*Assiut Journal of Agriculture Science 53 (4) 2022 (27-38)* *Website:* http://ajas.journals.ekb.eg/
*ISSN: 1110-0486 / EISSN: 2356-9840* *E-mail:* ajas@aun.edu.eg

*(Original Article)*

# Effect of Organic and Bio-Nitrogen Fertilizers on Growth and Fruiting of Manfalouty Pomegranate Trees

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DOI: 10.21608/ajas.2022.144023.1150


## Abstract

The current investigation was executed at in a private the Orchard, located at El-Badary district, Assiut Governorate, Egypt, to study the effect of organic and bio-form fertilizers on vegetative growth, nutrient status and fruiting of Manfalouty pomegranate trees during 2019 and 2020 seasons. The experiment was arranged in a complete randomized block design with five replications and it consisted of five treatments.

The results can be summarized as follow:

Using the recommended dose of nitrogen (RND) via thrice form (mineral plus organic and bio-form) significantly increased the shoot length compared to use RND via mineral-N fertilizer (check treatment). All fertilization treatments significantly increased leaf area, chlorophyll and contents of N, P and K in leaves compared to check treatment. The fertilization treatments significantly increased the yield/tree and significantly decreased the fruit splitting and sunburn percentage compared to use mineral-N source only. Fertilization with any twice form (organic plus mineral)or thrice form (organic + bio + mineral) significantly improved the fruit properties by increasing the fruit weight, arils percentage and total soluble solids as well as sugar, anthocyanin and vitamin C contents and decreasing the total acidity compared to using the check treatment.

It is clear from the current results the importance of fertilization through organic and bio-form for pomegranates productivity, via improve the fruit quality which reflects on induce the increase packable yield. In addition, such fertilization treatments reduce the cost of production and environmental pollution.

***Keywords:*** *bio-fertilization, organic, pomegranate yield, nutrient status, fruiting*

## Introduction

Pomegranate (*Punica granatum* L.) economically is important commercial fruit plant species belonging to family Punicaceae. The tree is tolerant drought, hard winter and can grow well under the stress of desert conditions. Pomegranates are a good source for nutrients and minerals and the compounds that called antioxidant. The whole tree parts including the fruits are using for treating many diseases, i.e., diarrhea, hyperacidity, tuberculosis, leprosy, abdominal pain and

Received: 15 June 2022/ Accepted: 25 September 2022/ Published online: 1 October 2022

fever. Due to its multipurpose medicinal uses it is also known as "Dadima" in Ayurveda (Paranjpe, 2001) and as "super fruit" in the global functional food industry (Martins *et al*., 2006). Juice of pomegranates have antioxidants i.e., polyphenols, tannins and anthocyanins, hence can be used to control of cancer and chronic inflammation (Michel *et al*., 2005; Ephraim and Robert, 2007 and Amin *et al*., 2017).

The total area of pomegranate trees was estimated to be about 0.5% of the total fruit acreage in Egypt (76924 feddans). Assiut Governorate is considered the main producer of Egyptian pomegranate according to M.A.L.R. (2020). Recently, there has been an increasing demand for pomegranate (*Punica granatum* L.) to meet the need of local as well as the foreign markets of some European and Arabic countries.

Growth, yield, fruiting and nutritional status of pomegranate trees significantly effects by fertilization (Hunter *et al*., 2011 and Srivastava and Malhotra, 2017). Nitrogen (N) is one of the most important nutrients that have an important impact on plant growth and fruiting (Canovas *et al*., 2018). In addition, it is an essential component of acids, chlorophyll and many phytohormones may studies have confirmed that its deficiency has many symptoms and a negative impact on growth, yield and fruit quality (Marschner, 2012).

Under field and surface irrigation conditions the efficiency of nitrogen fertilization rarely exceeds 50% and it ranges between 30 and 40%. (Saharawat, 1979). The nitrogen loss by leaching, volatilization, denitrification is considered the most important problem in the Egyptian soils. Thus, the N applied sources management is required to solve this problem. Currently, there is great interest to solve this problem in terms of reducing chemical fertilizers used to reduce cost and avoid its harmful effects.

Therefore, attention should be paid to modern methods and innovative techniques in fertilization methods and horticultural services. Thus, using of organic and bio-fertilization, which affects raising the fertilization efficiency, increasing the growth and yield and improving the fruit quality (Aseri *et al*., 2008; Mosa *et al*., 2014 and El-Salhy *et al.*, 2015). Additionally, to improving the vital activity and nutrients absorption which affects growth and fruiting (Kohler *et al*., 2007).

Bio-fertilizer improve growth and fruit quality of pomegranate (Aseri *et al*., 2008; El-Salhy *et al*., 2015 and Amin *et al*., 2017).

Replacing the chemical fertilizer with organic and bio-fertilizers that depend on the recycling of farm residues and animal manure that increase soil fertility and facilitate absorption nutrients are the best alternative for avoiding all forms of pollution that may result from conventional agriculture techniques (Cook, 1986; Miller *et al*., 1990 and Yagodin, 1990 and Abd-Ella *et al*., 2010). Importantly the previous reports found that they improve the growth and fruit quality of pomegranate (Aseri *et al*., 2008; El-Salhy *et al*., 015 and Amin *et al*., 2017).

Taking into account the abovementioned aspects, this investigation was planned to study the effect of organic and bio-fertilization on vegetative growth, leaf chlorophyll and some mineral content, yield and fruit physical and chemical characteristics of Manfalouty pomegranate trees as a trial to reduce the costs of fertilizers, increase the yield and improve fruit quality.

## Materials and Methods

This study implements out during the two successive seasons of 2019 and 2020 on Manfalouty pomegranate trees grown at a private Orchard located at El-Badary distinct, Assiut Governorate, Egypt, where the soil has a clay texture and its properties were presented in Table (1), according to Wilde *et al*. (1985).

**Table 1. Some physical and chemical properties of soil (0-90 cm deep) of the experimental site**

| Soil property | Value | Soil property | Value |
|---|---|---|---|
| Sand (%) | 5.25 | $CaCO_3$ (%) | 3.24 |
| Silt (%) | 20.00 | Organic matter (%) | 0.05 |
| Clay (%) | 74.48 | Total nitrogen (%) | 0.17 |
| Texture grade | Clay | $NaHCO_3$-extractable P (ppm) | 133.4 |
| pH (1-2.5) | 7.37 | $NH_4OAC$-extractable K (ppm) | 39.0 |
| EC (ml) | 0.764 | | |

Twenty-five healthy trees with no visual nutrient deficiency symptoms were chosen and devoted for carrying out this experiment. The chosen trees were divided into five groups. Each group had five trees and subjected to the following treatments:

$T_1$-Applying the recommended nitrogen dose (RND) at 600 g N/tree (100%) via mineral source (check treatment).

$T_2$-Applying RND at 75% organic plus 25% out of RND via mineral source.

$T_3$-Applying RND at 25% mineral plus 25% organic + 50% bio (Azotin)

$T_4$-Applying RND at 25% mineral plus 50% organic + 25% bio (Azotin).

$T_5$-Applying RND at 33% mineral + 33% organic + 33% bio-form.

The experiment was set up as a randomized complete block design with five replications per treatment, one tree each. The organic N fertilizer (farmyard manure, 0.3% N) was added once at the last week of December. Azotin was added in two equal batches at growth start and one month later. Azotin as a bio-fertilize that contains nitrogen fixation *Paenifacullus polymxa* was brought fresh. It used by mixing with moist sand before the application, added in soil holes around the trunk of the tree and then, directly irrigated after covering the holes with soil. Ammonium nitrate (33.3% N) as a mineral source was added three times at the first week of March, May and August. Other horticultural practices were carried out as recommended.

The following parameters were measured during the two studied seasons:

**Vegetative growth**

Four main branches almost nearly in growth and distribution in four sides of tree were selected and labeled in April for the following vegetative measurements:

Shoot length (cm).

Leaf area ($cm^2$), where thirty full mature leaves/tree (from the $3^{rd}$ to $4^{th}$ basal nodes of shoot base) were randomly taken and weighing 60 sections of 1 $cm^2$ (2 sections of 1 $cm^2$/leaf) and then the average leaf area was estimated according to the following equation:

$$The\ average\ leaf\ area\ (cm^3) = \frac{Leaves\ weight\ (g)}{Sections\ weight\ (g)}\ x\ 2$$

Leaf total chlorophyll was estimated by using chlorophyll meter (Minolta SPAD 502 plus). Using ten leaves from the fourth terminal expended leaf of the shoot.

**Nitrogen, phosphorus and potassium percentages**

Samples of fifty mature leaves were randomly selected from the non-fruiting spring shoots on mid-September to determine N, P and K in leaves using the digestion with a mixture of sulfuric acid and hydrogen peroxide (Wilde *et al.,* 1985). Nitrogen was measured by the micro-kjeldahl methods (Bremner and Mulvaney, 1982), phosphorus and potassium were determined by colorimetricaly and flame photometer, respectively (Jackson, 1958).

**Yield and its components**

Fruits were harvested at once at the recommended maturity standard according to El-Salhy (1985) and then the total yield (sound, splitting and sunburned fruits). The defective fruits were separated to estimate the percentage of splitting and sunburning fruits.

**Fruit quality**

Samples of 10 fruits were randomly taken at harvest time from each tree to estimate the fruit quality. The fruit weight, arils % and juice percentage as well as the chemical fruit quality such as total soluble solids, total acidity (expressed as g citric acid/100 ml juice), ascorbic acid (mg/100 ml juice) and sugar contents were determined according to A.O.A.C. methods (1985). In addition, the total anthocyanin content of the juice was calculated according to Rabino and Mancinelli (1986).

The obtained data were statistically analyzed according to Gomez and Gomez (1984) and Mead *et al*. (1993) using the L.S.D. values at 5% to define the significance of the differences among various treatment means.

## Results

### Effect of different nitrogen fertilization sources on vegetative growth

Data presented in Tables (2 and 3) showed the effect of different nitrogen fertilization sources on shoot length and leaf parameters as well as the percentage of N, P and K in leaves during 2019 and 2020 seasons. It is obvious from the data that the results took similar trend during the two studied seasons.

**Table 2. Effect of bio and organic nitrogen fertilizers on shoot length, leaf area and total chlorophyll of Manfalouty pomegranate trees during 2019 and 2020 seasons**

| Characteristics / Treatments | Shoot length (cm) | | | Leaf area ($cm^2$) | | | Total chlorophyll (%) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2019 | 2020 | Mean | 2019 | 2020 | Mean | 2019 | 2020 | Mean |
| **T1** | 65.12 | 63.36 | 64.24 | 6.48 | 7.63 | 7.06 | 64.9 | 58.6 | 61.8 |
| **T2** | 62.53 | 60.87 | 61.70 | 6.21 | 7.28 | 6.75 | 65.8 | 60.2 | 63.0 |
| **T3** | 69.65 | 67.85 | 68.75 | 6.95 | 8.20 | 7.56 | 68.5 | 61.9 | 65.2 |
| **T4** | 70.16 | 69.41 | 69.79 | 7.16 | 8.43 | 7.79 | 70.6 | 63.4 | 67.0 |
| **T5** | 71.83 | 70.25 | 71.04 | 7.32 | 8.68 | 8.00 | 71.1 | 65.1 | 68.1 |
| **LSD 5%** | 3.51 | 3.11 | | 0.37 | 0.45 | | 2.63 | 2.51 | |

T1 (100%) mineral, T2 (25%) M+(75%) organic, T3 (25%) M + (25%) O + (50%) Bio, T4 (25%) M + (50%) O + (25%) Bio, T5 (33%) M + (33%) O + (33%) Bio.

**Table 3. Effect of bio and organic nitrogen fertilizers on percentage of leaf N, P and K of Manfalouty pomegranate trees during 2019 and 2020 seasons.**

| Characteristics / Treatments | N% | | | P% | | | K% | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2019 | 2020 | Mean | 2019 | 2020 | Mean | 2019 | 2020 | Mean |
| **T1** | 1.55 | 1.70 | 1.63 | 0.26 | 0.28 | 0.27 | 1.25 | 1.24 | 1.25 |
| **T2** | 1.62 | 1.77 | 1.70 | 0.29 | 0.31 | 0.30 | 1.28 | 1.27 | 1.28 |
| **T3** | 1.64 | 1.80 | 1.72 | 0.28 | 0.32 | 0.30 | 1.27 | 1.31 | 1.29 |
| **T4** | 1.67 | 1.83 | 1.75 | 0.31 | 0.35 | 0.33 | 1.30 | 1.32 | 1.31 |
| **T5** | 1.71 | 1.86 | 1.79 | 0.31 | 0.38 | 0.35 | 1.31 | 1.32 | 1.32 |
| **LSD 5%** | 0.08 | 0.07 | | 0.02 | 0.02 | | 0.05 | 0.04 | |

T1 (100%) mineral, T2 (25%) M+(75%) organic, T3 (25%) M + (25%) O + (50%) Bio, T4 (25%) M + (50%) O + (25%) Bio, T5 (33%) M + (33%) O + (33%) Bio.

Data showed that the shoot length and leaf traits as well as N, P and K percentage in leaves were significantly affected by various sources of nitrogen fertilization compared to use the recommended dose of nitrogen (RND) only (check treatment). Using the RND via thrice form (RND) at 25% mineral-N plus 25 and 50% bio-form and 50 or 25% organic or 33% of them significantly increased the shoot length compared to use check treatment ($T_1$). There are no significant differences on these studied traits due to fertilization via either 25% mineral-N plus 25% organic and 50% bio ($T_3$), 25% mineral plus 50% organic and 25% Azotin ($T_4$) or 33% mineral-plus 33% organic and 33% bio-form ($T_5$). Also, no significant differences due to fertilization via twice form at 25% mineral plus 75% organic ($T_2$) compared to check treatment.

Moreover, all fertilization treatments significantly increased the percentage of N, P and K in leaves compared to use RND via mineral source only ($T_1$).

The increment percentage of leaf area and total chlorophyll were attained 7.08, 10.34 & 13.31 and 5.50, 8.41 & 10.19% for average of the two studied seasons) due to $T_3$, $T_4$ to $T_5$ over the check treatment ($T_1$), respectively. The increment percentage of N% $T_2$, $T_3$, $T_4$ and $T_5$ over $T_1$ were 4.29, 5.25, 7.36 and 9.81% average of the two studied seasons, respectively. Maximum values of vegetative traits were detected on Manfalouty pomegranate trees fertilized with the combined fertilizer from organic plus inorganic and bio-form ($T_5$).

**Effect of different nitrogen fertilization sources on yield**

Data presented Table (4) showed that fertilized the trees by combination of mineral-N with organic (twice form) or via mineral-N plus organic and bio-form (thrice fertilization form) led to a significant increase in yield/tree comparing to use the RND via mineral-N source only (check treatment, $T_1$). On the other hand, these fertilization treatments significantly decreased the fruit splitting and sunburn percentage compared to mineral-N source only.

The recorded yield/tree was 72.60, 81.08, 83.31, 88.32 and 89.82 kg/tree, (as an average of the two studied seasons) due to $T_1$ to $T_5$, respectively.

**Table 4. Effect of bio and organic nitrogen fertilizers on yield/tree (kg), fruit splitting and sunburns percentage of Manfalouty pomegranate trees during 2019 and 2020 seasons**

| Characteristics / Treatments | Yield/tree (kg) | | | Fruit splitting % | | | Sunburn (%) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2019 | 2020 | Mean | 2019 | 2020 | Mean | 2019 | 2020 | Mean |
| **T1** | 74.87 | 70.32 | 72.60 | 9.73 | 9.21 | 9.47 | 27.2 | 28.4 | 27.8 |
| **T2** | 82.19 | 79.97 | 81.08 | 9.12 | 8.63 | 8.88 | 20.2 | 21.1 | 20.7 |
| **T3** | 80.81 | 85.81 | 83.31 | 8.87 | 8.50 | 8.69 | 17.1 | 18.8 | 18.0 |
| **T4** | 87.13 | 89.51 | 88.32 | 8.55 | 8.10 | 8.33 | 15.3 | 16.6 | 16.0 |
| **T5** | 90.13 | 89.51 | 89.82 | 8.45 | 8.15 | 8.30 | 12.2 | 11.5 | 11.9 |
| **LSD 5%** | 4.14 | 4.38 | | 0.41 | 0.47 | | 0.81 | 1.11 | |

T1 (100%) mineral, T2 (25%) M+(75%) organic, T3 (25%) M + (25%) O + (50%) Bio, T4 (25%) M + (50%) O + (25%) Bio, T5 (33%) M + (33%) O + (33%) Bio.

The increment percentage of yield/tree was 11.68, 14.75, 21.65 and 23.72 due to $T_2$ to $T_5$ over $T_1$, respectively. Also, the fruit splitting and fruit sunburn percentages attained 9.47, 8.88, 8.69, 8.33 & 8.30 and 27.8, 20.7, 18.0, 16.0 and 11.7% as an av. of two seasons due to $T_1$ to $T_5$, respectively. The decrement percentage of fruit splitting and fruit sunburn due to fertilization treatments under fertilization via mineral-N source only ($T_1$) attained 6.23, 8.24, 12.04 & 12.35% and 25.54, 35.25, 42.45 & 57.91 as an av. of the two seasons due to $T_2$ to $T_5$, respectively.

The heaviest weight yield/tree and lowest defective fruits percentage were recorded on the trees that treated with three different fertilizers source ($T_5$). Therefore, it is clear that fertilization with a mixture of three sources (organic + bio + mineral) fertilizer have beneficial effects on the pomegranate production.

## Effect of different nitrogen fertilization sources on fruit quality

It is noticed from the obtained data presented in Tables (5 and 6) that the fertilization with any twice form (organic plus mineral, organic plus bio) or thrice sources (organic + bio + mineral) fertilizer significantly improved the fruit quality in terms of increasing the fruit weight and their contents of total soluble solids and a decrease the total acidity compared to use the recommended nitrogen dose (RND) via the release (mineral-N) source. No significant differences in these traits as a result of fertilize by either organic plus inorganic or mixture of the three sources. Using mixture of the three sources gave the highest values of most studied traits. The recorded fruit weight was 324.9, 345.9, 346.2, 362.2 and 366.5g as av. of the two studied seasons due to $T_1$ to $T_5$, respectively. The corresponding TSS and vitamin C contents were 14.9, 15.8, 15.9, 16.0 & 16.1% and 22.90, 26.53, 27.59, 29.57 & 30.22 mg/100g as an av. of two studied seasons, respectively. The increment percentage in fruit weight was (6.46, 6.56, 11.48 & 12.80 as an av. of the two studied seasons due to $T_2$ to $T_5$ over the control, respectively. In addition, the corresponding increment percentages of TSS% and V.C contents were 6.04, 6.71, 7.38 & 8.05% and 15.85, 20.48, 29.12 & 31.96 as an av. of the two studied seasons, respectively.

Such fertilization programs are very important for the production of pomegranate fruits, because the improvement of fruit quality leads to increase in packable yield. In addition, such fertilization treatments reduce the production cost and environmental pollution.

**Table 5. Effect of bio and organic nitrogen fertilizers on fruit weight, arils, juice percentage and TSS of Manfalouty pomegranate trees during 2019 and 2020 seasons**

| Characteristics / Treatments | Fruit weight | | | Arils percentage | | | Juice percentage | | | TSS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2019 | 2020 | Mean | 2019 | 2020 | Mean | 2019 | 2020 | Mean | 2019 | 2020 | Mean |
| **T1** | 332.3 | 317.6 | 324.9 | 50.1 | 53.3 | 51.70 | 62.1 | 62.4 | 62.3 | 14.7 | 15.2 | 14.9 |
| **T2** | 356.4 | 335.3 | 345.9 | 52.2 | 55.9 | 54.05 | 62.4 | 62.8 | 63.1 | 15.4 | 16.1 | 15.8 |
| **T3** | 342.6 | 349.8 | 346.2 | 53.5 | 55.3 | 54.40 | 65.3 | 64.6 | 64.9 | 15.9 | 15.9 | 15.9 |
| **T4** | 385.8 | 358.6 | 362.2 | 53.8 | 57.8 | 55.80 | 65.8 | 67.5 | 66.7 | 15.6 | 16.4 | 16.0 |
| **T5** | 371.5 | 361.5 | 366.5 | 55.7 | 57.7 | 56.7 | 66.9 | 67.8 | 67.4 | 15.6 | 16.5 | 16.1 |
| **LSD 5%** | 13.65 | 16.83 | | 2.11 | 1.98 | | 2.08 | 1.98 | | 0.41 | 0.45 | |

T1 (100%) mineral, T2 (25%) M+(75%) organic, T3 (25%) M + (25%) O + (50%) Bio, T4 (25%) M + (50%) O + (25%) Bio, T5 (33%) M + (33%) O + (33%) Bio.

**Table 6. Effect of bio and organic nitrogen fertilizers on some juice traits of Manfalouty pomegranate trees during 2019 and 2020 seasons**

| Characteristics / Treatments | Vitamin C (%) | | | Reducing sugar (%) | | | Acidity (%) | | | Anthocyanin | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2019 | 2020 | Mean | 2019 | 2020 | Mean | 2019 | 2020 | Mean | 2019 | 2020 | Mean |
| **T1** | 21.12 | 24.68 | 22.90 | 12.53 | 12.16 | 12.35 | 1.16 | 1.12 | 1.14 | 40.2 | 41.2 | 40.7 |
| **T2** | 24.77 | 28.29 | 26.53 | 13.21 | 13.67 | 13.44 | 1.12 | 1.08 | 1.10 | 46.6 | 47.3 | 47.00 |
| **T3** | 26.33 | 28.84 | 27.59 | 13.25 | 13.61 | 13.43 | 1.06 | 1.04 | 1.05 | 49.8 | 48.5 | 49.1 |
| **T4** | 28.75 | 30.38 | 29.57 | 13.57 | 13.92 | 13.75 | 1.04 | 0.99 | 1.02 | 50.3 | 52.3 | 51.3 |
| **T5** | 29.52 | 30.92 | 30.22 | 13.63 | 13.98 | 13.81 | 0.97 | 0.94 | 0.96 | 52.9 | 54.4 | 53.7 |
| **LSD 5%** | 0.85 | 1.08 | | 0.41 | 0.38 | | 0.03 | 0.03 | | 1.92 | 1.84 | |

T1 (100%) mineral, T2 (25%) M+(75%) organic, T3 (25%) M + (25%) O + (50%) Bio, T4 (25%) M + (50%) O + (25%) Bio, T5 (33%) M + (33%) O + (33%) Bio.

## Discussion

Nitrogen is the most important nutrient element for plants, as it is from 1-5% of the dry matter and it is the basic unit of many organic compounds such as proteins, amino acids and enzymes (Marschner, 2012). It is also a major compound to overcome the low soil fertility deficiency. So, it requires frequent use and high concentration which becomes an expensive item for orchard management and environmental pollution. Therefore, modern technologies that are based on organic and biological production and that are dependent on the use of organic and bio-fertilization should be used while reducing the use of chemical nitrogen fertilizers, as well as their safety for soil, human, animals and environment (Verma, 1990; Mosa *et al*., 2014; El-Salhy *et al*., 2015 and Amin *et al*., 2017).

The use of organic and biological fertilizers results in positive effects such as improving the bioactivity, increasing the nutrients absorption and improving the fertilization efficiency. They also, improves the nutritional status of trees in terms of building nutrients i.e., carbohydrates and proteins, which leads to a balance between nutrients and the synthesis of carbohydrates in plant, thus increasing the bud's formation and improving flowering, fruit set and yield. In addition, early ripening and improve the fruits characteristics (Subba Rao, 1984 and Kannaiyan, 2002). Such effect considers the most important amendment for soil reclamation and improvement especially for Egyptian soils having alkaline and high pH are induced a low in their available nutrients. This means that applying the yeasts avoiding P deficiency in the trees and P fixation in the soil.

All these effects improve vegetative vigor, nutritional status of trees induce an increasing nutrient uptake and synthesis of total carbohydrates and proteins. As well as, maintaining a good balance between total carbohydrates and N in favour of improving floral bud induction and fertility coefficient. Moreover, it hastened the maturation and improved fruit quality.

The results of the present study are in accordance with those obtained by Khanizadeh *et al*. (1995), Abo-Taleb-Safia *et al*. (1999),Wadee (2007), Kohler *et al*. (2007) and Aseri *et al*. (2008). They concluded that application of bio-fertilizer along with mineral-N source were effective for improving growth aspects, yield and fruit quality.

Organic fertilization has several benefits, as an increase the activity of micro flora, soil structure aggregation, soil organic matter, water holding capacity, soil humus content and the availability of most nutrients. This beneficial affects lead to increase the nutrients absorption, improve the biosynthesis of organic foods and cell division (Miller *et al.,* 1990).

The positive effects of the organic fertilization on the growth of fruit trees were reported by Nijjar (1985), Miller *et al*. (1990), El-Rawy (2007), Mostafa (2008) and El-Salhy *et al*. (2015). They found that the application of either organic-N alone or beside with mineral resources was effective on improving most growth characteristics of trees compared to use N completely as a mineral source.

The current research demonstrates the importance of organic and bio-N fertilization on growth and fruiting of pomegranate. Nitrogen is required for normal fruit growth, but the use of mineral N fertilization only causes small and lack color, delayed ripening and low aril percentage and weight. On the other hand, using thrice forms caused about 10% increase in leaf area, 9.5% in leaf-N content compared to use mineral-N only. Moreover, using thrice fertilization form increased the yield by about 23% and fruit weight about 13% and decreased the fruit cracking percentage by about 12% compared to the check treatment. Also, this fertilization treatment increased the TSS and vitamin C of juice about 8% and 31% compared to use check treatment, respectively. These results are in line with those obtained by Mosa *et al*. (2014), El-Salhy *et al*. (2015) and Amin *et al*. (2017). They revealed that there is a potential benefit due to bio and organic-N in the commercial production of pomegranate for its effective.

## Conclusion

Therefore, it could be concluded that use of either two or three fertilization sources improved the tree nutrients status, yield and fruit quality and leading to an increase in the marketable yield, as well as minimize the production costs and environmental pollution which could be occurred by excess use of chemical fertilizers.

These advantages will eventually enable growers to obtain high yield with good fruit quality. Furthermore, use of organic and bio-fertilization sources improves the soil fertility and reduces the added fertilizer requirements. Thus, the growers are able to produce organic farming products.

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# تأثير الأسمدة العضوية والحيوية النيتروجينية على نمو واثمار أشجار الرمان المنفلوطي

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**الملخص**

أجريت هذه الدراسة خلال موسمي 2019، 2020 بمزرعة خاصة بمنطقة البداري – محافظة أسيوط – مصر لدراسة تأثير إضافة خليط من الأسمدة العضوية والحيوية على النمو الخضري والحالة الغذائية والمحصول وخصائص ثمار أشجار الرمان المنفلوطي مقارنة بإضافة الأسمدة المعدنية سريعة الذوبان فقط. حيث تم إضافة الأسمدة سريعة الذوبان على ثلاث دفعات (مارس – مايو – أغسطس) بينما أضيفت الأسمدة الحيوية مرتين في بداية النمو وبعد شهر.

وقد أظهرت النتائج ما يلي

سبب استخدام الجرعة السمادية من خلال الصورة الثلاثية (معدني + عضوي + حيوي) زيادة معنوية في طول الأفرع ومساحة الأوراق ومحتواها من الكلوروفيل والعناصر الغذائية مقارنة باستخدام الجرعة السمادية كلية من الأسمدة المعدنية سريعة الذوبان. مما أدي إلي تحسين المساحة الكلية للأوراق والحالة الغذائية للأشجار.

أدت جميع المعاملات السمادية إلي زيادة المحصول بينما حدث نقص معنوي في نسبة تشقق الثمار ولسعة الشمس مقارنة باستخدام الأسمدة المعدنية سريعة الذوبان فقط. وسجل أعلي محصول وأقل نسبة للثمار الغير جيدة بالأشجار المسمدة بالصورة الثلاثية (33% معدني + 33% عضوي + 33% حيوي).

أدت جميع المعاملات السمادية إلي تحسين خصائص الثمار من حيث زيادة وزن الثمرة ونسبة اللب وكذلك زيادة محتواها من السكريات والأنثوسيانين وفيتامين (C). وذلك مقارنة باستخدام الأسمدة المعدنية سريعة الذوبان فقط.

من نتائج هذه الدراسة يمكن التوصية باستخدام الأسمدة في الصورة الثانية (عضوي + معدني) أو الصورة الثلاثية (33% عضوي + 33% معدني + 33% حيوي) حيث يؤدي ذلك إلي تحسين النمو الخضري والحالة الغذائية للأشجار مع إنتاج محصول عال وثمار جيدة علاوة على تقليل تكاليف التسميد والتلوث البيئي الناشئ عن الأسمدة الازوتية.