Substitution of Conventional Organic and Chemical Fertilization by Some Biostimulants and Their Effect on Growth, Flowering and Bulb Productivity of Narcissus Tazetta Plant.

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ABSTRACT
A study was carried out at El-Mathana Agricultural Research Station, Luxor Governorate, Egypt in two seasons of 2017 and 2018 where plants of Narcissus tazetta were treated with NPK at 2 g/plant, salicylic acid at 100 and 200 ppm, garlic extract at 125 ml/plant, ascorbic acid at 100 and 200 ppm, citric acid at 100 and 200 ppm and yeast at 3 and 5 g/plant. Results showed that plants treated with salicylic acid at 200 ppm (after transaction with NPK) achieved the highest value of all morphological characteristics of plants i.e. plant height, number of leaves per plant, flowering duration, number of bulblets per plant, bulb diameter, bulb fresh weight as well as fresh and dry weight of leaves beside chemical content of chlorophyll a,b and carotenoids in addition to the percentage of nitrogen, phosphorus and potassium compared to the control. Applying salicylic acid at 100 ppm (after transaction with NPK) had the highest stimulate effect on fresh, dry weight, diameter and longevity of cut flower, also, it had a strong effect in increasing fresh, dry and length of scape of flowers with raising chemical traits. This experiment clarified the importance of natural materials for increasing the efficiency of the vegetative and flower qualities of Narcissus tazetta.

Keywords: Narcissus tazetta, Organic, Chemical Fertilization, Biostimulants

1. Introduction
Narcissus bulbs belong to the Amaryllidaceae family, that includes about thirty six species classified into twelve divisions (Hamks, 1993; Dole and Wilkins, 2005). It’s native to the Mediterranean of Europe. Narcissus is considered one of the most perfect plants as a cut flower, landscape flowering plants and used in cosmetic products like perfumes. The majority of compounds found in the Amaryllidaceae are alkaloids in four groups namely lycorine, crinie, tazettine and galanthamin (Kornienko and Evidente, 2010).

Fertilizer, are one of the most critical factors that increase plant production and its source of plant nutrient can be added to the soil to supply its natural productivity. The application of suitable fertilizers is perceived as a crucial management practices that can boost the growth and development of plants in qualitatively and quantitatively (Sakakibara et al., 2006). Maintaining a proper nutritional balance can play a vital role with a view to promote the sustainable cropping system in agriculture (Mishra and Dash, 2014). The primary soil nutrients needed for all plant growth are NPK (nitrogen, phosphorus and potassium). Nitrogen (N) acts as a central role in synthesis of the plant constituents via various enzymatic activities (Khalid and Shedeed, 2015). In addition, the amount and timing of N application impairs plant morphology, nutrient availability and physiological characteristics (Zhao et al., 2008). Phosphorus (P) is thought to be one of the most decisive macro nutrient elements required for the growth and development of plants. P is playing a vital role in lateral root morphology and root branching (Lopez-Bucio et al., 2003). Potassium (K) is considered as the most abundant cation in higher plants due to its pivotal role in plant physiology and enzymatic activity. NPK fertilization has regarded as the key management system associated with conventional agricultural practices.

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Salicylic acid (SA) is an endogenous growth regulator of phenolic nature, SA is considered as a hormone-like substance which plays an important role in regulating a number of physiological processes and provide protection against biotic and abiotic stresses in plant. SA is naturally produced by plants as a secondary metabolite. SA plays various important roles in plant growth and development such as ethylene biosynthesis, stomatal conductance, respiration and defense in different types of plants. SA has a vital role in plant defense and is implicated in the activation of defense systems against different pathogens (Amin, 2017b).

Citric acid (CA) is an organic acid and it source of both carbon and energy for cells also, used in the respiratory cycle and some other biochemical pathways. Citrate complex is one of the mobile forms of iron in plants, thus it plays an important role in iron transport. CA like other organic acids, can influence the vase life of cut flowers (Amin, 2017a).

Ascorbic acid (AsA) is synthesized in higher plants and affects plant growth and development that plays an important role in the electron transport system, acts as a co-enzymatic reaction by which carbohydrates, proteins are metabolized and involved in photosynthesis and respiration processes (Sheikh et al., 2015). Bolkhina et al. (2003) reported that ascorbic acid is the most abundant antioxidant which protects plant cells and it is involved in a wide range of important functions such as an antioxidant defense, photoprotection, regulation of photosynthesis and growth. AsA is an inhibitor for bacteria growth and protectes flowers from physical plugging.

Yeast (Saccharomyces cerevisiae) is considered as a biologic catalyst and natural biological fertilizer that clearly enhance the growth and yield of many crops (Abd-El-Motty et al., 2010). It is a natural source of cytokinins that stimulate cell division, cell differentiation and stimulation of protein synthesis, nucleic acids and chlorophyll production which are added in two ways either by foliar spraying or by adding it to the soil. It also contains some major and minor nutrients and growth regulators (such as algalins and auxins), sugars and vitamins, especially vitamin B. It has a clear and important role in increasing the efficiency of enzymes and improving nutrient absorption and other factors which stimulate vegetative growth of plants in general (Abed Nasser et al., 2019). Now there is considerable interest in the possibility of using yeast as natural and safe factor to stimulate plant growth. In recent decades, yeast became a successful alternative to chemical fertilizer and is safe for humans and environment (Omran, 2000).

Garlic extract is the sap of garlic bulb Allium sativum, it is distinguished by containing a high amount of amino acids, which contain sulphur element, such as cysteine and methionin and contains volatile oil, allicin, allii, sugars, iodine and vitamins hence the garlic extract has many effects due to its hormonal nature, which has an important role in lateral extension and elongation of cells (El-Rokiek et al., 2019). Garlic is one of the most important nutrients in leaf fertilization due to containing water, proteins, lactose sugar, fat, nutrients and a few vitamins (Aati and Al-Sahaf, 2007).

The objective of this study was to compare the effect of various salicylic acid, ascorbic acid, citric acid as well as the impact of adding organic fertilizer, garlic extract and bio fertilizer yeast all of them and fertilization NPK on morphological and chemical constitute of Narcissus tazetta plants.

2. Materials and Methods

The present study was carried out at El-Mathana Agricultural Research Station, Luxor Governorate, Egypt, during the two successive winter seasons of 2017 and 2018. It was intended to study the effect of substitution of conventional organic and chemical fertilizer and the impact of replacing it with natural stimulants on vegetative growth, flowering, bulbs production, longevity of Narcissus tazetta L subsp. Italicus plants. The bulbs were obtained from nursery of Cairo, the average bulb diameter was 3cm with average weight of 8.2 g. The bulbs were planted at October 2017 and 2018 for the first and the second season respectively. The bulbs were planted in rows, 50 cm distance apart and laying bulbs in hills, 30 cm apart between them with at a 15 cm. The tested bio-stimulants were applied as a foliar spray for 5 times at 10 days intervals (only treatments with NPK and yeast were added to the soil media) and treatments beginning from 30 days after transplanting. First application was supplied during vegetative growth and the last one was at the beginning of flowering in the two consecutive seasons. The experiment included the following treatments:
1. Control (untreated plants).
2. NPK at 2 g/p
3. Salicylic acid at 100 and 200 ppm.
4. Ascorbic acid at 100 and 200 ppm.
5. Citric acid at 100 and 200 ppm.
6. Yeast at 3 and 5 g/plant.
7. Garlic extract at 125 ml.

During both seasons, the following parameters were measured:
- Plant height (cm), Number of leaves per plants, Flowering duration (days), Number of bulblets per plant, Bulb diameter (mm), Bulb fresh weight (g), Fresh weight of leaves (g), Dry weight of leaves (g), Flower fresh weight (g), Flower dry weight (g), Flower diameter (cm), Longevity of cut flowers (days), Scape length (cm), Scape fresh weight (g), Scape dry weight (g).
- Chlorophyll a and b content (mg/g f.w) according to Saric et al. (1976).
- Carotenoids content (mg/g f.w) according to Saric et al. (1976).
- N % according to Black (1965).
- P % according to John (1970).
- K % according to Dewis and Freitas (1970).

The physical and chemical analysis of the used soil, yeast and garlic extract are shown on tables, a, b and c respectively.

Table a: Physical and chemical properties of the used soil.

| Character       | Value | Character       | Value |
|-----------------|-------|-----------------|-------|
| Soil type       | Sandy loam | Total N% | 0.06 |
| Sand%           | 58.50 | Avail P% | 6.10 |
| Silt%           | 17.70 | Extr. K mg/100g | 1.18 |
| Clay%           | 23.80 | DTPA Fe | 5.00 |
| Org. Matt %     | 0.63 | Ext. ppm Cu | 1.32 |
| CaCO₃           | 6.15 | Zn | 1.9 |
| pH (1:2.5)      | 7.84 | Mn | 10.60 |

Table b: Chemical analysis of activated yeast (mg/ 100g dry weight) according to Marzauk et al. (2014)

| Minerals | Amino acids | Amino acids |
|----------|-------------|-------------|
| Total N  | 7.23        | Arginine    | 1.99 |
| P2O5     | 51.68       | Histidine   | 2.63 |
| K2O      | 34.39       | Isoleucine  | 2.31 |
| MgO      | 5.76        | Leucine     | 3.09 |
| CaO      | 3.05        | Lysine      | 2.95 |
| SiO2     | 1.55        | Methionine  | 0.72 |
| SO2      | 0.49        | Phynylalanine | 2.01 |
| NaCl     | 0.30        | Theronine   | 2.09 |
| Fe       | 0.92        | Tryptophan  | 0.45 |
| Ba       | 157.6       | Valine      | 2.19 |
| Co       | 67.8        | Glutamic acid | 2.00 |
| Pd       | 438.6       | Serine      | 1.59 |
| Mn       | 81.3        | Aspartic acid | 1.33 |
| Sn       | 223.9       | Praline     | 1.53 |
| Zn       | 335.6       | Tyrosine    | 1.49 |

2.1. Preparation of materials
2.1.1. Garlic extract
Average of 250 g of a local garlic varieties were taken, after cleaning from impurities were mixed with 250 ml distilled water using electrical blender for 3 min then the solution was filtered using filter paper (whatmann1), the filtrate was considered as a completely strong solution of 100% according to Abdulrazzaq (2017).

2.1.2. Yeast
Commercial dry yeast at 3 or 5 g with 1 g sucrose and warm water.
Table C: Chemical composition (mg/100g garlic oil) according to Mnayer et al. (2014)

| Component          | Value  |
|--------------------|--------|
| Water (g)          | 59     |
| Calories (kcal)    | 149    |
| Lipids (g)         | 0.5    |
| Carbohydrates (g)  | 33.07  |
| Fiber (g)          | 2.1    |
| Manganese (mg)     | 1672   |
| Potassium (mg)     | 401    |
| Sulphur (mg)       | 70     |
| Calcium (mg)       | 181    |
| Phosphorus (mg)    | 153    |
| Magnesium (mg)     | 25     |
| Sodium (mg)        | 17     |
| Vitamin C (mg)     | 31     |
| Vitamin B6 (mg)    | 1235   |
| Glutamic acid (g)  | 0.805  |
| Arginine (g)       | 0.634  |
| Aspartic acid (g)  | 0.489  |
| Leucine (g)        | 0.308  |
| Lysine (g)         | 0.273  |

Table D: Nutritional composition of garlic according to Mardomi (2017).

| Compound                        | Value  |
|---------------------------------|--------|
| D.W) Dipropyl disulfide         | 0.25   |
| Diallyl disulfide               | 37.90  |
| Dimethyl trisulfide             | 0.33   |
| Dimethyl thiophene a            | 0.08   |
| Allyl methyl disulfide          | 3.69   |
| Methyl propyl disulfide         | 0.25   |
| Methyl 1-propenyl disulfide     | 0.46   |
| Allyl propyl sulfide            | 0.09   |
| Bis-(1-propenyl)-sulfide a      | 0.08   |
| Diallyl sulfide                 | 6.59   |
| Dimethyl disulfide              | 0.15   |
| Allyl methyl teterosulfide      | 1.07   |
| Allyl propyl trisulfide         | 0.23   |
| Diallyl sulfide                 | 28.06  |
| Eugenol                         | 0.23   |

2.2. Statistical analysis:

The experimental design under factorial complete randomized blocks with 3 replications for each treatment as described by Snedecor and Cochran (1980) and means of all characters were compared by L.S.D test at 0.05.

3. Results

Plant height

Table (1) showed that the effect of treatments on plant height were significant, the tallest plant in both seasons were those treated with NPK (the primary fertilization), in general as part of an attempt to substitute some natural stimulants as an alternative to this chemical fertilization, the clear obtained proportions of salicylic acid were the highest levels. Salicylic acid at 200 ppm gave 25.60 and 25.70 cm in the first and second seasons respectively with a significant differences compared to control treatment. Whilst plants treated with garlic extract at 125 ml gave a minimum height of 22 and 21.93 cm compared to other treated plants with the different treatments but still taller than control plants (18.46 and 18.50 cm in first and second seasons, respectively).

Number of leaves/plant

The obtained results presented in Table (1) exhibited that all transactions studied gave obvious differences between themselves. Applications salicylic acid at 200 ppm gave the highest number of
leaves as 3.88 and 3.99 in both seasons which differed significantly in comparison with other treatments except NPK. This was followed treatment by the ascorbic acid at 200ppm gave 3.55 and 3.88 in both seasons. The lowest value was in untreated plants.

**Fresh weight of leaves**

Data presented in Table (1) indicated that, all tested applications enhanced fresh weight of plants in comparison with control in both seasons. In the first rank (after treatment with NPK) a foliar spray with SA at 200 ppm was the strongest as produced maximum fresh weight of leaves 23.56 in both seasons with great difference from control which gave 11.60 and 11.30, in first and second seasons, respectively.

**Dry weight of leaves**

Data presented in Table (1) cleared that, the application of NPK significantly enhanced dry weight of leaves when compared to other treatments. On the other hand, the heaviest dry weight was belonged to plants treated with either salicylic acid at 200ppm (7.96 and 7.93 g) or ascorbic acid at 200 ppm (7.87 and 7.90g) in first and second seasons, respectively.

**Table 1:** Effect of fertilization treatment and some stimulators on some vegetative growth characteristics of *Narcissus tazetta* plants during 2017 and 2018 seasons.

| Treatments         | Plant height (cm) | Number of leaves/plant | Fresh weight of leaves (g) | Dry weight of leaves (g) |
|--------------------|-------------------|------------------------|-----------------------------|--------------------------|
|                    | 1st Season        | 2nd Season             | 1st Season                  | 2nd Season               | 1st Season              | 2nd Season               |
| Control            |                   |                        |                             |                          |                         |                         |
| NPK at 2 g         | 18.46 f           | 18.50 d                | 2.55 d                      | 2.55 b                   | 11.60 f                 | 11.30 e                  |
| Garlic extract at 125 ml |                |                        |                             |                          |                         |                         |
| Salicylic acid at 100 ppm | 25.60 b       | 25.70 ab               | 3.88 ab                     | 3.99 ab                  | 16.36 c                 | 16.36 d                  |
| Ascorbic acid at 100 ppm |                |                        |                             |                          |                         |                         |
| Citric acid at 100 ppm |                |                        |                             |                          |                         |                         |
| Yeast at 3 g       |                   |                        |                             |                          |                         |                         |
| LSD at 0.05        |                   |                        |                             |                          |                         |                         |

**Bulb diameter**

Data presented in Table (2) proved that, NPK at 2g/p gave higher value (5.13 and 5.16 mm) than the lowest one in the treatment by yeast at 3g/p (2.70 mm and 2.73 mm in the first and second seasons) all of those compared with control (1.90 and 1.93 mm), in addition to the widest diameter emerged on those treated with SA (salicylic acid) at 200ppm (4.56 and 4.60 mm).

**Bulb fresh weight**

Data in Table (2) displayed clearly that, all application treatments exposed significant differences and raised bulb weight but the clearest effect was obtained by adding NPK at 2g/p (10.82 and 10.83 g in first and second seasons, respectively) as superior to that of other treatments, also, ascorbic acid (AsA) at 200ppm recorded the heaviest bulb weight in the first season (8.54g) nevertheless the heavy bulb weight in the second season (8.53 g) resulted from salicylic acid (SA) at 200 ppm.

**Flowering duration**

Results presented in the Table (2) revealed that the flowering duration was gradually increased when the plants were exposed to several treatments however; NPK at 2g/p showed the highest values
(18.21 and 18.33 days in first and second seasons, respectively). Followed by the treatments of SA at 200 ppm and almost the same value was given by AsA at 200 ppm.

**Number of bulblets/plant**

Irrespective of the high transaction value of NPK, the statistical analysis showed that the highest mean values of number of bulblets per plant, of Narcissus tazetta was achieved when plants received both salicylic acid and ascorbic acid as foliar spray (2.55 and 2.66 in first and second seasons, respectively).

**Table 2:** Effect of fertilization treatment and some stimulators on the bulb characteristics and flowering duration of Narcissus tazetta plants during 2017 and 2018 seasons.

| Treatments             | Bulb diameter (mm) | Bulb fresh weight (g) | Flowering duration (days) | Number of bulblets/plant |
|------------------------|--------------------|-----------------------|---------------------------|--------------------------|
|                        | 1st Season | 2nd Season   | 1st Season | 2nd Season   | 1st Season | 2nd Season   | 1st Season | 2nd Season   | 1st Season | 2nd Season   |
| Control                | 1.90 e      | 1.93 d        | 4.59 f    | 4.63 d        | 10.88 e     | 10.99 e      | 0.66 c     | 0.77 b        |
| NPK at 2 g             |             |              |           |               |            |              |            |               |
| Garlic extract at 125 ml| 2.73 de     | 2.89 bc       | 6.08 e    | 6.13 cd       | 14.44 cd    | 14.11 d      | 1.77 b     | 1.78 ab       |
| Salicylic acid at 100 ppm| 3.70 cd   | 3.43 bc       | 6.36 cd   | 6.40 cd       | 15.21 bc    | 15.22 bc     | 2.21 ab    | 2.33 a        |
| Salicylic acid at 200 ppm| 4.56 ab   | 4.60 ab       | 8.40 b    | 8.53 b        | 17.55 a     | 17.55 a      | 2.55 ab    | 2.66 a        |
| Ascorbic acid at 100 ppm| 3.00 cd    | 3.03 bc       | 6.31 de   | 6.33 cd       | 14.88 bc    | 14.88 cd     | 2.22 ab    | 2.33 a        |
| Ascorbic acid at 200 ppm| 4.20 ab    | 4.23 ab       | 8.45 b    | 8.46 b        | 17.32 a     | 17.44 a      | 2.55 ab    | 2.66 a        |
| Citric acid at 100 ppm | 2.93 de    | 2.96 bc       | 6.27 de   | 6.26 cd       | 14.66 cd    | 14.66 cd     | 2.11 b     | 2.22 a        |
| Citric acid at 200 ppm | 3.90 bc    | 3.97 ab       | 8.38 bc   | 7.83 bc       | 16.88 ab    | 16.88 ab     | 2.44 ab    | 2.44 a        |
| Yeast at 3 g           | 2.70 de    | 2.73 cd       | 6.23 e    | 6.27 cd       | 14.21 d     | 14.22 d      | 1.99 b     | 2.11 a        |
| Yeast at 5 g           | 3.40 bc    | 3.47 bc       | 8.28 bc   | 8.33 b        | 16.32 ab    | 16.44 ab     | 2.22 ab    | 2.33 a        |
| LSD at 0.05            | 1.212      | 1.642         | 2.034     | 1.799         | 2.046       | 1.963        | 0.972      | 1.397         |

**Flower fresh weight**

It is evident from data presented in Table (3) that flower fresh weight was increased with significant differences by treatments in various rates in both seasons, particularly NPK at 2 g/p which gave 13.53 and 14.11 g in the first and second seasons respectively. Meanwhile, foliar plants by salicylic acid at 100ppm gave closely near to that of NPK (13.22 and 14.08g in the first and second seasons, respectively).

**Flower dry weight**

Data presented in Table (3) showed that all transactions caused positive increment in dry weight of flowers compared to control. The heaviest dry weights of flowers were obtained from NPK at 2g in both seasons (5.87 and 6.53g in the first and second seasons, respectively) followed without significant difference by those obtained from applying salicylic acid at 100ppm (5.66 and 6.32g in the first and second seasons, respectively) compared to untreated plants (2.78 and 3.22g in the first and second seasons, respectively).

**Flower diameter**

According to data presented in Table (3) it can be concluded that, the supremacy effect that gave the maximum flower diameter (4.33 and 5.19 cm in the first and second seasons, respectively) was recorded in NPK at 2g and SA at 100ppm (4.23 and 5.07 cm in the first and second seasons, respectively) with slight effect between them and by a wide margin from control (2.37 and 3.25cm in two seasons).

**Longevity**

Results in Table (3) manifested a significant effect of the applied treatments and improving the flower longevity by using those treatments in this study, the superior influence was either NPK at 2g.
Table 3: Effect of fertilization treatment and some stimulators on flower fresh and dry weight, flower diameter and longevity of *Narcissus tazetta* plants during 2017 and 2018 seasons.

| Treatments | Flower fresh weight (g) | Flower dry weight (g) | Flower diameter (cm) | Longevity (days) |
|------------|-------------------------|-----------------------|----------------------|-----------------|
|            | 1st Season | 2nd Season | 1st Season | 2nd Season | 1st Season | 2nd Season | 1st Season | 2nd Season |
| Control    | 4.54 gb     | 5.08 gb     | 2.78 gb     | 3.22 gb     | 2.37 ea     | 3.25 ea     | 5.67 fa     | 6.45 fa     |
| NPK at 2 g | 13.53 ab    | 14.11 ab    | 5.87 ab     | 6.53 ab     | 4.33 aa     | 5.19 aa     | 6.33 fa     | 12.80 ab    |
| Garlic extract at 125 ml | 8.11 fg | 9.98 fg | 2.70 fg | 3.78 fg | 2.67 de | 3.45 de | 6.33 fa | 7.22 fa |
| Salicylic acid at 100 ppm | 13.22 ab | 14.08 ab | 5.66 ab | 6.32 ab | 4.23 ab | 5.07 ab | 11.67 ab | 12.46 ab |
|           | 13.80 ab    | 13.33 ab    | 5.41 ab     | 6.26 ab     | 4.13 ab     | 4.92 ab     | 11.00 ab    | 11.82 ab    |
| Ascorbic acid at 100 ppm | 12.23 ab | 12.80 ab | 5.09 ab | 5.98 ab | 4.00 ab | 4.75 ab | 10.33 ab | 11.17 ab |
| Citric acid at 100 ppm | 10.84 cd | 11.55 cd | 4.29 cd | 5.21 cd | 3.70 ab | 4.48 ab | 8.67 ab | 9.46 ab |
| Yeast at 3 g | 9.23 ef | 10.81 ef | 3.32 ef | 4.32 ef | 3.27 bc | 4.03 bc | 7.33 dc | 8.13 dc |
| Yeast at 5 g | 8.31 fg | 10.35 fg | 2.81 fg | 3.92 fg | 3.03 cd | 3.78 cd | 6.67 ef | 7.48 ef |

**Scape length**

Data averaged in Table (4) showed that, the increment on length of scape was influenced by NPK at 2g substantially, it achieved the highest recorded values (19.7 and 19.60 cm) compared to control (12.53 and 12.67 cm), as well as foliar application with SA at 100 ppm which enhanced this increment with close values (19.10 and 19.23 cm) in the first and second seasons, respectively.

Table 4: Effect of fertilization treatment and some stimulators on flowering characteristics of *Narcissus tazetta* plants during 2017 and 2018 seasons.

| Treatments | Scape length (cm) | Scape fresh weight (g) | Scape dry weight (g) |
|------------|-------------------|------------------------|----------------------|
|            | 1st Season | 2nd Season | 1st Season | 2nd Season | 1st Season | 2nd Season |
| Control    | 12.53 ga     | 12.67 ga     | 12.20 fa     | 12.43 ea     | 3.45 da     | 3.61 da     |
| NPK at 2 g | 19.47 aa    | 19.60 aa    | 19.78 aa     | 19.34 aa     | 6.95 aa     | 7.12 aa     |
| Garlic extract at 125 ml | 13.70 fg | 13.80 fg | 13.09 ef | 13.26 de | 3.92 cd | 3.99 cd     |
| Salicylic acid at 100 ppm | 19.10 ab | 19.23 ab | 18.75 ab | 18.97 ab | 6.74 aa | 6.90 aa     |
|           | 18.70 ab    | 18.83 ab    | 18.25 ab     | 18.48 ab     | 6.47 ab     | 6.64 ab     |
| Ascorbic acid at 100 ppm | 18.20 ab | 18.33 ab | 17.65 ab | 18.42 ab | 6.17 ab | 6.34 ab     |
| Citric acid at 100 ppm | 17.60 bc | 17.73 bc | 16.98 bc | 17.20 ab | 5.85 ab | 6.02 ab     |
| Yeast at 3 g | 16.90 cd | 17.00 cd | 16.23 bc | 16.45 bc | 5.49 ab | 5.66 ab |
| Yeast at 5 g | 16.10 de | 16.23 de | 15.39 cd | 15.62 cd | 5.09 ab | 5.26 ab |
| LSD at 0.05 | 16.48 c | 16.61 c | 15.99 c | 16.20 c | 5.34 c | 5.49 c |

**Scape fresh weight**

It can be observed from the data illustrated in Table (4) revealed that the highest recorded values of scape fresh weight were noticed in plants treated by NPK at 2g (19.78 and 19.34g) meanwhile, the lowest values were obtained from garlic extract at 125ml (13.09 and 13.26 g) compared to control which produced the minimum values in this concern (12.20 and 12.43g) in the first and second seasons, respectively.
Scape dry weight

It is obvious from data presented in Table (4) that the highest dry weight was induced by plants treated with NPK at 2g followed without significant difference by SA at 100ppm. On the other hand the garlic extract at 125ml gave the lowest values between the transactions, but it was still the higher value than control.

Photosynthetic pigments

As shown in Table (5) data indicated that, the highest pigment content of chlorophyll a,b and carotenoids in the leaves of treated plants was attained as a result of NPK at 2g in comparison to control and other treatments. Salicylic acid at 200ppm improved pigments content it gave a high amount of chl.a by average of 3.10 and 3.12 mg/g.f.w compared to control (1.45 and 1.52 mg/g.f.w). In case of chl.b and carotenoids thus shared the previous mentioned treatments in the same order between treatments in this investigation. The lowest value of the transactions was garlic extract at 125ml in chl.a and chl.b despite the fact that it recorded a higher value than the control, whilst adding yeast at 3g/p produced(1.23 and 1.27 mg/g.f.w in the first and second seasons, respectively). The lowest amount of carotenoids in comparison to other treatments nevertheless it was higher than the control value (0.97 and 0.94 mg/g.f.w in the first and second seasons, respectively).

| Treatments                  | Chlorophyll a (mg./g.f.w) | Chlorophyll b (mg./g.f.w) | Carotenoids (mg./g.f.w) |
|-----------------------------|----------------------------|---------------------------|-------------------------|
|                             | 1st Season                 | 2nd Season                | 1st Season              | 2nd Season              |
| Control                     | 1.45                       | 1.52                      | 0.77                    | 0.83                    | 0.97                     | 0.94                     |
| NPK at 2 g                  | 3.19                       | 3.12                      | 1.84                    | 1.72                    | 2.17                     | 2.18                     |
| Salicylic acid at 100 ppm   | 2.58                       | 2.61                      | 1.49                    | 1.53                    | 1.47                     | 1.40                     |
| Salicylic acid at 200 ppm   | 3.10                       | 3.09                      | 1.64                    | 1.57                    | 1.99                     | 1.86                     |
| Ascorbic acid at 100 ppm    | 2.54                       | 2.63                      | 1.46                    | 1.38                    | 1.32                     | 1.40                     |
| Ascorbic acid at 200 ppm    | 2.90                       | 2.80                      | 1.52                    | 1.46                    | 1.91                     | 1.93                     |
| Citric acid at100 ppm       | 2.46                       | 2.37                      | 1.28                    | 1.30                    | 1.26                     | 1.27                     |
| Citric acid at 200 ppm      | 2.76                       | 2.76                      | 1.42                    | 1.46                    | 1.73                     | 1.85                     |
| Yeast at 3 g                | 2.32                       | 2.30                      | 1.20                    | 1.27                    | 1.23                     | 1.27                     |
| Yeast at 5 g                | 2.71                       | 2.72                      | 1.32                    | 1.33                    | 1.69                     | 1.68                     |
| Garlic extract at 125 ml     | 2.18                       | 2.30                      | 1.16                    | 1.19                    | 1.30                     | 1.34                     |

Nitrogen, phosphorus and potassium %

Data illustrated in Table (6) demonstrated that the highest contents of N, P and K percentages in leaves were recorded as a result of applying by NPK at 2g and gave superior nitrogen value than those obtained from treaty by other stimulators NPK induced the N% in plants (3.15 and 3.24 % compared to control which gave 1.89 and 1.92% in the first and second seasons, respectively).

| Treatments                  | N%              | P%              | K%              |
|-----------------------------|-----------------|-----------------|-----------------|
|                             | 1st Season      | 2nd Season      | 1st Season      | 2nd Season      | 1st Season      | 2nd Season      |
| Control                     | 1.89            | 1.92            | 0.06            | 0.09            | 0.16            | 0.22            |
| NPK at 2 g                  | 3.15            | 3.24            | 0.82            | 0.79            | 1.22            | 1.26            |
| Salicylic acid at100 ppm    | 2.22            | 2.32            | 0.28            | 0.31            | 1.07            | 1.03            |
| Salicylic acid at200 ppm    | 2.87            | 2.68            | 0.68            | 0.58            | 1.20            | 1.18            |
| Ascorbic acid at100 ppm     | 2.20            | 2.21            | 0.25            | 0.31            | 1.02            | 1.01            |
| Ascorbic acid at200 ppm     | 2.85            | 2.56            | 0.64            | 0.66            | 1.18            | 1.20            |
| Citric acid at100 ppm       | 2.18            | 2.20            | 0.24            | 0.30            | 1.00            | 1.00            |
| Citric acid at 200 ppm      | 2.77            | 2.45            | 0.50            | 0.58            | 1.16            | 1.14            |
| Yeast at3 g                 | 2.16            | 2.15            | 0.20            | 0.19            | 1.01            | 0.96            |
| Yeast at5 g                 | 2.67            | 2.38            | 0.46            | 0.51            | 1.10            | 1.06            |
| Garlic extract at125 ml      | 2.36            | 2.28            | 0.30            | 0.29            | 0.96            | 0.92            |
It promoted P % that achieved 0.82 and 0.79 % compared to control as 0.06 and 0.09 %, besides it gave 1.22 and 1.26% of potassium compared to control treatment as 0.16 and 0.22 % in the first and second seasons, respectively. Regarding the effect of stimulators applications it can be noticed that, salicylic acid at 200ppm promoted the ratio of nitrogen, phosphorus and potassium content whereas it gave the best results obtained. On the other hand, treated plants by yeast at 3g gave the least percentage of N % (2.16 and 2.15), as well as the least percentage of P% (0.20 and 0.19) and the lowest one of K % was obtained from garlic extract as 0.96 and 0.92 in the first and second seasons, respectively.

4. Discussion

1. Effect of chemical fertilizers (NPK)

1-1. Effect of chemical fertilizers (NPK) on vegetative growth of Narcissus tazetta plants

It is clear that means of all vegetative and bulb growth traits, expressed as: plant length (cm), number of leaves/plant, fresh weight of leaves (g), dry weight of leaves (g) as well as bulb diameter (mm), bulb fresh weight (g) and number of bulblets/plant in Narcissus tazetta plant were markedly improved in response to amending the NPK. This may be attributed to the role of the combined effect to the three types of NPK, the nitrogen which is vital in amino acids, proteins, alkaloids, co-enzymes and some vitamins which is why it has an essential role in the metabolism process, in heredity, reproduction and growth. Phosphorus relates mainly to the growth of plants as it exists in all cell nuclei as phosphoric acid combined with other components to form nucleic acid, it is also quite important for root growth. Potassium possesses a highly significant role in the formation of proteins and carbohydrates, in water condition regulation in plant cells and the water loss by photosynthesis and transpiration (Youssef et al., 2019). The same author found that application of NPK at 6g enhanced vegetative growth as it gave a the highest number of leaves per plant, fresh and dry weight of leaves, fresh and dry weight of root and finally it gave the tallest plant of Swietenia mahagoni. In this regard, many investigators studied the effect of chemical NPK fertilizers on various foliage plants and showed its positive effect on producing vigorous growth (Lumis et al., 2000 on Euonymus and Thuja; Abd El-Aziz, 2007 on Codiaeum variegatum). Abbasiyazare et al. (2012) studied the effects of chemical fertilizers on growth indices of Spathiphyllum illusion, and showed that chemical fertilizers treatment resulted in increasing leaf number, dry and fresh weight of leaves and the size of spadix, else, Habib (2012) on Caryota mitis, found that application of NPK at the rat 4 gm/pot had a remarkable effect on increasing plant height, number of leaves/plant, leaf area, fresh weight. El Mokadem and Sorour (2014) reported that Petunia hybrida fertilized with 5g/pot complete fertilizer of NPK gave the best growth parameters in terms of plant height and number of branches as well as dry weight of shoots and roots. A joint opinion with them, El-Naggar et al. (2016) on Anthurium andreanum. Hassan et al. (2016) mentioned that the highest values of growth parameters were obtained from Gladiolus grandiflorus L. plants which received NPK at 16g/pot. Likewise, Abd El Gayed and Attia (2018) postulated that increasing vegetative growth of Celosia cristata L. plants as a result of the effect of growing media and NPK fertilization.

1-2. Effect of chemical fertilizers (NPK) on flowering growth of Narcissus tazetta plants

It is clear that means of all flowering growth traits, expressed as: flowering duration (days), flower fresh weight (g), flower dry weight (g), flower diameter (cm) longevity (days) as well as scape length (cm), scape fresh weight (g) and scape dry weight (g) in the tested plant of Narcissus tazetta, gave a similar trend to that of vegetative growth characters in this study also exerted a pronounced effects and enhanced flowering growth parameters. These gains may be reasonable due to the positive impact of the extracts and nitrogen and phosphorus in stimulating the production of auxin and increase the activity of GA3 in the plant tissues, which encourage the process of cell division and elongation of the cells and their expansion and increasing size (Abdul-Karim, 2005). The role of fertilizers in enhancing flowering growth and quality of ornamentals was previously documented by Khan et al. (2006) that addition of nitrogen, phosphorus and potassium caused significant increase in vase life in cut tulip increase due to nutrient treatment which may be attributed to a healthy scape and leaves which may have more food reserves to be utilized during the vase period when the natural source of food is cut off from the plant consequent to harvest. A healthy scape may also facilitate
better water uptake essential for maintaining turgor, and thus, freshness of cut flowers. High potassium level in the tissue may also have contributed directly to maintaining turgor and thus resulted in increased vase life. These findings are in agreement with the results of Singh et al. (2017) who revealed that increasing rates of NPK increased number of flowers/stem of alstroemeria cv. Capri plants. Abd El Gayed and Attia (2018) postulated that all NPK fertilization rates significantly increased inflorescence parameters of *Celosia cristata* compared to control.

1-3. Effect of chemical fertilizers (NPK) on chemical composition of *Narcissus tazetta* plants

A similar trend to that of vegetative and flowering growth characters was also obtained regarding the impact of different treatments employed in this study on chemical composition of the leaves, where application of NPK markedly improved concentrations of chlorophyll a, b and carotenoids (mg/g.f.w) and the percentages of N, P and K in the leaves of plant. Increasing chlorophyll content in the leaves could be due to the role of the element of nitrogen in the structure of porphyrin, which is involved in the construction of chlorophyll. Regarding the effect of phosphorus in the formation of a radical total and thus increase absorption of nutrients, which may be accompanied by increased production of chlorophyll and thus increase the concentration of this pigment in the plant. Similar results were reported by Abd El-Aziz (2007) on *Codiaeum variegatum*. and Habib (2012) who demonstrated that NPK at the rat 4 gm/pot had increasing contents of chlorophyll a, and N, P and K% in *Caryota mitis*. Matter and El Sayed (2015) found that NPK fertilizer led to enhance plant nitrogen percentage and total chlorophyll of caraway plant and El-Naggar et al. (2016) on *Anthurium andraeanum*. El-Sayed and Ismail (2017) demonstrated that, the highest values of leaf N, P and K for all these chemical constituents in *Codiaeum variegatum* were due to full dose of NPK. Besides, Youssef et al. (2019) noted that, the effect of NPK on chemical composition of plant is due to increasing the amount of photosynthetic pigments (chlorophyll a, b and carotenoids), also, it gave the maximum value of N,P and K% compared to untreated plants.

2. Effect of salicylic acid (SA)

2-1. Effect of salicylic acid (SA) on vegetative growth of *Narcissus tazetta* plants

It is clear that means of all vegetative and bulb growth traits, expressed as: plant length (cm), number of leaves/plant, fresh weight of leaves (g), dry weight of leaves (g) as well as bulb diameter (mm), bulb fresh weight (g) and number of bulblets/plant in *Narcissus tazetta* plant were markedly improved in response to applying the salicylic acid. This may be attributed to the role of salicylic acid which plays as a molecular signal in creating a defensive response against various biotic and abiotic stresses by various mechanisms such as improved photosynthetic capacity (Arfan et al., 2007). It also maintain the stability of membranes and thereby enhanced activity of antioxidants that protect the plants from oxidative damages (El-Tayeb, 2005). Moreover salicylic acid plays a vital role in alleviation abiotic stresses through increasing the growth-regulating hormones such as auxins and cytokinins, GA3, ABA (Zarghami et al., 2014). The results are in accordance with those pointed out by Martin-Mex et al. (2005) on African violet, Drazic et al. (2006) on *Medicago sativa*, Kaur et al. (2007) on chickpea, Yildirm et al. (2008) on cucumber, Hashish et al., (2015) on *Calendula officinalis*, and Qureshi et al. (2015) on *Dianthus caryophyllus*. El-Kinany et al. (2019) mentioned that the highest values of *Delphinium ajacis* (L.) Schur height, plant fresh weight, plant dry weight, root length, root fresh weight, and root dry weight were observed at 100 ppm salicylic acid. The promotive effect of salicylic acid could lead to its bio regulator effects on physiological and biochemical processes in plants such as ion uptake by the stressed plant, cell elongation, cell division, cell differentiation, enzymatic activities, protein synthesis, sink/source regulation and increase CO2 assimilation and photosynthetic rate as well as increase the antioxidant capacity of plants. Foliar spray with SA improved all vegetative and flowering traits of *Gazania rigens* (Abdul Kareem and Saeed, 2020).

2-2. Effect of salicylic acid (SA) on flowering growth of *Narcissus tazetta* plants

It is clear that means of all flowering traits, expressed as: flowering duration (days), flower fresh weight (g), flower dry weight (g), flower diameter (cm), longevity (days) as well as scape length (cm), scape fresh weight (g) and scape dry weight (g) in tested plans gave a similar trend to that of vegetative growth characters was also exerted a pronounced effect and enhanced flowering growth parameters. These gains may be reasonable due to the positive impact of the role of salicylic acid
which induced flowering by acting as a chelating agent (Pieterse and Muller, 1977). This view was supported by (Raskin et al., 1987) who reported that salicylic acid functioned as an endogenous growth regulators of flowering and florigenic effects. The molecular mechanisms of salicylic acid involved in the bud- stimulating behaviors just like phenolic nature substances because of this harmonic behavior could act as natural regulators or act together with growth substances, by the reason metabolism of indole-3-acetic acid can be shifted in presence of phenolic chemicals (Grambow and Schwich, 1983). Salicylic acid has an outstanding correlation size of flower by cell elongation and cell expansion (Raskin, 1992). Salicylic acid as a manager of blooming time interacts with both photoperiod-dependent and self-governing pathways (Martínez et al., 2004). SA acts as a growth regulator which participates in the regulation of physiological processes in plants like, stimulating flowering in a range of plants, increases flower life, controls ion uptake by roots and stomatal conductivity (Hayat et al., 2007). In addition, increases flavonoids contents in the inflorescence which lead to enhancing flower length and width influenced positively the flower size and plant growth (Kim et al., 2009). Spray application of SA has been reported to prolong flower vase-life by increasing the activity of the ROS-scavenging enzyme catalase and improving the water balance (Cocetta and Ferrante, 2018). Increasing the number of flowers and flower longevity leads to an increase in flowering duration. Also, increasing flower diameter may lead to an increase in flower fresh and dry weight. Furthermore, El-Kinany et al. (2019) mentioned that salicylic acid at 100 ppm increased the given flower parameters may be due to the role of SA as a growth regulator. Treatment by SA at 300 ppm gave the best results in terms of number of flowers, flower diameter and flowering date of Gazania rigens (Abdul Kareem and Saeed, 2020).

2.3. Effect of salicylic acid (SA) on chemical composition of Narcissus tazetta plants

A similar trend to that of vegetative and flowering growth characters was also obtained regarding the impact of different treatments employed in this study on chemical composition of the leaves, where application of salicylic acid markedly improved concentrations of chlorophyll a, b and carotenoids (mg/g.fw) and the percentages of N, P and K in the leaves of plant and that enhancement could be attributed to that SA application triggers scavenging of ROS that may increase Chl content and the impact of salicylic acid on chlorophyll may be related with its influence on the anti-oxidative enzyme activities. SA plays an important role in enhancing chlorophyll content and photosynthetic rate (Fariduddin et al., 2003). the superior influence of salicylic acid treatments on stimulating plant photosynthesis pigments may be due to the role of SA in enhancing net photosynthetic rate which could be due to improving the functional state of the photosynthetic machinery in plants either by the mobilization of internal tissue nitrate or by chlorophyll biosynthesis (Shi et al., 2006).

3. Effect of ascorbic acid (AsA)

3.1. Effect of ascorbic acid (AsA) on vegetative growth of Narcissus tazetta plants

It is clear that means of all vegetative and bulb growth traits, expressed as: plant length (cm), number of leaves/plant, fresh weight of leaves (g), dry weight of leaves (g) as well as bulb diameter (mm), bulb fresh weight (g) and number of bulblets/plant in Narcissus tazetta plants were markedly improved in response to applying the ascorbic acid, This may be attributed to the improvement of vegetative and floral qualities as a result of spraying with AsA due to its role in different functions. It is a cofactor for the enzymes involved in a variety of processes including flavonoids, plant hormone synthesis, and xanthophyll cycle. Also this increment in vegetative growth may be attributed to the fact that this acid co-regulates the cell division Similarly, the increase in floral characteristics as a result of foliar spray with AsA may be due to the effect of the used material on improving the vegetative growth of gazania plants, consequently the production and accumulation of the biosynthesizes would be increased, thus more flowers could be initiated and developed on the plant (Abdul Kareem and Saeed, 2020). Furthermore, ascorbic acid treatment reduced the damaging action of drought and decreased enzyme activity due to scavenging of reactive oxygen species; thereupon it may be effective for improvement of stressed plants in arid and semi-arid regions (Dolatabadian et al., 2009a). Results are in agreement with those reported by Athar et al. (2008) who suggested that ascorbic acid could accelerate cell division and improve the growth. Abdul Kareem and Saeed (2020) declared that treated Gazania rigens by AsA at 200ppm gave the highest number of leaves, the highest leaf area and increased dry weight of leaves.
3-2. Effect of ascorbic acid (AsA) on flowering growth of Narcissus tazetta plants

It is clear that means of all flowering growth traits, expressed as: flowering duration (days), flower fresh weight (g), flower dry weight (g), flower diameter (cm), longevity (days) as well as scape length (cm), scape fresh weight (g) and scape dry weight (g) in plants gave a similar trend to that of vegetative growth characters. Also exerted a pronounced effect and enhanced flowering growth parameters. These gains may be reasonable due to the positive impact of ascorbic acid as an antioxidant, which can scavenge $O_2$ and $H_2O_2$ non-enzymatically, and takes part in APX mediated scavenging of $H_2O_2$ and decreased the activity of these enzymes by elimination of free radicals, when AsA was applied in nutrition solution, there was an obvious decrease in CAT and SOD activities in the leaves. A role of AsA in the ascorbate–glutathione cycle in mitochondria and peroxisomes has been described. It also plays a protective role against ROS that are formed during biotic and abiotic stress (Dolatabad and Jouneghani, 2009b). Moreover, the increase in the flowering duration by foliar spray with AsA compared to control treatment may be due to that using AsA at optimum concentrations act as scavengers, helping to prevent cell and tissue damage and delays of the flowers senescence (Sewedan et al., 2012). Similarly, Abdul Kareem and Saeed (2020) indicated that treatment by AsA led to a significant increase in fresh and dry weight of flower and gave the best results in terms of flower diameter and flowering duration compared to control of Gazania rigens.

3-3. Effect of ascorbic acid (AsA) on chemical composition of Narcissus tazetta plants

A similar trend to that of vegetative and flowering growth characters was also obtained regarding the impact of different treatments employed in this study on chemical composition of the leaves, where application of ascorbic acid markedly improved concentrations of chlorophyll a, b and carotenoids (mg/g.f.w) and the percentages of N, P and K in the leaves of plant that enhancement could be attributed to ascorbic acid is one of the water soluble reductants which is very important antioxidant which protects plants by suppressing oxidative injury, by affecting many enzymes activities and also is required for regeneration of x-tocopheral Ascorbate occurs in the cell wall where it is a first line of defense against ozone; Ascorbate also has been implicated in regulation of cell division and photosynthesis. Several authors also reported that ascorbic acid has played important roles in some biochemical activities as an enzyme cofactor (Szarka et al., 2013), electron transport (Ivanov, 2014) and antioxidant on chloroplast cell membrane (Gallie, 2013). Increasing contents that was confirmed by Dolatabad and Jouneghani (2009b) who observed that ascorbic acid increased chlorophyll content of bean at all of stressed and non-stressed treatments and Asrar (2012) on snapdragon, in which ascorbic acid treatments increased the chlorophyll content of the cut flowers, another author Farahat et al. (2013) showed that the combined treatment of ascorbic acid with salinity level significantly increased chlorophyll a, b, and total chlorophyll content of shoots, compared with control of Grevillea robusta. Abd-El-Rhman et al. (2017) observed that, foliar application by ascorbic acid increased percentages of N, P and K in leaves of Punica granatum.

4-Effect of citric acid (CA)

4-1. Effect of citric acid (CA) on vegetative growth of Narcissus tazetta plants:

It is clear that means of all vegetative and bulb growth traits, expressed as: plant length (cm), number of leaves/plant, fresh weight of leaves (g), dry weight of leaves (g) as well as bulb diameter (mm), bulb fresh weight (g) and number of bulblets/plant in Narcissus tazetta plant were markedly improved in response to applying the citric acid. This may be attributed to the improvement of vegetative and floral qualities as a result of spraying with citric acid due to its role as a buffer solution in the plant cell that prevents sudden change in pH, which affects the metabolic activities of plants and the presence of these solutions resist the sudden change in pH (Al-Saadi and Al-Moussawi, 1980). Citric acid (CA) is an organic acid mainly served as antioxidant and involved in plant metabolism through its role in Krebs cycle during the respiration in mitochondria which produces cellular energy by oxidative phosphorylation (Taize and Zaiger, 2002). This energy is required for different physiological processes and development of the mechanisms of resistance systems under different stress factors. Improvement of vegetative growth due to foliar spray with CA in this study in agreement with those obtained by Maleki, et al. (2013) who explained that foliar spraying of citric acid significantly increased root fresh and foliage weights/plant compared to untreated treatment.
Eidyan et al. (2014) noted a synergism between foliar application of Fe and citric acid in increasing of bulblet size in tuberose.

4-2. Effect of citric acid (CA) on flowering growth of Narcissus tazetta plants

It is clear that means of all flowering growth traits, expressed as: flowering duration (days), flower fresh weight (g), flower dry weight (g), flower diameter (cm), longevity (days) as well as scape length (cm), scape fresh weight (g) and scape dry weight (g) in tested plants gave a similar trend to that of vegetative growth also exerted a pronounced effects and enhanced flowering growth parameters. These gains may be reasonable due to the positive impact citric acid that has protective effects on peroxidation-linked membrane deterioration, free radical scavenging, maintenance of membrane stability. In this regard, Darandeh and Hadavi (2012) found that preharvest spray of citric acid (0.15%, w/v) increased the mean vase life of cut lilium cv. Brunello, “Frontiers. Similar observations were also attained by Eidyan (2010) who cleared the positive effect of pre-harvest citric acid sprays on post harvest longevity of cut flowers of tuberose.

4-3. Effect of citric acid (CA) on chemical composition of Narcissus tazetta plants

A similar trend to that of vegetative and flowering growth characters was also obtained regarding the impact of different treatments employed in this study on chemical composition of the leaves in the tested plants, where application of citric acid markedly improved concentrations of chlorophyll a, b and carotenoids (mg/g.f.w) and the percentages of N, P and K in the leaves of plant as that enhancement may be attributed to It’s possible effect on the protease inhibitors or induces enzymatic activation or both of them. The aforementioned results are in well agreement with those manifested by Abd-El-Rhman et al. (2017) who established that, foliar application by citric acid increased percentages of N, P, K in the leaves of Punica granatum.

5-Effect of yeast

5-1. Effect of yeast on vegetative growth of Narcissus tazetta plants:

It is clear that means of all vegetative and bulb growth traits, expressed as: plant length (cm), number of leaves/plant, fresh weight of leaves (g), dry weight of leaves (g) as well as bulb diameter (mm), bulb fresh weight (g) and number of bulblets/plant in Narcissus tazetta plant were markedly improved in response to applying the yeast, This may be attributed to the improvement of vegetative and floral qualities as a result of spraying with yeast extract which is a very interesting natural plant inducer due to its role in producing some growth regulators, as well as its ability to act as a biostimulant of plant growth or the biosynthesis of plant pigments and some other bioactive compounds (Taha et al., 2016 on Azadirachta indica and Złotek, 2017 on marjoram). The yeast may also contain some of the major nutrients such as nitrogen, phosphorus, potassium, sugars and vitamins, which lead to increase these elements after the treatment of plants (Mostafa and Abou Raya, 2003). Studies and researches conducted on the yeast solution to determine the positive effect of this solution on vegetative growth and internal nutrient content showed that the yeast solution had a positive effect as it contains tryptophan, which is the source of IAA formation (Mostafa and Abou Raya, 2003). Abdel-Wahed et al. (2006) reported that using yeast twice at the rate of 4 g/l plus 6 g NPK significantly increased plant height, fresh and dry weights of shoots of Euonymous japonicas plant, while yeast alone led to an increment in No. branches, stem diameter, root length and fresh and dry weights of roots. Analogous observations to those aforementioned were also noticed regarding foliar spraying to Vicia faba with the yeast extract caused as significant increase in many growth indicators such as leaves number, the dry weight of leaves and stems as well as leaves area (AbouEL-Yazied and Mady, 2012).

5-2. Effect of yeast on flowering growth of Narcissus tazetta plants

It is clear that means of all flowering growth traits, expressed as: flowering duration (days), flower fresh weight (g), flower dry weight (g), flower diameter (cm), longevity (days) as well as scape length (cm), scape fresh weight (g) and scape dry weight (g) in tested plants gave a similar trend to that of vegetative growth characters also exerted a pronounced effects and enhanced flowering growth parameters. These gains may be reasonable due to the beneficial effect of application with yeast extract and may be attributed to the promotion of plant hormones as a result of yeast application;
the natural cytokinins content in yeast stimulates cell division and enlargement as well as synthesis of protein, nucleic acid and chlorophyll. The positive impact of the role of its effect on enzymatic activity, the production of some plant hormones, improvement of nutrient absorption ability, conversion of phosphorus from insoluble to soluble, and increasing its absorbability by plants, all of these increase the content of the mineral elements in the plants (Abbas, 2013). At present, there is considerable interest in the possibility of using yeast as natural and safe factor to stimulate plant growth, as it is considered as a promising factor to stimulate the growth of many plant crops. In recent decades, yeast became a successful alternative to chemical fertilizer and is safe for human, animals and the environments (Omran, 2000).

5-3. Effect of yeast on chemical composition of Narcissus tazetta plants

A similar trend to that of vegetative and flowering growth characters was also obtained regarding the impact of different treatments employed in this study on chemical composition of the leaves in the tested plants, where application of yeast markedly improved concentrations of chlorophyll a, b and carotenoids (mg/g. f.w) and the percentages of N, P and K in the leaves of plant as that enhancement may be attributed to a significant increase in content caused by yeast solution as may be attributed to the increase in photosynthetic pigments due to the role of cytokines (which is produced by the yeast) in delaying leaves senescence through reducing the degradation of chlorophyll and enhancing the building of RNA and proteins (Marzauk et al., 2014). Also, the increase in leaf content of chlorophyll may be due to the fact that yeast contains vital growth regulators that affect the balance between photosynthesis and respiration in the plants. The increase in leaf content of chlorophyll may be also due to the fact of yeast containing cobalt and manganese (Dawood et al., 2013). A parallel results were also obtained by Abou EL-Yazied and Mady (2012). The application of yeast was found to increase the contents of chlorophylls, carotenoids, and phenolic compounds in neem leaves also, it increased the N, P, and K content in neem plants (Taha et al., 2016).

6- Effect of garlic extract

6-1. Effect of garlic extract on vegetative growth of Narcissus tazetta plants:

It is clear that means of all vegetative and bulb growth traits, expressed as: plant length (cm), number of leaves/plant, fresh weight of leaves (g), dry weight of leaves (g) as well as bulb diameter (mm,) bulb fresh weight (g) and number of bulblets/plant were markedly improved in response to applying the garlic extract. This may be attributed to the improvement of vegetative and floral qualities as a result of applying garlic extract that, is considered as a source of vitamins (especially vitamin B complex and vitamin C), antioxidants, flavonoids and minerals especially P, K and Se, being even considered a rich source of other non-volatile phytonutrients with important medicinal and therapeutic properties, from which a particular emphasis is given to flavonoids, saponins and sapogenins, phenolic compounds, nitrogen oxides, amides and proteins. Garlic extract accelerates plant growth through the stimulation of photosynthetic pigments and soluble sugar content. This finding was demonstrated before by Morsy et al. (2009) who found that garlic or onion extracts significantly improved all plant growth characteristics of cucumber, i.e. number of leaves/plant, number of flowers/plant, shoot and root length and fresh and dry weight of shoot and root system compared with non sprayed plants. Hanafy et al. (2012) on Schefflera arboricola stated that the highest values of plant height, dry weight of leaves/plant, total carbohydrates and nitrogen contents were obtained when using garlic extract as a soil drench. Abdou et al. (2018) reported that spraying with garlic extract at 300 mg/l significantly enhanced the most vegetative growth parameters of Gladiolus grandiflorus plants.

6-2. Effect of garlic extract on flowering growth of Narcissus tazetta plants

It is clear that means of all flowering growth traits, expressed as: flowering duration (days), flower fresh weight (g), flower dry weight (g), flower diameter (cm), longevity (days) as well as scape length (cm), scape fresh weight (g) and scape dry weight (g) in tested plant Narcissus tazetta, were gave a similar trend to that of vegetative growth characters was and also exerted a pronounced effect and enhanced flowering growth parameters. These gains may be reasonable due to the positive impact of garlic extracts that can induce or prime the defense system of the plants, resulting in advanced protection against fungal diseases thereby increased growth parameters of plants. The previous results
conform with those attained by Emam (2010) on *Polianthes tuberosa* where reported that garlic extract at 1 and 5ml/l improved flowers traits, increased clump fresh weight, clump dry weight, number of bulbs/plant and number of bulblets/plant. El-Babyl (2017) who reported that the spraying garlic extract on *Polianthes tuberosa* induced precocity in flowering, increased spike and rachis length, number of florets per spike, fresh and dry weights of spike.

**6-3. Effect of garlic extract on chemical composition of Narcissus tazetta plants**

A similar trend to that of vegetative and flowering growth characters was also obtained regarding the impact of different treatments on chemical composition of the leaves in the tested plants, where application of garlic extract markedly improved concentrations of chlorophyll a, b and carotenoids (mg/g.f.w) and the percentages of N, P and K in the leaves of plant that enhancement may be attributed to a significant increase in content caused by garlic extract could be established by the fact that it contain various growth-promoting compounds such as starch, vitamins and organosulphur compounds such as allicin and diallyl disulphide. Such promotional effects of garlic extracts upon the formation of chlorophyll might be due to the active role of such agents in the pathway of synthesis of α-amino levulinic acid, the precursor of chlorophyll biosynthesis. Analogous observations were also elicited by Hammad (2008) who reported that, the interactive effect of drought stress and the usage of natural substances (garlic extract) increased photosynthetic pigments content in leaves of pea plants. Atowa (2012) on *Freesia refracta* found that application of garlic extract at 500 ml/l increased number and fresh weight of cormlets and chlorophyll (a), whereas using garlic extract at 250 ml/l significantly increased total carbohydrates, N, P and K contents in the leaves. EL-Sayed et al. (2015) on *Freesia refracta* showed that using garlic extract at 500 ml/l increased number of cormlets/plot, fresh weight of cormlets and chlorophyll (a) in the leaves as well as a great influence was detected on carbohydrates content.

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