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# Impact of Maize Silks Extract, its Application Methods and Their Interaction on Growth and Yield of Tomato Plant *Lycopersicon esculentum* Mill. Cv. Wijdan.

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***Abstract:*** *The current study was conducted during the growing season (2014 – 2015), at a private orchard at Safwan area in Basra province-Iraq; to study the effect of several concentrations of maize silks, their application methods and their interaction on some indicators of growth and yield of tomato plants cv. Wijdan. The experiment was factorial and included (24) factorial treatments (4*2*3) resulted from: four levels of maize silks and two application methods, each in three replicates. The results showed a superiority of (60 ml. L.-1) of maize silks extract on most studied characteristics, which was non-significantly differed from the concentration (40 ml. L.-1). For the methods of application, the applying to soil method was superior with most characteristics. Concerning the interaction, the treatment (60 ml. L.-1 maize extract level + applying to soil method) was superior in its effect on most characteristics of tomato plant cv. Wijdan.*

***Keywords:*** *stigmata maydis, Zea mays ( L.), Tomato, chlorophyll, productivity.*

## I. Introduction

Tomato *Lycopersicon esculentum* (Mill.) is a member in the family *Solanaceae* and one of important fruitful vegetables around the world including Iraq for their high nutritional and economic value, where tomatoes are rich sources of vitamins, different minerals and calories [1].In addition, their fruits contain many antioxidants (e.g. Lycopene), which eliminate the free radicals, the cause behind cancer diseases, then decrease the probability of infection with it [2]. Many methods have used to elevate the productivity of tomato, either pre-harvesting by using some of agricultural procedures such as determining the types (organic or chemical) and quantity of fertilizers, using some plant extracts or developing new cultivars, or post- harvesting by the manufacturing operations during storing or canning ( [3], [4]). Some studies confirmed that the use of plant extracts, including maize silks extract or so called maize silks (hairs) or stigmata maydis of maize plant *Zea mays* ( L.), had a good encouraging effect on vegetative and flowering growth of many horticultural plants; this might be due to the plant content of naturally chemical compounds, which different in quantity and quality depending on the species, plant part, growth stage and environmental conditions the plant lives in [5]. And because of the negative effects of these industrial chemicals on man, environment and living beings live in, besides to environmental pollution, there was a new trend to find alternatives of natural compounds that may cause the same effect of those industrial compounds [6]. Then these extracts started to be applicable on the plants for their content of nutrients or secondary products which may be used as initiators of many compounds like plant hormones and antibiotics, so in this field, many plant extracts including the maize silks extract have used [7]. Also, some studies have shown that the use of some plant extracts like maize silks had a similar effect to that of growth regulators to enhance vegetative and flowering features of different plants ( [8], [9], [10]). And the effect of maize silks extract on plant growth was a Gibberellin- like [9], also it contains many active compounds such as: proteins, organic acids, maizeric acid, maysin, flavonoids, phenols, alkaloids, resins as well as different nutrients.Besides to some fungal antibiotics [11]. So, and due to lack and rarity of studies on how effect were the concentrations of maize silks extracts, their application methods and their interaction on some qualitative and quantitative features of growth and yield of tomato plants cv. Wijdan this study has conducted.

## II. Material And Methods

**Location of Experiment**

This study has conducted during the growing season (2014 – 2015), at a private orchard at Safwan area in Basra province, inside a greenhouse of (450 $m.^2$) area and of (9 m. * 50 m.) dimensions. Meanwhile ten soil samples been taken (on 15/8/2014) from different places and deeps (0-30 cm) form the greenhouse, mixed together homogenously, exposed to sun for 72 hrs., grinded and sifted through a sieve (of 2 mm., hole diameters), then one random soli sample been taken from this mixture to be analyzed for some of its physical and chemical characteristics in laboratories of college of agriculture, university of Basra, and below the table (1) which shows the results of this analysis.

**Table (1):** Some physical and chemical characteristics of the greenhouse soil before planting.*

| Characteristics | | Units of measurement | Values for growing season(2014) | |
|---|---|---|---|---|
| Soil Texture | Sand | g. kg.$^{-1}$ | 213 | Loamy sand soil |
| | Silt | g. kg$^{-}$ | 341 | |
| | Clay | g. kg.$^{-1}$ | 446 | |
| Potential of Hydrogen | | pH | 7.9 | |
| Electrical Conductivity (E.C.) | | Ds. M.$^{-1}$ | 4.67 | |
| Calcium $Ca^{+2}$ | | mmole. L.$^{-1}$ | 20.87 | |
| Sodium $Na^{+}$ | | mmole. L.$^{-1}$ | 11.49 | |
| Potassium $K^{+}$ | | mmole. L.$^{-1}$ | 0.61 | |
| Magnesium $Mg^{+2}$ | | mmole. L.$^{-1}$ | 15.77 | |
| Chloride $Cl^{-}$ | | mmole. L.$^{-1}$ | 21.14 | |
| $HCO_3^{-}$ | | mmole. L.$^{-1}$ | 2.5 | |
| $SO4^{-2}$ | | mmole. L.$^{-1}$ | 19.33 | |
| Available Fe | | mg. L.$^{-1}$ | 0.36 | |
| Organic Matter (O.M.) | | g. kg.$^{-1}$ | 8.7 | |

*The soil samples were analyzed in the laboratories of College of Agriculture/ University of Basra.

**Preparation of The Aqueous Extract of Maize Silks**

The maize silks (hairs) (see table 2 and 3, some of their compounds and nutrients have illustrated) brought from the native market, washed with tap water several times, boiled one time in distilled water, cooled for (12) hrs., centrifuged under 3000 rpm for (30) min., then the extract has filtered through a Whatman No.1 filter paper in a funnel, and the filtrate has kept under (-18 ◦ C) as a (100 % ) crude extract for the next use to prepare the rest of concentrations of maize silks extract in the experiment, this procedure was according to [12].These maize extract concentrations were as follow (see table 4):

1- Conc.1: control group, distilled water only, (0 ml. L.$^{-1}$)
2- Conc.2: (20 ml. L.$^{-1}$).
3- Conc.3: (40 ml. L.$^{-1}$).
4- Conc.4: (60 ml. L.$^{-1}$).

These concentrations have applied to the plants by two methods, which were:

1- Applying to soil method.
2- Spraying the foliage (foliar spraying) method.

The applications done (for both methods) on two dates as follow:

1- First application date was on 10/11/2014.
2- Second application date was on 25/11/2014.

**Table (2):** The content of maize silks extract of chemical compounds (%)*

| Compounds | Concentrations (%) |
|---|---|
| Water content | 71.38 |
| Protein | 13.00 |
| Flavonoids | 3.24 |
| Total organic acids | 2.78 |
| Maizeric acid | 2.00 |
| Ash | 7.60 |

* The extract been analyzed in laboratories of college of agriculture/ university of Basra.

**Table (3):** The content of maize silks extract of nutrients (mg. kg. $^{-1}$).**

| Nutrients | Concentrations (mg. kg. $^{-1}$) |
|---|---|
| Potassium | 6000.00 |
| Calcium | 546.00 |
| Magnesium | 409.00 |
| Ferrate | 12.10 |
| Copper | 4.70 |
| Zinc | 64.00 |
| Manganese | 9.70 |
| Sodium | 246.30 |

** The extract was analyzed in laboratories of College of Agriculture/ University of Basra.

**Table (4):** The concentrations of maize silks extract used in this study and their content of dry matter.

| Concentrations | Dry matter content (g.) |
|---|---|
| Crude extract (100 %) | 1.22 |
| Conc. (20 ml. $L.^{-1}$) | 0.28 |
| Conc. (40 ml. $L.^{-1}$) | 0.36 |
| Conc. (60 ml. $L.^{-1}$) | 0.40 |

**Preparation of The Soil of Greenhouse**

The soil has tilled twice (orthogonally) in a depth of (30-40 cm) during which an organic decomposed fertilizer (remnants of sheep) has added (4 $m^3$. $Dunam^{-1}$), as well as the addition of phosphorus as Tri-super phosphate (45 % $P_2O_5$) ( 10 kg. $dunam^{-1}$). Then the soil has dismantled, softened, settled and treated with the fungicide Benlet (1 ml. of fungicide per 1 L. of water).

**Cultivation of The Greenhouse**

The seeds of hybrid cultivar of tomato, Wijdan, which produced by the Mexican Seminis vegetable seeds Co., have directly planted at the greenhouse, on 2/9/ 2014, inside rows at a distance of 50 cm between each two plants, and of 75 cm between each two terraces. Three seeds been put inside each planting hole, minimized into one plant after the emersion of first true leaf [13]. The irrigation method was by dropping (it is the followed method at this area- Safwan), and all agricultural procedures (Hoeing, weeding, combat, … etc.) have done as recommended and depending on the needs of plants [14].

**Studied Characteristics**

**1. Plant Height (cm)**

Measured by Metal measuring tape, from the soil surface up toward the top of the plant..

**2. Total Number of Leaves. $Plant^{-1}$**

Accounted per each plant of the five randomly chosen plants from each factorial treatment.

**3. Leaf Area ($cm^2$)**

The leaf area calculated in terms of weight as mentioned in [15], by applying this equation:

$$\text{Leaf area } (cm^2) = \frac{\text{Area of 30 discs} \times \text{total dry weight of plant leaves (g.)}}{\text{Dry weight of 30 discs (g.)}}$$

**4. Total Chlorophyll Content (mg. 100 $g.^{-1}$ dry weight)**

Five random samples of leaves have taken from each experimental unit, where the fifth leaf has chosen from the apical tip [16], of each plant , then this fifth leaf has washed perfectly with water, later 5 grams of the leaf tissue, cut into pieces to facilitate the process of extracting, then 10 ml. of (85 % ) Acetone have added onto each sample and the tissue crushed well inside a ceramic mortar, then the dye solution filtered through a (Whatman No.1 ) filter paper. This process has repeated another time with another 10 ml. of Acetone to extract the rest of dye till the tissue became white, thereafter the total volume of filtrate completed with Acetone to 100 ml. [17]. Later the Spectrophotometer used, to measure the light absorbance (Optical Density) at two wavelengths (645 and 663 nm), at post-graduate lab. at college of agriculture, university of Kufa, where the quantity of total chlorophyll have measured after the emergence of 10 and 15 true leaves at the apex, for both seasons of study, by applying the following equation:

$$\text{Total Chlorophyll} = 20.2 \times D645 + 8.02 \times D\,663 (V/W \times 1000)$$

Where: D= Optical Density reading.

V= Volume of total extract (ml.).

W= Weight of leaf tissue (g.).

**5. Total Soluble Carbohydrates Quantity (mg. $g.^{-1}$ dry weight)**

Estimated in tomato leaves according to [18] method which called Modified phenol – Sulphuric acid Colorimetric method.

**6. Number of Inflorescences Per Plant**

Inflorescences have accounted per each plant of the five chosen plants from each experimental unit, where the averages have taken.

**7. Number of Fruits Per Plant**

Calculated from dividing the total number of fruits of each experimental unit on the number of its plants.

**8. Weight of Fruit (g.)**
Calculated from dividing the total yield of each experimental unit plants on the number of its fruits.
**9. Each Plant Yield (kg. plant$^{-1}$)**
Calculated from dividing the total yield of each experimental unit plants on the number of its plants at the end of season.

**Designation and Analysis of The Experiment**

Data of the experiment have analyzed according to Randomized completely block design ( R.C.B.D.) as a factorial experiment with two factors in 24 (4*2*3) factorial treatments resulted from: 4 concentrations of the first factor, maize silks extract (0, 20, 40 and 60 ml. L.-$^{1}$); the second factor, the application methods of the extract to the plants were 2 methods (applying to soil and foliar spraying ) and 3 replicates for each experimental unit. To analyze the results, the SPSS statistical program has used. To compare among the averages of treatments, the Revised Least Significant Difference (R.L.S.D.) has used, under a probability level of (0.05), as mentioned in [19].

## III. Results And Discussion

**Effect of Maize Silks Extract, Their Application Methods and Their Interaction on The Average of Main Plant Height (Cm)**

Data in table (5) show significant differences among the treatments concerning plant height. It's obvious that the treatment (60 ml. L.$^{-1}$) of maize silks extract was superior (168.78 cm) over all treatments, while the control treatment (0 ml. L.$^{-1}$) gave the least height (131.67 cm). This result May be due to the basic role of growth regulator-like compounds found in maize silks extract, in increasing the Activity of treated plants, then reflect in side effects on growth indicators like vegetative and flowering traits of these plants; this result is in accordance with ( [8], [9], [10]). As well as, the content of this extract of minerals and nutrients and its Gibberellin-like action, may cause an increment in vegetative and flowering growth of treated plants [9].
For the singular effect of application methods, the data show that the applying to soil method was significantly superior (160.71 cm) over the spraying one (147.17cm).

Concerning the interaction, the table points to a significant superiority of the maize silks extract concentration (60 ml. L.$^{-1}$) which applied to plants by applying to soil method (178.88 cm plant height), on the other hand the control treatment (0 ml. L.$^{-1}$ of maize silks extract) applied to the plants by spraying the foliage method, gave the least plant height (131.67 cm), whilst the rest of treatments varied among them in this characteristic.

**Table 5.** Effect of maize silks extract, their application methods and their interaction on the average of main plant height (cm).

| Conc. Of maize silks extract (ml. L.$^{-1}$) | Application methods | | Average of Conc. Of maize silks extract (ml. L.$^{-1}$) |
|---|---|---|---|
| | Foliar spraying | Applying to soil | |
| 0 | 131.67 | 131.67 | 131.67 |
| 20 | 143.14 | 166.11 | 154.63 |
| 40 | 151.21 | 166.17 | 158.69 |
| 60 | 158,67 | 178.88 | 168.78 |
| Average of application methods | 147.17 | 160,71 | |
| RLSD ( 0.05) of conc. Of extract = 11.14 | RLSD( 0.05 ) of application methods = 7.06 | | RLSD( 0.05) of interaction = 21.02 |

**Effect of Maize Silks Extract, Their Application Methods and Their Interaction on The Average of Total Leaf Number Per Plant**

Indications from table (6) have confirmed the treatment (60 ml. L.$^{-1}$) of maize silks extract to be significantly superior (31.38 leaf/ plant ) over all other treatments, but wasn't differ from (40 ml. L.$^{-1}$) (27.98 leaf/ plant), while the least leaf no. found at control plants (23.00 leaf/ plant ). This increment in leaf no. may be due to the role of extract components from vitamins (B1, B2, B3, C, E, Folic acid..) [20]. Also, the reason for this increase might be due to a combination of nutrients found in maize silks extract and the role of these elements in biological processes in plants, especially in photosynthesis , where nitrogen works on stimulating the vegetative growth for its role in the structure of chlorophyll and in activating the enzymes and its participation in the structure of amino acids needed to build proteins that help in increasing the number of plant tissues, plant growth, increase the photosynthesis products and the synthesis of sugars which help in cell division and growth, and thus increasing the plant height and leaf number [16]. Also nitrogen participates in the construction of some plant hormones like auxins and gibberellins which promote cell division and cell elongation and in the building cytokinins that increase the meristimatic apex activity, cell division and elongation [21] and this will reflect on plant growth [22].

Regarding the application methods, there wasn't any significant differences between the two methods of application concerning the total leaf number per plant. For the effect of interaction, data show a significant superiority of the treatment (60 ml. $L.^{-1}$ of maize silks extract) applied to the plants by applying to soil method (35.56 leaf per plant) this value was the highest, comparing with the least value in control plants (0 ml. $L.^{-1}$ of maize silks extract ) applied to the plants by the foliar spraying method (23.00 leaf per plant), the rest of treatments were varied among them in this characteristic.

**Table 6.** Effect of maize silks extract, their application methods and their interaction on the average of total leaf number per plant.

| Conc. Of maize silks extract (ml. $L.^{-1}$) | Application methods | | Average of Conc. Of maize silks extract (ml. $L.^{-1}$) |
|---|---|---|---|
| | Foliar spraying | Applying to soil | |
| 0 | 23.00 | 23.00 | 23.00 |
| 20 | 25.16 | 28.11 | 26.64 |
| 40 | 25.88 | 30.07 | 27.98 |
| 60 | 27.19 | 35.56 | 31.38 |
| Average of application methods | 25.31 | 29.19 | |
| RLSD ( 0.05) of conc. Of extract = 4.14 | RLSD( 0.05 ) of application methods = N.S. | | RLSD( 0.05) of Interaction = 6.62 |

**Effect of Maize Silks Extract, Their Application Methods and Their Interaction on Leaf Area ($Cm^2$)**

Data in table (7) reveal that the maize silks extract conc. (40 ml. $L.^{-1}$) was significantly superior (202.49 $cm^2$), while the control treatment (0 ml. $L.^{-1}$ ) resulted the least leaf area (156.60 $cm^2$). Perhaps the reason behind this increment in leaf area is the role of growth regulator-like compounds found in maize silks extract, that have a basic role in increasing the treated plants activity. Also, the role of active substances of this extract may cause positive effects on growth indicators in plants. This result is in accordance with that of other researchers, where it was confirmed that the use of some plant extracts such as maize silks extract has a growth regulators-like effect in improving the vegetative and flowering features of different plants ( [8], [9], [10]), besides to its importance in increasing the vegetative and flowering growth of plants due to its content of wide group of elements and nutrients, also its action is Gibberellin-like [9].

For the effect of application methods of extract to tomato plants, no significant differences were noted between both methods concerning this characteristic.

The effect of interaction among the levels of maize extract and the two methods on tomato leaf area, it was noted that the treatment (40 ml. $L.^{-1}$ maize extract which applied to soil) was significantly superior (207.31 $cm^2$) comparing with other treatments, in the other hand, the least area resulted by both treatments of control group (0 ml. $L.^{-1}$ maize extract which foliar sprayed and 0 ml. $L.^{-1}$ maize extract which applied to soil) ( both were of 156.60 $cm^2$), whilst a variation in effect were noted for rest of treatments concerning leaf area.

**Table 7.** Effect of maize silks extract, their application methods and their interaction on leaf area ($cm^2$).

| Conc. Of maize silks extract (ml. $L.^{-1}$) | Application methods | | Average of Conc. Of maize silks extract (ml. $L.^{-1}$) |
|---|---|---|---|
| | Foliar spraying | Applying to soil | |
| 0 | 156.60 | 156.60 | 156.60 |
| 20 | 199.13 | 189.55 | 194.34 |
| 40 | 197.67 | 207.31 | 202.49 |
| 60 | 195.35 | 193.14 | 194.25 |
| Average of application methods | 187.19 | 186.65 | |
| RLSD ( 0.05) of conc. Of extract = 22.1 | RLSD( 0.05 ) of application method = N.S. | | RLSD( 0.05) of interaction = 37.67 |

**Effect of Maize Silks Extract, Their Application Methods and Their Interaction on The Average of Quantity of Total Chlorophyll in Tomato Leaves (Mg. 100 $G.^{-1}$ Fresh Weight)**

At a glance to table (8), it's obviously noted that the maize extract conc. (60 ml. $L.^{-1}$) was significantly superior (96.19 mg. 100 $g.^{-1}$ fresh weight), which didn't differ from the conc. of extract (40 ml. $L.^{-1}$) of (95.87 mg. 100 $g^{-1}$ fresh weight) comparing with the control plants that gave the least value (67.97 mg. 100 $g^{-1}$ fresh weight). This increment in chlorophyll might be a reflect of the role of maize silks extract and its content of growth regulator-like substances which take part as a main player in increasing the activity of treated plants, besides to the role of active substrates or components which known as a cause of the positive effects on plant growth indicators. This result is in accordance with [9]. For the effect of application methods of extract to tomato plants, no significant differences were noted between both methods concerning this characteristic Concerning the interaction, the data indicate to a significant superiority of the treatment (40 ml. $L.^{-1}$ maize extract applied to the soil) of (99.37 mg. 100 $g^{-1}$ fresh weight) which wasn't differ from the treatments (60 ml.

$L.^{-1}$ maize extract applied to the soil) of ( 98.71 mg. 100 $g^{-1}$ fresh weight) and (40 and 60 ml. $L.^{-1}$ maize extract foliar sprayed) of (92.36 and 93.67 mg. 100 $g^{-1}$ fresh weight respectively). Also the(0 ml. $L^{-1}$ maize extract applied by both methods) gave the least quantity of chlorophyll (67.97 mg. 100 $g^{-1}$ fresh weight). Other treatments of interaction were varied in values.

**Table 8.** Effect of maize silks extract, their application methods and their interaction on the average of quantity of total chlorophyll in tomato leaves (mg. 100 $g.^{-1}$ fresh weight)

| Conc. Of maize silks extract (ml. $L.^{-1}$) | Application methods | | Average of Conc. Of maize silks extract (ml. $L.^{-1}$) |
|---|---|---|---|
| | Foliar spraying | Applying to soil | |
| 0 | 67.97 | 67.97 | 67.97 |
| 20 | 88.14 | 76.98 | 82.56 |
| 40 | 92.36 | 99.37 | 95.87 |
| 60 | 93.67 | 98.71 | 96.19 |
| Average of application methods | 85.54 | 85.76 | |
| RLSD ( 0.05) of conc. Of extract = 5.14 | RLSD( 0.05 ) of application methods = N.S. | | RLSD( 0.05) of interaction = 7.03 |

**Effect of Maize Silks Extract, Their Application Methods and Their Interaction on The Average of Quantity of Total Soluble Carbohydrates (Mg. $G^{-1}$ Dry Weight) in Tomato Leaves**

Data in table (9) illustrate a significant superiority of the maize silks extract conc. (40 ml. $L.^{-1}$)of (202.47 mg. $g^{-1}$ dry weight) of total soluble carbohydrates in leaves, which wasn't differ from (60 ml. $L.^{-1}$) of (200.94 mg. $g^{-1}$ dry weight), also the least value of carbohydrates was at (0 ml. $L.^{-1}$ of extract) of ( 143.41 mg. $g^{-1}$ dry weight). This result was in accordance with ( [8], [9], [10]), who have explained their results as a result of the growth regulator-like substances and many nutrients contained in the maize silks extract. For the effect of application methods of extract to tomato plants, and for the interaction of these methods with the maize extract concentrations on tomato leaf content of total soluble carbohydrates, there was no statically significant differences among treatments.

**Table 9.** Effect of maize silks extract, their application methods and their interaction on the average of quantity of Total soluble carbohydrates (mg. g.-1 dry weight)

| Conc. Of maize silks extract (ml. $L.^{-1}$) | Application methods | | Average of Conc. Of maize silks extract (ml. $L.^{-1}$) |
|---|---|---|---|
| | Foliar spraying | Applying to soil | |
| 0 | 143.41 | 143.41 | 143.41 |
| 20 | 156.23 | 163.29 | 159.76 |
| 40 | 207.27 | 197.66 | 202.47 |
| 60 | 201.66 | 200.23 | 200.94 |
| Average of application methods | 177.14 | 176.15 | |
| RLSD ( 0.05) of conc. Of extract = 15.69 | RLSD( 0.05 ) of application methods = N.S. | | RLSD( 0.05) of interaction = N.S. |

**Effect of Maize Silks Extract, Their Application Methods and Their Interaction on The Average of Number of Inflorescences Per Plant**

It's obvious from table (10), that the maize extract conc. (40 ml. L.-1) was significantly superior (9.08 Inflorescences per plant) over the rest of concentrations of the maize extract, but wasn't differ from (60 ml. L.-1) of (8.70 Inflorescences per plant), while the least number was at (0 ml. L.-1) of (7.05 Inflorescences per plant). This result was in accordance with [9], and was perhaps due to the gibberellin-like substances in the extract of maize silks (Mosa et al., 2002)[9], and might be resulted from the presence of minerals and vitamins in the extract of maize silks [20].The effect of application methods alone and interacted with the concentrations of maize extract all statistically had no differences among them concerning this characteristic .

**Table 10.** Effect of maize silks extract, their application methods and their interaction on the average of Number of Inflorescences per plant.

| Conc. Of maize silks extract (ml. $L.^{-1}$) | Application methods | | Average of Conc. Of maize silks extract (ml. $L.^{-1}$) |
|---|---|---|---|
| | Foliar Spraying | Applying to soil | |
| 0 | 7.05 | 7.05 | 7.05 |
| 20 | 8.17 | 7.99 | 8.08 |
| 40 | 9.00 | 9.16 | 9.08 |
| 60 | 8.37 | 9.03 | 8.70 |
| Average of application methods | 8.15 | 8.31 | |
| RLSD ( 0.05) of conc. Of extract = 0.67 | RLSD( 0.05 ) of application methods = N.S. | | RLSD( 0.05) interaction = N.S. |

**Effect of Maize Silks Extract, Their Application Methods and Their Interaction on The Average of Fruits Number Per Plant**

Table (11) indicated to a significant superiority of the maize silks extract conc. (60 ml. L.-1) of (55.26 fruit per plant), which wasn't differ from the (40 ml. L.-1) of (50.44 fruit per plant), while the least no. of fruits found in the control plants (34.16 fruit per plant). This increment (in the no. of fruits per plant) might be resulted from the role of maize silks extract content of vitamins ( B1, B2, B3, E, C, Folic acid) [20] , in addition to another combination of nutrients in this extract (see table 3), where these nutrients participate in many biological processes in plant, especially the photosynthesis, where the Nitrogen works on the activation of vegetative growth as: a structural element in chlorophyll molecule, his role in activation of enzymes, his participation in the structure of amino acids needed to synthesize the proteins that push towards an increase in plant tissues and growth, also increasing the photosynthesis products then building carbohydrates which help the cell division and growth [16]. The effect of application methods alone and interacted with the concentrations of maize extract all statistically had no differences among them concerning this characteristic, too .

**Table 11.** Effect of maize silks extract, their application methods and their interaction on the average of fruits number per plant

| Conc. Of maize silks extract (ml. $L.^{-1}$) | Application methods | | Average of Conc. Of maize silks extract (ml. $L.^{-1}$) |
|---|---|---|---|
| | Foliar spraying | Applying to soil | |
| 0 | 34.16 | 34.16 | 34.16 |
| 20 | 45.16 | 48.11 | 46.64 |
| 40 | 50.11 | 50.77 | 50.44 |
| 60 | 53.19 | 57.33 | 55.26 |
| Average of application methods | 45.66 | 47.59 | |
| RLSD ( 0.05) of conc. Of extract = 4.93 | RLSD( 0.05 ) of application methods = N.S. | | RLSD( 0.05) interaction = N.S. |

**Effect of Maize Silks Extract, Their Application Methods and Their Interaction on The Average of Fruit Weight(G.)**

Data in table (12) show a significant superiority of maize extract conc. (60 ml. $L.^{-1}$) of (64.76 g.), that wasn't differ from (40 ml. $L.^{-1}$) of (55.94 g.), besides the least weight were given by the control plants (38.11 g.); this increment in weight may be due to the role of maize silks extract content of vitamins ( B1, B2, B3, E, C, Folic acid) [20] , in addition to another combination of nutrients in this extract (see table 3), where these nutrients participate in many biological processes in plant, especially the photosynthesis, where the Nitrogen works on the activation of vegetative growth as: a structural element in chlorophyll molecule, his role in activation of enzymes, his participation in the structure of amino acids needed to synthesize the proteins that push towards an increase in plant tissues and growth, also increasing the photosynthesis products then building carbohydrates which help the cell division and growth [16]. For the application methods effect alone, it was shown that the applied to soil method were statically superior (53.33 g.) over the foliar spraying (50.27 g.). Finally no significant differences among the means of the interaction treatments have found.

**Table 12.** Effect of maize silks extract, their application methods and their interaction on the average of fruit weight (g.):

| Conc. Of maize silks extract (ml. $L.^{-1}$) | Application methods | | Average of Conc. Of maize silks extract (ml. $L.^{-1}$) |
|---|---|---|---|
| | Foliar spraying | Applying to soil | |
| 0 | 38.11 | 38.11 | 38.11 |
| 20 | 46.67 | 50.11 | 48.39 |
| 40 | 53.11 | 58.77 | 55.94 |
| 60 | 63.19 | 66.33 | 64.76 |
| Average of application methods | 50.27 | 53.33 | |
| RLSD ( 0.05) of conc. Of extract = 9.93 | RLSD( 0.05 ) of application methods = 1.27 | | RLSD( 0.05) interaction = N.S. |

**Effect of Maize Silks Extract, Their Application Methods and Their Interaction on The Average of Each Plant Yield ( Kg. $Plant^{-1}$)**

Data of table (13) give a sign for a significant superiority of the maize extract conc. (60 ml. $L.^{-1}$) of (4.181 kg. plant), which wasn't differ from the (40 ml. $L.^{-1}$) of (4.111 kg. plant), while the control group gave the least yield (3.660 kg. plant). This increment perhaps was because of the role of maize silks extract content of vitamins ( B1, B2, B3, E, C, Folic acid) [20] , in addition to another combination of nutrients in this extract (see table 3), where these nutrients participate in many biological processes in plant, especially the photosynthesis, where the Nitrogen works on the activation of vegetative growth as: a structural element in chlorophyll

molecule, his role in activation of enzymes, his participation in the structure of amino acids needed to synthesize the proteins that push towards an increase in plant tissues and growth, also increasing the photosynthesis products then building carbohydrates which help the cell division and growth [16].Concerning the effect of application methods alone and interacted with the concentrations of maize extract all statistically had no differences among them concerning this characteristic.

**Table 13.** Effect of maize silks extract, their application methods and their interaction on the average of each plant yield (kg. plant$^{-1}$):

| Conc. Of maize silks extract (ml. L.$^{-1}$) | Application methods | | Average of Conc. Of maize silks extract (ml. L.$^{-1}$) |
|---|---|---|---|
| | Foliar spraying | Applying to soil | |
| 0 | 3.660 | 3.660 | 3.660 |
| 20 | 4.061 | 4.017 | 4.039 |
| 40 | 4.115 | 4.107 | 4.111 |
| 60 | 4.193 | 4.169 | 4.181 |
| Average of application methods | 4.007 | 3.988 | |
| RLSD ( 0.05) of conc. Of extract = 0.076 | RLSD( 0.05 ) of application methods = N.S. | | RLSD( 0.05) interaction = N.S. |

## IV. Conclusions And Recommendations

From the results of this study it was concluded that the maize silks extract conc. (60 ml. L.-1) was significantly superior over all other treatments, while wasn't differ from the (40 ml. L.-1), concerning most vegetative and productivity studied characteristics, also the applying to soil method was superior over the foliar spraying method concerning most characteristics, too. So, the author recommend to use the maize silks extract concentrations (60 and 40 ml. L.-1), in a condition, that to be applied to the soil as an application method, this for the cultivars grown under Basra-Iraq environmental conditions.

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