EFFECT OF ORGANIC FERTILIZER SOURCE AND FOLIAR SPRAY WITH SOME MICROELEMENTS ON GROWTH, YIELD, FRUIT QUALITY AND STORABILITY OF STRAWBERRY UNDER SANDY SOIL CONDITIONS

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ABSTRACT: A filed experiment was carried out during the two successive winter seasons of 2017/2018 and 2018/2019 at the Experimental Farm of El-Kassasein, Hort. Res. Station, Ismailia Governorate, Egypt, to investigate the effect of different organic manure sources, i.e. chicken manure (3.75 ton/fad.) vermicompost (4.44 ton/fad.) and compost (7.50 ton/fad.) (equal 120 kg N/fad., of each), and foliar spray with some microelements (B at 25 ppm, Zn at 100 ppm and Fe at 200 ppm) on vegetative growth, yield, fruit quality and storability of strawberry under sandy soil conditions. Fertilizing strawberry plants grown in sandy soil with 4.44 ton vermicompost /fad increased foliage dry weight, average fruit weight, yield/plant, early yield and total yield/fad, fruit firmness, TSS and Vit. C and gave the lowest values of deformed fruits (%) and fruit weight loss (%) as well as decay (%) during cold storage periods. Spraying with Fe at 200 ppm increased foliage dry weight, average fruit weight, yield/plant, early yield and total yield/fad. Spraying with B at 25ppm increased fruit firmness, TSS and Vit. C, whereas spraying with Zn at100 ppm gave the lowest values of deformed fruits (%) and fruit weight loss as well as decay (%) during cold storage periods The interaction between fertilizing with vermicompost at 4.44 ton/fad., and spraying with Fe at 200 ppm, significantly increased foliage dry weight, average fruit weight, yield/plant, early yield and total yield/fad., whereas the interaction between fertilizing with vermicompost at 4.44 ton/fad., and spraying with Zn at 100 ppm gave the lowest value for each of fruit weight loss (%) and fruit decay (%) during cold storage periods. The interaction between fertilizing with vermicompost at 4.44 ton/fad., and spraying with B at 25 at ppm increased fruit firmness, TSS and Vit. C in fruits and moreover it gave the lowest value of deformed fruits (%).

Key words: Strawberry, organic manure, vermicompost, compost, growth, yield, weight loss and decay.

INTRODUCTION

Strawberry (Fragaria x ananassa Duch.) is one of the most popular vegetable crops. In Egypt, it occupies an important position among the exportable vegetable crops due to its multifarious use as local fresh consumption, food processing and exportation. The crop is commonly grown in sandy soils for getting early yields and good fruit quality. Sandy soils have their own problems as single grain structure, susceptibility to erosion, and low levels of nutrients and organic matter as well as microorganisms (Nour, 1999). Owing to their poverty in nutrients and organic matter, fertilizer requirements of strawberry plants grown in such soils, are quite high. The excessive use of inorganic fertilizers might cause ground water contamination and environmental hazards, in addition to their high costs (Lee, 1992). Thus substitution of inorganic fertilizers with organic sources is needed.

Vermicomposts are finely-divided mature plant-like materials with a high porosity, aeration,
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drainage and water-holding capacity and microbial activity which are stabilized by interactions between earthworms and microorganisms in a non-thermophilic process (Edwards and Burrows, 1988). Vermicompost application at 10 ton/ha significantly increased leaf area, plant shoot biomass, number of flowers, number of runners and marketable fruit weight of strawberry (Arancon et al., 2004). Vermicompost at 7.5 ton/ha increased total fruit yield, firmness, total soluble solids and ascorbic acid content of strawberry (Rajbir et al., 2008).

Zinc is effective in plant nutrition for the synthesis of plant hormones and balancing intake of P and K inside the plant cells. Boron is essential for plant growth, new cell division in meristematic tissue, translocation of sugar, starch, nitrogen, phosphorus, certain hormones, synthesis of amino acids and protein, regulations of carbohydrate metabolism, development of phloem etc. Iron act as catalyst in synthesis of chlorophyll molecule and helps on the absorption of other elements. It is a key element in various redox reactions of respiration, photosynthesis and reduction of nitrates and sulphates (Wallihan et al., 1958; Zende 1996).

Boron has an effect on cell wall structure, cell elongation (pollen tube) and root growth (Barker and Pilbeam, 2006). Zinc reduces pollen tube growth through functioning tryptophan as an auxin precursor biosynthesis (Chaplin and Westwood, 1980). Boron deficiency and poor pollination cause deformed berries. Micronutrients deficiencies such as boron may cause pollination problems.

Ekka et al. (2018) revealed that spraying with Fe at 0.4% recorded maximum values of plant height, number of leaves/plant, number of flowers per plant, number of fruits per plant, fruit yield per plant, TSS, total sugars, ascorbic acid and benefit cost ratio of strawberry cv. Chandler, whereas spraying with Zn at 0.2% recorded maximum values of fruit weight, fruit diameter, fruit length and specific gravity.

Therefore, the aim of this work was to obtained high yield and good quality of strawberry plants by using organic manure and foliar spray with microelements under sandy soil conditions.

MATERIALS AND METHODS

A field experiment was carried out during the two successive winter seasons of 2017/2018 and 2018/2019 at the Experimental Farm of El-Kassaein, Hort. Res. Station, Ismailia Governorate, Egypt, to investigate the effect of organic manure sources (chicken manure, vermicompost and compost) and foliar spray with some microelements (B, Zn and Fe) on vegetative growth, yield, fruit quality and storability of strawberry under sandy soil conditions. The soil was sandy in texture 0.08 and 0.09% organic matter, 7.92 pH, 1.04 mmhos/cm EC.

Frigo transplants of strawberry (Festival cultivar) were transplanted on 25th and 27th September during the 1st and 2nd seasons, respectively. The experimental unit area was 12.6 m². It contains three dripper lines of 6m length and 0.7 distance between each two dripper lines. The distance between strawberry transplants was 25 cm.

This experiment included 12 treatments, which were the combinations between three sources of organic manure, i.e., chicken manure (3.2% N) at 3.75 ton/fad., vermicompost (2.7% N) at 4.44 ton/fad., and compost (1.6% N) at 7.50 ton/fad. (equal 120 kg N/fad.) and three microelements, i.e., B at 25 ppm, Zn at 100 ppm and Fe at 200 ppm in the form of H₂BO₃, ZnSO₄ and FeSO₄, respectively, beside unsprayed plants. These treatments were arranged in a split plot design with three replicates. Organic manure sources were randomly arranged in the main plots, while foliar application with microelements were randomly arranged in the sub plots. Organic manure sources were placed pre transplanting and microelements (B, Zn and Fe) were sprayed four times at 70, 85, 100 and 115 days after transplanting. Untreated plants were left as a control treatment and sprayed with tap water. The agricultural practices concerning cultivation, irrigation, fertilization and insect control were conducted according to Ministry of Agriculture recommendation.

Data Recorded

Plant growth

Random samples each of five plants from each plot were randomly taken at 120 days after
transplanting in the two growing seasons for measuring the vegetative growth, i.e., plant height (cm), number of leaves/plant and shoot dry weight/plant (g) which measured using dried fresh shoot/plant at 70°C till constant weight.

**N, P and K contents in shoots**

Nitrogen, phosphorus and potassium percentages in shoots (leaves and branches) were determined in dry weight at 120 days after transplanting in the 2nd season according to AOAC (2005), and total protein percentage in dry shoots were determined by multiplying nitrogen content by 6.25.

**Yield and its components**

The early yield was determined as weights of all harvested fruits from each plot during February and March months, and then early yield per fad., was calculated. Total yield was recorded from each plot as weights of all harvested fruits during the season up to mid of May, then, yield per plant (g) and total yield per fad. (ton) were calculated, also average fruit weight as well as deformed fruits percent were determined. (fad.= 4200 m²=0.42 ha.)

**Fe and B contents in fruits**

Iron and boron contents (ppm) in the fruits at harvest time were determined by atomic absorption spectrophotometer as described by Evenhuis and De Waard (1980).

**Fruit quality at harvest**

Fruit quality was measured in the mid of the harvesting season as follows: Firmness was determined by using a Chattillon pressure meter equipped with a plunger (N4, USA) a needle 3mm diameter. Total soluble solids contents (TSS) as brix°: Samples of ten ripe fruits were chosen randomly from each experimental plot at full ripe stage to measure the percentage of total soluble solids content using the hand refractometer. Samples of 100g fruits from each experimental plot at full ripe stage were randomly chosen to determine titratable acidity of juice by titration with 0.1 NaOH solution, according to the method described in AOAC (2005). Ascorbic acid content (Vit. C), was determined in juice as the method mentioned in AOAC (2005).

**Storability**

At ripe stage, 500g of strawberries fruits (uniform size and color) of each experimental unit were freshly harvested, surface-dried using blotting paper, divided into three lots (different cold storage periods, 5, 10, and 15 days) were stored at zero °C ±1°C and 90 -95 % relative humidity, to determine the following data:

**Weight loss (%)**

Weight loss percentage was measured at 5, 10 and 15 days from cold storage. Fruits of each treatment were weighed after 5 days by intervals, then weight loss percentage was calculated. The weight was measured by Digital Electrical Balance at zero day and was taken as reference weight then it was calculated by using the following equation:

\[
\text{Weight loss} (\%) = \frac{\text{Initial weight} - \text{Weight of fruits at different sampling dates}}{\text{Initial weight of fruits}} \times 100
\]

**Fruit decay (%)**

Percentage of fruit decay was calculated after 5, 10 and 15 days from cold storage.

**Statistical Analysis**

Recorded data were subjected to the statistical analysis of variance according to Snedecor and Cochran (1980) and means separation was done according to least significant difference (LSD) at 0.05 levels of probability.

**RESULTS AND DISCUSSION**

**Plant Growth**

Fertilizing strawberry plants grown in sandy soil with 4.44 ton vermicompost/fad., recorded the tallest plants and gave the highest number of leaves/plant and foliage dry weight/ plant at 120 days after transplanting followed by chicken manure at 3.75 ton/fad., (Table 1). These results agree with those reported by Arancon et al. (2004).

Foliar spray with B at 25 ppm, Zn at 100 ppm and Fe at 200 ppm increased plant height, number of leaves/plant and foliage dry weight/ plant compared to control (sprayed with tap water). Spraying with Fe at 200 ppm significantly
Table 1. Effect of organic manure and foliar spray with some microelements on growth parameters of strawberry plants at 120 days after transplanting during 2017/2018 and 2018/2019 seasons

| Treatment          | Plant height (cm) | Leaf number/plant | Foliage dry weight (g) |
|--------------------|-------------------|-------------------|------------------------|
|                    | 1st season | 2nd season | 1st season | 2nd season | 1st season | 2nd season |
| Chicken manure     | 15.78      | 14.95      | 25.83      | 26.53      | 31.55      | 32.53      |
| Vermicompost       | 16.67      | 16.55      | 27.70      | 28.27      | 34.67      | 35.03      |
| Compost            | 14.20      | 12.99      | 23.58      | 23.89      | 26.73      | 27.29      |
| LSD at 0.05 level  | 0.99       | 0.70       | 0.49       | 1.30       | 1.05       | 1.02       |

Organic manure source

| Microelement (ppm) | Plant height (cm) | Leaf number/plant | Foliage dry weight (g) |
|--------------------|-------------------|-------------------|------------------------|
| Control            | 13.10              | 12.11              | 23.32                  | 23.82                  | 20.94                  | 20.83                  |
| B at 25            | 15.11              | 14.68              | 26.27                  | 26.62                  | 32.00                  | 32.66                  |
| Zn at 100          | 16.50              | 15.49              | 26.05                  | 26.44                  | 34.03                  | 35.00                  |
| Fe at 200          | 17.49              | 17.05              | 27.16                  | 28.05                  | 36.98                  | 37.99                  |
| LSD (0.05)         | 0.86               | 0.61               | 0.42                   | 1.14                   | 0.91                   | 0.89                   |

Quantity of chicken manure, vermicompost and compost were about 3.75, 4.44 and 7.50 ton/fad.

increased plant height, number of leaves/plant and foliage dry weight/plant in both seasons (Table 1). Spraying strawberry plants with Fe at 0.4% was found the best treatment for growth (Ekka et al., 2018).

The interaction between fertilizing with vermicompost at 4.44 ton/fad., and foliar spray with Fe at 200 ppm significantly increased plant height, number of leaves/plant and foliage dry weight/plant without significant differences with the interaction between fertilizing with chicken manure at 3.75 ton/fad., and foliar spray with Fe at 200 ppm with respect to plant height in both seasons.

N, P, K and protein contents in shoots

Fertilizing with vermicompost at 4.44 ton/fad., increased N, P, K and total protein in shoots with no significant differences with fertilizing with chicken manure at 3.75 ton/fad., with respect N, P and total protein (Table 3).

Spraying plants with Fe at 200 ppm gave the highest values of N, P, K, total protein with no significant differences with Zn at 100 ppm (Table 3).

The interaction between fertilizing with vermicompost at 4.44 ton/fad., and foliar spray with Fe at 200 ppm increased N and total protein in shoots with no significant differences with the interaction between fertilizing with chicken manure at 3.75 ton/fad., and foliar spray with Fe at 200 ppm with respect to N content in shoots (Table 4).

Yield and its Components

Results in Table 5 show that fertilizing strawberry plants grown in sandy soil with vermicompost at 4.44 ton/fad., gave the highest value for each of average fruit weight, yield/plant and total yield/fad., followed by fertilizing with chicken manure at 3.75 ton/fad., in both seasons. As for early yield, fertilizing with vermicompost at 4.44 ton/fad., and chicken manure at 3.75 ton/fad., increased early yield (ton/fad.). These results agree with those reported by Arancon et al. (2004) and Rajbir et al. (2008).

The positive effects of fertilizing with vermicompost on plant growth and yield of strawberry may be due to that: Vermicompost contains most nutrients in plant available forms
Table 2. Effect of interaction between organic manure and foliar spray with some microelements on growth parameters of strawberry plants at 120 days after transplanting in 2017/2018 and 2018/2019 seasons

| Treatment            | Plant height (cm) | Leaf number/plant | Foliage dry weight (g) |
|----------------------|-------------------|-------------------|------------------------|
|                      | 1st season | 2nd season | 1st season | 2nd season | 1st season | 2nd season |
| **Organic manure**   |            |            |            |            |            |            |
| Control              | 13.66      | 12.00      | 22.16      | 23.66      | 20.16      | 20.83      |
| B at 25 ppm          | 15.00      | 14.16      | 27.66      | 28.00      | 33.27      | 34.60      |
| **Chicken manure**   |            |            |            |            |            |            |
| Zn at 100 ppm        | 16.83      | 15.66      | 26.50      | 26.66      | 35.85      | 36.60      |
| Fe at 200 ppm        | 17.66      | 18.00      | 27.00      | 27.83      | 36.94      | 38.12      |
| Control              | 14.00      | 14.33      | 25.66      | 25.16      | 25.51      | 24.83      |
| B at 25 ppm          | 16.00      | 16.22      | 27.66      | 28.45      | 34.41      | 34.60      |
| **Vermicompost**     |            |            |            |            |            |            |
| Zn at 100 ppm        | 18.03      | 17.66      | 28.00      | 28.83      | 36.94      | 38.11      |
| Fe at 200 ppm        | 18.66      | 18.00      | 29.50      | 30.66      | 41.85      | 42.60      |
| Control              | 11.66      | 10.00      | 22.16      | 22.66      | 17.16      | 16.83      |
| B at 25 ppm          | 14.33      | 13.66      | 23.50      | 23.43      | 28.32      | 28.80      |
| **Compost**          |            |            |            |            |            |            |
| Zn at 100 ppm        | 14.66      | 13.16      | 23.66      | 23.83      | 29.30      | 30.29      |
| Fe at 200 ppm        | 16.16      | 15.16      | 25.00      | 25.66      | 32.17      | 33.25      |
| LSD 0.05             | 1.50       | 1.06       | 0.74       | 1.98       | 1.59       | 1.54       |

Quantity of chicken manure, vermicompost and compost were about 3.75, 4.44 and 7.50 ton/fad.

Table 3. Effect of organic manure and foliar spray with some microelements on chemical composition of strawberry shoots at 120 days after transplanting during 2018/2019 season

| Treatment            | N (%) | P (%) | K (%) | Total protein (%) | Fe (ppm) | B ppm |
|----------------------|-------|-------|-------|-------------------|----------|-------|
|                      |       |       |       |                   |          |       |
| **Organic manure**   |       |       |       |                   |          |       |
| Chicken manure       | 2.43  | 0.093 | 1.38  | 15.24             | 132.21   | 2.39  |
| Vermicompost         | 2.53  | 0.090 | 1.87  | 15.81             | 110.51   | 1.61  |
| Compost              | 2.06  | 0.088 | 1.32  | 12.92             | 121.33   | 6.79  |
| LSD at 0.05 level    | 0.15  | 0.002 | 0.10  | 0.94              | 6.54     | 0.32  |
| **Microelement**     |       |       |       |                   |          |       |
| Control              | 2.10  | 0.096 | 1.39  | 13.17             | 98.83    | 3.10  |
| B at 25              | 2.31  | 0.083 | 1.52  | 14.48             | 119.07   | 3.45  |
| Zn at 100            | 2.42  | 0.091 | 1.55  | 15.12             | 123.96   | 5.39  |
| Fe at 200            | 2.53  | 0.091 | 1.63  | 15.85             | 143.53   | 2.44  |
| LSD 0.05             | 0.13  | 0.004 | 0.08  | 0.82              | 5.71     | 0.28  |

Quantity of chicken manure, vermicompost and compost were about 3.75, 4.44 and 7.50 ton/fad.
Table 4. Effect of the interaction between organic manure and foliar spray with some microelements on chemical composition of strawberry shoots at 120 days after transplanting during 2018/2019 season

| Treatment | N (%) | P (%) | K (%) | Total protein (%) | Fe (ppm) | B ppm |
|-----------|-------|-------|-------|--------------------|----------|-------|
| Organic manure | Microelement |       |       |                    |          |       |
| Control    | 2.14  | 0.101 | 1.31  | 13.38              | 121.42   | 1.55  |
| B at 25 ppm | 2.46  | 0.080 | 1.32  | 15.39              | 138.05   | 3.47  |
| Chicken manure | Zn at 100 ppm | 2.52  | 0.103 | 1.43  | 15.75 | 129.34 | 2.00  |
| Fe at 200 ppm | 2.63  | 0.090 | 1.46  | 16.44              | 140.04   | 2.57  |
| Control    | 2.28  | 0.097 | 1.67  | 14.25              | 101.20   | 1.70  |
| B at 25 ppm | 2.48  | 0.085 | 1.88  | 15.50              | 98.51    | 2.96  |
| Vermicompost | Zn at 100 ppm | 2.62  | 0.089 | 1.88  | 16.38 | 112.58 | 1.05  |
| Fe at 200 ppm | 2.74  | 0.090 | 2.07  | 17.13              | 129.74   | 0.73  |
| Control    | 1.90  | 0.090 | 1.21  | 11.88              | 73.88    | 6.05  |
| B at 25 ppm | 2.01  | 0.086 | 1.37  | 12.56              | 120.65   | 9.76  |
| Compost    | Zn at 100 ppm | 2.12  | 0.083 | 1.34  | 13.25 | 129.96 | 7.32  |
| Fe at 200 ppm | 2.24  | 0.094 | 1.38  | 14.00              | 160.81   | 4.04  |
| LSD 0.05   | 0.22  | 0.007 | 0.15  | 1.42               | 9.90     | 0.49  |

Quantity of chicken manure, vermicompost and compost were about 3.75, 4.44 and 7.50 ton/fad.

Table 5. Effect of organic manure and foliar spray with some microelements on yield and its components and deformed fruits of strawberry during 2017/2018 and 2018/2019 seasons

| Treatment | Average fruit weight (g) | Yield / plant (g) | Early yield (ton/fad.) | Total yield (ton/fad.) | Deformed fruits (%) |
|-----------|--------------------------|-------------------|------------------------|------------------------|---------------------|
|           | 1st season | 2nd season | 1st season | 2nd season | 1st season | 2nd season | 1st season | 2nd season | 1st season | 2nd season |
| Organic manure source | Chicken manure | 20.94 | 21.81 | 302.45 | 300.20 | 4.226 | 4.162 | 14.442 | 14.444 | 5.31 | 6.17 |
| Vermicompost | 22.62 | 22.53 | 323.76 | 318.48 | 4.446 | 4.362 | 15.473 | 15.111 | 3.83 | 4.69 |
| Compost | 17.59 | 16.63 | 211.13 | 190.23 | 2.836 | 2.628 | 9.779 | 8.752 | 4.67 | 5.69 |
| LSD at 0.05 level | 1.07 | 0.73 | 7.52 | 9.81 | 0.392 | 0.425 | 0.654 | 0.981 | 0.40 | 0.11 |

Microelement (ppm)

| Treatment | Control | B at 25 | Zn at 100 | Fe at 200 | LSD at 0.05 level |
|-----------|---------|---------|-----------|-----------|-------------------|
| Organic manure source | 18.19 | 18.26 | 209.75 | 199.81 | 2.929 | 2.847 | 10.025 | 9.591 | 6.33 | 7.42 |
| B at 25 | 19.98 | 19.59 | 268.70 | 240.11 | 3.873 | 3.457 | 12.899 | 11.625 | 3.28 | 3.97 |
| Zn at 100 | 20.59 | 21.09 | 293.27 | 298.13 | 4.084 | 4.047 | 13.933 | 13.922 | 4.17 | 5.08 |
| Fe at 200 | 22.77 | 22.35 | 344.73 | 340.51 | 4.458 | 4.519 | 16.068 | 15.937 | 4.64 | 5.58 |
| LSD at 0.05 level | 0.93 | 0.64 | 6.57 | 8.57 | 0.343 | 0.269 | 0.571 | 0.857 | 0.33 | 0.29 |

Quantity of chicken manure, vermicompost and compost were about 3.75, 4.44 and 7.50 ton/fad.
Fad. = 4200 m2 = 0.42 ha.
such as nitrates, phosphates and exchangeable calcium and soluble potassium (Orozco et al., 1996; Edwards, 1998). Vermicompost have a large particulate surface areas that provide many microsites for microbial activity and for strong retention of nutrients (Shi-wei and Fu-zhen, 1991), vermicompost are rich in microbial population and diversity, particularly fungi, bacteria and actinomycetes (Tomati et al. 1988, and Edwards, 1998). Vermicompost contain plant growth regulators and other plant growth influencing material produced by microorganisms (Grappelli et al., 1987; Tomati et al., 1988) including humates (Atiyeh et al., 2002).

Spraying strawberry plants with B at 25 ppm, Zn at 100 ppm and Fe at 200 ppm increased yield and its components compared to control (spraying with tap water) in both seasons. Foliar spray with Fe at 200 ppm increased average fruit weight, yield/plant, early yield and total yield /fad., followed by foliar spray with Zn at 100 ppm in both seasons (Table 5). Spraying plants with Fe at 0.4% was found the best treatment for yield of strawberry (Ekka et al. 2018).

Iron acts as catalyst in synthesis of chlorophyll molecule and helps the absorption of other elements. It is a key element in various redox reactions of respiration, photosynthesis and reduction of nitrates and sulphates (Wallihan et al. 1958; Zende, 1996).

The interaction between fertilizing with vermicompost at 4.44 ton/fad. and foliar spray with Fe at 200 ppm and the interaction between fertilizing with chicken manure at 3.75 ton/fad., and foliar spray with Fe at 200 ppm increased average fruit weight, yield per plant, early yield and total yield/fad., in both seasons (Table 6).

As for deformed fruits percentage, fertilizing with vermicompost at 4.44 ton/fad. gave the lowest values of deformed fruits (%) compared to chicken manure and compost in both seasons. Spraying with B at 25 ppm, Zn at 100 ppm and Fe at 200 ppm decreased deformed fruits (%) compared to control (spraying with tap water). Boron at 25 ppm recorded minimum values of deformed fruits (%) followed by spraying plants with Zn at 100 ppm. The interaction between fertilizing with vermicompost at 4.44 ton/fad., and spraying with B at 25 ppm gave the lowest values of deformed fruits (%) in both seasons.

Boron has an effect on cell wall structure, cell elongation (pollen tube) and root growth (Barker and Pilbeam, 2006). Zinc reduces pollen tube growth through functioning tryptophan as an auxin precursor biosynthesis (Chaplin and Westwood, 1980).

**Fruit Quality at Harvest**

Fertilizing strawberry plants with vermicompost at 4.44 ton/fad. increased fruit firmness, TSS and Vit C in strawberry fruits, whereas fertilizing with compost at 7.50 ton/fad. increased total acidity in fruits at harvest in both seasons (Table 7). Fertilizing with vermicompost at 7.5 ton/ha. increased firmness, total soluble solids and ascorbic acid content of strawberry (Rajbir et al., 2008).

Foliar spray with B at 25 ppm increased fruit firmness, TSS and Vit. C in fruits, at harvest in both seasons. Sprayed plants with tap water control increased total acidity in fruits (Table 7). Maximum ascorbic acid values were noticed with Fe at 0.04% compared to control (Ekka et al., 2018).

Boron is essential for translocation of sugar, starch, nitrogen, phosphorus, certain hormone, synthesis of amino acids and protein, regulation of carbohydrate metabolism as well as development of phloem.

The interaction between fertilizing with vermicompost at 4.44 ton/fad. and foliar spray with B at 25 ppm increased fruit firmness, TSS and Vit. C in fruits at harvest in both seasons. Fertilizing with compost at 7.50 ton/fad. and spraying with tap water (control) increased total acidity in fruits (Table 8).

**Fe and B Contents in Fruits at Harvest**

The obtained results in Table 9 illustrate that fertilizing with chicken manure at 3.75 ton/fad., increased Fe content in strawberry fruits, whereas fertilizing with compost at 7.50 ton/fad., increased B content in strawberry fruits. Spraying plants with Fe at 200 ppm gave the highest values of Fe in content strawberry fruits, whereas spraying with Zn at 100 ppm increased B content in strawberry fruits (Table 9).
Table 6. Effect of the interaction between organic manure and foliar spray with some microelements on yield and its components and deformed fruits of strawberry during 2017/2018 and 2018/2019 seasons

| Treatment          | Average fruit weight (g) | Yield/plant (g) | Early yield (ton/fad.) | Total yield (ton/fad.) | Deformed fruits (%) |
|--------------------|--------------------------|-----------------|------------------------|------------------------|---------------------|
|                    | 1\(^{st}\) season | 2\(^{nd}\) season | 1\(^{st}\) season | 2\(^{nd}\) season | 1\(^{st}\) season | 2\(^{nd}\) season | 1\(^{st}\) season | 2\(^{nd}\) season | 1\(^{st}\) season | 2\(^{nd}\) season | 1\(^{st}\) season | 2\(^{nd}\) season | 1\(^{st}\) season | 2\(^{nd}\) season |
| Organic manure     |                          |                 |                        |                        |                    |                    |                        |                        |                    |                    |                        |                        |                    |                    |
| Chicken manure     |                          |                 |                        |                        |                    |                    |                        |                        |                    |                    |                        |                        |                    |                    |
| Fe at 200 ppm      | 23.30                   | 24.41           | 378.62                 | 370.23                 | 5.050              | 5.180              | 18.147                 | 17.915                 | 5.17               | 6.00               |                        |                        |                    |                    |
| Control            | 20.38                   | 20.18           | 235.32                 | 220.57                 | 3.334              | 3.180              | 11.436                 | 10.589                 | 5.00               | 5.75               |                        |                        |                    |                    |
| B at 25 ppm        | 21.46                   | 23.09           | 309.21                 | 325.11                 | 4.454              | 4.385              | 14.833                 | 15.600                 | 4.83               | 5.50               |                        |                        |                    |                    |
| Zn at 100 ppm      | 22.13                   | 22.27           | 317.14                 | 295.41                 | 4.571              | 4.356              | 15.222                 | 14.507                 | 2.83               | 3.50               |                        |                        |                    |                    |
| Vermicompost       |                          |                 |                        |                        |                    |                    |                        |                        |                    |                    |                        |                        |                    |                    |
| Fe at 200 ppm      | 24.82                   | 24.29           | 392.14                 | 392.17                 | 5.128              | 5.087              | 18.407                 | 18.937                 | 4.00               | 5.00               |                        |                        |                    |                    |
| Control            | 15.93                   | 15.31           | 170.13                 | 148.52                 | 2.352              | 2.141              | 8.166                  | 7.128                  | 6.25               | 7.50               |                        |                        |                    |                    |
| B at 25 ppm        | 17.07                   | 16.08           | 190.81                 | 149.79                 | 2.750              | 2.151              | 9.159                  | 7.163                  | 3.50               | 4.25               |                        |                        |                    |                    |
| Zn at 100 ppm      | 17.15                   | 16.79           | 220.15                 | 203.49                 | 3.045              | 2.929              | 10.140                 | 9.755                  | 3.50               | 4.50               |                        |                        |                    |                    |
| Compost            |                          |                 |                        |                        |                    |                    |                        |                        |                    |                    |                        |                        |                    |                    |
| Fe at 200 ppm      | 20.21                   | 18.35           | 263.44                 | 259.14                 | 3.198              | 3.291              | 11.650                 | 10.960                 | 4.75               | 5.75               |                        |                        |                    |                    |
| Control            | 15.93                   | 15.31           | 170.13                 | 148.52                 | 2.352              | 2.141              | 8.166                  | 7.128                  | 6.25               | 7.50               |                        |                        |                    |                    |
| B at 25 ppm        | 17.07                   | 16.08           | 190.81                 | 149.79                 | 2.750              | 2.151              | 9.159                  | 7.163                  | 3.50               | 4.25               |                        |                        |                    |                    |
| Zn at 100 ppm      | 17.15                   | 16.79           | 220.15                 | 203.49                 | 3.045              | 2.929              | 10.140                 | 9.755                  | 3.50               | 4.50               |                        |                        |                    |                    |

LSD at 0.05 level: 1.62, 1.10, 11.38, 14.85, 0.594, 0.467, 0.990, 1.485, 0.57, 0.50

Table 7. Effect of organic manure and foliar spray with some microelements on fruit quality of strawberry at harvest during 2017/2018 and 2018/2019 seasons

| Treatment          | Firmness (g/cm²) | TSS (brix°) | Total acidity (mg/100 ml juice) | Vitamin C (mg/100 ml juice) | 1\(^{st}\) season | 2\(^{nd}\) season | 1\(^{st}\) season | 2\(^{nd}\) season | 1\(^{st}\) season | 2\(^{nd}\) season | 1\(^{st}\) season | 2\(^{nd}\) season |
|--------------------|-----------------|-------------|-------------------------------|-----------------------------|------------------|------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                    |                 |             |                               |                             | 1\(^{st}\) season | 2\(^{nd}\) season | 1\(^{st}\) season | 2\(^{nd}\) season | 1\(^{st}\) season | 2\(^{nd}\) season | 1\(^{st}\) season | 2\(^{nd}\) season |
| Organic manure     |                 |             |                               |                             | 1\(^{st}\) season | 2\(^{nd}\) season | 1\(^{st}\) season | 2\(^{nd}\) season | 1\(^{st}\) season | 2\(^{nd}\) season | 1\(^{st}\) season | 2\(^{nd}\) season |
| Chicken manure     |                 |             |                               |                             | 1\(^{st}\) season | 2\(^{nd}\) season | 1\(^{st}\) season | 2\(^{nd}\) season | 1\(^{st}\) season | 2\(^{nd}\) season | 1\(^{st}\) season | 2\(^{nd}\) season |
| Fe at 200 ppm      | 450.1           | 454.7       | 9.59                          | 9.32                        | 0.63             | 0.69             | 39.33           | 40.06           |                  |                 |                 |                 |
| Control            | 473.4           | 501.9       | 9.96                          | 10.00                       | 0.60             | 0.61             | 45.79           | 45.54           |                  |                 |                 |                 |
| Vermicompost       |                 |             |                               |                             | 1\(^{st}\) season | 2\(^{nd}\) season | 1\(^{st}\) season | 2\(^{nd}\) season | 1\(^{st}\) season | 2\(^{nd}\) season | 1\(^{st}\) season | 2\(^{nd}\) season |
| Fe at 200 ppm      | 436.4           | 455.2       | 8.47                          | 8.61                        | 0.75             | 0.78             | 28.67           | 30.04           |                  |                 |                 |                 |
| Compost            |                 |             |                               |                             | 1\(^{st}\) season | 2\(^{nd}\) season | 1\(^{st}\) season | 2\(^{nd}\) season | 1\(^{st}\) season | 2\(^{nd}\) season | 1\(^{st}\) season | 2\(^{nd}\) season |
| LSD at 0.05 level  | 16.36           | 10.14       | 0.52                          | 0.39                        | 0.06             | 0.09             | 1.41            | 2.29            |                  |                 |                 |                 |

LSD at 0.05 level: 14.29, 8.86, 0.45, 0.34, 0.06, 0.08, 1.59, 1.35

Quantity of chicken manure, vermicompost and compost were about 3.75, 4.44 and 7.50 ton/fad.
Table 8. Effect of the interaction between organic manure and foliar spray with some microelements on fruit quality of strawberry at harvest during 2017/2018 and 2018/2019 seasons

| Treatment | Microelement | Firmness (g/cm²) | TSS (brix°) | Total acidity (mg/100 ml juice) | Vitamin C (mg/100 ml juice) |
|-----------|--------------|------------------|-------------|---------------------------------|----------------------------|
|           |              | 1st season       | 2nd season  | 1st season                      | 2nd season                 |
| Organic manure | Microelement | 1st season       | 2nd season  | 1st season                      | 2nd season                 |
| Control   | B at 25 ppm  | 332.6            | 350.0       | 8.00                            | 7.70                       | 0.72                        | 0.79                       | 31.70                       | 32.70                       |
| Chicken manure | Zn at 100 ppm | 467.9            | 472.0       | 9.60                            | 9.20                       | 0.61                        | 0.76                       | 40.44                       | 41.16                       |
|          | Fe at 200 ppm | 480.0            | 480.0       | 9.80                            | 9.80                       | 0.51                        | 0.54                       | 41.64                       | 41.16                       |
| Control   | B at 25 ppm  | 352.0            | 376.0       | 8.80                            | 9.10                       | 0.72                        | 0.69                       | 41.40                       | 43.56                       |
| Vermicompost | Zn at 100 ppm | 469.9            | 479.9       | 9.69                            | 10.01                      | 0.62                        | 0.62                       | 43.96                       | 42.44                       |
|          | Fe at 200 ppm | 487.9            | 531.9       | 10.39                           | 10.03                      | 0.57                        | 0.57                       | 47.40                       | 46.60                       |
| Control   | B at 25 ppm  | 343.9            | 359.9       | 7.14                            | 7.25                       | 0.96                        | 0.92                       | 27.16                       | 28.84                       |
| Compost   | Zn at 100 ppm | 439.9            | 449.3       | 8.64                            | 8.97                       | 0.74                        | 0.81                       | 28.19                       | 29.42                       |
|          | Fe at 200 ppm | 477.9            | 491.8       | 8.92                            | 8.77                       | 0.56                        | 0.72                       | 27.18                       | 28.49                       |
| LSD at 0.05 level |            | 24.76            | 15.35       | 0.79                            | 0.59                       | 0.09                        | 0.14                       | 2.75                        | 2.34                       |

Quantity of chicken manure, vermicompost and compost were about 3.75, 4.44 and 7.50 ton/fad.

Table 9. Effect of organic manure and foliar spray with some microelements on iron and boron contents of strawberry fruits at harvest during 2018/2019 season

| Treatment | Fe (ppm) | B (ppm) |
|-----------|----------|---------|
| Organic manure source |          |         |
| Chicken manure | 132.21   | 2.39    |
| Vermicompost   | 110.51   | 1.61    |
| Compost        | 121.33   | 6.79    |
| LSD at 0.05 level | 6.54     | 0.32    |
| Microelement (ppm) |          |         |
| Control         | 98.83    | 3.10    |
| B at 25         | 119.07   | 3.45    |
| Zn at 100       | 123.96   | 5.39    |
| Fe at 200       | 143.53   | 2.44    |
| LSD 0.05        | 5.71     | 0.28    |

Quantity of chicken manure, vermicompost and compost were about 3.75, 4.44 and 7.50 ton/fad.
The interaction between fertilizing with compost at 7.50 ton/fad., and foliar spray with Fe at 200 ppm increased Fe content in strawberry fruits, whereas the interaction between fertilizing with compost at 7.50 ton/fad., and foliar spray with B at 25 ppm increased B content in strawberry fruits (Table 10).

Storability

**Fruit weight loss (%) and Decay (%)**

Fruit weight loss (%) and decay (%) increased with increasing cold storage periods. Fertilizing with vermicompost at 4.44 ton/fad., gave the lowest value for each of fruit weight loss (%) and decay (%), whereas fertilizing with compost at 7.5 ton/fad., gave the highest value for each of weight loss (%) and decay (%) during cold storage periods in both seasons (Tables 11 and 12).

Spraying strawberry plants with B at 25 ppm, Zn at 100 ppm and Fe at 200 ppm recorded the minimum value for each of fruit weight loss (%) and decay (%) compared to control (spraying with tap water). Spraying with Zn at 100 ppm and Fe at 200 ppm decreased weight loss (%) and decay (%) in fruits during cold storage periods (Tables 11 and 12).

The interaction between fertilizing with vermicompost at 4.44 ton/fad., and foliar spray with Zn at 100 ppm decreased weight loss (%) and decay (%) in fruits during cold storage periods, followed by the interaction between fertilizing with vermicompost at 4.44 ton/fad., and foliar spray with Fe at 200 ppm (Tables 13 and 14).

### Table 10. Effect of the interaction between organic manure and foliar spray with some microelements on iron and boron contents of strawberry fruits at harvest during 2018/2019 season

| Treatment          | Fe (ppm) | B (ppm) |
|--------------------|----------|---------|
| **Organic manure** |          |         |
| Control            | 121.42   | 1.55    |
| B at 25 ppm        | 138.05   | 3.47    |
| Chicken manure     |          |         |
| Zn at 100 ppm      | 129.34   | 2.00    |
| Fe at 200 ppm      | 140.04   | 2.57    |
| Control            | 101.20   | 1.70    |
| B at 25 ppm        | 98.51    | 2.96    |
| Vermicompost       |          |         |
| Zn at 100 ppm      | 112.58   | 1.05    |
| Fe at 200 ppm      | 129.74   | 0.73    |
| Control            | 73.88    | 6.05    |
| B at 25 ppm        | 120.65   | 9.76    |
| Compost            |          |         |
| Zn at 100 ppm      | 129.96   | 7.32    |
| Fe at 200 ppm      | 160.81   | 4.04    |
| **LSD 0.05**       | **9.90** | **0.49** |

Quantity of chicken manure, vermicompost and compost were about 3.75, 4.44 and 7.50 ton/fad.
Table 11. Effect of the interaction between organic manure and foliar spray with some microelements on fruit weight loss (%) of strawberry during storage period during 2017/2018 and 2018/2019 seasons

| Treatment | Weigh loss (%) | Storage periods (day) | 5 days | 10 days | 15 days |
|-----------|----------------|-----------------------|--------|---------|--------|
|           |                |                       | 1st season | 2nd season | 1st season | 2nd season | 1st season | 2nd season |
| Organic manure source |                |                         |        |         |        |        |        |         |
| Chicken manure |                |                         | 1.26 | 1.28 | 1.89 | 1.85 | 3.13 | 3.21 |
| Vermicompost |                |                         | 0.99 | 0.95 | 1.40 | 1.22 | 2.20 | 2.33 |
| Compost |                |                         | 1.56 | 1.59 | 2.48 | 2.44 | 3.51 | 3.60 |
| LSD at 0.05 level |                |                         | 0.16 | 0.24 | 0.17 | 0.25 | 0.32 | 0.42 |

| Microelement (ppm) |                |                         |        |         |        |        |        |         |
| Control |                |                         | 1.59 | 1.62 | 2.61 | 2.42 | 3.84 | 3.98 |
| B at 25 |                |                         | 1.35 | 1.34 | 2.06 | 1.97 | 3.13 | 3.22 |
| Zn at 100 |                |                         | 1.03 | 1.06 | 1.44 | 1.46 | 2.34 | 2.35 |
| Fe at 200 |                |                         | 1.11 | 1.08 | 1.57 | 1.50 | 2.48 | 2.65 |
| LSD at 0.05 level |                |                         | 0.14 | 0.21 | 0.15 | 0.22 | 0.28 | 0.37 |

Quantity of chicken manure, vermicompost and compost were about 3.75, 4.44 and 7.50 ton/fad.

Table 12. Effect of the interaction between organic manure and foliar spray with some microelements on fruit weight loss (%) of strawberry during storage periods in 2017/2018 and 2018/2019 seasons

| Treatment | Weigh loss (%) | Storage periods (day) | 5 | 10 | 15 |
|-----------|----------------|-----------------------|---|----|----|
|           |                |                       | 1st season | 2nd season | 1st season | 2nd season | 1st season | 2nd season |
| Organic manure | Microelement |                         |        |         |        |        |        |         |
| Control |                |                         | 1.49 | 1.74 | 2.62 | 2.78 | 3.97 | 4.10 |
| B at 25 ppm |                |                         | 1.32 | 1.32 | 1.98 | 1.87 | 3.14 | 3.30 |
| Chicken manure | Zn at 100 ppm |                         | 1.19 | 1.11 | 1.53 | 1.57 | 2.50 | 2.51 |
| Fe at 200 ppm |                |                         | 1.06 | 0.96 | 1.45 | 1.18 | 2.93 | 2.96 |
| Control |                |                         | 1.30 | 1.21 | 1.97 | 1.72 | 2.78 | 3.19 |
| B at 25 ppm |                |                         | 1.13 | 1.00 | 1.44 | 1.17 | 2.51 | 2.40 |
| Vermicompost | Zn at 100 ppm |                         | 0.53 | 0.67 | 0.88 | 0.85 | 1.72 | 1.64 |
| Fe at 200 ppm |                |                         | 1.02 | 0.94 | 1.31 | 1.15 | 1.79 | 2.12 |
| Control |                |                         | 1.98 | 1.92 | 3.26 | 2.77 | 4.78 | 4.65 |
| B at 25 ppm |                |                         | 1.62 | 1.72 | 2.78 | 2.87 | 3.74 | 3.98 |
| Compost | Zn at 100 ppm |                         | 1.39 | 1.41 | 1.93 | 1.97 | 2.80 | 2.91 |
| Fe at 200 ppm |                |                         | 1.26 | 1.34 | 1.95 | 2.18 | 2.73 | 2.88 |
| LSD at 0.05 level |                |                         | 0.24 | 0.37 | 0.26 | 0.39 | 0.49 | 0.64 |

Quantity of chicken manure, vermicompost and compost were about 3.75, 4.44 and 7.50 ton/fad.
Table 13. Effect of organic manure and foliar spray with some microelements on decay (%) of strawberry fruits during storage periods in 2017/2018 and 2018/2019 seasons

| Treatment                  | Decay (%) | Storage periods (day) |          |          |          |          |          |          |          |          |          |
|----------------------------|-----------|-----------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                            |           |                       | 5        | 10       | 15       | 1st season| 2nd season| 1st season| 2nd season| 1st season| 2nd season|
| Organic manure source      |           |                       |          |          |          |          |          |          |          |          |          |
| Chicken manure             | 9.30      | 9.28                  | 14.42    | 13.82    | 22.80    | 22.79     |           |           |           |           |           |
| Vermicompost               | 7.96      | 7.64                  | 11.20    | 9.78     | 17.60    | 18.70     |           |           |           |           |           |
| Compost                    | 12.50     | 12.78                 | 19.84    | 19.91    | 28.10    | 28.84     |           |           |           |           |           |
| LSD at 0.05 level          | 0.68      | 2.35                  | 2.65     | 1.93     | 1.67     | 2.07      |           |           |           |           |           |
| Microelement (ppm)         |           |                       |          |          |          |          |          |          |          |          |          |
| Control                    | 11.63     | 11.68                 | 19.94    | 18.52    | 27.71    | 31.37     |           |           |           |           |           |
| B at 25 ppm                | 10.85     | 10.77                 | 16.53    | 15.76    | 25.04    | 22.34     |           |           |           |           |           |
| Zn at 100 ppm              | 8.29      | 8.50                  | 11.57    | 11.70    | 18.72    | 18.82     |           |           |           |           |           |
| Fe at 200 ppm              | 8.90      | 8.64                  | 12.56    | 12.02    | 19.86    | 21.22     |           |           |           |           |           |
| LSD at 0.05 level          | 0.82      | 1.73                  | 1.98     | 2.08     | 0.91     | 2.11      |           |           |           |           |           |

Table 14. Effect of the interaction between organic manure and foliar spray with some microelements on decay (%) of strawberry fruits during storage periods in 2017/2018 and 2018/2019 seasons

| Treatment                  | Decay (%) | Storage periods (day) |          |          |          |          |          |          |          |          |          |
|----------------------------|-----------|-----------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                            |           |                       | 5        | 10       | 15       | 1st season| 2nd season| 1st season| 2nd season| 1st season| 2nd season|
| Organic manure Microelement|           |                       |          |          |          |          |          |          |          |          |          |
| Control                    | 8.66      | 10.00                 | 18.00    | 18.33    | 22.66    | 31.40     |           |           |           |           |           |
| B at 25 ppm                | 10.56     | 10.56                 | 15.84    | 14.96    | 25.12    | 16.00     |           |           |           |           |           |
| Zn at 100 ppm              | 9.52      | 8.88                  | 12.24    | 12.56    | 20.00    | 20.08     |           |           |           |           |           |
| Fe at 200 ppm              | 8.48      | 7.68                  | 11.60    | 9.44     | 23.44    | 23.68     |           |           |           |           |           |
| Control                    | 10.40     | 9.68                  | 15.76    | 13.76    | 22.24    | 25.52     |           |           |           |           |           |
| B at 25 ppm                | 9.04      | 8.00                  | 11.52    | 9.36     | 20.08    | 19.20     |           |           |           |           |           |
| Vermicompost Zn at 100 ppm | 4.24      | 5.36                  | 7.04     | 6.80     | 13.76    | 13.12     |           |           |           |           |           |
| Fe at 200 ppm              | 8.16      | 7.52                  | 10.48    | 9.20     | 14.32    | 16.96     |           |           |           |           |           |
| Control                    | 15.84     | 15.36                 | 26.08    | 23.49    | 38.24    | 37.20     |           |           |           |           |           |
| B at 25 ppm                | 12.96     | 13.76                 | 22.24    | 22.96    | 29.92    | 31.84     |           |           |           |           |           |
| Compost Zn at 100 ppm      | 11.12     | 11.28                 | 15.44    | 15.76    | 22.40    | 23.28     |           |           |           |           |           |
| Fe at 200 ppm              | 10.08     | 10.72                 | 15.60    | 17.44    | 21.84    | 23.04     |           |           |           |           |           |
| LSD at 0.05 level          | 1.42      | 3.01                  | 3.43     | 3.61     | 1.59     | 3.66      |           |           |           |           |           |
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تأثير مصدر السماد العضوي والرش الورقي بعض العناصر الصغرى على النمو وميزة المحصول ونوعية التثمار والقدرة التخزينية للقرونة تحت ظروف الأراضي الرملية

مثال عبدالمجيد مندور - إبناس عبده بريسى أحمد

1- المعمل المركزي للزراعة العضوية - مركز البحوث الزراعية - الدقي - الجيزة - مصر
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أجريت تجربة حقلية خلال موسمين متتاليين لأعوام 2018/2019 و2017/2018 في مزرعة التجارب

بمحتوى بحث البساتين بالقليوبية، محافظة الإسماعيلية، مصر لدراسة تأثير مصادر الأملاح العضوية (سماد الدجاج

بمعدل 3.75 طن/قد، والفريومكسيست بـ 4.44 طن/قد، والكمبوناست بمعدل 7.5 طن/قد) والتي تعادل 120

كيلو جرام نتاجين للقرون والرش الورقي لبعض العناصر الصغرى (البيرونج 25 جزء في المليون والزنك

بتركيز 100 جزء في المليون) على النمو والمحصول وجودة التثمار والقدرة التخزينية للقرونة تحت ظروف الأراضي الرملية. أدى تسميد نباتات القرونة بالفيرومكسيست بمعدل 4.44 طن/قدان إلى

زيادة الوزن الجاف للمجموم الخضري، متوسط وزن الثمار، محصول النبات، المحصول الكلي للقرون،

صلابة الثمار، نسبة المواد الصلبة الذائبة الكلية، فيتامين ج في الثمار وعفن قيماً أقل من نسبة للثمار المشوهة ونسبة الفقد

في الوزن وعفن الثمار خلال فترة التخزين المبرد، أدى رش نباتات القرونة بتركيز 200 جزء في المليون إلى

زيادة الوزن الجاف للمجموم الخضري، متوسط وزن الثمار، محصول النبات، المحصول الكلي للقرون.

أدى الرش بالبيرونج بتركيز 25 جزء في المليون إلى زيادة صلابة الثمار، نسبة المواد الصلبة الذائبة الكلية وفيتامين ج

بينما أدى الرش بالزنك بتركيز 100 جزء في المليون إلى انخفاض نسبة التثمار، نسبة الفقد في الوزن وعفن الثمار

خلال فترة التخزين المبرد، أدى التفاعل بين التسميد بالفيرومكسيست بمعدل 4.44 طن/قدان والرش بالزنك

بتركيز 200 جزء في المليون، فدان إلى زيادة الوزن الجاف للمجموم الخضري، متوسط وزن الثمار، محصول النبات، المحصول

الكلي للقرون، بينما أعطى التفاعل بين التسميد بالفيرومكسيست بمعدل 4.44 طن/قدان والرش بالزنك

بتركيز 100 جزء في المليون، فدان أقل نسبة في الفقد في الوزن وعفن الثمار خلال فترة التخزين المبرد، أدى التفاعل بين

التمديد الفيرومكسيست بمعدل 4.44 طن/قدان والرش بالبيرونج بتركيز 25 جزء في المليون إلى زيادة صلابة الثمار,

نسبة المواد الصلبة الذائبة الكلية وفيتامين ج وعفن قيماً أقل من نسبة تام مشوهة.

المحكومون:
1- أ.د. محمد إمام رجب
2- أ.د. داليا أحمد سامي نور