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EFFECT OF INTERACTION BETWEEN BIOFERTILIZERS AND ORGANIC OR MINERAL FERTILIZERS ON SOIL OC, NPK AVAILABILITY AND PRODUCTION OF *Narcissus tazetta*, L.

El-Naggar A.A.M.[1] and Ramzy M.R. Hedia[2]

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ABSTRACT

A pot experiment was conducted on Narcissus (Narcissus tazetta, L) during the two successive seasons 2002/2003 and 2003/2004 to study the effect of inoculation with the biofertilizers Nitrobine+Phosphorein (NP) or Biogine+Phosphorein (BP) combined with cattle (CC) or green (GC) compost at the rate of 10g/pot or a mineral NPK fertilizer 19:19:19 (at 3.0 and 6.0 g/pot, KR1 and KR2, respectively) on vegetative growth, flowering, bulbs parameters and mineral contents of Narcissus leaves and bulbs. Also, NPK availability and soil organic carbon loss were investigated. The results indicated that application of KR1 or KR2 combined with NP or BP inoculation enhanced all vegetative growth, spike and bulbs parameters. The inoculation of CC with NP had similar effects on most of the measured plant parameters as for the mineral fertilizer. The NP+CC or NP+GC treatments gave the same significant effect on all flowering parameters except spike length, bulb fresh weight, bulb circumference and total chlorophylls content. An increase in flowers duration, number of flowers/spike and early flowering, was obtained with CC or GC compost inoculated with NP. The highest N, P and K contents of narcissus leaves were obtained by applying the BP+KR2 treatment. The highest level of P and K availability was obtained with the BP+KR2 or NP+KR2 treatment. The BP+CC or NP+CC treatment enhanced N availability. Addition of CC or GC inoculated with NP or BP helped in building the soil organic matter pool which is considered as a nutrients reservoir. If narcissus plants are to be grown for mother bulbs production, it is recommended that mineral fertilizers can be applied inoculated with NP. This will increase the amount of nutrient storage in bulbs and hence stimulate growth rate and flowering characteristics in the subsequent season.

INTRODUCTION

Environmental stress and potential pollution of natural resources are due to the excessive use of chemical fertilizers under intensive agricultural systems to meet the demands of the overpopulated societies. This may pose health hazards. Therefore, alternative agriculture such as organic farming or using biofertilizers in agriculture is considered to be a way to preserve the environment and prevent pollution (Ramadan *et al.*, 2002). In addition to their expensive costs, chemical fertilizers might suppress the activity of microflora and stability of soil organic matter (Pokorna Kozova, 1984). Organic and biofertilizers provide an alternative to agricultural chemicals as more sustainable and ecologically sound practice to increase crop productivity (Pankhurst and Lynch, 1995). Recent investigations revealed that the application of organic fertilizers and/or biofertilizers to the soil can promote nutrients availability and plant uptake, increase crop yield, reduce inputs of chemical fertilizers and minimize environmental risks (Barsoom, 1998; Khalid *et al.*, 2000; Koreish, 2003; Koreish *et al.*, 2004). A group of bacteria termed as "plant growth promoting rhizobacteria" (PGPR) are commonly used as biofertilizers (Klopper and Schroth, 1978).

Few research works have been carried out on the use of biofertilizers and organic fertilizers in the production of ornamental flowering bulbs. In a pot experiment, Wange and Palil (1994) and Wange *et al* (1995) found that applying N-fertilizers alone or inoculated with *Azotobacter+Azospirillum* mixtures significantly increased flowers and bulb yields of tuberose (*Polianthes tuberosa* cv. Single). Sheik *et al.* (2000) revealed that floret size and bulbs weight and diameter of Dutch iris (*Iris hollandica* cv. Prof. Blaauw) was enhanced by inoculation with *Azotobacter* and *Azospirillum* combined with chemical N-fertilizer. Conte e Castro *et al.*(2001) found that poultry manure, hog manure, bovine manure urban waste compost substantially increased plant height, bulb diameter and dry weight of aerial parts of gladiolus cv. Red Beauty. They stated that all organic fertilizers provided satisfactory results and can, therefore, be used as substitutes to chemical fertilizers. Alkaff *et al.*(2002) evaluated the biofertilizers Halex 2 (mixture of *Azospirillum*, *Azotobacter* and *Klebsiella*), mineral fertilizer and farmyard manure to onion cv. Baftaim and concluded that Halex 2 increased bulb diameter. The highest increase in bulb diameter and height was recorded with the mineral fertilizer. Jayathilake *et al.*(2002) found that an increase in plant height and leaf number was observed with onion plants treated with *Azotobacter* + vermicompost + 50% recommended N. A significantly higher bulb weight and bulb diameter was recorded upon treatment with *Azospirillum* + 50% recommended N through vermicompost+50% N.

However, rare research work has been done on the effect of the interaction between biofertilizers and organic or mineral fertilizers on narcissus (*Narcissus tazetta*, L.) production in Egypt. Therefore, the objectives of this study were: 1) to investigate the effects of the application of three biofertilizers and their interactions with organic or mineral fertilizers on the vegetative growth, flowering parameters and bulbs

[1]Ornamental Plants Research Dept., Antoniades Gardens, Horticultural Research Inst., Alexandria, Egypt.
[2]Soil and Water Sciences Dept., Faculty of Agriculture, Alexandria University, El-Shatby, Alexandria, Egypt.

production of narcissus (*Narcissus tazetta*, L.), cv. Paper white 2) to evaluate the effects of these treatments on the availability and plant uptake of N, P and K. and 3) to investigate the effects of these treatments on the loss of soil organic carbon.

MATERIALS AND METHODS

An outdoor pot experimental study was conducted at Antoniades Research Branch, Horticultural Research Institute, Alexandria, Egypt. Narcissus plants (*Narcissus tazetta, L.*) were grown throughout two successive growth seasons (2002/2003) and (2003/2004).

Narcissus Plants:

Narcissus tazetta, L. belongs to the family *Amaryllidaceae*. It is hardy or tender herbaceous perennial growing from bulbs and seeds. It is predominant over all spring flowers by its insurmountably strong but pleasing fragrance. It is grown as cut flowers and can be planted in beds, in edging and borders along the paths or sides, in pots or bowls in gardens (Hanks, 2002). It is also used for extraction of aromatic oils.

The Growing Medium:

PVC pots (20 cm in diameter and 25 cm depth) were packed with lacustrine sandy clay loam soil from Antoniades Garden area mixed with sand at 1:1 on volume basis. Each pot contained 2.0 kg medium. Analyses of some chemical and physical properties of the used growing medium were carried out according to Page *et al.* (1982) and are listed in Table (1).

Table (1): Some physical and chemical Properties of the growing medium

Property	Results of Analysis
Sand, %	68.1
Silt, %	18.7
Clay, %	13.2
Textural Class	Sandy Loam
WHC, %	15.71
EC, dS m^{-1} *	2.24
pH *	8.19
$CaCO_3$, %	3.91
CEC, $cmol_c$ kg^{-1}	18.41
Organic Carbon, g kg^{-1}	6.61
Total Nitrogen, g kg^{-1}	0.64

* Measured in the soil paste extract.

Organic and Mineral Fertilizers:

Two commercial types of compost were used; cattle compost (CC) and green compost (GC). The chemical properties of these composts were determined according to Westerman (1990) and are presented in Table (2). The mineral fertilizer used was Kristalon™ (19:19:19); EC= 0.9 dS/m at1.0 g l^{-1}.

Table (2) Some chemical properties of the used cattle and green composts.*

Properties	Cattle Compost (CC)	Green Compost (GC)
Organic Carbon, %	24.98	12.45
N, %	1.855	0.703
P, %	0.28	0.14
K, %	0.18	0.13
C/N Ratio	13.46	17.71

* Calculation was made on dry mass basis.

Biofertilizers:

The three used biofertilizers Biogein, Nitrobine and Phosphorein are produced by the Biofertilizers Unit, ARC, Ministry of Agriculture and Land Reclamation. Biogein contains *Azotobacter* on peatmoss, vermiculite and plant charcoal carrier (Abdalla *et al.*, 2001). Nitrobine contains *Azotobacter chroococcum* and *Azospirillum barasilense* on the same previous carrier (Shalan, *et al.*, 2001) Both *Azotobacter* and *Azospirillum* are non-symbiotic nitrogen fixing bacteria (Klopper and Schroth, 1978). The biofertilizer Phosphorein, containing phosphate dissolving vesicular and arbuscular mycorrhiza and Silicane bacteria (Abdalla *et al.*, 2001), was added to the growing medium with either the Biogein or Nitrobine for the all biofertilizers treatments.

Fertilizer Treatments:

Fertilizer treatments were split into two groups. The first group was amended with Biogein + Phosphorein (BP) while the second amended with Nitrobine + Phosphorein (NP). Under each group, pots were amended with either CC or GC compost at the rate of 10 g/pot before planting or with Kristalon at two application rates of 3.0 and 6.0 g/pot after planting (KR1 and KR2, respectively). A control treatment was established that did not receive any biofertilizers, organic compost or mineral fertilizers.

10 g of either cattle (CC) or green (GC) compost were thoroughly mixed with the top 5 cm of the packed media immediately before planting narcissus bulbs. The amount of applied Kristalon was split into two equal doses (1.5 g and 3.0 g/pot for KR1 and KR2, respectively). The first dose was applied two weeks after planting and the second dose was applied one month later.

The treatments were arranged in three replicates with five plants in each experimental unit in a complete randomized block design (Snedecor and Cochran, 1967). Recommended agricultural practices such as weeding and watering as basic dressing were carried out for all treatments whenever necessary.

Planting Narcissus Bulbs:

Narcissus mother bulbs, uniform in size (10 -12 cm circumference) were used for planting. One bulb was planted in each pot at 5 - 6 cm depth. Bulbs were planted on 1st and 5th November of the growth seasons 2002/2003 and 2003/2004, respectively. The flowering seasons terminated on 10th and 15th February for the two seasons, respectively. After flowers fading, the plants were regularly watered until foliage began to turn yellow, then watering was stopped to let foliage die down. The soil was kept fairly dry until bulbs were dug out where the experiment was terminated on 25th and 30th of April for the two seasons, respectively.

Morphological Measurements:

During each growing season, flowering characteristics: flowering time (No. of days from planting bulbs to the showing color stage), flowering duration, fresh weight of flowers per plant, number of flowers per spike, spike length (cm) and spike diameter (cm) were measured. At the end of each growing season, the following morphological measurements were carried out on narcissus plants:

1-Vegetative growth characteristics: Foliage height (cm), number of leaves per plant, leaf length (cm), leaf width (cm), fresh and dry weights of leaves per plant (g).

2-Bulb characteristics: bulb circumference (cm), bulb fresh and dry weights (g).

Plant and Soil Analyses:

At the bud flower initiation stage, the total chlorophylls (a+b) content of fresh narcissus leaves (mg/100g) was determined according to (Moran and Porath, 1980). In addition, chemical analyses of oven-dry leaves and bulbs (dried at 60 °C for 72 hr) were carried out to determine their N, P and K contents (%) according to the methods outlined by Westerman (1990). Organic carbon contents (mg C) of the top 5 cm depth of the growing medium were also determined according to Page *et al.* (1982). Percent loss of organic carbon (% OC_{loss}) for each treatment was calculated according to Wagner and Wolf (1998) using the following equation:

$$\% \, OC_{Loss} = \frac{(OC_{final} - OC_{control\ soil})}{OC_{initial}} \times 100$$

Where, $OC_{initial}$ and OC_{final} are the organic carbon contents (mg C/5.0 cm) at the beginning and the end of the growing season for each treatment. $OC_{control}$ is organic carbon content of the control growing medium. The control growing medium initially contained 509.8 mg C/5.0 cm. In pots treated with organic composts, the upper 5.0 cm of each pot received 2497.7 and 1245.4 mg C for the cattle and green compost treatments, respectively (Table 1).

RESULTS AND DISCUSSION

A- Vegetative Growth Parameters:

1- Foliage Height:

Foliage height was significantly affected by fertilizer treatments as shown in Table (3). Applying KR2 inoculated with BP gave the tallest foliage height. This resulted in an increase of 147.43 and 149.23% relative to the control for the two seasons respectively. This was followed by the BP+GC and BP+KR1 treatments with no significant differences between them. It was found that, inoculation with BP alone was better than NP alone. Insignificant differences were recorded between plants received BP+CC or BP+KR1. Also, inoculation with BP and treating the soil with CC or KR1 had significant similar effect on foliage height. This promoting effect on plant growth expressed as foliage height could be due to the increase in total nitrogen fixation and available phosphorus in the soil which released by phosphate solubilization process caused by the phosphate dissolving bacteria, PDB (Rodriguez and Fraga, 1999).

2- Number of Leaves:

The data in Table (3) show that all fertilizer treatments significantly increased this parameter as compared with the control except in case of inoculation with NP or BP alone which did not significantly differed from the control. The highest number of leaves/plant was found with plants received KR2+BP with 180.24 and 166.19% higher number of leaves relative to the control in both seasons, respectively. Applying NP+CC did not significantly differ from this treatment. Insignificant differences were detected between treatments BP+KR2 and BP+KR1; NP+GC and NP+CC. Moreover, it was noticed that applying BP+CC or BP+GC had significant similar effects.

Noel *et al.* (1996) found that applying mineral fertilizers and the inoculation with *Azotobacter and Azospirillum* strains led to the production of adequate amounts of IAA and cytokinins which might increase the surface area per unit root length and enhanced root hair branching thus an increase in the nutrients uptake might occur. The obtained results of foliage height and number of leaves are in agreement with those obtained by Jayathilake *et al.* (2002) and Rather *et al.* (2003) on onion and Tartoura (2002) on pea (*Pisum sativum*) who reported that the maximum plant height and number of leaves were recorded with *Azotobacter* and *Azospirillum* inoculation.

3- Leaf Length and Width:

The results listed in Table (3) revealed that all fertilizer treatments significantly affected leaf length except for treatments of BP and NP which did not significantly differ from the control. The treatment of BP+KR2 caused the highest leaf length compared with the control with increase of 176.66 and 180.67% relative to the control. The BP+KR2 and BP+KR1; NP+GC and NP+CC treatments had similar effects on leaf length. Also, it was found that applying BP+CC or BP+GC resulted in similar effects on leaf length. All fertilizer treatments also caused significant increase in leaf width compared with the control. The highest values of leaf width were recorded with BP+KR2. It can be noticed that applying NP+KR2 or BP+KR1 resulted in significant similar effects on leaf width.

Table (3): Effect of fertilizer treatments on plant height, number of leaves per plant, leaf length, leaf width, fresh weight of leaves per plant and dry weight of leaves per plant of *Narcissus tazetta*, L. plants during two growth seasons.

Treatments	Foliage height (cm)	No. of Leaves/plant	Leaf length (cm)	Leaf width (cm)	Fresh wt. leaves/plant (g)	Dry wt. leaves/plant (g)
	First Season					
NP	32.10 d	10.06 cd	27.46 e	1.13 d	11.50 e	2.25 h
NP+CC	36.63 c	10.70 bc	35.10 bcd	1.33 d	12.63 cde	2.40 g
NP+GC	38.66 b	11.13 bc	37.10 bcd	1.80 c	14.23 bcd	2.81 ef
NP+KR1	36.60 c	11.53 bc	34.96 bcd	1.76 c	12.14 de	2.69 f
NP+KR2	36.66 c	12.33 bc	37.80 bc	2.13 b	16.05 b	3.85 b
BP	36.26 c	10.20 bcd	27.60 e	1.30 d	11.53 e	2.26 h
BP+CC	38.66 b	12.56 ab	32.60 d	2.06 b	15.86 b	3.45 c
BP+GC	39.50 b	11.83 bc	33.30 cd	1.66 c	14.29 bcd	2.82 e
BP+KR1	38.86 b	10.73 bc	39.43 ab	2.10 b	14.58 bc	3.21 d
BP+KR2	41.43 a	14.60 a	42.86 a	2.33 a	18.16 a	4.31 a
Control	28.10 e	8.10 d	24.26 e	0.91 e	9.27 f	2.01 i
L.S.D.(0.05)	1.69	2.10	4.36	0.19	2.06	0.12
	Second Season					
NP	32.30 f	10.30 bc	27.93 d	1.33 e	11.53 e	2.27 g
NP+CC	37.13 d	11.23 b	34.43 bc	1.43 e	12.46 cde	2.42 f
NP+GC	38.73 c	11.43 b	38.46 b	1.86 c	13.93 cd	2.78 e
NP+KR1	37.03 d	11.73 b	35.06 bc	1.83 c	12.10 de	2.79 e
NP+KR2	38.76 c	12.40 ab	38.56 b	2.16 b	16.24 b	3.81 b
BP	36.10 d	10.30 bc	27.80 d	1.36 e	12.03 de	2.23 g
BP+CC	39.03 c	12.33 ab	33.03 c	2.10 b	16.00 b	3.52 c
BP+GC	40.20 b	11.60 b	34.10 bc	1.60 d	13.98 cd	2.78 e
BP+KR1	39.16 bc	11.06 b	38.70 b	2.13 b	14.41 bc	3.24 d
BP+KR2	42.13 a	13.96 a	43.00 a	2.43 a	18.69 a	4.35 a
Control	28.23 f	8.40 c	23.80 d	0.93 f	8.92 f	1.90 h
L.S.D (0.05)	1.09	1.86	4.11	0.15	1.90	0.08

L.S.D $_{(0.05)}$ = Least significant difference at 0.05 level of probability.

However, no significant differences in leaf width were observed due to applying NP+KR1 or NP+GC. Inoculation with NP or BP alone had significant effect on this parameter.

The enhancement in leaves growth as a result of applying mineral fertilizer and inoculation with NP may be due to the production of phytohormones by the biofertilizers and improving the availability of nutrients (Martin *et al.*, 1989 and Jagnow *et al.*, 1991).

These results are in conformity with those obtained by Barakat and Gaber (1998) who found that tomato leaves growth was greatly improved by inoculation *Azotobacter sp.* and *Azospirillum sp.* Rather *et al.* (2003) also observed a maximum increase in onion leaf length as a result of inoculation with *Azotobacter* and *Azospirillum*. Abou El-Khashab (2003) mentioned that, inoculating olive seedlings with *Azotobacter* and *Azospirillum* significantly increased all vegetative growth characteristics.

4- Fresh and Dry Weights of Leaves:

Applying all fertilizer treatments resulted in significant increases in fresh weight of leaves compared with the control (Table 3). The BP+KR2 treatment gave the highest values with rates of increase of 195.90 and 209.53% relative to the control in both seasons, respectively. The NP+KR2, BP+CC and BP+KR1 treatments had significant similar effects on fresh weight of leaves. On the other hand, there were no significant differences between the BP+CC, BP+GC, BP+KR1 and NP+GC treatments. Inoculation with NP or BP alone resulted in the lowest significant effect on this parameter.

Fertilizer treatments also significantly affected dry weight of leaves/plant as presented in Table (3). The greatest increase in leaves dry weight was recorded with the treatment of BP+KR2 with 214.42 and 224.94% increase relative to the control in both seasons, respectively. Also, it was noticed that applying NP+GC or NP+KR1 treatments had significant similar effects on leaves dry weight. Inoculation with BP or NP alone was less effective than other treatments.

The stimulating effects of biofertilizers on vegetative growth parameters were reported by El-Gamal *et al.* (1996) on tomato, Ashour *et al.* (1997) on potato, Attia (2000) on *Lawsonia inermis*, L., Koreish *et al.* (2004) on faba bean, Rather *et al.* (2003) on onion and El-Fawakhry *et al.* (2004) on ficus.

B – Flower Characteristics:

1- Flowering Time:

Data presented in Table (4) reveal significant effect of fertilizer treatments on number of days to flowering. The NP+CC treatment resulted in the most advanced flowering by 11.14 and 9.93 days earlier than that recorded with the control in the first and second seasons, respectively. The BP+CC, NP+GC and BP treatments had no significant differences from the BP+CC treatment. However, insignificant advance in flowering date was detected due to applying the BP+KR2, BP+KR1 and NP+KR2 treatments.

These results are in agreement with those obtained by Vorob'eva (1997) on China asters who found that inoculating China aster seeds with *Azotobacterin* mixture with *Phosphorobacterin* advanced plant development by 6-11 days. Also, Mansour *et al.* (2002) found that inoculation globe artichoke with Nitrobine + 50% recommended N had positive effect on early yield which might be due to increasing available nitrogen.

2- Flowers Duration:

Data illustrated in Table (4) reveal significant effects on flowers duration as a result of applying all fertilizer treatments except for NP treatment The maximum value of flowers duration was recorded with the treatment of BP+KR2 which caused longer flowers duration by 4.60 and 4.47 days compared with the control in both seasons, respectively. The results indicated that the treatments of NP+KR1, BP+CC and BP+GC had significant similar effects on flowers duration. Also, it was found that applying BP+CC gave more significant effects on flowering duration than NP+CC. Similarly, BP+GC effect was more than NP+GC treatment on this parameter. Similar results were obtained by Vorob'eva (1997) on China asters who found that seeds inoculation with the mixture of *Azotobacterin and phosphorobacterin* extended flowering period by 1-5 days.

3- Fresh Weight of Flowers per Plant:

It is clear from data in Table (4) that fertilizer treatments were very effective on fresh weight of flowers per plant. The highest flowers fresh weight/plant was recorded with plants receiving either of GC or CC inoculated with BP or NP. However, lesser but significant effects on flowers fresh weight was found with applying KR1 or KR2 inoculated with BP or NP. Inoculation with BP alone showed the lowest but significant effect on fresh weight of flowers. However, the NP treatment did not significantly affect this parameter. Moreover, amending the soil with CC or GC inoculated with NP gave similar effects.

The significant increase in flower fresh weight due to applying green or cattle compost in presence of Nitrobine or Biogine may be attributed to the combined effects of compost and biofertilizer on more accumulation of biosynthesizes leading to an increase in flowers weight. Similar results were obtained with tuberose by Wang and Patil (1994) and gladiolus "Red Beauty" by Conte e Castro *et al.* (2001).

4- Number of Flowers per Spike:

Data in Table (4) demonstrate the significant effects of the fertilizer treatments on number of flowers/spike except for the BP treatment. The highest number of flowers per spike was observed with the treatment of BP+KR1 with an increase of 157.78 and

Table (4): Effect of fertilizer treatments on number of days to flowering, flowers duration, fresh and dry weight of flowers per plant, number of flowers per spike, spike length and spike diameter of *Narcissus tazetta*, L. plants during the two growth seasons.

Treatments	Flowering time (day)	Flowers duration (day)	Flowers Fresh weight / plant (g)	No. of Flowers/spike	Spike length (cm)	Spike diameter (cm)
	First Season					
NP	52.00 bcde	10.70 de	9.19 cd	8.43 ab	26.10 e	0.98 c
NP+CC	46.56 f	11.73 c	11.06 abc	8.80 ab	28.53 d	1.08 abc
NP+GC	49.63 def	11.56 cd	11.38 ab	9.80 a	31.46 c	1.18 ab
NP+KR1	53.30 abcde	12.90 b	10.88 bc	9.83 a	31.16 c	1.23 a
NP+KR2	55.86 ab	11.96 c	10.93 bc	9.06 ab	30.53 cd	1.13 abc
BP	50.26 cdef	10.23 ef	9.76 bc	7.20 bc	28.83 d	1.03 bc
BP+CC	48.60 ef	12.93 b	12.91 a	8.60 ab	31.20 c	1.11 abc
BP+GC	55.06 abc	13.13 b	11.11 abc	9.10ab	33.76 ab	1.16 ab
BP+KR1	54.23 abcd	11.36 cd	10.30 bc	9.76 a	32.06 bc	1.13 abc
BP+KR2	54.56 abcd	14.20 a	10.18 bc	9.23 a	34.53 a	1.11 abc
Control	58.30 a	9.60 f	7.53 d	6.23 c	22.70 f	0.80 d
L.S.D $_{(0.05)}$	4.72	0.83	1.72	1.77	2.17	0.15
	Second Season					
NP	50.96 bcd	10.90 ef	8.69 cd	8.36 ab	25.13 f	1.01 b
NP+CC	48.73 d	11.50 de	11.31 b	8.66 ab	28.76 e	1.10 ab
NP+GC	49.40 cd	11.90 cde	11.94 ab	9.53 ab	31.16 bcd	1.20 a
NP+KR1	50.56 bcd	13.20 b	10.73 bc	9.96 a	31.60 bc	1.20 a
NP+KR2	54.96 ab	12.13 bcd	10.83 bc	9.23 ab	29.96 cde	1.18 a
BP	52.23 bcd	10.10 f	9.62 bc	7.60 bc	29.33 de	1.05 b
BP+CC	49.96 bcd	13.16 b	13.98 a	8.90 ab	30.90 bcd	1.10 ab
BP+GC	54.73 ab	12.96 bc	11.49 b	8.96 ab	32.96 ab	1.18 a
BP+KR1	53.73 abcd	11.50 de	10.46 bc	9.26 ab	32.36 ab	1.11 ab
BP+KR2	54.06abc	14.30 a	9.96 bc	9.00 ab	33.93 a	1.08 ab
Control	58.60 a	9.83 f	7.30 d	6.40 c	22.73 g	0.81 c
L.S.D $_{(0.05)}$	4.64	1.06	2.11	1.71	1.91	0.11

L.S.D $_{(0.05)}$ = Least significant difference at 0.05 level of probability.

155.62% relative to the control in both seasons, respectively. Also, applying NP+CC or NP+GC resulted in a significant similar effect. There were no significant differences between the effects of the KR1 and KR2 inoculated with NP or BP on this parameter. The observed significant effect of mineral fertilizer inoculated with NP or BP on the number of flowers per spike could be related to the increase in leaves number per plant, which in turn supplied the plant with more photosynthates. These results are in agreement with those of Wange and Palil (1994) on tuberose.

5- Spike Length and Diameter:

It can be observed from the data in Table (4) that the highest recorded spike length values were obtained with the treatment BP+KR2 with an increase of 152.11 and 149.27% relative to the control in both seasons, respectively. Also, it was found that fertilizing the plants with KR1 or KR2 in presence of NP gave significant similar effect on spike length. The results indicated that the treatments of NP+KR2 or NP+CC gave similar effect. Spike diameter was also increased by applying all fertilizer treatments. The highest spike length values were detected with the treatment of NP+KR1 with an increase of 153.75 and 148.14% relative to the control in both seasons, respectively. The treatment of NP+KR2 gave the same effect of the previously mentioned treatment. The results indicated that inoculation of CC or GC with NP or BP had the same effect on spike diameter. These results were in accordance with those reported by Conte e Castro *et al.* (2001) on gladiolus.

C- Bulb Characteristics:

1- Bulb Circumference:

Data presented in Table (5) show significant increase in bulb circumference due to all fertilizer treatments compared with control except for NP and BP treatments which recorded insignificant values compared with the control. The BP+KR2 treatment produced the largest bulb circumference with an increase of 144.12 and 139.94% relative to the control in both seasons, respectively. Inoculation with NP or BP at the two Kristalon application rates KR1 and KR2 showed insignificant differences. Inoculating the CC and GC with the tested biofertilizers gave significant similar effects on bulb circumference.

The significant increase in bulb circumference as affected by applying mineral fertilizer and inoculation with Nitrobine or Biogine might be attributed to the increasing availability of nutrients which led to an increase in accumulation of carbohydrates in bulbs. Hence, an increase in bulb circumference occurred. Similar results were recorded by Alkaff *et al.* (2002) and Rather *et al.* (2003) on onion who found significant increase in bulb diameter as a result of inoculating the soil with *Azospirillum* plus 50% recommended N.

2- Fresh and Dry Weights of Bulbs:

It is obvious from data in Table (5) that all fertilizer treatments significantly increased bulb fresh weight compared with the control except for the NP or BP treatments which did not significantly differ from the control. The highest bulb fresh weight values were obtained with the treatment of BP+KR2 with an increase of 163.28 and 156.92% relative to the control for the two seasons, respectively. Applying the NP+KR1 or NP+KR2 gave the same effect to the later. It was found that treating the soil with NP+CC or NP+GC had similar effects on bulb fresh weight. The NP+KR2 treatment gave the highest significant bulb dry weight values with an increase of 148.80 and 144.28% relative to the control for the two seasons, respectively. This was followed by the BP+KR1 treatment. It was also found that inoculation with NP or BP alone resulted in the lowest significant effect on bulb dry weight and both treatments did not differ significantly from each other. Application of the NP+KR1 or BP+CC treatment resulted in similar effect on this parameter.

The obtained results are in line with those obtained by Wange *et al.*, (1995) on tuberose who found that bulb yields were highest with 50 kg N/ha and inoculation with *Azospirillum*. Wange (1995) mentioned that the heaviest garlic bulbs were obtained with the treatment of 75 kg N/ha + inoculation with *Azospirillum*. Sheikh *et al.*, (2000) found that the interactions between biofertilizer and nitrogen were significant for bulb weight of *Duch iris*. Rather *et al.* (2003) also reported that the maximum onion bulb weight was recorded with *Azotobacter* inoculation. El-Gamal (1996) also found that dry weight of potato tubers generally increased as N application rate increased and with application of the biofertilizer HALEX 2.

D- <u>Total Chlorophylls Contents:</u>

As the data shown in Table (5), total chlorophylls (a + b) content was significantly increased with all fertilizer treatments except for inoculation with NP or BP alone which did not significantly affect this parameter. The highest values of chlorophylls content were observed with the NP+KR2 treatment with an increase of 164.91 and 163.16% relative to the control for the two seasons, respectively. This treatment was followed by the BP+KR2 and BP+KR1 treatments with no significant differences between them. Treating the soil with BP+GC or BP+CC had significant similar effects on chlorophylls content.

The significant increase in total chlorophylls content as a result of applying mineral fertilizer inoculated with NP or BP could be attributed to increasing the nutrients availability in the growing medium, consequently increasing their absorption by

Table (5): Effect of fertilizer treatments on bulb circumference, bulb fresh weight, bulb dry weight and total chlorophylls content of *Narcissus tazetta*, L. plants during the two growth seasons.

Treatments	Bulb circumference (cm)	Bulb fresh weight (g)	Bulb dry weight (g)	Total Chlorophylls content (mg/100g)
	First Season			
NP	12.83 cde	45.93 de	16.41 h	100.47 c
NP+CC	15.33 ab	49.70 cd	18.24 f	130.02 b
NP+GC	15.00 ab	50.70 cd	18.53 e	125.10 b
NP+KR1	15.33 ab	61.65 a	21.44 b	123.18 b
NP+KR2	15.83 ab	59.86 ab	20.32 c	152.94 a
BP	12.33 de	45.86 de	16.40 h	101.91 c
BP+CC	14.66 abc	54.35 bc	19.20 d	129.58 b
BP+GC	14.16 bcd	47.28 cd	17.44 g	134.18 b
BP+KR1	15.33 ab	50.05 cd	18.35 ef	137.78 ab
BP+KR2	16.66 a	64.71 a	22.32 a	139.86 ab
Control	11.56 e	39.63 e	15.44 i	92.74 c
$L.S.D_{(0.05)}$	1.82	6.79	0.26	15.33
	Second Season			
NP	13.00 cd	44.93 de	16.56 h	97.54 c
NP+CC	15.16 ab	48.91 cd	18.43 f	127.60 b
NP+GC	14.83 b	51.28 cd	18.76 e	130.63 b
NP+KR1	15.50 ab	60.90 ab	21.61 b	126.44 b
NP+KR2	16.16 ab	58.91 ab	20.56 c	148.92 a
BP	12.83 d	44.96 de	16.57 h	104.09 c
BP+CC	15.00 ab	55.20 bc	19.47 d	130.66 b
BP+GC	14.50 bc	48.25 cd	17.66 g	136.09 ab
BP+KR1	16.00 ab	50.56 cd	18.55 f	139.21 ab
BP+KR2	16.63 a	63.60 a	22.45 a	141.71ab
Control	11.63 d	40.53 e	15.56 i	91.27 c
$L.S.D_{(0.05)}$	1.56	6.73	0.19	14.46

$L.S.D_{(0.05)}$ = Least significant difference at 0.05 level of probability.

Table (6): Effects of fertilizer treatments on N, P and K contents (%) of *Narcissus tazetta*, L. leaves for the two growth seasons.

Treatments	First Season			Second Season		
	N	P	K	N	P	K
NP	1.31 e	0.177 cd	1.19 c	1.44 d	0.193 de	1.33 c
NP+CC	1.86 d	0.200 bc	1.57 b	2.05 c	0.220 bcd	1.75 b
NP+GC	1.86 d	0.210 b	1.58 b	2.06 c	0.230 bc	1.74 b
NP+KR1	1.91 cd	0.203 bc	1.59 b	2.11 bc	0.223 bcd	1.73 b
NP+KR2	2.03 abc	0.210 b	1.59 b	2.24 ab	0.231 bc	1.80 b
BP	1.36 e	0.190 bc	1.21 c	1.59 d	0.211 cd	1.35 c
BP+CC	2.07 ab	0.222 ab	1.58 b	2.28 a	0.243 abc	1.76 b
BP+GC	1.96 bcd	0.217 b	1.62 b	2.24 ab	0.252 ab	1.80 b
BP+KR1	1.84 d	0.208 bc	1.59 b	2.07 c	0.277 bcd	1.78 b
BP+KR2	2.15 a	0.251 a	1.71 a	2.37 a	0.272 a	1.90 a
Control	1.30 e	0.152 d	1.15 c	1.44 d	0.163 e	1.28 c
$L.S.D_{0.05}$	0.1270	0.0287	0.0753	0.133	0.0314	0.074

$L.S.D_{0.05}$ Least significant difference at 0.05 level of probability.

the plant. These results are in accordance with those obtained by El-Gamal (1996) who found that mixed biofertilizers (*Azotobacter, Azospirillum and Klebsiella*) significantly increased leaf chlorophylls content in potato plants. Reddy *et al.*, (2003) also reported that total chlorophylls could be increased considerably in mulberry varieties with *Azotobacter* inoculation. In addition, Abou El-Khashab (2003) revealed that inoculating olive seedlings cv. "Picual" with *Azotobacter* and *Azospirillum* highly influenced chlorophyll pigments.

E- N, P and K Contents of Leaves:

Results of the narcissus leaves analyses for their N, P and K contents (%) are listed in Table (6). Statistical analysis of these results revealed that the NP+KR2, NP+CC, BP+KR2 and NP+GC treatments resulted in the highest nitrogen content of narcissus leaves with no significant differences between them. However, treating with BP+KR1, BP+GC, BP+CC and NP+KR1 resulted in significantly lower leaf nitrogen contents than the aforementioned treatments. Meanwhile, the BP and NP treatments did not significantly affect this parameter.

In case of P content of narcissus leaves, the NP+KR2 and NP+CC treatments recorded the highest significant values of P content and there was no significant difference between these two treatments. However, there were no significant differences in the P content for the NP+CC, NP+GC, BP+GC and BP+KR2 and the NP+KR1, BP+KR1, BP+CC and NP treatments. The control was significantly lower than the all treatments except the BP treatment.

For leaves K content, the NP+KR2 treatment resulted in the highest significant K content in narcissus leaves. The NP+GC, BP+KR2, NP+KR1, BP+KR1, NP+CC, BP+GC and BP+CC treatments recorded significantly lower values of this parameter than the NP+KR2 treatment. The NP, BP and the control treatments resulted in the significantly lowest values of K content than the other treatments and had no significant differences between each others. Results of the two seasons were almost similar in the significance of the effects of the tested treatments. Slight interchanges in the treatments order were obtained.

These results are in agreement with those obtained by Alagawadi and Gaur (1992) on sorghum who reported that mixed inoculants (co-inoculation of phosphate solubilizing bacteria with nitrogen fixer *Azotobacter barasilense*) provided more balanced nutrition for the plants, and the improvement in N and P uptake was the major mechanism involved. El-Zeiny *et al.* (2001) found that biofertilizer application significantly increased NPK uptake by tomato leaves. Gomaa and Abo-Aly (2001) found that there were significant increase in NPK contents of anise plants due to inoculation with non-symbiotic N_2-fixers and half doses of the recommended N fertilizers. Abdou and El-Sayed (2002) reported that application of N at 30 or 60 kg/fed with Nitrobine inoculation was superior in enhancing N contents in leaves of caraway.

F- N, P and K Storage of Bulbs:

For cut flower production the larger the bulbs and the higher their nutrient storage, the better growth and flowering characteristics of the plant in the next season are (Bryan, 1995). Average values and statistical analysis of the N, P and K storages in narcissus bulbs as affected by the tested treatments are listed in Table (7). Treating with KR2 combined with the NP biofertilizer resulted in the significantly highest N, P and K storages in narcissus bulbs (956.0, 143.3 and 703.3 mg/bulb for N, P and K, respectively). Significant differences between the averages N storage resulted from the BP+KR2, NP+CC, BP+CC, BP+KR1, NP+GC, BP+GC and NP+KR1 treatments and that from the NP+KR2 treatment were obtained. Inoculation with either NP or BP alone resulted in the significantly lowest N storages which were not significantly different from the control. Averages bulb P storage responded to the tested treatments according to the following order: BP+KR1 = BP+KR2 = NP+CC >= BP+CC = NP+KR1 >= BP+GC, while the control recorded the significantly lowest bulb P storage (60.6 mg P/bulb).

From Table (7), the BP+KR2, BP+CC and BP+KR1, treatments had no significant differences in their influences on average bulb K storage but their averages were significantly lower than that of the NP+KR2 treatment. The NP, BP and control treatments recorded the significantly lowest averages of bulb K storage compared with the other treatments. From the above results, it can be noticed that the application of the BP+CC, BP+GC, NP+CC and NP+GC treatments resulted in the same amount of N, P and K taken up by the narcissus bulbs as did the BP+KR1 or BP+KR2 treatments. Similar study on the response of onion (*Allium cepa*, L.) plants to biofertilization under some plant mulches was conducted by Radwan and Hussein (2001). They found that the highest values of N and P content in onion bulbs were obtained as a result of combined effect of biofertilizers and 75% NPK.

G- <u>Nutrients Availability and Organic Carbon Loss:</u>

1- N, P and K Availability:

Data on the influence of the tested treatments on the N, P and K availability (mg kg^{-1}) in the growing medium are presented in Table (8). Statistical analysis of these data revealed that treatments in which biofertilizers were added to composts (i.e. BP+GC, NP+GC, NP+CC and BP+CC) recorded the significantly highest N availability at the end of the both two seasons. On contrast, when the mineral fertilizer Kristalon was applied, N availability was significantly reduced. Due to their slower release of mineral nitrogen through the mineralization process,

Table (7): Effects of fertilizer treatments on N, P and K storage (mg/bulb) in bulbs of *Narcissus tazetta*, L. plants for the two growth seasons.

Treatments	First Season			Second Season		
	N	P	K	N	P	K
NP	536.8 c	62.2 e	224.0 d	590.5 e	67.8 e	248.6 d
NP+CC	892.3 b	106.9 cd	636.8 bc	981.6 bc	116.5 cd	706.1 bc
NP+GC	873.2 b	105.9 d	632.8 c	960.5 cd	115.5 d	702.4 c
NP+KR1	881.1 b	133.9 b	634.9 bc	976.9 bc	124.1 b	704.8 c
NP+KR2	908.0 b	112.6 bc	645.7 b	998.8 b	122.7 bc	716.7 c
BP	523.2 c	62.6 e	226.9 d	575.6 e	68.2 e	251.9 d
BP+CC	905.6 b	110.7 bcd	625.3 c	996.2 b	120.6 bcd	694.0 c
BP+GC	874.5 b	104.8 d	625.5 c	935.0 d	116.4 cd	694.2 c
BP+KR1	869.9 b	106.6 cd	627.7 c	956.9 cd	116.2 cd	703.9 c
BP+KR2	956.0 a	143.3 a	701.3 a	1051.6 a	156.2 a	778.5 a
Control	529.5 c	60.6 e	222.8 d	582.5 e	66.0 e	247.3 d
$L.S.D_{0.05}$	36.72	5.85	11.50	28.02	6.12	11.35

$L.S.D_{0.05}$ Least significant difference at 0.05 level of probability.

Table (8): Effects of fertilizer treatments on N, P and K availability (mg kg^{-1}) in the growing medium of *Narcissus tazetta*, L. plants for the two growth seasons.

Treatments	First Season			Second Season		
	N	P	K	N	P	K
NP	60.7 d	5.34 e	103.8 e	66.8 f	5.82 d	115.2 cd
NP+CC	77.0 ab	6.09 cd	132.9 d	82.3 abcd	7.06 b	147.5 b
NP+GC	81.5 a	6.20 bc	137.4 d	89.6 a	7.05 b	152.6 b
NP+KR1	69.3 c	5.72 de	141.5 cd	76.23 cde	6.24 c	157.1 b
NP+KR2	70.7 bc	6.56 b	166.9 a	76.3 cde	7.15 b	185.3 a
BP	63.2 cd	5.43 e	115.0 e	69.5 ef	5.92 cd	127.7 c
BP+CC	77.2 ab	6.29 bc	165.1 ab	84.9 abc	7.07 b	183.2 a
BP+GC	79.2 a	6.38 bc	153.7 bc	87.2 ab	6.75 b	176.1 a
BP+KR1	66.8 cd	5.71 de	140.7 cd	73.5 def	6.23 c	156.1 b
BP+KR2	70.0 bc	7.76 a	169.3 a	78.7 bcd	8.47 a	187.9 a
Control	48.1 e	4.30 f	102.0 e	52.9 g	4.70 e	113.3 d
$L.S.D_{0.05}$	6.99	0.413	12.59	8.29	0.369	13.61

$L.S.D_{0.05}$ Least significant difference at 0.05 level of probability.

green and cattle composts succeeded to sustain in providing mineral N available to narcissus plants even at the end of the growing season. The reduced N availability with the Kristalon treatments (KR1 and KR2) at the end of the two seasons can be explained by the rapid plant uptake of this chemical fertilizer (Table 6 and 7) plus the expected leaching losses of the excess mineral nitrogen due to repeated watering along the growing season. The control recorded significantly lower N availability values than those of the NP and BP treatments. These two later treatments resulted in the same N availability levels. The two cattle compost treatments (NP+CC and BP+CC) were superior to that of green composts (NP+GC and BP+GC) in increasing N availability (narrower C/N for cattle compost).

For P availability, statistical analysis showed an opposite trend to the N availability data. The addition of biofertilizers NP or BP to the highest application rate of Kristalon (NP+KR2 and BP+KR2 treatments) recorded the significantly highest levels of P availability. Treatments where cattle and green composts were inoculated with biofertilizers gave significantly higher P availability than biofertilizers alone. This effect may be due to the integrated effect of the phosphorus dissolving bacteria (PDB) in the Phosphorein biofertilizer and the released phosphate ions during compost mineralization process (Rodriguez and Fraga, 1999). The control showed the significantly lowest P availability levels compared with the amended growing media (4.3 mg P kg^{-1}). Averages of K availability took the same trend as that of P availability. An exception is that the NP and BP treatments did not significantly increased K availability over the control.

2- Organic Carbon Loss in the Growing Medium:

Data of soil organic carbon of the top 5 cm of each pot (mg C) determined at the end of each season are presented in Figure (1). From these data, percent of organic carbon loss ($\%OC_{loss}$) was calculated and statistically analyzed (Table 9). Due to its narrower C/N ratio and hence faster decomposition rate, the two cattle compost treatments (NP+CC and BP+CC) recorded significantly higher $\%OC_{loss}$ than those for the two green compost treatments (NP+GC and BP+GC), wider C/N ratio (Myrold, 1998). No significant differences were found between the two biofertilizers NP and BP for their influences on $\%OC_{loss}$. Negative values of $\%OC_{loss}$ obtained with the two mineral fertilizer application rates (KR1 and KR2) inoculated with the used biofertilizers, NP, BP and the control may indicate that decomposition of soil organic carbon occurred compared with its initial state. Inoculation of the growing medium with both biofertilizers NP and BP alone resulted in significant decrease of soil OC content compared with the CC and GC treatments but this destruction level was significantly lower than that caused by the addition of the chemical fertilizer. Increasing the rate chemical fertilizer application from KR1 to KR2 led to severer destruction of the organic carbon pool of the growing medium (Parr and Hornick, 1992). These results can have the implication that using cattle or green composts inoculated with either NP or BP can provide narcissus plants with their nutrients requirements with a satisfactory growth patterns and preserve the soil organic pool as well.

CONCLUSION

From the obtained data it can be concluded that to increase narcissus flowers duration, number of narcissus flowers per spike and to advance flowering, cattle or green compost should be added accompanied with a mixture of Nitrobine plus Phosphorein biofertilizers. However, if narcissus plants are to be grown for mother bulbs production, it is recommended that mineral fertilizers can be applied with a mixture of Nitrobine and Phosphorein biofertilizers. This will increase the amount of nutrient storage in bulbs and hence stimulate growth rate and flowering characteristics in the subsequent season. The current study also revealed that addition of composts helped in building the soil organic matter pool which serves as a reservoir of nutrients. Inoculating the soil with biofertilizers can further promote the release of nutrients from applied composts.

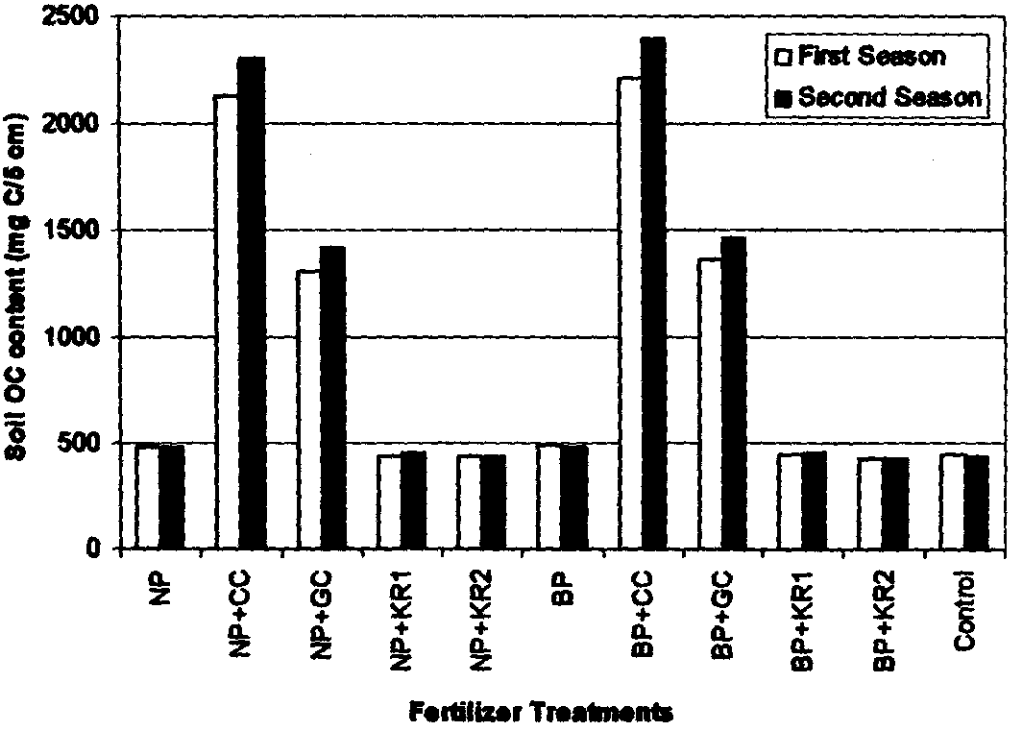

Figure (1): Effect of the fertilizer treatments on the organic carbon content in the top 5 cm (mg C/5cm) of the growing medium of *Narcissus tazetta*, L. for the two growth seasons.

Table (9): Effects of fertilizer treatments on the percent loss of organic carbon (OC_{loss}, %) in the growing medium at the end of the two growth seasons of *Narcissus tazetta*, L. plants

Treatments	First Season	Second Season
NP	-5.53 c	-6.14 c
NP+CC	53.93 a	59.87 a
NP+GC	45.83 b	52.16 b
NP+KR1	-15.00 de	-11.57 de
NP+KR2	-15.33 de	-14.60 ef
BP	- 4.63 c	- 5.1 c
BP+CC	56.57 a	62.79 a
BP+GC	48.90 b	54.28 b
BP+KR1	-12.40 d	-10.47 d
BP+KR2	-16.70 e	-17.20 f
Control	-12.67 d	-14.06 ef
$L.S.D_{0.05}$	3.463	3.34

$L.S.D_{0.05}$ Least significant difference at 0.05 level of probability.

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الملخص العربي

تأثير التفاعل بين الأسمدة الحيوية والأسمدة العضوية أوالمعدنية على الكربون العضوى وإتاحية عناصر النيتروجين والفوسفور والبوتاسيوم فى التربة وإنتاج النرجس البلدى

عاصم عباس النجار[1] ، رمزى مرسى هدية[2]
[1] معهد بحوث البساتين – قسم بحوث نباتات الزينة – حدائق أنطونيادس – الإسكندرية– مصر.
[2] قسم علوم الاراضى والمياه – كلية الزراعة (الشاطبى) – جامعة الاسكندرية– مصر.

أجريت التجربة على نباتات النرجس المنزرعة فى الاصص خلال الموسمين ٢٠٠٢/٢٠٠٣ و ٢٠٠٣/٢٠٠٤ لدراسة تأثير التلقيح بالأسمدة الحيوية النتروبين+الفوسفورين (NP) أو البيوجين+الفوسفورين (BP) مع اضافة كمبوست حيوانى (CC) أو نباتى (GC) بمعدل ١٠ جم/أصيص أو مع اضافة السماد المعدنى NPK (19:19:19) بمعدلى اضافة ٣ و ٦ جم/ أصيص (KR1 and KR2) وذلك على نمو وازهار وانتاج الابصال ومحتوى الاوراق والابصال من عناصر النتروجين والفوسفور والبوتاسيوم وأيضاً على اتاحية هذه العناصر فى التربة ومحتواها من الكربون العضوى.

وقد أوضحت النتائج أن اضافة السماد المعدنى مع التلقيح بالاسمدة الحيوية (NP) أدى الى زيادة معنوية ملحوظة فى كل صفات النمو الخضرى، وصفات كل من الحامل الزهرى والابصال، وكذلك محتوى الاوراق من الكلوروفيل الكلى. كما لوحظ أن اضافة السماد المعدنى سواء بمعدليه (KR1 or KR2) مع التلقيح بأى من الاسمدة الحيوية المختبرة كان له تأثير معنوى متماثل على العديد من الصفات المدروسة. ولم تلاحظ فروق معنوية بين اضافة السماد المعدنى بمعدل KR1 مع التلقيح بـ NP واضافة CC مع التلقيح بنفس الاسمدة الحيوية فى العديد من الصفات المدروسة. وقد وجد أن اضافة السماد المعدنى بمعدل KR1 أو اضافة CC مع التلقيح بـ NP كان له تأثير معنوى متماثل على عدد الاوراق/نبات، عدد الازهار/نبات، قطر الحامل الزهرى ومحيط البصلة. ولم تلاحظ أى فروق معنوية بين معاملتى اضافة CC or GC مع التلقيح بـ NP. وكلا المعاملتين أدتا الى زيادة معنوية فى معظم صفات النمو الخضرى والأبصال وكل صفات الازهار المدروسة ماعدا طول الحامل الزهرى ومحتوى الاوراق من الكلوروفيل الكلى. ووجد أن أعلى محتوى فى الاوراق من عناصر النتروجين، الفوسفور والبوتاسيوم تم التحصل عليها باضافة السماد المعدنى بمعدل KR2 مع التلقيح بـ NP. كما وجد أن أعلى مستوى معنوي من إتاحية الفوسفور والبوتاسيوم فى التربة تم الحصول عليه باضافة السماد المعدنى بمعدل KR2 مع التلقيح بـ BP or NP ، فى حين أن اضافة CC مع التلقيح بـ BP or NP أدى الى أعلى زيادة معنوية فى المتاح من عنصر النتروجين فى التربة.

ويمكن القول اجمالاً أنه لزيادة فترة بقاء أزهار نبات النرجس وعددها/حامل زهرى ولتبكير التزهير يضاف الكمبوست الحيوانى أو النباتى مع التلقيح بالنتروبين+الفوسفورين. كما أن اضافة الكمبوست مع التلقيح بالاسمدة الحيوية المستخدمة ساعد فى بناء المادة العضوية فى التربة، والتى بدورها تعمل كمصدر للامداد المستمر بالعناصر التى يحتاجها النبات. ولزراعة نباتات نرجس بغرض انتاج الابصال يوصى باضافة السماد المعدنى مع التلقيح بالاسمدة الحيوية النتروبين+الفوسفورين فهذا سيزيد من كمية العناصر المخزنة فى الابصال، وبالتالى يحسن معدل النمو وصفات الازهار فى الموسم اللاحق.