, the lowest value was of Nitroben with zero level of phosphorus, being 1501.55.L.E./fed. With reduction of 549.68 L.E. or 36.6 % compared with the highest treatment.

3- Net farm return of chickpea production and net return per one invested L.E. *

From results presented in tables (13 and 14) it is clear that the highest net farm return was recorded by adding 15 kg N/fed. with Phosphoren, being 564.43 L.E. /fed making a net return ratio of 0.38 L.E. /one invested pound. Similar results were also reported by Jain et al (1999), whereas Verma and Pandya (1993),Verma and Yadav (1993)and Tomar and Raghuwanshi (1995) found that net profit per rupee invested was highest with application of 10 or 20 kg N / ha alone. On the other hand , application of 31 kg P_2O_5 with zero level of nitrogen recorded loss valued by 26.71 L.E. / fed.

Table (13) : * Net farm return in L.E. per fed. Of chickpea as affected by the different N and P fertilizer.

Treatments	Phosphorus			
	Zero P_2O_5	15.5kgP_2O_5	31 kgP_2O_5	Phosphoren
Nitrogen				
Zero N	48.99	58.46	-26.71	185.41
15 kg N	197.83	249.76	241.69	564.43
Biogen	66.96	206.60	15.24	205.56

Nitroben	40.55	60.66	281.45	160.48

* Net farm return (L.E./fed.) = Total return- total costs.

Table (14) : * Net return per one invested L.E. of chickpea as affected by the different N and P fertilizer treatments .

Treatments	**Phosphorus**			
	Zero P_2O_5	**15.5kgP_2O_5**	**31 kgP_2O_5**	**Phosphoren**
Nitrogen				
Zero N	0.03	0.04	———	0.13
15 kg N	0.13	0.16	0.14	0.38
Biogen	0.05	0.14	0.01	0.14
Nitroben	0.03	0.04	0.18	0.11

$$\text{Net return per one invested L.E.} = \frac{\text{Net farm return}}{\text{total costs of production(Per fed.)}} *$$

It could be concluded that under the conditions of the experimental site and from an economic point of view using biological phosphate (Phosphoren) with 15 kg N /fed. could be considerd the best treatment for growing chickpea and it is also quite effective in increasing net farm return as a result of increasing chickpea production.