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# EFFECT OF NP-FERTILIZATION AND NAA FOLIAR SPRAY ON PLANT GROWTH, CHEMICAL COMPOSITION, FLOWERING, SEED YIELD AND QUALITY OF COMMON BEAN

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## ABSTRACT

*Two field experiments were carried out at the Exp. Farm of Fac. Agric. at Moshtohor in 1989 & 1990 summer seasons to investigate the response of common bean plant cv. Giza 3 to three levels of NPK in which K is added as a fixed quantity. The levels are (20, 16 and 24 kg), (40, 32 and 24 kg) and (60, 48 and 24 kg) of N, $P_2O_5$ and $K_2O$/fad. within four concentrations of NAA (0, 25, 50 and 75 ppm). Obtained results showed that most studied treatments of NP and/or NAA significantly promoted the vegetative growth, increased the photosynthetic pigments, promoted mineral contents of N, P and K as well as the concentrations of total indoles and phenols in plant foliage, delayed flowering, increased number of flowers per plant and total seed yield per faddan as well as the dry seed mineral content of N, P and K. The treatment of 60 kg N within 48 kg $P_2O_5$ + 24 kg $K_2O$ and/or 50 ppm of NAA were the most effective treatments in this respect.*

## INTRODUCTION

Common bean (Phaseolus vulgaris, L.) is one of the important legume crops, which is capable to utilize the atmosphoric nitrogen through the Rhizobium bacteria present in nodules of their plant roots, but still the quantity of N-fixed through this way is not enough adequate to plant growth (Follet et al., 1981). Recently, although N and P-applications being recommended but current recommendations are not supported by researches and there are very little informations available on the optimum level of NP-fertilizers. Moreover, NAA-spray proved to be important for the plants especially flowering criteria. So, this work aimed to study the response of common bean plants to the application of NP-fertilizers and NAA foliar spray either alone or in combination on plant growth, chemical constituents of plant foliage, flowering, seed yield and quality. Kumar et al., (1979), working on cowpea reported that NPK application at the highest rate resulted in best plant growth, similar trend was obtained by El-Neklawy (1985) on pea who assured a positive correlation between

NPK application rates and daily growth increments. Farag et al. (1988), on cauliflower seed production revealed that NP rates (60-48) or (80-64) kg of N and $P_2O_5$/fad. had a promotive influence on plant growth characteristics. The same result was also obtained by Eid et al. (1988), on broad bean when N was used at 33.5 kg and $P_2O_5$ at 16 or 32 kg/fad.

The role of NAA was reported by many research workers (Kumar and Sreekumar, 1981, on peas: Abdalla et al., 1984: Mousa, 1984 on common bean), as it had a promotive influence on plant height, number of leaves and fresh and dry weight per plant.

The addition of N and P fertilizers at 72 kg for both did not exert significant influence on a, b and total chlorophyll content (Farag. 1984 on squash) while N, P, K and indoles were increased as a result of combined addition of N and P (Farag et al., 1988 on cauliflower) and seperate addition of phosphorus (Gabal et al., 1989 on pea).

As regard to NAA foliar spray, a promotive effect was shown on chlorophyll content (Sedlovskii, 1972 on cucumber). Adverse effect on NPK contents was obtained by Abdalla et al. (1984), on common bean with respect to flowering, it was indicated that NP-fertilization up to the highest used level delayed flowering and increased seed yield of cauliflower (Farag et al., 1988). Contra results were obtained by Aricha (1982), on pea and Eid et al. (1988), on broad bean who stated that separate additions of N or P up to the highest used level i.e. 67 kg N or 48 kg $P_2O_5$/ fad. enhanced flowering and increased green seed yield.

NAA foliar spray enhanced flowering expressed as number of days required for the appearance of the first flower and number of flowers (Nada, 1981 on horse bean; Abdalla et al., 1984 on sweet pepper) and seed yield (Kaul et al., 1976 on cowpea; Abdalla et al., 1984 on common bean).

NP-fertilization was reported to be effective in improving the quality through increasing the chemical constituents of N, P and K contents of the dry seed (Neptune et al., 1978 on beans; Morsy, 1986 on cowpea) as a result of separate N addition, while extraradicular application of P-fertilizer exerted an enhancing influence on N, P and K accumulation in seeds (Eid et al., 1988 on broad bean; Gabal et al., 1989 on pea).

NAA-foliar spray stimulated the accumulation of N, P and K in seeds of broad bean (Youssef et al., 1972).

## MATERIALS AND METHODS

Two field experiments were conducted at the experimental farm of the Faculty of Agriculture Moshtohor, Zagazig University during the summer seasons of 1989 and 1990. The

soil of this farm is clay loam in texture with 7.7 pH value, 1.5% organic matter, 0.103% available N, 2.747 ppm soluble P, 0.50 meq-/L K. Seeds of common bean cv. Giza-3 were sown in hills 10 cm apart on one side of ridges 60 cm wide and 3.5m long on the 10th and 15th of March of 1989 and 1990 respectively. This experiment included 12 treatments which were the combination of 3 fertilization levels i.e. (20, 16, 24), (40, 32, 24) and (60, 48, 24) kg/fad. of N, $P_2O_5$ and $K_2O$ respectively, combined with 4 concentrations of the growth regulator NAA i.e., 0, 25, 50 and 75 ppm. The foregoing fertilizers were added as ammonium nitrate (33.5% N) and calcium superphosphate (16% $P_2O_5$). Potassium fertilizer was added in constant units(24 kg $K_2O$/fad) using potassium sulphate (48% $K_2O$). Fertilizers were added at two doses three and five weeks after sowing. Plants were sprayed with NAA two times when reached 3 and 5 true leaf stage. Treatments were tested in a split plot design in which the fertilization levels were arranged in the main plots and the growth regulator concentrations in the sub-plots. The sub-plot area was about 1/400 of fad. Normal cultural practices were carried out as commonly followed in the district.

Representative samples of 4 plants were chosen at random from each sub-plot, 45 days from sowing for measuring vegetative growth characteristics i.e. plant height, number of leaves and fresh and dry weight per plant. Nitrogen, phosphorus and potassium content in plant and seeds were determined according to the methods used by Pregl (1945); Murply and Riely (1962), as modified by John (1970); Brown and Lilleland (1946), respectively. Total indoles were determined as described by Gordon and Weber (1950) as modified by Filisson (1969), and total phenols were determined after A.O.A.C. (1965). Chlorophyll content was determined colorimetrically according to the methods described in A.O.A.C. (1970). Number of days to the appearance of the 1st flower anthesis and total number of flower per plant were recorded in 3 plants from each experimental plot. Seed yield per fad. and seed quality were also determined. All obtained data were subjected to statistical analysis according to Snedecor and Cochran (1968).

## RESULTS AND DISCUSSION

### 1- Plant growth:

Data presented on plant growth expressed as plant height, number of leaves, fresh and dry weight of common been plant are given in Table (1).

Concerning the effect of NP on the forementioned items, such data show that increasing NP-rate up to the highest used one (60 N. 48 $P_2O_5$ and 24 $K_2O$ kg/fad.) significantly increased plant height, number of leaves, fresh and dry weight per plant. The stimulative effect of NP fertilizers on the vegetative growth might be attributed to the enhancing effect of NP on the meristematic activity

Table (1): Effect of NP-fertilization and NAA foliar spray on the vegetative growth of Common bean plants.

| Season / Treatments (N $P_2O_2$ $K_2O$)(NAA) Kg/fad (ppm) | 1989 Plant height (cm) | 1989 Number of leaves/ plant | 1989 Fresh weight/ plant (gm) | 1989 Dry weight/ plant (gm) | 1990 Plant height (cm) | 1990 Number of leaves/ plant | 1990 Fresh weight/ plant (gm) | 1990 Dry weight/ plant (gm) |
|---|---|---|---|---|---|---|---|---|
| 20 16 24 0 | 35.2 | 17.0 | 69.0 | 11.3 | 46.7 | 17.3 | 73.7 | 9.5 |
| 20 16 24 25 | 36.5 | 18.7 | 73.4 | 13.0 | 52.0 | 18.0 | 86.7 | 12.4 |
| 20 16 24 50 | 40.5 | 18.9 | 85.9 | 16.1 | 53.7 | 19.3 | 91.7 | 12.9 |
| 20 16 24 75 | 39.7 | 18.0 | 83.2 | 14.2 | 52.7 | 19.0 | 95.3 | 14.0 |
| 40 32 24 0 | 37.6 | 18.3 | 75.3 | 12.8 | 48.0 | 18.3 | 98.0 | 12.7 |
| 40 32 24 25 | 45.3 | 19.2 | 79.2 | 15.4 | 52.3 | 19.0 | 100.0 | 14.6 |
| 40 32 24 50 | 51.0 | 20.0 | 114.9 | 23.6 | 57.3 | 22.7 | 108.3 | 16.1 |
| 40 32 24 75 | 48.4 | 21.5 | 85.5 | 16.3 | 57.0 | 22.7 | 111.0 | 14.8 |
| 60 48 24 0 | 41.4 | 18.9 | 85.3 | 15.4 | 49.3 | 23.7 | 101.7 | 13.5 |
| 60 48 24 25 | 44.3 | 21.4 | 89.6 | 16.5 | 52.3 | 25.3 | 113.0 | 15.6 |
| 60 48 24 50 | 45.6 | 23.9 | 120.8 | 25.2 | 59.4 | 28.7 | 126.3 | 18.0 |
| 60 48 24 75 | 54.1 | 23.6 | 118.3 | 24.3 | 57.3 | 27.7 | 125.7 | 17.7 |
| L.S.D.at 0.05 | 0.6 | 1.6 | 2.3 | 7.0 | 2.4 | 2.0 | 4.8 | 1.7 |
| 20 16 24 - | 37.9 | 18.2 | 77.9 | 13.7 | 51.3 | 18.4 | 86.9 | 12.2 |
| 40 32 24 - | 45.6 | 19.8 | 88.7 | 17.0 | 53.7 | 20.7 | 104.3 | 14.6 |
| 60 48 24 - | 48.6 | 21.9 | 103.5 | 20.4 | 54.6 | 26.4 | 116.7 | 19.2 |
| L.S.D. at 0.05 | 3.5 | 2.0 | 1.3 | 0.7 | 1.3 | 3.4 | 4.1 | 1.1 |
| - 0 | 38.1 | 18.1 | 76.6 | 13.2 | 48.0 | 19.8 | 91.1 | 11.9 |
| - 25 | 42.0 | 19.8 | 80.7 | 14.9 | 52.2 | 20.8 | 99.3 | 14.2 |
| - 50 | 48.7 | 20.9 | 107.2 | 21.6 | 56.8 | 23.6 | 108.8 | 15.7 |
| - 75 | 47.4 | 21.0 | 95.7 | 18.3 | 55.7 | 23.1 | 110.7 | 15.5 |
| L.S.D. at 0.05 | 0.3 | 0.9 | 1.3 | 5.0 | 1.4 | 1.2 | 2.8 | 1.0 |

of the plant tissue. Such result agreed with those obtained by Kumar et al. (1979), on Cowpea: El-Neklawy et al. (1985), on pea, Farag et al. (1988), on cauliflower and Eid et al. (1988), on broad bean.

Concerning the effect of NAA spray on the vegetative growth, it is indicated that NAA at 50 ppm had a significant promotive effect on the forementioned vegetative growth parameters. These results are in harmony with those obtained by Kumar and Sreekumar (1981), on peas, Abdalla et al., (1984), and Mousa (1984), on common bean.

As regard to the effect of interaction between NP-fertilization and NAA foliar spray, data presented in Table (1) show that fertilization of common bean plants with 60 kg N and 48 kg $P_2O_5$/fad. associated with NAA foliar spray at 50 ppm proved to be effective in increasing the vegetative growth characteristics.

**2- Chemical composition:**

Data shown in Tables (2 and 3) clearly show the effect of NP-fertilizers rate and NAA foliar spray on some of the chemical constituents of common bean plants. It is indicated that increasing NP-rate up to the highest used one i.e., 60 kg N within 48 kg $P_2O_5$ proved to be significantly effective in increasing all the determined chemical constituents i.e., chlorophyll a, b and carotene as well as the mineral contents of N, P and K and also the total phenols and indoles content. These results are in coincidence with those obtained by Farag et al. (1988), on cauliflower and Gabal et al. (1989), on pea as regard to N, P and K as well as total indoles contents and disagree with that obtained by Farag (1984), working on squash as regard to chlorophyll a and b content.

Concerning the effect on NAA on the chemical constituents, the same data indicate that NAA foliar spray at 50 ppm exerted a promotive influence on the photosynthetic pigments of chlorophyll a, b and carotene and minerals content of N, P and K as well as total indoles and phenols. These results are in accordance with those obtained by Sedlov'skii (1972), on cucumber as regard to chlorophyll content Adverse trend on NPK contents was obtained by Abdalla et al. (1983), on common bean.

The combining effect of NP fertilization (60 kg N + 48 kg $P_2O_5$/fad.) within NAA foliar spray (50 ppm) resulted in the highest values of the forementioned chemical constituents as shown in Tables (2 and 3). It is evident that such interaction was significantly effective in increasing all the chemical constituents with the exception of carotene, since no significant difference could be detected in this respect.

**Table (2):** Effect of NP-fertilization and NAA foliar spray on the photosynthetic pigments in Common bean leaves (mg/100 gm F.W.).

| Season | | | | 1989 | | | 1990 | | |
|---|---|---|---|---|---|---|---|---|---|
| Treatments | | | | Chlorophyll a | Chlorophyll b | Carotene | Chlorophyll a | Chlorophyll b | Carotene |
| N | $P_2O_5$ | $K_2O$ | (NAA) | | | | | | |
| (Kg/fad) | | | (ppm) | | | | | | |
| 20 | 16 | 24 | 0 | 78.5 | 39.5 | 48.5 | 77.8 | 39.2 | 46.6 |
| 20 | 16 | 24 | 25 | 89.4 | 42.4 | 55.6 | 87.5 | 42.[illegible] | 53.7 |
| 20 | 16 | 24 | 50 | 98.5 | 42.6 | 59.7 | 97.3 | 42.5 | 54.7 |
| 20 | 16 | 24 | 75 | 97.6 | 43.9 | 59.3 | 97.6 | 43.6 | 57.5 |
| 40 | 32 | 24 | 0 | 79.9 | 43.3 | 69.3 | 80.7 | 43.2 | 58.3 |
| 40 | 32 | 24 | 25 | 90.2 | 49.4 | 69.8 | 91.0 | 49.5 | 63.5 |
| 40 | 32 | 24 | 50 | 100.0 | 63.7 | 75.9 | 99.9 | 61.7 | 68.6 |
| 40 | 32 | 24 | 75 | 98.3 | 48.4 | 74.0 | 97.7 | 49.6 | 69.0 |
| 60 | 48 | 24 | 0 | 95.5 | 48.5 | 70.8 | 93.3 | 45.1 | 63.2 |
| 60 | 48 | 24 | 25 | 104.6 | 53.9 | 74.6 | 103.5 | 50.2 | 66.3 |
| 60 | 48 | 24 | 50 | 124.9 | 75.6 | 82.9 | 121.9 | 59. | 72.9 |
| 60 | 48 | 24 | 75 | 112.1 | 69.0 | 79.3 | 110.4 | 48.4 | 67.5 |
| L.S.D. at 0.05 | | | | 5.0 | 3.5 | n.s | 4.0 | 3.6 | n.s |
| 20 | 16 | 24 | - | 91.0 | 42.1 | 55.8 | 90.1 | 42.1 | 53.1 |
| 40 | 32 | 24 | - | 92.1 | 51.2 | 72.3 | 92.3 | 51.0 | 64.9 |
| 60 | 48 | 24 | - | 109.3 | 61.8 | 76.9 | 107.3 | 50.7 | 67.5 |
| L.S.D. at 0.05 | | | | 2.8 | 2.3 | 2.1 | 2.6 | 3.8 | 1.7 |
| - | | | 0 | 84.6 | 43.8 | 62.9 | 83.9 | 42.5 | 56.0 |
| - | | | 25 | 94.7 | 48.6 | 66.7 | 94.0 | 47.5 | 61.2 |
| - | | | 50 | 107.8 | 60.6 | 72.8 | 106.4 | 54.4 | 65.4 |
| - | | | 75 | 102.7 | 53.8 | 70.9 | 101.9 | 47.2 | 64.7 |
| L.S.D. at 0.05 | | | | 2.9 | 1.9 | 2.2 | 3.6 | 2.1 | 1.7 |

Table (3): Effect of NP-fertilization and NAA foliar spray on the chemical constituents of plant foliage of Common bean.

| Season / Treatments (N $P_2O_5$ $K_2O$)(NAA) kg/fad (PPm) | 1989 | | | | | 1990 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | N | P | K | Total phenols | Total indoles | N | P | K | Total phenols | Total indoles |
| | mg/100 gm D.W. | | | mg/100 | gm F.W. | mg/100 gm D.W. | | | mg/100 | gm F.W. |
| 20 16 24 0 | 3510 | 322 | 3010 | 430.6 | 353.4 | 3463 | 326 | 2600 | 389.5 | 347.2 |
| 20 16 24 25 | 3620 | 351 | 3160 | 441.3 | 340.0 | 3577 | 356 | 2800 | 399.6 | 358.3 |
| 20 16 24 50 | 3790 | 366 | 3250 | 448.4 | 357.4 | 3727 | 365 | 2867 | 443.7 | 358.3 |
| 20 16 24 75 | 3780 | 366 | 3210 | 458.0 | 349.1 | 3733 | 363 | 3267 | 451.6 | 369.5 |
| 40 32 24 0 | 3650 | 328 | 3110 | 442.1 | 357.3 | 3693 | 332 | 3133 | 411.2 | 355.1 |
| 40 32 24 25 | 4120 | 378 | 3320 | 457.6 | 368.2 | 4207 | 371 | 3267 | 435.3 | 365.3 |
| 40 32 24 50 | 4450 | 491 | 3850 | 483.5 | 377.1 | 4443 | 483 | 3433 | 456.4 | 379.5 |
| 40 32 24 75 | 4220 | 472 | 3470 | 488.0 | 390.0 | 4277 | 445 | 3500 | 478.3 | 386.9 |
| 60 48 24 0 | 4020 | 336 | 3500 | 453.1 | 378.0 | 4093 | 337 | 3333 | 442.2 | 375.3 |
| 60 48 24 25 | 4380 | 381 | 3610 | 477.0 | 388.3 | 4333 | 418 | 3667 | 470.3 | 390.3 |
| 60 48 24 50 | 4660 | 512 | 4000 | 532.6 | 399.4 | 4597 | 472 | 3933 | 485.6 | 405.4 |
| 60 48 24 75 | 4480 | 517 | 3880 | 518.9 | 411.5 | 4460 | 487 | 3866 | 473.0 | 415.0 |
| L.S.D. at 0.05 | 76 | 45 | 282 | 11.9 | 4.8 | 108 | 23 | 366 | 13.7 | 6.9 |
| 20 16 24 - | 3680 | 351 | 3160 | 444.6 | 349.9 | 3625 | 353 | 3275 | 421.1 | 358.3 |
| 40 32 24 - | 4110 | 417 | 3440 | 467.8 | 373.2 | 4155 | 408 | 3333 | 445.3 | 371.7 |
| 60 48 24 - | 4390 | 437 | 3750 | 495.4 | 394.3 | 4371 | 429 | 3700 | 467.8 | 396.5 |
| L.S.D. at 0.05 | 95 | 49 | 94 | 5.5 | 3.2 | 246 | 11 | 427 | 10.1 | 4.8 |
| - - 0 | 3730 | 329 | 3210 | 441.9 | 362.9 | 3750 | 332 | 3022 | 414.3 | 309.2 |
| - - 25 | 4040 | 370 | 3360 | 458.6 | 365.5 | 4039 | 382 | 3245 | 435.1 | 371.1 |
| - - 50 | 4300 | 456 | 3700 | 488.2 | 377.9 | 4256 | 440 | 3411 | 461.9 | 381.1 |
| - - 75 | 4160 | 452 | 3520 | 488.3 | 383.5 | 4157 | 432 | 3544 | 467.6 | 390.5 |
| L.S.D. at 0.05 | 44 | 26 | 163 | 6.8 | 2.8 | 63 | 13 | 340 | 7.9 | 3.9 |

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3- Flowering and seed yield:

It is evident as shown in Table (4) that NP-fertilization exerted a consistent delaying influence on flowering and a promising influence in increasing number of flowers as well as total seed yield per fad. Such increments were true during both seasons of growth, i.e., 1989 and 1990. The delaying of flowering may be due to the increment in plant vegetative growth, photosynthetic pigments and accumulation of N, P and K as well as total indoles and phenols. It is worthy to mention herein that the plant is always in a dynamic state of physiological equilibrium and this is ensured by the final noticeable increment in seed yield, although the number of flowers is not affected statistically. This result is in agreement with that obtained by Sharma et al. (1976), on bean and Farag et al. (1988), on cauliflower seed production. However, contra result was obtained by Eid et al. (1988), on broad been as regard to flowering earliness. Obtained results agree with those of Aricha (1982), on pea and Eid et al. (1988), on green seed yield through separate N and P addition and Farag et al. (1988), on cauliflower combined addition of NP (60 kg N + 48 kg $P_2O_5$/fad).

Regarding the effect of NAA on flowering criteria, data at Table (4) indicate that increasing NAA concentration up to 75 ppm showed a significant delaying effect on flowering. However, spraying NAA at 50 ppm stimulated the number of flowers per plant and also seed yield per faddan. Although, the highest seed yield was obtained by the foliar spray of NAA at 75 ppm, no significant difference could be noticed between the two concentrations i.e. 50 or 75 ppm. The increase in seed yield may be due to the physiological role of NAA in increasing number of flowers and setting of pods. These results are coincided with those obtained by Nada (1981), on horse bean and Abdalla et al. (1984), on sweet pepper as regard to flowering and with Kaul et al., (1978) on cow pea; Abdalla et al, (1984), on common bean as regard to total seed yield. The combined effect of NP-fertilization at 60 and 48 kg N, $P_2O_5$/fad. within NAA foliar spray at 50 ppm proved to be uneffective in enhancing flowering and in increasing number of flowers per plant but effective in increasing seed yield per faddan.

4- Seed chemical composition:

From data presented in Table (5), it is evident that Np-fertilization at 60 and 48 kg of N and $P_2O_5$ per fad. showed a favourable effect in increasing the contents of N, P and K in seeds. These results are in agreement with those obtained by Neptune et al. (1978) on beans and Morsy (1986) on cowpea when they added N individually. Moreover, extraradicular application of P-fertilizer exerted an enhancing influence too (Eid et al., 1988 on broad bean).

Table (4): Effect of NP-fertilization and NAA foliar spray on flowering and seed yield.

| Season / Treatments | | | | 1989 | | | 1990 | | |
|---|---|---|---|---|---|---|---|---|---|
| (N | $P_2O_5$ | $K_2O$) kg/fad. | (NAA) (ppm) | Early flowering (days) | No. of flowers/ plant | Seed yield/ faddan (Kg) | Early flowering (days) | No. of flowers/ plant | Seed yield/ faddan (Kg) |
| 20 | 16 | 24 | 0 | 38.4 | 18.5 | 520 | 37.5 | 18.0 | 500 |
| 20 | 16 | 24 | 25 | 38.5 | 19.8 | 527 | 37.6 | 19.5 | 518 |
| 20 | 16 | 24 | 50 | 39.9 | 19.9 | 568 | 38.7 | 20.7 | 519 |
| 20 | 16 | 24 | 75 | 39.9 | 19.8 | 560 | 39.8 | 20.7 | 562 |
| 40 | 32 | 24 | 0 | 41.0 | 20.1 | 535 | 40.1 | 20.1 | 547 |
| 40 | 32 | 24 | 25 | 43.5 | 23.0 | 556 | 42.6 | 25.3 | 567 |
| 40 | 32 | 24 | 50 | 43.9 | 23.6 | 600 | 43.0 | 24.5 | 609 |
| 40 | 32 | 24 | 75 | 45.2 | 23.9 | 647 | 44.8 | 25.5 | 607 |
| 60 | 48 | 24 | 0 | 42.2 | 23.2 | 600 | 43.1 | 21.1 | 577 |
| 60 | 48 | 24 | 25 | 44.3 | 24.6 | 645 | 44.7 | 24.4 | 600 |
| 60 | 48 | 24 | 50 | 46.5 | 27.9 | 760 | 46.2 | 27.6 | 665 |
| 60 | 48 | 24 | 75 | 49.9 | 24.2 | 725 | 49.2 | 26.3 | 650 |
| L.S.D. at | | | 0.05 | 2.4 | n.s | 9 | 1.2 | n.s | 10 |
| 20 | 16 | 24 | - | 39.2 | 19.5 | 544 | 38.4 | 19.7 | 525 |
| 40 | 32 | 24 | - | 43.4 | 22.7 | 585 | 42.6 | 23.9 | 583 |
| 60 | 48 | 24 | - | 45.7 | 25.0 | 683 | 45.8 | 24.9 | 623 |
| L.S.D. at | | | 0.05 | 2.2 | 1.5 | 14 | 1.4 | 2.7 | 13 |
| - | | | 0 | 40.5 | 20.6 | 552 | 40.2 | 19.8 | 541 |
| - | | | 25 | 42.1 | 22.5 | 676 | 41.6 | 22.1 | 562 |
| - | | | 50 | 43.4 | 23.8 | 643 | 42.6 | 24.3 | 598 |
| - | | | 75 | 45.0 | 22.6 | 644 | 44.6 | 24.2 | 606 |
| L.S.D. at | | | 0.05 | 1.4 | 1.2 | 5 | 0.7 | 1.4 | 4 |

**Table (5):** Effect of NP-fertilization and NAA foliar spray on seed chemical constituents of common bean.

| Season | | | | 1989 | | | 1990 | | |
|---|---|---|---|---|---|---|---|---|---|
| Treatments | | | | | | | | | |
| (N | $P_2O_5$ | $K_2O$) | NAA | N | P | K | N | P | K |
| kg/fad | | | (ppm) | mg/100 gm D.W. | | | mg/100 gm D.W. | | |
| 20 | 16 | 24 | 0 | 4620 | 300 | 3170 | 4667 | 315 | 3260 |
| 20 | 16 | 24 | 25 | 4750 | 366 | 3360 | 4750 | 335 | 3717 |
| 20 | 16 | 24 | 50 | 4820 | 377 | 3440 | 4750 | 368 | 3820 |
| 20 | 16 | 24 | 75 | 4670 | 378 | 3430 | 4790 | 372 | 3797 |
| 40 | 32 | 24 | 0 | 4930 | 329 | 3390 | 5077 | 333 | 3920 |
| 40 | 32 | 24 | 25 | 5110 | 380 | 3450 | 5100 | 355 | 3923 |
| 40 | 32 | 24 | 50 | 5160 | 385 | 3450 | 5453 | 372 | 4167 |
| 40 | 32 | 24 | 75 | 5420 | 410 | 3480 | 5467 | 395 | 4297 |
| 60 | 48 | 24 | 0 | 5170 | 415 | 3920 | 5110 | 417 | 4167 |
| 60 | 48 | 24 | 25 | 5420 | 470 | 4500 | 5407 | 463 | 4550 |
| 60 | 48 | 24 | 50 | 5730 | 479 | 4550 | 5670 | 481 | 4597 |
| 60 | 48 | 24 | 75 | 5490 | 501 | 4880 | 5423 | 498 | 4863 |
| L.S.D. at 0.05 | | | | n.s. | 10 | n.s. | 77 | 5 | n.s. |
| 20 | 16 | 24 | - | 4720 | 355 | 3350 | 4739 | 348 | 3649 |
| 40 | 16 | 24 | - | 5150 | 376 | 3440 | 5274 | 364 | 4077 |
| 60 | 16 | 24 | - | 5450 | 466 | 4460 | 5402 | 465 | 4544 |
| L.S.D. at 0.05 | | | | 326 | 6 | 129 | 32 | 16 | 68 |
| | | - | 0 | 4910 | 348 | 3490 | 4951 | 365 | 3782 |
| | | - | 25 | 5090 | 405 | 3770 | 5086 | 384 | 4063 |
| | | - | 50 | 5240 | 414 | 3810 | 5291 | 407 | 4195 |
| | | - | 75 | 5190 | 430 | 3930 | 5227 | 422 | 4319 |
| L.S.D. at 0.05 | | | | n.s. | 6 | n.s. | 44 | 3 | n.s. |

Regarding NAA foliar spray, it is shown from the same data in Table (5) that NAA had no effect on N and K content, but had a promotive effect in increasing N content in the second season and P content in both seasons of growth.

The interactive effect of NP fertilizer rate within NAA foliar spray concentration behaved similarly as NAA effect. The results obtained with the effect of NAA on N P and K content in seeds agree with those indicated by Youssef et al. (1972) working on broad bean.

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## تأثير التسميد النيتروجين والفوسفاتى والرش بحمض النفثالين أستيك أسيد على النمو والتركيب الكيماوى والازهار والمحصول البذرى والجودة لنباتات الفاصوليا

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قســم البساتين – كلية الزراعـــة بمشتهـــــر

أجريت تجربتان حقليتان بمزرعة كلية الزراعة بمشتهر خلال الموسم الصيفى لعامـــى ١٩٨٩ ، ١٩٩٠ لدراسة استجابة نباتات الفاصوليا صنف جيزة ٣ لثلاث مستويات من التسميد النتروجينى والفـــوسفـــاتى بالإضافـــة الى البوتاسيوم والذى أضيـــف بكميات ثابتـــة والمستويات عبارة عن (٣٠، ١٦، ٢٤، ) ، ( ٤٠ ، ٣٢، ٢٤ ) و ( ٤٨،٦٠ ، ٢٤ ) لكل مـــن ن ، فوأه ، بهـ ا كجم / فدان على التوالى مع أربعة تركيزات من النفثالين وهى ( صفـــر ، ٢٥، ٥٠، ٧٥ جزء فى المليون ) . وقد أظهرت النتائج المتحصل عليها بأن معظم المعاملات المدروسة شجعت النمو الخضرى معنويا وكذلك زيادة الصفات الانتاجية التمثيـــل الضـــوئي والمحتوى المعدنى من ن ، فوبو وأيضا الاندولات والفينولات الكلية بالنبات كمـــا أدت الى تأخير الأزهار وزيادة عدد الازهار بالنبات وكذلك المحصول البذرى للفدان ومحتـــوى البذور من النتروجين والفوسفور والبوتاسيوم وأظهر التسميد النتروجينى بمعدل ٦٠ كجـــم / فدان مع التسميد الفوسفاتى بمعدل ٤٨ كجم فوم أ ٥ / فدان بالاضافة الـــى أو الـــرش بنفثالين حمض الخليك بتركيز ٥٠ جزء فى المليون أكبر الإثر فى هذا الخصوص .