SUMMARY & CONCLUSION

5- SUMMARY AND CONCLUSION

Two field experiments were conducted at the Farm of the Faculty of Agriculture, Moshtohor, Zagazig University during the two successive summer seasons of 1992 and 1993.

This study aimed to investigate the effect of three sowing rates (20, 30, 40 kg seeds/fad.) and three levels of each of nitrogen fertilizer (30, 60, 90 kg N/fad.) and phosphorus fertilizer (32, 64, 96 kg P_2O_5/fad.) on the different plant characteristics of common bean (*Phaseolus vulgaris* L.) cv. Giza-3.

Obtained results were as follows:

I. Plant vegetative growth:

1- Using either 20 or 40 kg seeds/fad. increased plant height than using 30 kg seeds/fad. However, there were continuous, gradual and significant reduction in values of most studied growth characteristics, i.e. number of both leaves and branches as well as fresh and dry weights/plant with increasing sowing rate from 20 to 40 kg seeds/fad.

2- Application of the highest used level of nitrogen fertilizer (90 kg N/fad) resulted in the highest values of different studied characteristics of plant vegetative growth.

3- There was a constant and significant increase in the different studied vegetative growth parameters of bean plants by increasing the application level of phosphorus fertilizer up to the highest used level (96 kg P_2O_5/fad.).

4- Using either 20 or 30 kg seeds/fad. within application of 60 or 90 kg N/fad. showed mostly the highest values of growth parameters.

5- Sowing rate of 20 kg seeds/fad. in combination with 96 kg P_2O_5/fad. resulted in the highest values of different studied plant growth parameters.

6- Application of 60 kg N within 96 kg P_2O_5/fad produced plants of the highest growth features.

7- Using 20 kg seeds/fad. and application of the highest used levels of both nitrogen (90kg N/fad.) and phosphorus (96 kg P_2O_5/fad.) fertilizers resulted mostly in the highest values of different studied plant growth parameters.

II- Chemical composition of plant leaves:

a- Photosynthetic pigments:

1- The highest values of a, b and total chlorophyll as well as carotenoids leaves content was obtained by using the lowest sowing rate (20 kg seeds/fad.) where the content of photosynthetic pigments of bean leaves was gradually increased by decreasing sowing rate from 40 kg down to 20 kg seeds/fad.

2- Increasing nitrogen application level from 30 up to 90 kg N/fad. significantly increased the chlorophyll and carotenoids leaves content

3- The chlorophyll a, b and total as well as carotenoids leaves content was significantly increased with increasing phosphorus fertilizer level from 32 up to 64 kg P_2O_5/fad. only.

4- Sowing 20 kg seeds/fad. within application of nitrogen fertilizer at 60 or 90 kg N/fad. was of more pronounced effect in this respect.

5- The maximum values of a, b and total chlorophyll were obtained from plants grown under the lowest sowing rate (20 kg seeds/fad.) and received the medium level of phosphorus fertilizer, i.e. 64 kg P_2O_5/fad. Meanwhile, sowing rate either 20 or 30 kg seeds/fad. within 64 kgP_2O_5/fad. resulted in the highest plant leaves carotenoids content.

6- The highest values of photosynthetic pigments were mostly obtained by application of 30-60 kg N combined with 64-96 kg P_2O_5/fad.

7- Sowing 20 kg seeds/fad. combined with application of 60-90 kg N and 32-64 kg P_2O_5/fad resulted in the highest values of photosynthetic pigments in plant leaves.

b- Total N, P and K concentration and uptake/plant leaves:

1- Sowing 20 kg seeds/fad. resulted in the highest values of N, P and K as concentration or uptake in the bean plant leaves.

2- Inceasing nitrogen fertilizer level from 30 up to 60 kg N/fad. showed the highest increment of N, P and K leaves content either as concentration or uptake.

3- The maximum concentration and uptake of N, P and K was obtained by application of phosphorus fertilizer at its highest used level (96 kg P_2O_5/fad.).

4- Sowing 20 kg seeds/fad. within application of 60-90 kg N/fad. increased in the highest values in this respect.

5- Sowing 20 kg seeds/fad. and application of 96 kg P_2O_5/fad. produced the highest values of N and P concentration and uptake in plant leaves whereas, using 20 kg seeds/fad. combined with 32 or 96 kg P_2O_5/fad.was more effective in

increasing potassium concentration and uptake of plant leaves.

6- The treatments received 60 kg N and 96 kg P_2O_5/fad resulted in the highest values of N, P and K concentrations in plant leaves. Meanwhile, application of 60 or 90 kg N within 64 or 96 kgP_2O_5/fad. resulted in the maximum values of N, P and K uptake in plant leaves.

7- Sowing 20 kg seeds/fad. and application of 30 or 60 kg N/fad. within 96kg P_2O_5/fad. for bean plants resulted in the highest values of N, P and K concentration as well as their uptake in plant leaves.

III- Dry seeds yield and its components:

1- Increasing seeding rate from 20, 30 up to 40 kg seeds/fad. significantly and gradually decreased the values of each of number of pods/plant, number of seeds/pod, seed index, netting percentage and dry seed yield/plant except number of seeds/pod in the first season.. However, the highest dry seed yield/fad. was increased with increasing sowing rate up to the highest used one (40 kg seeds/fad.).

2- Increasing level of nitrogen fertilizer from 30 to 60 or 90 kg N/fad. produced the highest values of different studied characteristics of plant yield and its components as well as dry seed yield/fad.

3- Most of the studied yield parameters were significantly increased by increasing the level of P-fertilizer up to the highest used one (96 kg P_2O_5/fad.).

4- Sowing 20 kg of seeds/fad. in combination with application of nitrogen fertilizer at 90 kg/fad. resulted in the highest values of number of pods/plant, weight of 100 seeds and dry seed

yield/plant at both growing seasons of this trial. Sowing rate of 40 kg seeds/fad. combined with either 60 or 90 kg N/fad. led to the highest dry seed yield/fad.

5- Sowing 20 kg seeds/fad. within application of 96 kg P_2O_5/fad. resulted in the highest dry seed yield/plant and its different studied components. Meanwhile, the highest dry seed yield/fad. was produced by using the same level of phosphorus fertilizer combined with using 40 kg seeds/fad.

6- The application of 60-90 kg N within 64-96 kg P_2O_5/fad. resulted in the highest values of dry seed yield and its components for both plant or faddan.

7- Sowing 20 kg seeds/fad. within application of 90 kg N and 32-64 kg P_2O_5/fad. resulted in the highest values of dry seed yield/plant and its components. Moreover, sowing 40 kg seeds/fad. combined with the application of N and Pfertilizers at the rate of 60-90 kg N and 64-96 kg P_2O_5/fad. resulted in significantly higher dry seed yield/fad. of Giza-3 variety of common bean than the other used combinations.

IV. Seed quality characteristics (The nutritive value):

a- Total N, P and K concentrations:

1- Sowing 30 kg seeds/fad. significantly increased the concentration of N, P and K in dry seeds.

2- Using 60-90 kg N/fad. in case of N- dry seeds content, 60 kg N/fad in case of P-content and 30 kg N/fad. regarding K-seeds content gave the highest value of N, P and K concentrations of dry seeds in both growing seasons.

3- Application of 64 or 96 kg P_2O_5/fad. were the most effective levels showing the highest values of N, P and K dry seeds content.

4- Sowing 20-30 kg seeds/fad. within application of 30 kg N/fad. showed the highest values of N and K concentration. Moreover, the combination between 30 kg seeds/fad and 60 kg N/fad. resulted in the highest seeds P-content.

5- Sowing seeds at the rates of 30 or 40 kg seeds/fad within phosphorus fertilizer application at levels of 64 or 96 kg P_2O_5/fad. significantly increased the concentration of N, P and K in dry seeds.

6- The highest increment in the dry seeds content of total N and K was obtained by application of60 kg N within application of 64 kg P_2O_5/fad. However, in case of dry seeds P-content, using 60 kg N within 96 kg P_2O_5/fad. resulted in the highest phosphorus dry seeds content.

7- The dry seed content of N, P and K was varied according to combination between sowing rate within each of N and P-fertilizer used levels, where using 40 kg seeds combined with 60 kg N and 64 kg P_2O_5/fad. resulted in the highest N-seed content. Whereas, the treatment of the combination between 30 kg seeds within 60 kg N and 96 kg P_2O_5/fad produced seeds of the highest P-content. Moreover, regarding K-dry seeds content, using seed sowing rate of 20 kg in combination with 30 kg N and 96 kg P_2O_5/fad.produced seed of the highest K-content. Similar trend was observed in both growing seasons.

b- Reducing, non-reducing and total sugars percentage:

1- The percentages of reducing sugars in dry seeds was not significantly affected by sowing rate. Meanwhile, decreasing sowing rate to the lowest used one (20 kg seeds/fad.) resulted in the highest percentages of non-reducing and total sugars in dry seeds.

2- Nitrogen fertilizer at 90 kg N/fad. in both seasons and resluted in significantly higher values of non-reducing and total sugars.

3- Application of the highest used level of P-fertilizer (96 kg P_2O_5/fad.) increased non-reducing and total sugars percentages in dry seeds while, reducing sugars were not clearly affected in this respect.

4- Sowing 20 kg seeds/fad. within application of N-fertilizer at 30 kg N/fad was of more pronounced effect of non-reducing and total sugars percentages.

5- The interaction between sowing rate at 20 kg seeds/fad. combined with P-fertilizer at the level of 96 kg P_2O_5/fad. resulted in the highest increment regarding seed content of reducing, non-reducing and total sugars percentages.

6- N-fertilizer level at 30kg N/fad. within 64 or 96 kg P_2O_5/fad. resulted in the highest values in this concern.

7- Seed sowing rate of 20 kg within 60 kg N/fad. in the first season and 30 kg N/fad. in the second season and 96 kg P_2O_5/fad. resulted in the highest values of sugar fractions in dry seeds.

c- Protein and total carbohydrates percentage and yield (kg/fad.):

1- The lowest used rate of seeds (20kg/fad) resulted in the highest percentage of either protein or carbohydrates in the seeds except protein percentage in the second season which showed highest values with 30 kg seeds/fad. However, the yield of each of them as kg/fad. was continously and gradually increased with increasing plant density or sowing rate from 20, 30 up to 40 kg seeds/fad.

2- Although increasing N-fertilizer level did not show clear effect on the percentage of either protein or carbohydrates in dry seeds, otherwise, such increase of nitrogen fertilizer level up to 60-90 kg N/fad. led to significant increment in the yields of protein and carbohydrates/fad.

3- Although, no constant trend was observed concerning protein and carbohydrates percentages in dry seeds, as affected by the level of phosphorus fertilizer, otherwise the highest level of P-fertilizer (96 kg P_2O_5/fad.) resulted in the highest yield of both protein and carbohydrates.

4- The lowest used rate of sowing seeds (20 kg/fad.) in combination with the lowest used level of N (30 kg/fad.) in the first season and the medium N level (60 kg N/fad.) in the second one resulted in the highest values of both protein and carbohydrates percentages. Sowing seeds at the rate of 40 kg seeds/fad. within 60-90 kg N/fad. led to the production of dry seeds containing the highest protein and carbohydrates yield/fad.

5- Sowing seeds at the rate of 30 kg seeds/fad. combined with the application of 96 kg P_2O_5/fad. resulted in higher values of the percentages of protein in dry seeds. However, the lowest used rate of sowing seeds (20 kg seeds/fad.) within the lowest P-fertilizer level (32 kg P_2O_5/fad.) resulted in the highest percentages of carbohydrates in dry seeds. The highest values of both protein and carbohydrates yields were obtained with seed sowing rate of 40 kg/fad. within the highest used P-fertilizer level (96 kg P_2O_5/fad.) in the frist season and with the medium used one (64 kg P_2O_5/fad.) in the second season.

6- It may be stated, in general, that application of 30 kg N with 64-96 kg P_2O_5/fad. resulted in higher values of protein percentage in dry seeds, while the interaction between the

same level of nitrogen within 64 kg P_2O_5/fad. showed the highest values of carbohydrates percentages in dry seeds. Application of 60-90 kg N within 64-96 kg P_2O_5/fad. resulted in the highest protein and carbohydrates yields of dry seeds.

7- Sowing 40 kg seeds/fad. and application of 60 kg N within 64 kg P_2O_5/fad. resulted in the highest percentage of protein in dry seeds. Meanwhile, sowing 20 kg seeds/fad. combined with the application of 60 kg N within 32 kg P_2O_5/fad. resulted in the highest values of carbohydrates percentages in dry seeds. The highest yields of both protein and carbohydrates were resulted with sowing the highest used rate of seeds (40 kg seeds/fad.) combined with 60-90 kg N within 64-96 kg P_2O_5/fad. Obtained results are not going in the same trend in both growing seasons and this may be due to the seasonal changes in the climatical conditions and to the changes in the soil environment.

Finally, it may be concluded that sowing seeds of common bean cv. Giza-3 at a rate of 40 kg seeds/fad. and fertilizing plants with 60-90 kg N (as ammonium nitrate, 33.5% N) within 64-96 kgP_2O_5 (as calcium superphosphate, 16% P_2O_5)/fad. at two equal portions at three and eight weeks from seed sowing, may be recommended to produce the highest dry seed yield with best quality due to its highest content of total crude protein and total carbohydrates.