5. SUMMARY AND CONCLUSION

Field studies on common bean (*Phaseolus vulgaris* L) cv. Nebraska were carried out at the Farm of the Horticultural Services Unit at Moshtohor, Kaliobia during the two summer seasons of 1998 & 1999. Seeds were sown in the field, clay loam soil with pH 7.5, at 26th February of both years. Two separate experiments were carried out as follows:

**First Experiment:**

"Effect of level and source of phosphorus fertilizer on growth, dry seed yield and chemical composition of common bean."

This experiment included 12 treatments which were the combinations of 4-phosphorus fertilizer levels; (0, 24, 32 and 40 kg P2O5/fed) within 3- phosphorus source; calcium superphosphate (SP) 16% P2O5, monoanmonium phosphate (MAP) 45% P2O5+ 11% N and diammonium phosphate (DAP) 41% P7O5 16% N. Treatments were arranged in split plot clesigen with 4-replicates Whereas, P-level served as main plots and P-source served as sub-plots. All treatments recived 40kg N + 48kg K20 /fed. Nitrogen was added as ammonium sulphate (20% N) and potassium was added as potassium sulphate (48%
Other agriculture practices were done as commonly followed in the district. Obtained results revealed the following:

1. Vegetative growth characteristics:

   a- Increasing level of P-application from 0, 24 up to 32 kg P2O5 fed. increased vegetative growth parameters; plant height, number of leaves and branches/plant and stem diameter in one season only. However; fresh and dry weight/plant were significantly increased by increasing level of P-application up to 32kg P2O5/fed. in both seasons. Heavy P-application from 32 up to 40 kg P2O5/fed. did not result any considerable increase in vegetative growth parameters of common bean plants.

   b- Results showed that plants supplied with DAP encouraged vegetative growth parameters; number of leaves, fresh and dry weight per plant in both seasons as compared with SP or MAP, in both seasons. However, plant height, number of branches and stem diameter were not significantly differed due to source of P-fertilizer, as a general trend in both seasons.

   c- Concerning with the interaction effect of level within source of 13-application on vegetative growth, results showed that plants received DAP at 32 kg P2O5/fed. had significantly higher total fresh and dry weight per plant, as compared with...
other treatments in both seasons. This result could be referred to the increase in number of branches/plant and stem diameter. However, plant height and number of leaves per plant were not significantly differed due to the interaction between sources and levels of P-fertilizer in both seasons.

2. Chlorophyll content of leaves:

a- Increasing level of P-fertilizer from 0, 24 up to 32 kg P\textsubscript{2}O\textsubscript{5}/fed. gradually and significantly increased chlorophyll a,b and total chlorophyll as well as carotenoids content of leaves in both seasons. However, application of P at 40 kg P\textsubscript{2}O\textsubscript{5}/fed. decreased chlorophyll and carotenoids content of leaves as compared with that of plants received 32 kg P\textsubscript{2}O\textsubscript{5}/fed.

b- Adding P-fertilizer source as DAP increased chlorophyll a,b and total chlorophyll as well as carotenoids as compared with SP or MAP, as shown in both seasons.

c- Regarding with the interaction effect between P-level and P-source on chlorophyll and carotenoids content, plants received DAP at 32 kg P\textsubscript{2}O\textsubscript{5} had the highest chlorophyll a, total chlorophyll as well as carotenoids as compared with the other tested treatments in both seasons. Whereas, chlorophyll b was only significantly in the second season.
3- Dry seed yield and its components:

a. Number of seeds /pod:

1- Increasing level of phosphorus fertilizer from 0, 24 up to '32 kg P205/fed. significantly increased number of seeds/pod, especially in the second season.

2- Results showed that all used of P- sources did not affect on number of seeds /pod, as shown in both season.

3- There was no considerable effect on number of seeds / pod due to the interaction between level and source of P-fertilizer.

b. Number of pods per plant:

1- Increasing levels of P-application from 0 up to 24 kg P205 /fed. gradually and significantly increased number of pods/plant in both seasons. Whereas, increasing P-fertilizer level from 24, 32 up to 40 kg P205/fed. did not significantly affect on number of pods /plant.

2- Adding DAP as a source of P-fertilizer significantly increased number of pods /plant, especially in the first season, as compared with the other sources; SP or MAP.

3- Concerning with the interaction effect of Plevels within P-sources on number of pods/ plant, the most favourable
treatments was DAP at 32 kg P20; /fed. which significantly increased number of pods /plant in both seasons as compared with the other tested treatments.

**c- Seed index (100-seeds weight):**

Increasing P-fertilizer level up to 32 kg P205/fed. significantly increased seed index, especially in the second season. Although, the same trend was detected in the first season, but variances were not significant

2- IDAP application increased seed index, especially in the second season as compared with the other sources; SP or NIA')

3- There interaction effect between level and source of P-application on seed index, as shown in both seasons.

**/I: Netting %:**

1- Increasing levels of P-application from 0 up to 24 or 32 kg /fed. considerably improved netting % in the first and second season, respectively

2- Adding phosphorus fertilizer as DAP gave higher netting % as compared with the other sources, especially in the second season.

3- No significant differences due to the interaction effect between P-levels and P-sources on netting °A) in both seasons.
e- Dry seed yield per plant or per feddan:

1- Increasing levels of phosphorus fertilizer from 0, 24 up to 32 kg P2O5 /fed. gradually, and significantly increased dry seed yield / plant of per feddan in both seasons. This increment in dry seed yield /fed. by using P2O5 32kg P2O5 /fed. ranged from 37.7 —74.8 °A,) over the control and from 16.87-21.65 % over 131 level; 24 kg P2O5 /fed, as shown in 1998 and 1999, respectively. This increment was mainly due to the increase in number of pods / plant and seed index. However, increasing 13-fertilizer level from 32 up to 40 kg 13205 /fed. did not significantly increase dry seed yield / plant or per feddan.

2- Results showed that adding P-fertilizer source as DAP gave higher and significantly increased dry seed yield /plant or per feddan in both seasons as compared with the other sources, SP or MAP

3- Concerning with the interaction effect of P-level within P-source on dry seed yield /plant or per feddan, results show that plants supplied DAP at 32 kg P2O5 /fed. gave higher and significantly increased dry seed yield /plant or per feddan as compared with the other tested treatments The superiority of using P2 x DAP versus P2 x SP reached 20.2-37.4 % in dry seed yield ifeddan.

Summary and conclusion
4- Chemical constituents of common plant foliage and dry seed:

a- \textit{N-content of plant foliage:}

1- Increasing levels of P-application from 0, 24 up to 32 kg P2O5 /fed led to a gradually and significantly increased N-content of leaves, stem and total plant foliage in both seasons. Whereas, increasing P-fertilizer level from 32 up to 40 kg 13,0, /fed. did not significantly increase N-content of plant foliage.

2- Adding 13-fertilizer source as DAP contained higher N% and uptake in stem and total plant foliage as compared with that of other sources; SP or MAP as a general trend in both seasons. However, N% in leaves was not considerably differed due to 13-source in both seasons.

3- Studies showed a significant effect due to the interaction. effect between 13-level and P-source on N-uptake of stem and total plant foliage in both seasons. Whereas, N-content of leaves were significantly increased in the second season only. The most favourable treatment was DAP at 32 kg P2O3 as compared with the other tested treatments.

\textit{P-content of plant foliage:}

1- Increasing 13-fertilizer level from 0, 24 up to 32kg 132O5 /fed led to a significant increase in 13-content of leaves, stem and
total plant foliage, as shown in both seasons. Heavier, P-fertilizer level from 32 up to 40 kg P205 /fed. did not significantly increase P-content of plant foliage.

2- Results showed that plants supplied with DAP gave higher P-content of leaves, stem and total plant foliage in both seasons as compared with other P-source; SP or MAP.

3- With regard to the interaction effect of P-level within P-source on P-content of plant foliage, studies indicated that plants supplied with DAP at 32 kg P205 /fed. significantly increased P-content of leaves, stem and total plant foliage, as shown in both seasons. Whereas, P% in stem was not affected by interaction effect between level and source of P-fertilizer both seasons.

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I- Lieicw;ing level honk 0.24 up to 32Ig led io significnnt increase in lc-conk:1u leave±,. Yen' and total plant foliage in both seasons. However. increasing 1)-feifiliter level from 32up lcg P;/(), /fed did noi significantly increase 1K-content of plant Foliage.

2- /Wiling phosphorus frAriliter souscus 1)A1) oi SP had
3- Results showed a significant increase due to the interaction effect of P-fertilizer level within source on K-content of leaves, stem and total plant foliage as shown in both seasons. The favourable treatment was DAP at 32 kg P2O5 /fed, as compared with the other studied treatments.

d- N, P and K content of dry seeds:

1- Increasing P-fertilizer level from 0, 24 up to 32 kg P2O5 /fed. significantly increased N, P and K content of dry seeds, as shown in both seasons. However, increasing P-fertilizer level from 32 up to 40 kg P2O5 /fed. did not significantly increase in N PK content of dry seeds.

2- Adding DAP or SP as phosphorus fertilizer sources gave higher N-content of seeds in the second and first season, respectively. Whereas, plants supplied with SP or DAP gave higher P and K-content especially in the second season.

3- Results showed a significant increase due to the interaction effect between P-level and P-source of NPK content in one season only. The favourable treatment was DAP at 32 kg P2O5 /fed. as compared with the other tested treatments

Conclusion:

As for fertilizing common bean plants cv. Nebraska grown for clry seeds, it could be recommended to added 32 kg
P2O5 /fed. as diammonium phosphate (DAP) in order to increase plant growth, dry seed yield /feddan and improve its components. The increment in dry seed yield /feddan reached to 20.2-37.4% by using DAP at 32 kg P2O5 / fed. as compared with calcium super phosphate at the same level.

Second Experiment:

''Effect of time and frequency of P-application on growth, dry seed yield and its quality of common bean,'

This experiment included 6 treatments of tittles and frequency of P-application at a standard level of 200 kg of calcium super phosphate per feddati. Treatments were as follows:
* Control; without phosphorus application.
* 200kg calcium super phosphate (SP) in one time at germination stage.
* 50kg SP at pre-planting + 150 kg SP at germination stage.
* 100kg SP at germination stage + 100kg SP at flowering stage.
* 00kg SP + 25 kg element sulphur at germination stage + 100kg SP +25 kg element sulphur at flowering stage.
* Adding super phosphate fertilizer at 3-times; 50 kg SP at pre-planting + 100 kg SP at germination stage + 50 kg SP at -flowering stage.
Treatments were arranged in a complete randomized block design, with 4-replicates. All treatments received 40 kg N as ammonium sulphate (20%N) + 48 kg K20 as potassium sulphate (48%K20) per feddan. Other agriculture practices were done as commonly followed in the district. Obtained results revealed the following:

1- Vegetative growth characteristics:
Adding phosphorus fertilizer as calcium super-phosphate at 3-split application resulted the largest vegetative growth expressed as number of leaves per plant, fresh and dry weight per plant, in both seasons, as compared with adding super phosphate at one or two applications. However, there were not any significant increase on number of branches/plant, plant height and stem diameter in both seasons.

2. Dry seed yield and its components:
Dividing P-fertilizer as SP at 3-split applications significantly increased dry seed yield / plant or per feddan as a result of increasing number of pods/plant in both seasons, seed index and netting, only in the second season. as compared with adding SP at 1 or 2 times.
3- Chemical composition of plant foliage and dry seeds:

    a- *N, P and K content of plant foliage*:

    Adding calcium super phosphate at 3-split applications significantly increased total N, P and K content (% and uptake) of leaves and stem, at both seasons as compared with that of plants received SP at one or two times.

    b- *N, P and K content of dry seeds*:

    Results showed that splitting calcium super phosphate fertilizer at 3-times significantly increased N and K content (% and uptake) of dry seeds at both seasons as compared with that of plants received SP at one or two times. Although, P content showed the same trend but results were significantly increased in the second season only.

Conclusion:

    As for dry seeds, fertilizing common bean cv Nebraska grown for it could be recommended to added calcium super phosphate fertilizer at 3- split applications; 50 kg SP at pre-planting +100 kg SP at germination stage +50 kg SP at time in order to improve plant growth and to increase dry seed yield and its components as compared with adding SP at one or two times. The average increment to dry seed yield / fed. reached to 42.31, 21.66 % by using SP at 3.-
split applications as compared with added SP at one or two times, respectively.