Productivity of Some Onion Varieties Under Different Silicates Forms in Relation to Thrips (*Thrips tabaci* L.) Infection

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ABSTRACT

The two field experiments were carried out at the Experimental Farm, Faculty of Agriculture, Saba Basha, Alexandria University, Alexandria Governorate, Egypt, during the two winter seasons of 2018/2019 and 2019/2020 to study the effect of foliar application of silicon forms on yield, quality and trips population of some onion varieties. This experiment was laid out in split-plot design in three replications in both seasons. The main plot was four onion varieties named; Giza Red, Giza 20, Hybrid Red (Al-Hamra), and Hybrid Yellow (Alabkar), while the subplots were different silicon forms (water = control, nano silicon, silicon in tablets, and silicon in powder form) was in both seasons. The obtained results showed that onion varieties differed in the studied characters, foliar application of the different forms of silicon significantly affected yield, and trips population, as well as the interaction between varieties and Si form, was significant in both seasons. Whereas on the other hand, Giza Red recorded the highest values of the studied parameters followed by Giza 20 as compared with the other varieties, also silicon in form nanoparticles (Si NPs) increased growth, yield quality, and decreased population of thrips in onion in both seasons. The interaction between Si forms and onion varieties was significant on all the studied characters, where planting Giza 20 with foliar application of nanoparticles (Si NPs) form recorded the highest values also reduced the population of thrips in the two cropping seasons under the study conditions.

INTRODUCTION

Onion (*Allium cepa* L)) is one of the most important crops grown in Egypt. The area harvested was about 63,723 (ha), while the national production was about 2304210 tons (FAO, 2018).
Onion has been considered as a supply of micro food, minerals, salts, vitamins, and as well as other nutrients. It has been noted that onions are subjected to many diseases due to the attack of insect pests that may cause a reduction in the yield and quality of crops (Lorbeer et al., 2002). Thrips are considered the most damaging pests of onion and related allium crops worldwide. Thrips are slender like in shape and nearly 2mm long in their body size. They can be seen when onions are cultivated and can be found in warmer regions (Brewster, 2008). Seven species of thrips were listed as pests of allium crops of which *Thrips tabaci* is found to be a severe pest of allium crops.

Silicon (Si) is the second most abundant element in the lithosphere. Soils commonly contain as much as 30 % Si, the majority of which is found in minerals and rocks. In plants, the element Si is recognized as a “beneficial quasi-essential” mineral nutrient. It is taken up by the plant roots and trans-located to aerial parts through transpiration streams. Soluble Si in the plant system attracts natural predators and parasitoids during pest attack and consequently increases biological control. Although, a large set of data shows that Si provides a natural defense against pest attack, the application of Si as a pest control agent has not gained much attention from the scientists, policymakers, and farming communities. Here, current knowledge regarding Si-mediated plant defense to pest attack is reviewed. Si-application tends to reduce pest infestations and may provide a sustainable environment-friendly integrated strategy as an alternative to extensive pesticide use (Bakhat et al., 2018). Foliar sprays with silicates are effective as pesticides, while (stabilized) silicic acid sprays increase growth and yield and decrease biotic and abiotic stresses. The limited data on foliar silica-nano sprays show a tendency to decrease biotic stress and to stimulate a limited increase in growth and yield (Henk 2018). The application of silicon in crops provides a viable component of integrated management of insect pests and diseases because it leaves no pesticide residues in food or the environment, and it can be easily integrated with other pest management practices as biological control (Laing et al., 2015).

Nanotechnology has become one of the most promising new approaches for pest control in recent years. Nanoparticles represent a new generation of environmental remediation technologies that could provide an effective solution to some of the most challenging environmental clean-up problems (Chinnamuthu and Boopathi, 2009). Silica nanoparticles (Si NPs) have been evaluated against the cotton leafworm *Spodoptera littoralis* (El-Bendary and El-helaly, 2013), the tomato borer *Tuta absoluta*, the stored grain insect-pest [the rice moth] *Corcyra cephalonica* (Vani and Brindhaa, 2013), the pink bollworm *Pectinophora gossypiella* (Derbalah et al., 2014) and the lesser grain borer beetle *Rhyzopertha dominica* and the red flour beetle *Tribolium castaneum* (El-Samahy et al., 2014).

The aims of this study were to:

1- Study the effect of different forms of silicon (Si) on yield and thrips infection of some onion varieties.

2- Study the interaction effect between silicon forms and onion varieties to determine the best combination, which will increase the production and quality of onion and avoid exposure of the crop to thrips infection.

**MATERIALS AND METHODS**

Two field experiments were conducted out at the experimental farm, Faculty of Agriculture, Saba Basha, Alexandria University, Alexandria Governorate, Egypt, during the two seasons of 2018/2019 and 2019/2020 to study the effect of foliar application of different forms of silicon (Si) concentrations on some onion varieties productivity and Thrips infection under the soil as affected by salts.
The physical and chemical properties of experimental soil are presented in Table 1 which according to the method described by Page et al. (1982).

This experiment was laid out in split-plot design in three replications in both seasons. The main plot was four onion varieties names as follow; Giza Red, Giza 20, Hybrid Red (Al Hamra) and Hybrid Yellow (Alabkar), while the subplots were different silicon forms (water = control, nano silicon (Si NPs), silicon in tablets, and silicon in powder form) in both seasons.

**Table 1.** Soil physical and chemical properties of experimental sites in both seasons

| Soil properties         | 2018/2019 | 2019/2020 |
|-------------------------|-----------|-----------|
| A- Mechanical analysis  |           |           |
| Sand                    | 14.5      | 14.7      |
| Silt                    | 42.1      | 42.1      |
| Clay                    | 43.4      | 43.2      |
| Soil texture            | Clay loam | Clay loam |
| B- Chemical properties  |           |           |
| pH (1:1)                | 7.7       | 7.6       |
| EC (1:1) dS/m           | 3.4       | 3.5       |
| 1- Soluble cations (1:2)|           |           |
| K⁺                      | 1.4       | 1.5       |
| Ca⁺⁺                    | 14.2      | 15.4      |
| Mg⁺⁺                    | 11.3      | 11.5      |
| Na⁺                     | 13.6      | 13.8      |
| 2- Soluble anions (1:2) |           |           |
| CO₃⁻⁻ HCO₃             | 2.8       | 2.9       |
| CL⁻⁻                   | 19.7      | 19.8      |
| SO₄²⁻                   | 12.4      | 12.5      |
| Calcium carbonate (%)   | 6.7       | 6.9       |
| Total nitrogen (%)      | 1.1       | 1.2       |
| Available P (mg/kg)     | 3.7       | 3.6       |
| Organic matter (%)      | 1.5       | 1.6       |

Recommended doses of nitrogen, phosphorus, and potassium fertilizers were added at the rate of 90 kg N, 45 kg P₂O₅, and 48 kg K₂O/fed.

The foliar application of Si nanoparticles at the rate of 250 cm/100 L water, Si form in tablets at the rate of (100 g/100 L water) and Si in anormal form at the rate of 100 cm/100 L water at three times 30, 45, and 60 days after transplanting.

All other cultural practices for onion production in clay soil in Alexandria conditions were followed according to the Ministry of Agriculture and Land Reclamation.

Twenty randomly selected plants were taken from each plot in both seasons to measure: Plant height (cm), fresh weight (g/plant), number of green leaves/plant, total chlorophyll content, dry weight (g)/plant, total yield (tons/fed.), marketable yield (t/fed.), average bulb weight (g), and bulb total soluble solids (TSS).

Population density of Thrips was survived at 75, 105, 120, and 135 days after transplanting in both seasons.

All collected data were subjected to analysis of variance according to Gomez and Gomez (1984). All statistical analysis was performed using analysis of variance technique by means of CoStat (2005) computer software package.

**RESULTS AND DISCUSSION**

The results obtained in Tables (2 and 3) showed the significant effect of silicon forms on plant height (cm), fresh weight (g/plant), dry weight (g/plant), number of
leaves/plant, and leaf length (cm), bulb weight (g), bulb yield (tf/fed), total soluble substances (TSS), K (%) and Si contents (mg/kg) in 2018/2019 and 2019/2020 seasons.

Concerning the four onion varieties, Tables (2 and 3) revealed that onion varieties differed in all the studied characters i.e. plant height (cm), fresh weight (g/plant), dry weight (g/plant), number of leaves/plant and leaf length (cm), bulb yield (tf/fed), total soluble substances (TSS), K (%) and Si contents (mg/kg) except bulb weight (g) in both seasons, whereas Giza Red variety the tallest plants and the highest mean values of dry weight, bulb yield, TSS (%), K (%) and Si content, on the other hand, Giza 20 recorded the highest values of dry weight, number of leaves/plant, and leaf length with no significant with Giza Red variety and Giza 20 variety as compared with the other two varieties hybrid Red and Yellow in both seasons. These results are in agreement with those indicated by Fasika et al. (2008); Shah et al. (2012); Abou Azoom et al. (2014); Devi et al. (2014); Das et al. (2015); Singh et al. (2015); Solanki et al. (2015) they found that there was an asignificant difference among the studied varieties in growth, yield and quality characters that due to the genetic factors.

In respect of the effect of silicon forms on onion attributes, results in Tables (2 and 3) indicated that application of Si in nano- form as nanoparticles (Si Nps) recorded the highest mean values of the all studied characters i.e. plant height (cm), fresh weight (g/plant), dry weight (g/plant), number of leaves/plant and leaf length (cm), bulb weight (g), bulb yield (tf/fed), total soluble substances (TSS), K (%) and Si contents (mg/kg) in comparison with the other from followed by Si in Tablets/powder as compared with the control treatments in both seasons. This increase of these characters due to the vital role of Si in the growth and productivity of the field crop especially under salinity condition. These findings results in harmony with those recorded by Clarkson (2011); Liu et al. (2011); Ahmad et al. (2013); Mikhael et al. (2018); Shedeed (2018) they who detected that Si application increased growth and yield in various field crop by enhancing utilization rate and absorbing ability of nutrients and increasing photosynthesis efficiency.

Table 2. Plant attributes of onion varieties as affected by silicon forms (Si) and their interaction in both seasons

| Treatment       | Plant height (cm) | Fresh weight (g/plant) | Dry weight (g/plant) | Number of leaves/plant | Leaf length (cm) |
|-----------------|------------------|------------------------|----------------------|------------------------|-----------------|
|                 | 2018/2019 | 2019/2020 | 2018/2019 | 2019/2020 | 2018/2019 | 2019/2020 | 2018/2019 | 2019/2020 |
| Giza Red        | 58.3            | 54.4                   | 104.3                | 102.4                  | 117.6           | 113.4       | 8.6        | 8.2        | 26.5       | 28.3       |
| Giza 20         | 55.5            | 51.3                   | 125.0                | 108.0                  | 111.2           | 109.2       | 8.8        | 8.3        | 27.6       | 27.6       |
| Hybrid Red      | 56.5            | 46.7                   | 148.1                | 142.2                  | 77.3            | 76.9        | 8.8        | 9.6        | 24.3       | 24.9       |
| Hybrid Yellow   | 52.8            | 47.3                   | 143.2                | 142.1                  | 97.2            | 98.8        | 9.1        | 9.1        | 34.7       | 41.1       |
| LSD0.05 (A)     | 3.9             | 2.5                    | 13.9                 | 78                     | 14.2            | 13.5        | 0.1        | 0.7        | 6.4        | 2.3        |
| Control         | 53.5            | 45.3                   | 120.2                | 106.9                  | 88.5            | 85.8        | 7.6        | 8.0        | 30.4       | 30.0       |
| Si nanoparticles| 57.1            | 55.8                   | 155.4                | 153.6                  | 121.3           | 115.6       | 10.4       | 9.9        | 24.9       | 28.1       |
| Si Tablets      | 55.7            | 47.3                   | 118.8                | 117.6                  | 96.9            | 92.4        | 8.5        | 8.8        | 30.1       | 32.4       |
| Si Powder       | 56.8            | 51.3                   | 126.2                | 136.7                  | 96.5            | 104.4       | 8.8        | 8.5        | 27.8       | 31.4       |
| LSD0.05 (B)     | 3.0             | 3.6                    | 15.7                 | 9.7                    | 10.8            | 7.05        | 0.9        | 0.9        | 2.9        | 3.2        |

* and ns: significant and not significant difference at 0.05 level of probability.
Concerning the interaction between onion varieties and Si forms, the results obtained in Tables (4 and 5) reported there was significant interaction between the two factors (Varieties x Si forms) in all the studied character such as plant height (cm), fresh weight (g/plant), dry weight (g/plant), number of leaves/plant and leaf length (cm), bulb weight (g), bulb yield (t/plant), total soluble substances (TSS), K (%) and Si contents (mg/kg) in both seasons, where the cultivar Giza Red + Si NPs recorded the highest values of plant height, and the tallest leaf, meanwhile Giza 20 + NPs of Si gave the highest mean values of fresh weight (g/plant), dry weight (g/plant), number of leaves/plant, bulb weight (g), bulb yield (t/plant), total soluble substances (TSS), K (%) and Si contents (mg/kg) in both seasons. On the other hand, sowing Hybrid Red + Control (water spray) recorded the lowest ones in both seasons.

The results in Table (6) showed Thrips population density (Adult and nymph) of onion varieties as affected by silicon forms (Si) and their interaction in both seasons. Where the onion varieties showed significant response for Thrips population in this respect Giza Red and Giza 20 gave the lowed numbers of Thrips comparing with the other varieties in both seasons. Belong to the effect of Si forms, application of Si in any form as Si NPs, Si Powder, and Si Tablets made asignificant reduction of the Thrips population density (Adult and nymph) in both seasons (Table 6). The reduction in the population of Thrips due to the main role of Si for control of insects, in this respect Takahashi (1996) and Epstein (1999) reported that silicon deposited in the epidermal tissue may have several functions including support and protection as a mechanical barrier against pathogen and herbivore invasions. Also, Belanger et al. (1995); Ma and Takahashi (2002); Meyer and Keeping, (2005) indicated that silicon applications can contribute significantly to reducing damage due to pests and diseases. On the other hand, Bucchus (2010) found that the silicon application improved the resistance to pests, disease, and other environmental stresses. Whereas, Qari et

### Table 3: Plant attributes of onion varieties as affected by silicon forms (Si) and their interaction in both seasons

| Treatment          | Bulb weight (g) | Bulb yield (t/fed) | TSS (%) | K (%) | Si (mg/kg) |
|--------------------|----------------|-------------------|---------|-------|------------|
|                    | 2018/2019       | 2019/2020         | 2018/2019 | 2019/2020 | 2018/2019 | 2019/2020 | 2018/2019 | 2019/2020 |
| Giza Red           | 183.3           | 183.6             | 9.4      | 9.2   | 14.4       | 14.5      | 1.6       | 1.6       | 35.5      | 35.9      |
| Giza 20            | 171.8           | 178.1             | 8.7      | 8.7   | 14.3       | 14.4      | 1.5       | 1.5       | 35.2      | 35.6      |
| Hybrid Red         | 171.6           | 182.5             | 8.5      | 8.9   | 13.7       | 13.6      | 1.4       | 1.5       | 32.8      | 33.5      |
| Hybrid Yellow      | 186.7           | 182.4             | 9.2      | 9.1   | 13.8       | 13.6      | 1.5       | 1.5       | 33.0      | 33.6      |
| LSD_{0.05/(A)}     | ns              | ns                | 0.3      | 0.4   | 0.4        | 0.8       | 0.1       | 0.1       | 2.2       | 2.0       |
| A x B              | *               | *                 | *        | *     | *          | *         | *         | *         | *         |

* and ns: significant and not significant difference at 0.05 level of probability
al. (2013) found that the initial reduction% of the *T. tabaci* population in onion fields after application of a high concentration of nanoparticles (Aerosil 200® (4 ml/l)) and 8000 ppm concentrations of the four plant extracts were 83.66, 81.08, 86.92, 74.49, and 91.38%, respectively, whereas their persistence effects were 73.18, 67.78, 71.46, 66.94, and 78.29%, respectively. Furthermore, the total chlorophyll contents in onions treated with the nanoparticles and four plant extracts were 1.35, 1.17, 1.09, 1.07, and 1.18 mg/g, respectively; additionally, the concentrations of phenols were 4.65, 3.15, 3.15, 2.85, and 3.70 mg/g in onions treated with *C. camphora, M. chamomilla, M. arvensis, T. foenum-graecum*, and Aerosil 200®, respectively.

Moreover, there was asignificant interaction between verities and Si forms in the two seasons (Table 6).

**Table 4. Interaction effect between Si forms and onion varieties in both seasons**

| Treatments | Plant height (cm) | Fresh weight (g/plant) | Dry weight (g/plant) | Number of leaves/plants | Leaf length (cm) |
|------------|------------------|------------------------|----------------------|-------------------------|-----------------|
| Onion varieties | Si forms | 2018/2019 | 2019/2020 | 2018/2019 | 2019/2020 | 2018/2019 | 2019/2020 | 2018/2019 | 2019/2020 |
| Guia Red | Control | 51.7 | 47.0 | 159.3 | 116.0 | 110.1 | 96.7 | 7.3 | 8.0 | 29.8 | 28.7 |
| | Si NPs | 56.3 | 51.0 | 186.0 | 190.0 | 144.8 | 146.6 | 11.3 | 10.0 | 24.6 | 28.8 |
| | Si Tablets | 60.7 | 45.7 | 121.7 | 126.0 | 111.1 | 101.7 | 8.7 | 9.7 | 28.9 | 26.9 |
| | Si Powder | 60.7 | 45.3 | 130.3 | 136.7 | 104.3 | 110.6 | 9.0 | 8.7 | 22.8 | 28.8 |
| Guia 20 | Control | 53.0 | 54.7 | 116.7 | 119.7 | 93.3 | 96.3 | 8.0 | 7.7 | 29.3 | 25.8 |
| | Si NPs | 61.3 | 60.3 | 180.3 | 171.3 | 140.0 | 120.3 | 10.3 | 10.0 | 21.2 | 22.7 |
| | Si Tablets | 48.0 | 42.7 | 151.7 | 146.0 | 151.4 | 112.6 | 8.7 | 7.7 | 32.9 | 32.1 |
| | Si Powder | 57.7 | 47.3 | 120.0 | 131.3 | 96.0 | 107.3 | 8.3 | 8.0 | 27.0 | 28.8 |
| Hybrid Red | Control | 56.7 | 47.7 | 88.0 | 74.0 | 110.6 | 118.2 | 8.3 | 10.0 | 22.6 | 23.3 |
| | Si NPs | 58.0 | 52.3 | 121.0 | 120.0 | 97.2 | 96.4 | 9.3 | 10.0 | 21.4 | 22.3 |
| | Si Tablets | 56.0 | 43.7 | 106.3 | 110.3 | 92.1 | 87.5 | 8.7 | 10.0 | 26.3 | 28.5 |
| | Si Powder | 55.3 | 43.0 | 102.0 | 105.3 | 82.1 | 82.3 | 9.0 | 8.3 | 26.9 | 26.2 |
| Hybrid Yellow | Control | 50.7 | 56.0 | 116.7 | 118.0 | 75.2 | 81.5 | 6.7 | 6.3 | 40.1 | 43.2 |
| | Si NPs | 52.7 | 59.3 | 135.3 | 133.0 | 90.7 | 93.9 | 10.7 | 9.7 | 32.2 | 38.3 |
| | Si Tablets | 58.0 | 57.0 | 95.7 | 88.0 | 108.3 | 109.9 | 8.0 | 7.7 | 32.1 | 42.1 |
| | Si Powder | 49.7 | 45.3 | 152.3 | 173.3 | 79.2 | 73.1 | 9.0 | 9.0 | 34.2 | 46.8 |
| LSDs (A x B) | 6.3 | 7.2 | 31.5 | 19.0 | 21.5 | 14.1 | 1.9 | 1.9 | 5.9 | 0.5 |

**Table 5. Interaction effect between Si forms and onion varieties in both seasons**

| Treatments | Bulb weight (g) | Bulb yield (t/ha) | TSS (%) | K (%) | Si (mg/kg) |
|------------|-----------------|------------------|---------|-------|-----------|
| Onion varieties | Si forms | 2018/2019 | 2019/2020 | 2018/2019 | 2019/2020 | 2018/2019 | 2019/2020 | 2018/2019 | 2019/2020 |
| Guia Red | Control | 156.3 | 156.7 | 7.7 | 7.7 | 12.7 | 12.6 | 1.3 | 1.3 | 23.3 | 24.3 |
| | Si NPs | 208.7 | 212.0 | 10.7 | 10.8 | 15.1 | 15.3 | 1.8 | 1.9 | 42.7 | 43.5 |
| | Si Tablets | 173.0 | 176.0 | 9.1 | 9.1 | 13.9 | 14.7 | 1.7 | 1.7 | 40.0 | 38.3 |
| | Si Powder | 196.3 | 199.6 | 9.1 | 9.1 | 14.4 | 14.6 | 1.6 | 1.6 | 36.0 | 36.3 |
| Guia 20 | Control | 141.7 | 150.2 | 7.1 | 7.1 | 12.7 | 12.6 | 1.1 | 1.1 | 30.0 | 33.1 |
| | Si NPs | 194.3 | 203.7 | 9.7 | 9.7 | 14.9 | 15.3 | 1.6 | 1.8 | 37.3 | 36.8 |
| | Si Tablets | 179.0 | 178.3 | 8.9 | 9.0 | 15.9 | 15.4 | 1.4 | 1.4 | 36.9 | 37.7 |
| | Si Powder | 172.3 | 180.0 | 9.1 | 9.1 | 13.9 | 14.2 | 1.7 | 1.6 | 36.7 | 36.3 |
| Hybrid Red | Control | 138.7 | 162.6 | 7.4 | 7.4 | 11.9 | 12.2 | 1.1 | 1.1 | 28.9 | 30.6 |
| | Si NPs | 199.1 | 191.7 | 9.7 | 9.7 | 14.6 | 14.1 | 1.6 | 1.7 | 34.7 | 35.0 |
| | Si Tablets | 180.0 | 187.3 | 9.4 | 9.4 | 14.2 | 14.0 | 1.4 | 1.5 | 35.3 | 35.8 |
| | Si Powder | 168.7 | 188.4 | 9.5 | 9.5 | 14.8 | 14.1 | 1.6 | 1.6 | 32.3 | 32.3 |
| Hybrid Yellow | Control | 171.7 | 163.3 | 8.9 | 8.8 | 13.4 | 13.1 | 1.2 | 1.3 | 28.1 | 27.5 |
| | Si NPs | 207.3 | 207.3 | 10.1 | 10.1 | 14.7 | 14.3 | 1.5 | 1.5 | 34.3 | 33.3 |
| | Si Tablets | 188.7 | 183.0 | 9.2 | 9.2 | 14.2 | 14.4 | 1.5 | 1.7 | 36.5 | 36.9 |
| | Si Powder | 178.1 | 173.6 | 8.7 | 8.7 | 12.8 | 12.7 | 1.6 | 1.6 | 33.0 | 36.7 |
| LSDs (A x B) | 25.3 | 17.2 | 0.9 | 0.8 | 1.9 | 1.5 | 0.3 | 0.3 | 3.8 | 4.6 |
Table 6. Thrips population density (Adult and nymph) of onion varieties as affected by silicon forms (Si) and their interaction in both seasons.

| Days after transplanting (DAT) | 75 | 90 | 105 | 120 | 135 |
|-----------------------------|----|----|-----|-----|-----|
|                             | 2018/2019 | 2019/2020 | 2018/2019 | 2019/2020 | 2018/2019 | 2019/2020 | 2018/2019 | 2019/2020 | 2018/2019 | 2019/2020 |
| A- Onion varieties          |     |     |     |     |     |     |     |     |     |     |     |
| Giza Red                    | 6.9 | 15.8 | 7.2 | 6.7 | 8.9 | 8.0 | 13.3 | 7.3 | 1.4 | 1.4 | 4.3 | 4.2 | 9.5 | 0.9 | 3.0 | 1.4 | 2.4 | 0.8 | 3.2 | 1.2 |
| Giza 20                     | 6.6 | 12.4 | 5.8 | 7.5 | 5.6 | 8.3 | 3.2 | 10.9 | 2.2 | 7.1 | 3.7 | 3.5 | 2.2 | 1.5 | 3.2 | 1.9 | 2.2 | 0.9 | 3.1 | 1.4 |
| Hybrid Red                  | 11.7 | 25.3 | 12.4 | 21.0 | 10.9 | 12.7 | 5.8 | 17.9 | 8.4 | 11.4 | 4.4 | 4.7 | 9.1 | 12.9 | 4.6 | 1.0 | 3.0 | 3.4 | 2.6 | 1.0 |
| Hybrid Yellow               | 18.4 | 34.6 | 20.8 | 42.3 | 24.1 | 21.4 | 8.8 | 25.6 | 12.0 | 11.4 | 9.0 | 5.8 | 12.8 | 15.1 | 4.4 | 3.1 | 4.2 | 3.5 | 2.6 |
| LSD (5%)                    | 1.0 | 2.9 | 3.2 | 5.2 | 12.0 | 4.2 | 4.4 | 4.5 | 2.3 | 3.2 | 0.8 | 1.5 | 0.9 | 1.6 | 0.9 | 1.4 | 1.3 | 0.7 |
| B- Si forms                 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Control                     | 15.9 | 35.6 | 15.8 | 28.0 | 11.2 | 24.7 | 7.6 | 26.1 | 8.6 | 17.4 | 8.0 | 9.7 | 11.1 | 10.9 | 5.9 | 4.1 | 6.9 | 1.1 | 3.8 | 4.3 |
| Si NPs                      | 9.0 | 17.2 | 11.4 | 14.0 | 11.6 | 9.9 | 5.3 | 10.6 | 5.1 | 7.1 | 5.9 | 1.5 | 3.4 | 4.8 | 5.6 | 1.1 | 1.7 | 5.2 | 0.9 | 1.1 |
| Si Tablets                  | 10.1 | 15.9 | 10.1 | 10.5 | 10.9 | 9.9 | 4.8 | 11.6 | 5.6 | 9.9 | 4.3 | 2.3 | 4.3 | 5.4 | 2.6 | 2.0 | 1.9 | 2.2 | 2.1 | 1.1 |
| Si Powder                   | 8.6 | 10.7 | 8.9 | 17.2 | 11.7 | 10.0 | 5.4 | 13.4 | 4.7 | 9.9 | 4.6 | 5.5 | 6.5 | 4.8 | 3.3 | 2.2 | 3.1 | 2.9 | 2.1 |
| LSD (5%)                    | 2.0 | 8.1 | 3.2 | 11.0 | 5.9 | 5.1 | 1.6 | 2.3 | 1.8 | 3.4 | 1.1 | 2.6 | 1.8 | 3.4 | 1.1 | 1.7 | 1.9 | 1.3 | 0.7 |
| A x B                       | *   | *   | *   | *   | *   | *   | *   | *   | *   | *   | *   | *   | *   | *   | *   | *   | *   | *   | *   |

a and ns: significant and not significant difference at 0.05 level of probability.

CONCLUSION:
This study demonstrated that onion varieties differed in all the studied characters i.e. growth, productivity, and bulbs quality whereas Giza 111 recorded the highest values of growth, yield, and quality characters. Foliar application of nano-silicon (Si NPs) led to improve total yield and bulb quality of onion. As well as, Giza 111 + Si NPs improved vegetative growth and yield of onion plants under study conditions at Alexandria Governorate, Egypt.

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ARABIC SUMMARY

أنتجية بعض أصناف البصل تحت صور سليكات مختلفة وعلاقتها بالأصابة بالتربس

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1 قسم الأنتاج النباتي - كلية الزراعة - جامعة الأسكندرية
2 قسم بحوث آفات المحاصيل الحقلية - جامعة الزراعة - الإسكندرية
3 قسم وقاية النباتات - كلية الزراعة - جامعة الأسكندرية

أجريت هذه الدراسة في مزرعة كلية الزراعة – ساوانشا - بمنطقة أبيس – محافظة الأسكندرية خلال الموسم الشتوي لعامي 2018/2019 و 2019/2020 وذلك لدراسة تأثير التسميد الورقي وبعض صور السيليكات على أنتاجية بعض أصناف البصل ودراسة تأثير بعض صور السيليكات على حشرة التربس ودراسة النتاجية بين بعض أصناف البصل وصور السيليكات. وش행ت تجارب حقلية باستخدام تصميم المتساوية مرة واحدة في ثلاثة مكررات بحيث أن القطن الرئيسية ورعت بها أربعة أصناف من البصل و هي جيزة أحمر، جيزة أبيض، هجين أصفر (أبكار)، هجين أحمر (الحمراء)، وانتهى أصفر (أبكار). وفي القطع الفرعية وزعت صور السيليكات (كترول (الرش بالماء) والرش بالأقراص من السليكون، وأقرص السليكون فوارة، سيليكون في صورة بودرة).

- الصفات النمو والمحصول:
- اختلفت أصناف البصل الأربعة فيما بينها في صفات النمو والمحصول والجودة مثل ارتفاع النباتات والوزن الطاجج (جم/نبات) ووزن الجفاف للنباتات وطول الأوراق وزن الورقة وزن البصلة (بالجم) ومحتوى الصل (مل/كم) ودرجات الصل (من الفاصل إلى العامل) ونسبة الصل (%) ونسبة الصل ككلية (%) ونسبة الصل من البودرة这句话的最后部分似乎未完成或不完整。下文中的句子可能与之相关，提供了关于施用不同类型的硅酸盐的影响的信息。

- أثر الرش الورقي بالصور المختلفة للسليكون تأثيراً معنويةً على أصناف البصل والمحصول والجودة للحصول على أفضل النتائج.

- موسمية النباتات حيث أوضحت النتائج أن الرش الورقي للسليكون في صورة فوارة نانو (جزيئات فردية الصغر) أظهر أفضل أثر على نمو النباتات والمحصول وحقق أعلى معدلات من التربس (الرش بالماء) وحقق أعلى مستويات قيم لهذه الصفات وال 활용 هذه النباتات أكثر إصابة بحشرات التربس الكبيرة والشحيطات خلال موسمى الزراعة.
كان التداخل بين عاملين الدراسة (الأصناف وصور السيليكون) معنويًّا في كل الصفات المدروسة حيث سجل الورق الورقي لصنف جيزة أحمر بصورة النانو سيليكون أعلى متوسطات في جميع الصفات كما سجل أقل كثافة عددية لحشرة التربس (البالغة والحوريات) مقارنة بباقي المعالات في حين أن صنف هجين أحمر مع الكنترول سجل أقل متوسطات قيم للصفات المدروسة وأعلى كثافة عددية لحشرة التربس (الحوريات والحشرة الكاملة) خلال موسمي الدراسة.

النتيجة:

توصي الدراسة بزراعة صنف جيزة أحمر أو جيزة 20 مع الورق الورقي بمعدلات الورق الورقي للسيليكون في الصورة النانوية حيث أن ذلك حقق أعلى نمو ومحصول وجودة وقللت من الاصابة بحشرة التربس خلال موسمي الدراسة وتحت ظروف منطقة أبيس – محافظة الإسكندرية – مصر وظروف المناطق المماثلة لها.