

## Effect of different types of organic fertilizers on the growth and productivity of peach cv "Florida prince"

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### ABSTRACT

This study was carried out during two successive seasons 2014 and 2015 on eight years old peach trees cv "Florida prince" budded on Nemagard rootstock grown in sandy soil of private orchard at El- Sadat region in El- Menoufiya governorate Egypt. This investigation was aimed to study the effect of soil application of organic manure (plant compost, chicken manure and control) and some organic fertilizers as foliar spraying (Algae extract, Amino acids, compost tea and control) on vegetative growth, yield and fruit quality of peach cv "Florida prince". The results indicated that the chicken manure at 100% alone or with foliar spraying by algae extract at 100% gave the highest values of all vegetative growth parameters including trunk diameter, shoot length, leaf area, total chlorophyll and leaf mineral contents in both seasons. Also gave the best fruit physical and chemical characteristics.

**Keywords:** Peach, organic manure, Algae extract, Amino acids, compost tea, vegetative growth, fruit quality.

### Introduction

Peaches (*Prunus Persica* L.) are native to family Rosaceae. It is the most successful deciduous fruit grown and widespread in Egypt. The harvested area in Egypt reached 20574 ha produced 266628 tons. (FAO, 2018). Florida prince peach is a promising cultivar under the Egyptian conditions. It needs at least chill hours, and early fruit ripening in April so a high adaptation with the local environmental conditions and a good chance for export. This cultivar increased in many areas in Egypt especially in the newly reclaimed lands. So, fertilization practices have aimed to supply enough nutrients to enhance economical yield with a high quality in peach production.

Organic farming is an environmental management system that enhances biodiversity, biological cycles and improves the physical and chemical properties of the soil, in addition to organic matter increase microorganism's activity in the soil (Venkateshwarlu, 2008).

Algae extracts are regarded as natural fertilizers which containing macronutrients - micronutrients, amino acids, and vitamins that stimulate vegetative growth, yield and fruit quality Craigie (2010). Also, it containing various natural plant hormones like IAA, GA3 and cytokinins that role in many biological processes leading to enhances growth and yield Stirck *et al.*, (2003).

Forens *et al.*, (2002) reported that seaweed extract increased the yield, while Al- Rawi *et al.*, (2016) recommended the combination of seaweed extract +GA3 in order to increase tree vegetative growth and improve their nutrition status in peach trees. In addition Abd El-Motty *et al.*, (2010) showed that spraying trees once at full bloom with algae at 2% alone improve fruit set, fruit retention number of fruits /tree and yield.

Amino acids are considered as bio-stimulants which influence the physiological activities in plant growth and development (Davis, 1982) Moreover, the exogenous application of amino acids have been reported to modulate the growth, yield and fruit quality of grape trees (Khan *et al.*, 2012; Ahmed *et al.*, 2011). Many investigations cleared out that, application of amino acids as a foliar spray was found to increase growth, leaf mineral content, fruit set, yield and quality. Haggag *et al.*, (2014) reported that the amino acids improving productivity and growth vegetative of "Le-Conte" Pear trees. Also, Abd El-Razek and Saleh, (2012) reported that amino acids improve productivity and fruit quality of cv "Florida prince" peach trees. Also, Elsayed *et al.* (2014) on pomegranate tree found that treatments of proline and tryptophan amino acids significantly improved growth parameters and increased yield.

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Compost tea is as concentrated organic liquid fertilizer that made form steeping biologically active compost in aerated water (Steve, 2009). It is containing nutrients that can help provide plants and organic matter beneficial soil organisms. Mostafa *et al.* (2009) on Washington navel orange trees, Masoud and Abd Elaal, (2012) on "Balady" Lime trees and Fayek *et al.* (2014) on pear cv "Leconte" whom reported that using compost tea enhance growth and improving yield and fruit quality.

The present study aimed to improving productivity, fruit quality and yield of peach" Florida prince" cultivar by using algae extract, amino acids and compost tea under the conditions of organic fertilization.

## Materials and Methods

This study was carried out during two successive seasons (2014 and 2015) in a private orchard located at El Sadat district El- Menofiya governorate, Egypt. The study was conducted on eight years old Florida prince trees budded on Nemagard rootstock. The trees were planted at 4\*5 m apart grown in sandy soil, under drip irrigation system and uniform in shape and received the common horticultural practices. The orchard soil analysis is given in Table 1.

**Table 1.** Physical and chemical analysis of the experimental orchard soil

| Clay              | Silt     | Fine sand | Coarse sand | Texture    | PH (1:10)       | EC (1:10) ds/m |                  |
|-------------------|----------|-----------|-------------|------------|-----------------|----------------|------------------|
| 5.19              | 8.14     | 31.43     | 55.20       | sandy      | 8.17            | 1.63           |                  |
| CaCO <sub>3</sub> | Total N% | Total P%  | K mg/100g   | Mg mg/100g | SO <sub>4</sub> | Cl-            | HCO <sub>3</sub> |
| 11.82             | 0.051    | 0.33      | 0.13        | 0.90       | 0.86            | 1.85           | 2.07             |

**Table 2:** Chemical and Physical analysis of organic sources.

| Properties                  | Compost | Chicken manure |
|-----------------------------|---------|----------------|
| Weight of m <sup>3</sup> kg | 520     | 344            |
| Moisture %                  | 31      | 28             |
| Organic matter              | 57      | 64.16          |
| Organic carbon              | 41.78   | 49.37          |
| pH(1.10)                    | 6.74    | 7.93           |
| EC ds/m                     | 3.56    | 5.38           |
| Ash %                       | 23.10   | 14.89          |
| Total N%                    | 2.0     | 3.28           |
| Total P%                    | 0.81    | 2.12           |
| Total k %                   | 1.16    | 1.69           |
| Total Ca %                  | 0.85    | 2.76           |
| Total Fe ppm                | 1226    | 1370           |
| Total Mn ppm                | 218     | 223            |
| Total Zn ppm                | 36      | 280            |
| Total Cu ppm                | 161     | 27             |
| C/N ratio                   | 22.39   | 15.8           |

Three soil application of compost (100% plant compost at 33 kg /tree , 100% chicken manure at 20kg/tree and combination between them 50% plant compost+50% chicken manure (16.5 kg +10 kg/tree) were added at the soil in this study beside control treatment (without organic application). Soil application were applied in mid of October in two trenches at 30 cm depth at both tree sides with or without four foliar spraying treatment at 5l/ tree of either 50% amino acids (2.5g/l) or 100% Algae extract (2 g/l) or 100% compost tea or water spraying (control of the foliar application) .

Phosphor obtained from natural rock phosphate (18%P<sub>2</sub>O<sub>5</sub>).In addition 7kg of potassium obtained from Feldspar (10%K<sub>2</sub>O). The analysis of Algae extract and Amino acids are presented in Table 3.

The foliar application of these treatments were applied three times during (full bloom- after fruit set - maturity fruit stage) during both seasons.

**Table 3:** Chemical analysis of Algae extract and Amino acids.

| Algae extract      | Contents | Amino acids | Contents<br>Mg/g (D/W) |
|--------------------|----------|-------------|------------------------|
| Total N (%)        | 2.8      | Glutamine   | 7.21                   |
| Total P (%)        | 0.5      | Valine      | 2.20                   |
| Total K (%)        | 13       | Lysine      | 1.74                   |
| Mg %               | 0.21     | Arginine    | 4.48                   |
| Ca %               | 0.1      | Glycine     | 18.83                  |
| Fe (ppm)           | 0.02     | Iso Leucine | 1.21                   |
| Mn (ppm)           | 0.08     | Hystidine   | 0.46                   |
| Amino acids %      | 16       | Leucine     | 1.99                   |
| O.M %              | 45:50    | proline     | 3.15                   |
| Alginic acid %     | 2.12     |             |                        |
| Mannitol %         | 5.17     |             |                        |
| Phyto hormones ppm | 500      |             |                        |

### Compost Tea preparation:

Compost tea was extracted by soaking 15 kg of plant mature compost with 100 liters+ 100 cm molasses for 7 days in special unit, attached to air pump and aerator provides continuous flow of air bubbler to extract compost tea until completion of the fermentation process and extract color becomes light brown. The analysis of compost tea presented in Table 4

**Table 4:** Some chemical characteristics of the compost tea.

| pH     | Ec     | Minerals (ppm) |    |     |    |    |    |    |      |
|--------|--------|----------------|----|-----|----|----|----|----|------|
| (1:10) | (Ds/m) | N              | P  | K   | Mg | Ca | Fe | Mn | Zn   |
| 6.12   | 3.79   | 287            | 39 | 235 | 93 | 89 | 72 | 17 | 8.06 |

### Vegetative measurements.

Leaf area (cm<sup>3</sup>) 60 mature leaves per treatment were used to estimate leaves area means at mid-June by leaf area meter.

Shoot diameter (cm) was measured on June by using a Vernier caliper.

Length of new shoot was calculated at the end of the season.

### Leaf mineral content:-

The leaves samples were taken from the middle part of outer current bearing shoots, cleaned then dried at 70 c until constant weight and finally digested according to Wolf, (1982).

The following mineral was estimated:

Nitrogen content (g/100g DW) by the modified microkjeldahl method as described by Plummer (1971).

Phosphorus content (g/100g D/W) was determined calorimetrically according to the method of Jackson (1958).

Potassium content (g/100g D/W) was determined against a standard using Flame photometer (Piper, 1950).

### Fruiting measurements and yield.

Fruit set percentage: Calculated according to the following equation:

(No. of fruit set before thinning /No. of total flower) \*100

Fruit weight (g). Average of fruit weight was determined by weighing a sample of 30 fruits from each treatment and the average fruit weight was calculated.

Yield (kg):- The fruit yield was harvested at commercial harvesting time (mid -April).Weight and number of fruits per individual tree were determined (kg /treatment).

### Statistical Analysis: -

The experimental design was a split plot design with 16 treatments and 3 replicates for each treatment; each replicate consisted of one tree. Obtained results were subjected to analysis of variance according to Snedecor and Cochran (1990). Mean comparison was carried out by using L S D at 0.05.

## Results and Discussion

### Vegetative growth:-

Data in Table (5). Obviously show that effect of different types of organic manure as soil application and some foliar application on shoot length, diameter and leaf area of peach trees cv" Florida prince " during the two successive seasons of 2014 and 2015.

As for different types of organic manure as soil application alone caused significant increases in shoot length, diameter and leaf area. Chicken manure at 100% gave the highest values followed by the combination between plant compost at 50 % + chicken manure at 50% as compared with the other treatments in the two seasons, respectively.

**Table 5:** Effect of different types of organic manure on shoot and diameter length and leaf area of peach cv. Florida prince (2014/2015).

| Soil Application                      | Foliar treatments | Shoot length (cm) |              | Shoot diameter (cm) |             | Leaf area (cm <sup>3</sup> ) |              |
|---------------------------------------|-------------------|-------------------|--------------|---------------------|-------------|------------------------------|--------------|
| Plant compost 100%                    | Amino acids       | 43.46             | 43.28        | 0.75                | 0.82        | 44.74                        | 45.60        |
|                                       | Algae extract     | 46.0              | 46.24        | 0.81                | 0.86        | 46.56                        | 47.08        |
|                                       | Compost tea       | 45.25             | 45.97        | 0.78                | 0.84        | 45.80                        | 46.48        |
|                                       | Without foliar    | 41.20             | 42.03        | 0.66                | 0.76        | 42.42                        | 43.53        |
|                                       | Average           | 43.98             | 44.38        | 0.75                | 0.82        | 44.88                        | 45.67        |
| Chicken manure 100%                   | Amino acids       | 46.64             | 47.02        | 0.82                | 0.85        | 46.76                        | 48.33        |
|                                       | Algae extract     | 49.64             | 50.31        | 0.86                | 0.89        | 48.87                        | 48.95        |
|                                       | Compost tea       | 49.89             | 49.49        | 0.84                | 0.86        | 47.94                        | 48.90        |
|                                       | Without foliar    | 43.91             | 44.13        | 0.77                | 0.83        | 44.79                        | 44.76        |
|                                       | Average           | 47.16             | 47.71        | 0.82                | 0.86        | 47.09                        | 47.35        |
| Plant compost 50%+ chicken manure 50% | Amino acids       | 43.94             | 44.62        | 0.78                | 0.81        | 46.77                        | 47.35        |
|                                       | Algae extract     | 46.99             | 46.94        | 0.85                | 0.87        | 47.70                        | 47.62        |
|                                       | Compost tea       | 46.33             | 46.64        | 0.75                | 0.85        | 46.93                        | 47.57        |
|                                       | Without foliar    | 42.15             | 43.05        | 0.73                | 0.79        | 43.34                        | 43.49        |
|                                       | Average           | 44.85             | 45.31        | 0.78                | 0.83        | 46.19                        | 46.53        |
| Without soil Application (control)    | Amino acids       | 32.80             | 31.96        | 0.44                | 0.39        | 35.28                        | 34.60        |
|                                       | Algae extract     | 34.45             | 32.28        | 0.49                | 0.43        | 36.24                        | 35.13        |
|                                       | Compost tea       | 33.63             | 27.82        | 0.45                | 0.40        | 35.82                        | 34.77        |
|                                       | Without foliar    | 28.09             | 31.26        | 0.39                | 0.37        | 31.18                        | 30.51        |
|                                       | Average           | 32.24             | 31.26        | 0.44                | 0.40        | 34.63                        | 33.75        |
| A.V. of Foliar Application            | Amino acids       | 41.71             | 41.76        | 0.70                | 0.72        | 43.39                        | 43.69        |
|                                       | Algae extract     | 44.33             | 44.12        | 0.75                | 0.77        | 44.84                        | 44.69        |
|                                       | Compost tea       | 43.56             | 43.60        | 0.72                | 0.74        | 44.12                        | 44.46        |
|                                       | Without foliar    | 38.63             | 39.23        | 0.64                | 0.69        | 40.43                        | 40.57        |
| L.S.D at 5%                           | Soil APP          | <b>0.902</b>      | <b>0.942</b> | <b>0.054</b>        | <b>0.04</b> | <b>0.647</b>                 | <b>0.887</b> |
|                                       | Foliar Tr         | <b>0.607</b>      | <b>0.589</b> | <b>0.046</b>        | <b>0.04</b> | <b>0.685</b>                 | <b>0.699</b> |
|                                       | Soil APP*Folia    | <b>1.214</b>      | <b>1.178</b> | <b>0.092</b>        | <b>0.09</b> | <b>1.371</b>                 | <b>1.399</b> |

As regard to the effect of tested foliar fertilizers treatments Algae extract recorded the highest significant shoot length, diameter and leaf area for the first and second seasons respectively, which followed by compost tea then amino acids as compared the lowest values of the control.

Regarding the interaction between different types of organic manure treatments with foliar fertilizers on shoot length, diameter and leaf area chicken manure at 100 % + foliar spraying of algae extract were significantly recorded the highest values of shoot length, diameter and leaf area as compared with untreated control trees in both seasons .

These results were in line with those obtained by Fayed (2005) and Bahaa (2007) on peach trees. They found that applying organic fertilization with bio fertilizers significantly increased shoot length and diameter. Hajji and Sanaa (2016) and Al-Hadethi *et al.*, (2017) in peach trees found that application of bio-fertilizers improved shoot length and diameter. Furthermore, on apple trees Zadeh *et al.*, (2013) observed that increases in shoot length and diameter by using chicken manure fertilization. Thanana *et al.*, (2016) found that effecting foliar spraying of seaweed extract plus amino

acids on apple trees increased shoot length. The positive action of chicken manure on vegetative growth may be due to containing a great percentage of organic matter and rich content of macro and micro nutrients which led to enhance vegetative growth (Bhangoo *et al.*, 1988). Regarding to The positive effect of Algae extract on vegetative growth it may be due to endogenous hormones, i.e IAA, GA3 and cytokinin which induce cell division and elongation .also its content of minerals, amino acids and vitamins which increase metabolic processes and activating photosynthesis process (Spinelli *et al.*,2009).

## 2. Leaves minerals (N P K) content:

Results in Table (6). Shows the effect of different types of organic manure and some foliar fertilizers on N, P and K leaf content of peach trees cv " Florida prince". With regard to the effect of soil application of organic manure alone caused significant increases in N, P and K leaf content as compared to the untreated trees (control) in the two seasons, respectively. With a remarkable effect for chicken manure treatment alone followed by plant compost +chicken manure.

**Table 6.** Effect of different types of organic manure on leaf mineral (NPK) of peach cv. Florida prince season (2014/2015).

| Soil Application                         | Foliar treatments | N%    | P%    | K%    |      |      |       |
|--|-------------------|-------|-------|-------|------|------|-------|
| Plant compost 100%                       | Amino acids       | 2.73  | 2.84  | 0.39  | 0.47 | 1.51 | 1.63  |
|  | Algae extract     | 2.88  | 2.96  | 0.54  | 0.59 | 1.64 | 1.70  |
|  | Compost tea       | 2.80  | 2.90  | 0.50  | 0.52 | 1.56 | 1.67  |
|  | Without foliar    | 2.69  | 2.80  | 0.33  | 0.44 | 1.50 | 1.59  |
|  | Average           | 2.77  | 2.89  | 0.44  | 0.50 | 1.55 | 1.64  |
| Chicken manure 100%                      | Amino acids       | 2.93  | 3.03  | 0.56  | 0.65 | 1.68 | 1.77  |
|  | Algae extract     | 3.16  | 3.12  | 0.64  | 0.73 | 1.81 | 1.90  |
|  | Compost tea       | 2.96  | 2.94  | 0.60  | 0.65 | 1.73 | 1.84  |
|  | Without foliar    | 2.83  | 2.91  | 0.43  | 0.60 | 1.63 | 1.78  |
|  | Average           | 2.97  | 3.05  | 0.56  | 0.66 | 1.70 | 1.83  |
| Plant compost 50%+<br>chicken manure 50% | Amino acids       | 2.81  | 2.93  | 0.48  | 0.51 | 1.62 | 1.74  |
|  | Algae extract     | 2.90  | 2.98  | 0.57  | 0.63 | 1.67 | 1.82  |
|  | Compost tea       | 2.88  | 2.90  | 0.55  | 0.61 | 1.67 | 1.70  |
|  | Without foliar    | 2.75  | 2.82  | 0.42  | 0.57 | 1.58 | 1.67  |
|  | Average           | 2.83  | 2.91  | 0.50  | 0.58 | 1.63 | 1.75  |
| Without soil Application<br>(control)    | Amino acids       | 2.30  | 2.07  | 0.25  | 0.19 | 1.27 | 0.98  |
|  | Algae extract     | 2.47  | 2.16  | 0.32  | 0.23 | 1.36 | 1.03  |
|  | Compost tea       | 2.38  | 2.11  | 0.27  | 0.21 | 1.34 | 1.0   |
|  | Without foliar    | 2.33  | 1.94  | 0.23  | 0.18 | 1.14 | 0.83  |
|  | Average           | 2.39  | 2.07  | 0.26  | 0.20 | 1.27 | 0.96  |
| A.V. of<br>Foliar Application            | Amino acids       | 2.71  | 2.74  | 0.42  | 0.45 | 1.52 | 1.52  |
|  | Algae extract     | 2.85  | 2.81  | 0.53  | 0.55 | 1.63 | 1.58  |
|  | Compost tea       | 2.75  | 2.72  | 0.48  | 0.50 | 1.57 | 1.52  |
|  | Without foliar    | 2.66  | 2.61  | 0.35  | 0.46 | 1.46 | 1.46  |
|  | Soil APP          | 0.094 | 0.089 | 0.063 | 0.03 | 0.08 | 0.094 |
| L.S.D at 5%                              | Foliar APP        | 0.099 | 0.099 | 0.059 | 0.05 | 0.06 | 0.046 |
|  | Soil *Foliar      | 0.199 | 0.199 | 0.119 | 0.10 | 0.13 | 0.092 |

Results indicated that all foliar fertilizers treatments were significantly higher than control for N, P and k content in both seasons. Also, Algae extract increased N, P and K content significantly compared to untreated tree (control).

Concerning the interaction between soil application of organic manure and foliar spraying of fertilizers on N, P and K leaf content, results presented in the same Table show that, the highest value of mineral (N,P and K) leaf content was achieved by chicken manure at 100% + algae extract in both seasons as compared with the other treatments.

The results confirmed by Eissa *et al.*, (2007) on peach trees who found that application of humic acid improved leaf N, P and K content , and El-Khawaga (2011) in peach trees cv "Florida prince " when treated with N inorganic at 50% +humic acid + algae extract who observed an increases leaf

content of N,P and K . Moreover (Hajji and Sanaa (2016) and Al-Hadethi (2017) on peach trees found that application of bio fertilizers significantly increased leaf macro nutrients. The same results were obtained by Masoud and Abou-Zaid (2017) on " Ruby seedless" grapevines. The positive action of chicken manure could be facilitating the availability of nutrients in the soil which affect production of root biomass and nutrients uptake (Dalbo, 1992). The positive effect of Algae extract on leaf mineral content may be due to a higher content of nutrients surely improving growth and nutritional status in the leaves (Crouch et al., 1990) and containing chelating compounds (i.e. mannitol) that can increase nutrient availability has recently been suggested (Shah *et al.*, 2013).

#### **Fruit set percentage and Yield:-**

Data in Table (7). Illustrates the effect of different types of organic manure and some fertilizers as foliar spraying on fruit set of peach trees cv " Florida prince" during 2014 and 2015 seasons. For the different types of organic manure alone as soil application. The chicken manure at 100% gave significant increases in fruit set percentage and total yield for the first and second seasons, respectively followed by combination of plant compost at 50%+ chicken manure at 50%, while the lowest value was with control.

Regarding to the effect of some fertilizers as foliar application, algae extract recorded the highest fruit set percentage and total yield with significant differences comparing other treatments in both seasons.

The interaction between different types of organic treatments and some foliar fertilizers indicates that the chicken manure at 100% + foliar treatment with algae extract recorded the highest fruit set percentage and total yield in both seasons.

#### **Fruit weight:-**

Table (7). Clears the effect of organic fertilizer either soil or foliar application on fruit weight of peach trees cv" Florida prince". In regard to the effect of different types of organic manure alone , the chicken manure at 100% gave a high significant fruit weight values (105.09 and 108.10 g) for the first and second seasons respectively , followed by combination of plant compost at 50% + chicken manure at 50% (100.49 and 102.18 g ) compared to the other soil application. Concerning to the effect of some foliar fertilizers, algae extract recorded the highest fruit weight values (95.54 and 96.22 g) in both seasons respectively as compared to other treatments.

As for interaction effect between various treatments on average fruit weight, values presented in Table (7). Shows that chicken manure at 100%+ algae extract gave the highest fruit weight (110.79 and 115.03 g) as compared with the control treatment (56.43 and 55.74 g ) with significant differences.

The obtained results are in the line with Bahaa (2007) on peach trees cv "Florida prince" who reported that application of compost plus bio fertilizers increased fruit set, fruit weight and total yield .Similar results found by Mansour *et al.*, (2013) on peach trees cv "Florida prince", Ahmed *et al.*, (2013) on "Crimson seedless" grapevines and Hegazi *et al.*, (2014) on "Flame seedless" grapevines. Also, on superior grapevines , Abd El-Moniem and Abd-Allah (2008) who found that foliar application of Algae extract increased fruit set and fruit weight and yield tree. The positive effect of chicken manure of tree yield could be due to a higher content of organic matter and nitrogen and some nutrients led to improve nutritional status of tree surely reflected trees yield (Kannaiyan, 2002).As the positive effect of spraying algae on fruit weight may be endogenous nutrients and hormonal plant especially cytokinin according to (Feeatonby -smith and van Staden 1987 ) who observed that correlated the effect of synthetic cytokinin and seaweed extract in fruit production in ground nut results indicated that cytokinin may be involve in development of these reproductive plant parts.

#### **Conclusion**

From our obtained results, we can conclude that all soil application of different organic manure with foliar spraying organic fertilizers as amino acids, algae extract and compost tea had a positive effect on vegetative growth and productivity as compared with the control peach trees moreover the soil application of chicken manure at 100%+foliar spraying algae at 100% extract was the best treatment to increasing vegetative growth and improve yield and fruit quality.

**Table 7:** Effect of different types organic manure on fruit set, yield and fruit weight of peach cv. Florida prince (2014/2015).

| Soil Application                         | Foliar treatments | Fruit set (%) | Fruit weight (g) | Total yield (kg) |
|--|-------------------|---------------|------------------|------------------|
| Plant compost 100%                       | Amino acids       | 43.46         | 43.28            | 96.88            |
|  | Algae extract     | 46.00         | 46.24            | 103.89           |
|  | Compost tea       | 45.25         | 45.97            | 99.86            |
|  | Without foliar    | 41.20         | 42.03            | 89.07            |
|  | Average           | 43.98         | 44.38            | 97.43            |
| Chicken manure 100%                      | Amino acids       | 46.64         | 47.02            | 103.64           |
|  | Algae extract     | 49.89         | 50.31            | 110.79           |
|  | Compost tea       | 49.04         | 49.49            | 107.79           |
|  | Without foliar    | 43.91         | 44.13            | 98.03            |
|  | Average           | 47.16         | 47.71            | 105.09           |
| Plant compost 50%+<br>chicken manure 50% | Amino acids       | 43.94         | 44.62            | 100.12           |
|  | Algae extract     | 46.99         | 46.94            | 104.46           |
|  | Compost tea       | 46.33         | 46.64            | 103.39           |
|  | Without foliar    | 42.15         | 43.05            | 94.0             |
|  | Average           | 44.85         | 45.31            | 100.49           |
| Without soil Application<br>(control)    | Amino acids       | 32.80         | 31.96            | 61.41            |
|  | Algae extract     | 34.45         | 32.99            | 63.02            |
|  | Compost tea       | 33.63         | 32.28            | 61.86            |
|  | Without foliar    | 28.09         | 27.82            | 56.43            |
|  | Average           | 32.24         | 31.26            | 60.68            |
| A.V. of<br>Foliar Application            | Amino acids       | 41.71         | 41.72            | 90.51            |
|  | Algae extract     | 44.33         | 44.12            | 95.54            |
|  | Compost tea       | 43.56         | 43.60            | 93.25            |
|  | Without foliar    | 38.63         | 39.23            | 84.38            |
| L.S.D at 5%                              | Soil APP          | 0.902         | 0.942            | 0.862            |
|  | Foliar APP        | 0.607         | 0.589            | 1.206            |
|  | Soil *Foliar      | 1.214         | 1.178            | 2.413            |

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