# A COMPARATIVE STUDY FOR THE EFFECT OF CHEMICAL-AND-BIOFERTILIZERS ON GROWTH, FLOWERING, BULB PRODUCTIVITY AND CHEMICAL COMPOSITION OF *IRIS TINGITANA* CV. WEDGWOOD PLANT.

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## ABSTRACT

*A series of pot experiments was carried out open field conditions at the Nursery of Hort. Res. Inst., ARC, Giza, Egypt during 2006 and 2007 seasons to study the effect of NPK chemical fertilizer (1:2:1) at 2 and 4 g/pot, nitrobien and phosphorien biofertilizers at 5g/pot for each and their interactions on growth, flowering, bulb productivity and chemical composition of Iris tingitana Bioss & Reut cv. Wedgwood plants grown in 20-cm-diameter clay pots filled with about 2.5 kg of sand amended with 100 g of farmyard manure compost.*

*The obtained results indicated that all treatments significantly improved plant height, No. leaves/plant and leaves fresh and dry weights in most cases of the two seasons with the superiority of the combined treatment between nitrobien, phosphorien (at 5 g/pot for each) and NPK (at 2g/pot). All treatments raised flowering stalk length and fresh weight. Moreover, number of bulb or bulblets/plant, as well as their circumference and fresh weight were also increased in response to the different fertilization treatments applied in this trial. The prevalence in all previous characters was found due to the combined treatment mentioned before, which also registered the highest contents of chlorophyll a, b, carotenoids, total carbohydrates, total indoles and total phenols, as well as N, P and K percentage in the leaves.*

*So, it is recommended to fertilize Iris tingitana cv. Wedgwood plants grown in 20-cm-diameter clay pot filled with 2.5 Kg of sand provided with 100 g of farmyard manure compost with 5g/pot nitrobien + 5 g/pot phosphorien + 2 g/pot NPK (1:2:1) as soil drench, three times with one month interval during the period of vegetative growth, and only one time immediately after flowering for best growth, flowering and bulb productivity.*


## INTRODUCTION

Iris L. (Fam. *Iridaceae*) is a genus of about 200 or more species of rhizomatous or bulbous perennial herbs, native mostly to the North Temperate Zone. Most irises are grown as ornamentals, but several old world species produce orris; the dried powdered rhizomes with the odor of violets and used in perfumery (Bailey, 1976). The species *tingitana* Bioss & Reut. with stout, cylindrical stem to 60 cm height and blue-purple, showy flowers is usually cultivated for cut flowers production and landscape design (Huxley *et al.* 1992). Among cultivars of such species well grown in Egypt is the cv. Wedgwood, which blooms from March to April.

Since years ago, the use of biofertilizers was suggested to be a choice restore the natural conditions of safe and clean environment. Biofertilizers are preparations containing one or more of beneficial microorganisms that can release nutrients from rocks and organic matter in the soil to become available for plants. Many efforts have been done in this regard, as Sheikh *et al.*, (2000) indicated that bioinoculants (*Azotobacter* and *Azospirillum*) and N treatment at 60kg/ increased plant height, flowering period, floret size and bulb weight and number of *Iris hollandica* cv. Prof. Blaauw plant. On *Iris tingitana* cv. Wedgwood, Hussien (2004) found that phosphorien, ascobene and rizobacterene biofertilizers, as well as Fe, Mn, Zn and B micronutrients increased plant height, No. leaves/plant, plants dry weight, length and diameter of stalks, fresh and dry weights of inflorescence, bulb and bulblets formation, pigments content in the leaves, as well as total carbohydrates, N, P, K, Fe, Mn, Zn and B in the leaves and bulbs.

On other ornamental bulbs, El-Naggar and Mahmoud (1994) mentioned that the different *Azosprillum* strains in the presence or absence of N fertilization considerably increased leaf number, yield and weight of inflorescences and bulb weight of Narcissus plant. Wange and Patil (1994) on *Polianthes tuberosa* reported that applying of 100 kg N/ha or inoculation with *Azotobacter* + *Azospirillum* significantly raised No. leaves, No. flowering stalks, No. florets/stalk and bulblets yield. Likewise, Wang *et al.*, (1995) on the same plant stated that the highest growth was obtained from the treatment with 50 kg N/ha + inoculation with Azospirillum, while cut flowers yield was the highest when plants treated with 150 kg N/ha + inoculation with Azospirillum. Similarly, were those results attained by Misra (1997), Prasad *et al.*, (2000) and Kathiresan and Venkatesha (2002) on gladiolus, El-Naggar (1998) on tuberose, Suzuki and Nakano (2002) on *Lilium formassanum*, *Agapanthus praecox* and *Muscari armeniacum*, Mohamed *et al.*, (2005) on *Lilium longiflorum* cv. Poliana, Abdou *et al.*, (2005) on *Gladiolus grandiflorus* cv. Eurovision and Mahmoud (2007) on *Chasmanthe aethiopica*.

This work aims to determine the beneficial effects of chemical and bio-fertilizers, when applied individually or in combinations, on growth, flowering, bulb productivity and chemical composition of iris plants.

## MATERIAL AND METHODS

A series of pot experiments was conducted under open field conditions at the Nursery of Hort. Res. Inst., Giza, Egypt throughout the two successive

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seasons of 2006 and 2007 to study the response of Dutch Iris (*Iris tingitana* Bioss & Reut. cv. Wedgwood) plant to fertilization with the NPK- and bio-fertilizers, alone or in combinations.

Locally produced bulbs of *I. tingitana* cv. Wedgwood at the size of 9.00± 0.20 cm circumference and about 7.50±0.25 g weight were firstly dipped in a fungicide solution of 0.25% orthocide for 15 minutes and then planted on October, 1st for the two seasons at 5 cm depth of soil surface in 20-cm-diameter clay pots (one bulb/pot) filled with about 2.5 kg of sand amended with 100 g of farmyard manure compost. Some physical and chemical properties of the used sand and compost are shown in Table (a) and (b).

**Table (a): Some physical and chemical properties of the used sand in the two seasons (2006 and 2007)**

| Season | Particle size distribution (%) | | | | S.P | pH | E.C. (ds/m) | Cations (meq/L) | | | | Anions (meq/L) | | | SAR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse sand | Fine sand | Silt | Clay | | | | $Ca^{++}$ | $Mg^{++}$ | $Na^{+}$ | $K^{+}$ | $HCO_3^-$ | $Cl^-$ | $SO_4^-$ | |
| 2006 | 89.03 | 2.05 | 0.40 | 8.52 | 23.00 | 7.92 | 3.18 | 7.50 | 1.63 | 33.60 | 0.50 | 3.20 | 22.00 | 18.03 | 15.73 |
| 2007 | 90.10 | 1.95 | 0.50 | 7.45 | 22.86 | 7.83 | 3.31 | 19.42 | 8.33 | 7.20 | 0.75 | 1.60 | 7.00 | 27.10 | 11.98 |

SAR: Sodium adsorption ratio

**Table (b): Some physical and chemical properties of the farmyard manure compost (FYMC) used in the study**

| Sample | Volume weight (of dry g/L) | Water capacity (% of volume) | Air capacity (% of volume) | D.M. (%) | pH | N (%) | $P_2O_5$ (%) | $K_2O$ (%) | MgO (%) | $CaCO_3$ (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| FYMC | 150 | 75 | 12.5 | 68.7 | 6.7 | 1.21 | 0.33 | 0.87 | 1.60 | 1.12 |

Irrigation and agricultural practices were done whenever plants needed, as usually grower did, till November, 15th as the plants were subjected to the following fertilization treatments:

1- No fertilization (control).
2- Chemical fertilization with a mixture of 1:2:1 NPK at the rates of 2 g/pot (0.02:0.04:0.02) g and 4 g/pot (0.04:0.08:0.04) g was added as soil drench three times with one month interval during the period of vegetative growth, while an additional batch was drenched immediately after flowering on 10th of March. Ammonium sulfate (20.5% N), calcium superphosphate (15.5% $P_2O_5$) and potassium sulfate (48.5% $K_2O$) fertilizers were used to obtain the required ratio.
3- Biofertilization with either nitrobien (a biofertilizer containes a specific strain of *Azotobacter chroococcum* bacteria, conc. $10^7$-$10^6$/cell) or phosphorien (a biofertilizer contains a specific clone of bacteria, which changes the unavailable triphosphate to available monophosphate) were added as a soil drench at the rate of 5g/pot for each and repeated four times, as just described before in case of chemical fertilization.
4- Seven combined treatments were used as follows:
   - NPK (2g/pot) + nitrobien (5g/pot).
   - NPK (4g/pot) + nitrobien (5g/pot).
   - NPK (2g/pot) + phosphorien (5g/pot).
   - NPK (4g/pot) + phosphorien (5g/pot).
   - Nitrobien (5g/pot) + phosphorien (5g/pot).
   - Combination No. 5 + NPK (2g/pot).
   - Combination No. 5 + NPK (4g/pot).

The layout of the experiment was a complete randomized design (Das and Giri, 1986) with three replicates and each replicate contained five plants.

Before flowering by about three weeks, fresh leaf samples from the middle part of the plants were taken to determine chlorophyll a, b and carotenoids content (mg/g F.W.) according to the method of Moran (1982), as well as total indoles and total phenols (mg/g F.W.) due to the methods given by A.O.A.C. (1990), while at flowering, plant height (cm), number of leaves/plant, leaves fresh and dry weights (g), number of days from planting to flowering (i.e. to full open of inflorescence), flowering stalk length and diameter at the base (cm) and the fresh weight of flowering stalk (g) were measured.

At the end of the experiment (on April, 10th), the plants were kept till the digging date (May, 15th) without irrigation to allow drying of the leaves. Then, the new bulbs and bulblets were separated from each others and divided into two groups; the first with

circumference more than 7 cm (referred to as bulbs) and the second with circumference less than 7 cm (referred to as bulblets). Number of bulbs or bulblets/plant, circumference of bulb or bulblet (cm), and their mean fresh weight (g) parameters were recorded. Data were then tabulated and statistically analyzed according to SAS program (1994) using Duncan's Multiple Range Test (1955) to verify the variance among means of the different treatments.

## RESULTS AND DISCUSSION

**Effect of chemical-, bio-fertilizers and their combinations on**

**1- Vegetative growth**

From the data averaged in Table (1), it is clear that all fertilization treatments significantly improved plant height (cm), No. leaves/plant and leaves fresh and dry weight (g) in most cases of both seasons, with the superiority of the combined treatment No.6 (nitrobien + phosphorien (both at 5g/pot) + NPK at 2g/pot), which gave in general the utmost high means of vegetative growth characters, when compared to control and other treatments in the two seasons. The least improvement, however was recorded by the treatments of NPK (2g/pot) and phosphorien (5g/pot), as well as the combinations numbers 3, 4 and 5.

Predominance of the combination No.6 over other treatments may be attributed to the synergistic effect of nitrobien, phosphorien and NPK mixture in supplying the new formed organs with their required nutrients necessary for the best growth. In addition, nitrogen is considered a major constituent of all proteins and nucleic acid, as well as of both structural and non-structural components of plant cell, while phosphorus would activate various metabolic processes and it is involved in energy transfer process, as well as in building of phospholipids and nucleic acids (Marschner, 1995). The function of potassium on cell division and elongation, carbohydrates and protein synthesis, translocation of sugars and starch in plant, as well as it's role as co-factor for about 60 enzymes involved in plant growth were also emphasized by Marschner (1995).

**Table (1) Effect of chemical, bio-fertilizers and their interactions on some vegetative growth parameters of *Iris tingitana* cv. Wedgwood plants during 2006 and 2007 seasons.**

| Fertilization treatments | Plant height (cm) | | No. leaves/plant | | Leaves F.W. (g) | | Leaves D.W. (g) | |
|---|---|---|---|---|---|---|---|---|
| | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 |
| **Control** | 35.88 e | 37.63 e | 6.58 dc | 6.70 dc | 11.96 d | 12.59 d | 4.33 d | 4.89 dc |
| **NPK at 2g/pot (A)** | 37.36 d | 38.75 d | 6.80 cd | 7.00 c | 12.38 c | 12.99 c | 4.50 c | 5.06 c |
| **NPK at 4g/pot (B)** | 38.11 dc | 39.07 c | 6.75 cd | 7.00 c | 13.17 b | 13.22 cb | 4.76 cb | 5.18 cb |
| **Nitrobien at 5g/pot (C)** | 43.25 b | 42.50 bc | 7.33 bc | 7.16 cb | 14.38 ab | 13.87 bc | 5.22 b | 5.40 bc |
| **Phosphorien at 5g/pot (D)** | 40.81 cb | 41.00 cb | 7.00 c | 7.20 cb | 13.22 b | 13.96 bc | 5.18 b | 5.09 c |
| **A+C (Comb.1)** | 41.75 bc | 43.50 b | 7.20 cb | 7.25 bc | 13.96 ba | 14.20 b | 5.08 bc | 5.53 b |
| **B+C (Comb.2)** | 42.10 b | 43.58 b | 7.50 b | 7.34 b | 14.11 ba | 14.26 b | 5.10 bc | 5.51 b |
| **A+D (Comb.3)** | 36.13 ed | 38.69 d | 7.00 c | 7.00 c | 12.97 bc | 13.34 cb | 4.71 cb | 5.18 cb |
| **B+D (Comb.4)** | 37.00 d | 39.76 c | 7.19 cb | 7.25 bc | 12.50 c | 12.68 dc | 4.53 c | 4.92 cd |
| **C+D (Comb.5)** | 39.38 c | 40.81 cb | 7.20 cb | 7.36 b | 12.76 cb | 12.78 c | 4.62 cb | 4.91 cd |
| **C+D+A (Comb.6)** | 46.36 a | 48.63 a | 8.00 a | 8.00 a | 15.58 a | 15.83 a | 5.81 a | 6.17 a |
| **C+D+B (Comb.7)** | 38.76 cd | 39.18 c | 7.10 cb | 7.30 b | 12.09 d | 12.63 d | 4.39 d | 4.90 cd |

Means within column having the same letters are not significantly different according to **Duncan's Multiple Range Test (DMRT) at 5% level.**

Regarding biofertilizers, Darwish (2002) demonstrated that microorganisms of biofertilizers include their stimulative effect on plant growth by fix atmospheric nitrogen, mobilize phosphate and micronutrients and secrete some growth-promoting factors, e.g. gibberellin, cytokinin-like substances and auxins. Such results, however are coincided with those recorded by Hussien (2004) on *Iris tingitana* cv. Wedgwood, El-Naggar and Mohamed (1994) on Narcissus, Wang *et al* (1995) on tuberose, Suzuki and Nakano (2002) on *Lilium formasanum, Agapanthus praecox* and *Muscari armeniacum* and Abdou *et al* (2005) on *Gladiolus grandiflorus* cv. Eurovision.

**2- Flowering**

Data in Table (2) reveal that all fertilization treatments employed in this study did not significantly affect the flowering time and/or diameter of the flowering stalk, when compared to control in the two seasons. The opposite was the right concerning flowering stalk length (cm) and fresh weight (g), as all treatments elevated the means of such traits with various significance levels, comparing with the means of control plants in both seasons. The prevalence, however was also for the combined treatment No. 6 between nitrobien + phosphorien (both at 5g/pot) + 2 g/pot NPK.

**Table (2) Effect of chemical, bio-fertilizers and their interactions on some flowering parameters of *Iris tingitana* cv. Wedgwood plants during 2006 and 2007 seasons.**

| Fertilization treatments | No. days from planting to flowering (days) | | Flowering stalk length (cm) | | Flowering stalk diameter (cm) | | Flowering stalk F.W. (gm) | |
|---|---|---|---|---|---|---|---|---|
| | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 |
| Control | 156.00 | 156.33 | 18.16 c | 17.86 d | 0.65 | 0.67 | 11.34 c | 10.87 c |
| NPK at 2g/pot (A) | 157.00 | 157.00 | 18.50 c | 18.27 c | 0.70 | 0.68 | 12.99 bc | 12.26 b |
| NPK at 4g/pot (B) | 157.00 | 156.76 | 18.56 c | 18.43 c | 0.72 | 0.71 | 13.68 ab | 13.42 a |
| Nitrobien at 5g/pot (C) | 156.60 | 156.87 | 20.13 b | 19.88 b | 0.73 | 0.73 | 13.87 ab | 13.50 a |
| Phosphorien at 5g/pot (D) | 156.83 | 157.00 | 18.87 cb | 18.16 c | 0.68 | 0.67 | 12.50 b | 11.96 b |
| A+C (Comb.1) | 156.20 | 156.50 | 20.50 b | 21.07 ab | 0.70 | 0.70 | 13.70 ab | 12.83 ab |
| B+C (Comb.2) | 156.25 | 157.00 | 19.81 bc | 19.33 cb | 0.71 | 0.70 | 12.96 ba | 12.58 ab |
| A+D (Comb.3) | 156.63 | 156.38 | 19.00 cb | 18.25 c | 0.70 | 0.70 | 12.38 bc | 11.90 b |
| B+D (Comb.4) | 157.55 | 157.33 | 19.36 bc | 19.03 cb | 0.71 | 0.73 | 12.76 b | 12.03 ba |
| C+D (Comb.5) | 157.00 | 157.00 | 20.56 b | 20.21 b | 0.73 | 0.76 | 13.80 ab | 12.67 ab |
| C+D+A (Comb.6) | 157.00 | 157.50 | 23.50 a | 22.76 a | 0.78 | 0.78 | 14.26 a | 13.50 a |
| C+D+B (Comb.7) | 157.50 | 157.67 | 21.10 ba | 20.62 ba | 0.73 | 0.75 | 13.71 ab | 13.12 ab |
| | n.s. | n.s. | | | n.s. | n.s. | | |

Means within column having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.

The excellence of the 6th combination may indicate the stimulatory effect of the different components of such balanced treatment on accelerating the division of flowering stalk meristematic cells and on encouraging metabolic processes in these cells as noticed by Sheikh *et al.*, (2000) on *Iris hollandica* cv. Prof. Blaauw, Prasad *et al.*, (2000) and Kathiresan and Venkatesha (2002) on gladiolus, Mohamed *et al.*, (2005) on *Lilium longiflorum* cv. Poliana and Mahmoud (2007) on *Chasmanthe aethiopica.*

**3- Bulb and bulblets production**

Data presented in Table (3) exhibit that number of bulbs or bulblets/plant, as well as their circumference (cm) and fresh weight (g) were increased in response to either of fertilization treatments used in the current work with various significant differences, comparing to control means in both seasons, except for combinations between 4g/pot NPK and 5g/pot phosphorien, and nitrobien + phosphorien at 5g/pot for each, which induced a slight decrement in bulb circumference in the two seasons, as well as phosphorien treatment (5 g/pot), which slightly reduced No. bulblets/plant in the first season to the minimum value (3.52) against 3.68 for control. The best results in the two seasons, however were recorded by the combinations numbers 1, 2, 6 and 7 with the mastership of No. 6, which gave in general the utmost high values in both seasons. This may explain the enhanced effects of biofertilizers in the presence of NPK mixture on carbohydrates and protein synthesis which accumulate in the new formed bulbs and bulblets to give in final the biggest and heaviest ones. In this concern, Misra (1997) found that biofertilizers caused a significant increase in number of gladiolus cormels and in their fresh and dry weights. Similarly, were those results of Hussien (2004) on *Iris tingitana* cv. Wedgwood, Abdou *et al.*, (2005) on *Gladiolus grandiflorus* cv. Eurovision and Mahmoud (2007) on *Chasmanthe aethiopica.*

**4- Chemical composition**

With regard to pigments content (mg/g F.W.) in the leaves, as shown in Table (4), it could be concluded that biofertilizers or NPK treatments alone slightly improved chlorophyll a, b and carotenoids contents, while in combinations, they were markedly raised the content of them to higher values, especially the combinations numbers 1, 2, 6 and 7 with the supremacy of the 6th combined treatment which gave the highest averages in the two seasons. A similar trend was also gained concerning total carbohydrates content (mg/g D.W.) and the percentages of N. P and K with few exceptions.

**Table (3) Effect of chemical, bio-fertilizers and their interactions on bulb and bulblets productivity of *Iris tingitana* cv. Wedgwood plants during 2006 and 2007 seasons.**

| Fertilization treatments | Bulbs (Circumference > 7 cm) | | | | | | Bulblets (Circumference < 7 cm) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. bulbs/plant | | Bulb circumference (cm.) | | Bulb F.W. (gm) | | No. bulblets/plant | | Bulblet circumference (cm.) | | Bulblet F.W. (gm) | |
| | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 |
| Control | 0.88 e | 0.93 e | 7.46 c | 7.31 cd | 2.14 d | 2.03 d | 3.68 d | 3.32 d | 3.10 c | 3.13 c | 1.42 c | 1.45 c |
| NPK at 2g/pot (A) | 1.32 dc | 1.27 d | 7.73 cb | 7.82 bc | 2.23 c | 2.16 c | 4.23 c | 4.38 cd | 3.67 cb | 3.65 cb | 1.65 bc | 1.63 bc |
| NPK at 4g/pot (B) | 1.41 c | 1.48 c | 7.88 b | 7.92 b | 2.30 c | 2.19 c | 4.50 c | 4.46 c | 3.75 cb | 3.80 cb | 1.68 bc | 1.69 bc |
| Nitrobien at 5g/pot (C) | 1.50 c | 1.57 c | 7.91 b | 7.96 b | 2.27 c | 2.21 c | 3.91 dc | 3.87 d | 3.59 c | 3.53 c | 1.62 cb | 1.58 cb |
| Phosphorien at 5g/pot (D) | 1.33 dc | 1.35 dc | 7.54 c | 7.50 c | 2.16 d | 2.08 d | 3.52 d | 3.41 d | 3.39 c | 3.46 c | 1.54 c | 1.52 c |
| A+C (Comb.1) | 1.81 b | 1.90 b | 8.58 a | 8.49 a | 3.18 a | 3.05 a | 5.61 ba | 5.52 b | 5.28 ba | 5.33 ab | 2.18 a | 2.13 a |
| B+C (Comb.2) | 1.87 b | 1.88 b | 8.71 a | 8.68 a | 3.20 a | 3.12 a | 5.67 ba | 5.73 b | 5.46 ab | 5.50 a | 2.26 a | 2.19 a |
| A+D (Comb.3) | 1.38 cd | 1.46 c | 7.90 b | 7.96 b | 2.80 b | 2.67 ba | 4.78 bc | 4.56 c | 4.10 bc | 4.03 bc | 1.85 b | 1.79 b |
| B+D (Comb.4) | 1.49 c | 1.50 c | 7.33 cd | 7.26 d | 2.98 ba | 2.85 ba | 4.88 b | 4.78 cb | 4.38 b | 4.47 b | 1.90 b | 1.90 b |
| C+D (Comb.5) | 1.28 d | 1.33 dc | 7.18 d | 7.30 cd | 2.36 a | 2.28 b | 5.00 b | 5.00 bc | 4.50 b | 4.52 b | 2.00 b | 2.0 a |
| C+D+A (Comb.6) | 2.10 a | 2.16 a | 8.75 a | 8.83 a | 3.33 a | 3.21 a | 6.40 a | 7.00 a | 6.10 a | 5.98 a | 2.38 a | 2.26 a |
| C+D+B (Comb.7) | 1.71 bc | 1.76 bc | 8.33 a | 8.27 ab | 3.06 ba | 3.03 a | 5.51 ba | 5.68 b | 5.00 ba | 4.81 ba | 2.03 a | 2.06 a |

Means within a column having the same letters are not significantly different according to Duncan's Multiple Rang Test (DMRT) at 5% level.

**Table (4) Effect of chemical, bio-fertilizers and their interactions on some constituents in the leaves of *Iris tingitana* cv. Wedgwood plants during 2006 and 2007 seasons.**

| Fertilization treatments | Chlorophyll (a) (mg/g F.W.) | | Chlorophyll (b) (mg/g F.W.) | | Carotenoids (mg/g F.W.) | | Total carbohydrates (mg/g. D.W.) | |
|---|---|---|---|---|---|---|---|---|
| | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 |
| Control | 1.403 | 1.436 | 0.858 | 0.910 | 1.124 | 1.058 | 42.88 | 45.03 |
| NPK at 2g/pot (A) | 1.451 | 1.487 | 0.869 | 0.928 | 1.216 | 1.144 | 43.36 | 45.58 |
| NPK at 4g/pot (B) | 1.468 | 1.548 | 0.871 | 0.979 | 1.228 | 1.154 | 44.31 | 46.6 |
| Nitrobien at 5g/pot (C) | 1.487 | 1.569 | 0.922 | 0.971 | 1.254 | 1.179 | 50.99 | 53.55 |
| Phosphorien at 5g/pot (D) | 1.417 | 1.405 | 0.880 | 0.916 | 1.235 | 1.156 | 44.83 | 47.08 |
| A+C (Comb.1) | 1.989 | 1.993 | 1.024 | 1.108 | 1.566 | 1.633 | 50.31 | 52.83 |
| B+C (Comb.2) | 2.024 | 2.086 | 1.091 | 1.086 | 1.573 | 1.548 | 51.50 | 54.08 |
| A+D (Comb.3) | 1.567 | 1.653 | 0.982 | 0.993 | 1.371 | 1.289 | 45.48 | 47.76 |
| B+D (Comb.4) | 1.603 | 1.696 | 0.989 | 1.041 | 1.378 | 1.301 | 47.14 | 49.50 |
| C+D (Comb.5) | 1.470 | 1.523 | 0.905 | 0.959 | 1.219 | 1.156 | 47.26 | 47.30 |
| C+D+A (Comb.6) | 2.136 | 2.237 | 1.221 | 1.294 | 1.672 | 1.576 | 55.97 | 58.81 |
| C+D+B (Comb.7) | 2.010 | 2.120 | 1.076 | 1.089 | 1.584 | 1.453 | 50.03 | 52.50 |

| Fertilization treatments | Indoles (mg/g F.W.) | | Phenols (mg/g F.W.) | | N (%) | | P (%) | | K (%) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 |
| Control | 0.142 | 0.131 | 1.120 | 1.031 | 0.98 | 1.04 | 0.22 | 0.21 | 0.82 | 0.87 |
| NPK at 2g/pot (A) | 0.182 | 0.168 | 2.067 | 1.903 | 1.21 | 1.28 | 0.31 | 0.29 | 0.87 | 0.93 |
| NPK at 4g/pot (B) | 0.191 | 0.174 | 2.148 | 1.901 | 1.22 | 1.30 | 0.30 | 0.33 | 0.93 | 0.98 |
| Nitrobien at 5g/pot (C) | 0.236 | 0.223 | 3.047 | 2.803 | 1.78 | 1.89 | 0.31 | 0.30 | 0.99 | 1.05 |
| Phosphorien at 5g/pot (D) | 0.208 | 0.193 | 2.346 | 2.162 | 1.14 | 1.22 | 0.40 | 0.38 | 0.89 | 0.95 |
| A+C (Comb.1) | 0.329 | 0.312 | 3.805 | 3.228 | 2.17 | 2.31 | 0.34 | 0.32 | 1.11 | 1.20 |
| B+C (Comb.2) | 0.312 | 0.287 | 3.578 | 3.292 | 2.36 | 2.43 | 0.37 | 0.38 | 1.18 | 1.25 |
| A+D (Comb.3) | 0.234 | 0.212 | 3.236 | 2.863 | 1.32 | 1.40 | 0.31 | 0.29 | 1.00 | 1.03 |
| B+D (Comb.4) | 0.235 | 0.217 | 3.098 | 2.850 | 1.44 | 1.53 | 0.32 | 0.30 | 1.06 | 1.13 |
| C+D (Comb.5) | 0.235 | 0.210 | 2.476 | 2.271 | 1.83 | 1.78 | 0.35 | 0.34 | 1.00 | 1.06 |
| C+D+A (Comb.6) | 0.401 | 0.378 | 4.603 | 4.133 | 2.48 | 2.63 | 0.42 | 0.41 | 1.26 | 1.34 |
| C+D+B (Comb.7) | 0.258 | 0.239 | 4.041 | 3.680 | 1.95 | 1.84 | 0.37 | 0.33 | 1.15 | 1.22 |

As for total indoles and total phenols content (mg/g F.W.), data indicated that both were greatly increased as a result of applying both chemical- and bio-fertilizers in combinations with the mastery of the sixth one in both seasons. However, individual application of them caused a slight increment in the content of these two constituents. It was noticed that the rate of increasing in total phenols content due to either of treatments was to somewhat more than that of total indols. This may be the reason of a slight delay in flowering, and many exhibit that phenols may play a role in the control of growth, flowering and bulbs production of the plant in conjunction with the other hormones.

In this concern, Kenneth (1979) reported that phenolic compounds modify the activity of IAA-oxidase and might therefore be acting on flowering or bulbs production by way of changes in endogenous auxins level.

However, the aforementioned results could be discussed as done before in case of vegetative growth.

According to the previous results, it could be concluded that to obtain the best vegetative growth, flowering and more bulbs and bulblets formation with good quality of *Iris tingitana* cv. Wedgwood, the plants should be fertilize with the combination of nitrobien + phosphorien (both at 5g/pot) + 2g/pot NPK (1:2:1) when grown in sand amended with farmyard manure compost.

## REFERENCES


Abdou, M.A.; F.A. Attia; M.K. Aly; M.M.Mohy-Eldin and I.H. Sayed (2005) Response of gladiolus plants to some bio- and chemical fertilization treatments. The 6th Arab Conf. Hort., March 20-22, Dept. Hort., Fac. Agric., Ismailia, Egypt: 1199-1221.

A.O.A.C. (1990) The Association Official Agricultural Chemists. 15th Ed., Arlington, Virginia 22201: 877-878.

Bailey, L.H. (1976) Hortus Third. Macmillan Publishing Co., Inc., 866 Third Avenue, New York, N.Y. 100 22.1290pp.

Darwish, F.M. (2002) Effect of different fertilizer sources and levels on growth, yield and quality of tomato. Ph.D. Thesis, Fac. Agric., Cairo Univ.

Das , M.N. and N.C. Giri (1986) Design and Analysis of Experiments. 2nd Ed., published by Mohinder Singh Sejwol for Wiley, New Delhi 110 002, 488 pp.

Duncan, D.B. (1955) Multiple range and multiple F-tests. J. Biometrics, 11:1-42.

El-Naggar, A.I. (1998) Investigation on the response of *Poilanthes tuberosa* L. cv. Double to biofertilization with *Azospirillum* strains mixture and N fertilization under four different soil textures. J. Agric. Sci., Mansoura Univ., 23(12):6177-6208.

El-Naggar, A.I. and S.M. Mahmoud (1994) Effect of inoculation with *Azospirillum* strains and N fertilization on *Narcissus tazeta* L. under different soil textures. Assuit J. Agric. Sci., 25(4): 135-151.

Hussien, S.M. Hagar (2004) Physiological studies on Iris plant. M.Sc. Thesis, Fac. Agric., Cairo Univ.

Huxley, A.; M. Griffiths and M. Levy (1992) The New Royal Hort. Soc. Dict. Gar., The Stockton Press, New York, 257 Park Avenue South, NY 100 10, USA, vol. 2, 747 pp.

Kathiresan, C. and J. Venkatesha (2002) Effect of biofertilizers with levels of N and P on gladiolus. J. Amer. Soc. Hort., 64(1):118-121.

Kenneth, V. T. (1979) Physiology of Plant Growth and Development. Nalcom B. Wilkins TATA Mc Graw-Hill Publishing Co. Ltd., New Delhi, 648 pp.

Mahmoud, A.M.A. (2007) Response of *Chasmanthe aethiopica* (L.) N.E. Br. Plants to foliar spray with Kinetin and kristalon. J. Agric. Sci., Mansoura Univ., 32(7):5517-5528.

Marschner, H. (1995) Mineral Nutrition of Higher plants. 2nd Ed., Academic Press, London. pp. 99-101.

Misra, R.L. (1997) Na fed super culture and the growth and corm production in gladiolus. Melodie Recent Hort., 4(1):76-77.

Mohamed, Safaa M.; A.S. El-Khayat and N.S. El-Shayeb (2005) Influence of P, K and yeast nutrition on growth, flowering and chemical composition of *Lilium longiflorum* cv. Poliana plants. Proc. 6th Arab. Conf. Hort., Ismailia, Egypt, March 20-22:1321-1338.

Moran, R. (1982) Formula for determination of chlorophyllous pigment extracted with N-N-dimethyl formamide. Plant physiol., 69:1376-81.

Prasad, V.; G.T. Manjunath and C.N. Reddy (2000) Influence of *Glomus fasciculatum* inoculation on growth and P uptake in *Gladiolus sp.* Mycorrhiza News, 11(4): 17-18.

SAS Institute (1994) SAS/STAT User's Guide: Statistics. Vers. 6.04, 4th Ed., SAS Institute Inc., Cary, N.C., USA.

Sheikh, M.Q.; A.Q. Jhon and M.Y. Zargar (2000) Effect of N fertilizer and biofertilizers on vegetative growth and bulb production of Dutch iris (*Iris holandica* cv. Prof. Blaauw). Appl. Biological Res., 2(1/2): 62-67.

Suzuki, S. and M. Nakano (2002) Agrobacterium mediated transformation in liliaceous ornamental plants. Jarq Japan Agric. Res. Quarterly, 36(3): 119-127.

Wange, S.S. and P.L. Patil (1994) Response of tuberose to biofertilizers and nitrogen. J. Maharashtra, Agric. Univ., 7(1):93-98.

———— ; ———— and J.J. Patil (1995) Effect of biofertilizers alone and with N levels on tuberose. J. Soils and Crops, 6(1):100-101.

## الملخص العربي

# دراسة مقارنة لتأثير الأسمدة الكيميائية و الحيوية على النمو، الإزهار، إنتاج الأبصال والتركيب الكيميائي لنبات الإيرس (صنف Wedgwood)

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أجريت سلسلة من تجارب الأصص فى الحقل المكشوف بمشتل معهد بحوث البساتين، الجيزة، مصر خلال الموسمين المتتاليين: ٢٠٠٦، ٢٠٠٧ و ذلك لدراسة تأثير السماد الكيميائي المركب نفوأه:بوأ (١:٢:١) بمعدلات ٢جم/إصيص ( ٠,٠٢:٠,٠٤:٠,٠٢) جم ، ٤ جم/إصيص ( ٠,٠٤:٠,٠٨:٠,٠٤) جم، الأسمدة الحيوية: النيتروبين و الفوسفورين بمعدل ٥ جم/إصيص لكل منهما، و التفاعلات بينهم على النمو، الإزهار، إنتاج الأبصال و التركيب الكيميائي لنبات الإيرس (*Iris tingitana* Bioss & Reut) صنف Wedgwood المنزرع في أصص فخار قطرها ٢٠سم و ملأت بحوالي ٥.٢ كجم رمل مدعم بحوالي ١٠٠ جم كمبوست مخلفات المزرعة.

و لقد أوضحت النتائج المتحصل عليها أن جميع المعاملات أحدثت تحسناً معنوياً في ارتفاع النبات، عدد الأوراق/نبات و كذلك الوزن الطازج و الجاف للأوراق في معظم الحالات لكلا الموسمين، مع تفوق المعاملة المشتركة بين النيتروبين + الفوسفورين (عند إضافة كل منهما بمعدل ٥جم/إصيص) + مخلوط NPK (عند إضافته بمعدل ٢ جم/إصيص). جميع المعاملات أدت إلى زيادة معنوية في طول و وزن الحامل الزهري. علاوة على ذلك، فان عدد الأبصال و البصيلات/نبات و كذلك المحيط و الوزن الطازج لكل منهما قد زاد أيضاً استجابة لكافة معاملات التسميد التي طبقت بهذا العمل البحثي. و كانت السيادة في جميع القياسات السابقة للمعاملة المشتركة المذكورة آنفاً، و التي سجلت أيضاً أعلى محتوى من كلوروفيللي أ، ب، الكاروتينويدات، الكربوهيدرات الكلية، الإندولات و الفينولات الكلية، و كذلك النسبة المئوية لعناصر النيتروجين و الفوسفور و البوتاسيوم في الأوراق.

و عليه، فإننا نوصي بتسميد نباتات الإيرس صنف (Weedy wood) المنزرعة في أصص فخار قطرها ٢٠ سم و مملوءة بحوالي ٢,٥ كجم رمل مدعم بحوالي ١٠٠ جم كومبوست مخلفات المزرعة بالتوليفة السمادية المكونة من ٥ جم نيتروبين + ٥ جم فوسفورين + ٢ جم مخلوط NPK (١:٢:١)/إصيص تكبيشاً للتربة، ثلاث مرات خلال فترة النمو الخضري و بفاصل شهر بين المرة و الأخرى، بالإضافة إلى مرة واحدة عقب انتهاء الإزهار مباشرة للحصول على أفضل نمو، إزهار و إنتاج للأبصال.