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## Influence of various commercial amino acid containing plant tonics on the quality of peach cultivars

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An experiment "Influence of various commercial amino acids containing plant tonics on the growth, yield and quality of peach cultivars was conducted at Agricultural Research Institute Tarnab Peshawar, Pakistan during, 2017. The experiment was laid out in Randomized Complete Block Design (RCBD), with split plot arrangement, having four replications. The experiment was laid out in square system having 6 m tree to tree and row to row distance. Three different peach cultivars, i.e. Florida King, Early Grand and Tex-y4-55, were considered as main plot, while different sources of plant tonics i.e. T1 (Amino acids + micro nutrients), T2 (Amino acids + organic matter + NPK) and T3 (Amino acids), along with one T0 (Control) was allotted to the sub plot. Results showed that Early Grand cultivar attained higher higher titratable acidity (0.8%), while higher TSS (8.2 °Brix), Sugar acid ratio (13), Reducing sugar (1.8%) and Non-reducing sugar (1.9 %) was recorded in Tex-y4-55. The higher TSS (8°Brix), titratable acidity (0.7 %), Reducing sugar (1.7 %), Non-reducing sugar (1.8 %), was recorded in T1. Hence it can be concluded that Peach cultivar Tex-y4-55 could be sprayed with T1 (Amino acids + micro nutrients) to get best quality under the agro climatic conditions of Peshawar.

**Keywords:** Plant tonics, Peach, amino acids, reducing sugar, yield

### INTRODUCTION

Peach (*Prunus persica* L) locally known as Aro or Shaftalo belongs to the family Rosaceae. It is very famous fruit of temperate and subtropical areas. Peaches trees are deciduous in nature and are originated from North-West China, where it was first adopted and cultivated (Faust and Timon 1995). The shape of the peach fruit may be round or elongated, containing seed in the center. The flesh of the fruit are in different colour. The white fleshed fruits are sweeter and slightly acidic as compared to yellow flesh peaches (Tavarini et al.

2008).

The chemical composition of peach fruit containing 10-21% dry matter, 5-12% total sugar, 0.4-1.3% protein, 0.2-0.7% pectin, 0.6-0.86% minerals such as potassium, phosphorus, calcium, magnesium, sodium, copper, zinc, iron and vitamin C, B<sub>1</sub>, B<sub>2</sub>, and B<sub>6</sub>, E (Iordanescu Micu et al. 2012). It plays an important role in stimulation of gastric secretion, digestion facilitation which are being expressed in acute infection diseases like arteriosclerosis and blood pressure, also decreased blood cholesterol level

and can also be used in the prophylaxis of cardiovascular and anemia and as well as renal disease. The fruit of peaches are also used for fresh consumption as well as industrialized for jam purposes etc (Sochor et al. 2011). Peaches could be cultivated on different types of soils depending upon the rootstock, but loamy, rich and well-drained soil with deep sub soil are very best for its cultivation. Swat local rootstocks are mostly used for better performance of peaches cultivar (Hussain et al. 1990).

Peach is considered an important fruit of Pakistan that are grown in different area of Khyber Pakhtunkhwa, especially in Peshawar, Swat, Chitral, Hazara, Gilgit, Hunza, South and Northern Waziristan but its production losses occur due to less preservation facilities. Early Grand, Texas, M-9, 8-A, Florida king, Carmon, Flordasun and 6-A are recommended Cultivars of Khyber Pakhtunkhwa, with chilling requirement ranges from 200-1000 hours (Choudhry et al. 1994). USDA (2012) reported that the worldwide production of peaches was about 19.4 million tons. The total area under cultivation of peaches in Pakistan was 15774 hectares with production of 83670 tons. The share of Khyber Pakhtunkhwa was 6191 ha, Baluchistan 9500 ha and Punjab 83 hectares with an annual production of 57834, 25362 and 474 tons respectively.

In Pakistan, the Northern area and Baluchistan are the most important regions for the production of peaches over the last decade regardless the large increase in growing area of peach, there has been a gradual improvement in ordinary fruit yield. In recent time, the production and commercialization of stone fruit especially peaches have more prominent throughout the world. In Pakistan mainly introduction of improved, low chilling cultivars and best handling of fruit are required for better production of peach fruit (Ali et al. 2014).

Amino acid is considered as a growth factor of higher plants and are considered an important part of protein (Levitt 1980). It also effect the physiological activities of plant growth and development by direct or indirect way. Moreover, it has been resulted that the growth, improve fruit weight, fruit quality and yield of the plant is modulated by the exogenous application of amino acids (Fayek et al. 2011). Amino acids is not only enhancing cell growth but also act as a buffer, source of carbon and energy, protect the cell from ammonia toxicity, due to amid formation (Franco-Mora et al. 2012). The performance of the plant will be stimulated by the application of amino

acids (Abdel-Mawgoud et al. 2011). It is observed that amino acid significantly increased yield, fruit size, shoot length, and also increased the amount of some microelements such as Cu, Fe, and Zn of leaves in 'Williams' peach. The foliar application of amino acid chelating also protects the leaves from browning, yellowing, and abscission (Koksal et al. 1999).

Keeping in view the significance of amino acid, the current research was designed to investigate the "Influence of various commercial amino acids containing plant tonic on the growth, yield and quality of peach cultivars" with the following objectives;

To find out the best plant tonic containing amino acids for the maximum fruit quality of peach cultivars in the Peshawar climate.

To find out the interaction between tonics and cultivars on the quality of peach.

## MATERIALS AND METHODS

An experiment "Influence of various commercial amino acids containing plant tonic on the growth, yield and quality of peach cultivars" was carried out at Agricultural Research Institute Tarnab Peshawar, Pakistan during 2017.

### Experimental Design

Randomized Complete Block Design (RCBD), with split plot arrangement having four replication was used for experimentation. However each tree was considered as one replicate. The experiment was conducted on nine years old tree having uniform age, height and shape. The tree to tree and row to row distance was 6 m. Total 48 trees were selected, while each cultivars had 16 trees.

### Factor A: Cultivars (Main plot) Factor B: Plant tonics (Sub plot)

- |                     |   |
|---------------------|---|
| 1. Early Grand      | 1. T0 (No treatment),                       |
| 2. Florida King     | 2. T1 (Amino acids + Micronutrients)        |
| 3. Tex-y4-55        | 3. T2 (Amino acids + Organic matter + NPK). |
| 4. T3 (Amino acids) |   |

### Management Practices

The irrigation, weeding, fertilizer application and plant protection measures were practiced uniformly and according to the need.

### Application of tonics

Each tonic at the rate of 5 ml L<sup>-1</sup> of water was applied as foliar spray after fruit set on each tree, accordingly.

### Attributes studied

The following quantitative and qualitative attributes were studied during experiment are given below.

### Total soluble solids (TSS) °Brix

Total soluble solid of peach fruit was obtained with the help of digital refractometer.

### Titrateable Acidity (TA) %:

The percent acidity was determined by titrating 5-ml juice with 0.1N sodium hydroxide using phenolphthalein as indicator (AOAC 2000).

### TSS: acid ratio

TSS: acidity ratio was determine by the following formula

$$\text{TSS acid ratio} = \frac{\text{TSS}}{\text{Acidity}}$$

### Reducing sugar (%)

#### Procedure

Fruit juice was added to 100 ml volumetric flask. Distilled water was used to raise its volume to specific point. The burette was filled from the sample of dilute solution. After that conical flask was filled with 10 milliliters of distilled water along with 5ml of Fehling (A+B) solution. The sample solution was added to the boiling solution from burette until the red color bricks in the flask was appeared. Methylene indicator was added to turn the blue color red.

### Calculations

Five milliliters of both Fehling A and B- X ml of 10% syrup solution-0.05 g of reducing sugar.

100 ml of 10% sample solution contain  $x = \frac{0.05 \times 100}{X \text{ ml}} = Y \text{ g}$  of reducing sugar

$$\text{Reducing sugar in sample (\%)} = \frac{Y \times 100}{\text{burette reading}}$$

### Non-Reducing sugar (%)

#### Procedure

100 ml volumetric flask was filled with 10 ml of peach fruit juice sample. Volume was raised by distilled water, after that 10 ml of 1 N NaoH was added in dilute sample solution and was heated for 5- 10 minutes. The 10 ml of 1 N NaOH was

done when it became cool, and solution become reached to 250 ml by the addition of distilled water. Burette was filled with sample solution, and also taken 10 milliliters of distilled water, along with 5 ml of Fehling (A+B) and then boiled. It again appear the red brick in the solution. Red color was appeared by the addition of Blue methylene.

### Calculations:

X ml of syrup solution contains = 0.05 g reducing sugar

$$250 \text{ ml syrup of solution} = \frac{250 \times 0.05}{X \text{ ml}} = Y \text{ of reducing sugar}$$

X ml – mean of three readings

250 ml solution obtained from 20 ml of 10% sample

So

$$100 \text{ ml sample contains} = \frac{P \times 100}{10} - Q \text{ g of total sugar}$$

Non-reducing sugar = Total reducing sugar- Free reducing sugar.

### Statistical Analysis

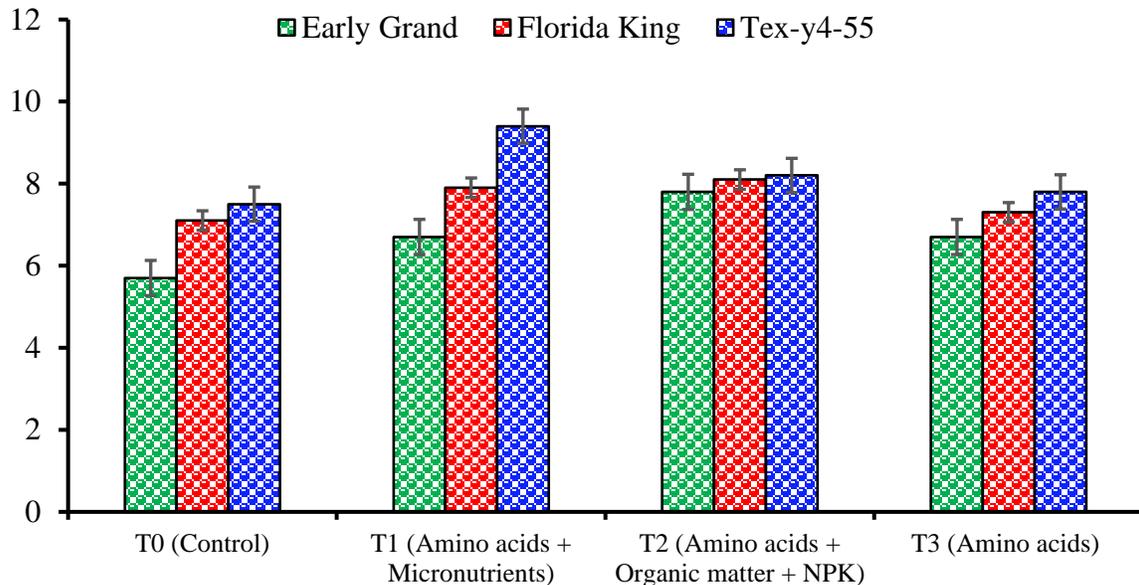
Data were statistically analyzed by statistical software, Statistix 8.1 for analysis of variance (ANOVA) of RCB Design with split plot arrangement. For the significant data (LSD) test was done (Steel and Torrie 1997).

## RESULTS AND DISCUSSION

### Total soluble solid (Brix)

Mean value of peach cultivars indicated that higher TSS (8.2 °Brix) was observed in Tex-y4-55 followed by Florida King (7.6 °Brix), while lowest TSS (6.7 °Brix) was recorded in Early Grand (Table 2). Maximum TSS (8.0 °Brix) was observed in T1 (Amino acids + Micronutrients) and T2 (Amino acids + Organic matter + NPK) followed by TSS (7.3 °Brix) observed in T3 (Amino acids) which was statistical at par with T0 (Control) (Table 1). Interactive effect of plant tonics and cultivars showed that application of Amino acids + Micronutrients significantly increased TSS with all cultivars particularly in combination with Tex-y4-55 (figure 1).

Different cultivars have different chemical structure and genetic nature. Khan et al. (1988) observed highest value for total soluble solids in Florida King and Early Grand as compared to other cultivars.



**Figure 1: Interactive effect of plant tonics and cultivars on total soluble solid (°Brix) of peach**

Increase in total soluble solid due to T1 (Amino acids + Micronutrients) might be due to the reason that it is a combination of amino acid and as well as some important micro nutrient that play an important role in photosynthesis and enzyme responsible for plant metabolism (Singh, 2002). Similar trend were observed by (Refaar and Naiub, 1998) reported that the TSS of the fruit significantly increase as a result of foliar application of pepton that contain amino acids. These result are also line with Sahar and El-Wahab, (2015) who reported that combine application of amino acid with Ca (NO<sub>3</sub>)<sub>2</sub> had significantly increased the level of TSS in fruit.

#### Titrateable acidity

The peach cultivars showed that the higher total acidity (0.8%) was noted in Early Grand, while lower total acidity (0.6%) was noted in Florida king and Tex-y4-55 (Table 1).

Mean value of tonic revealed that the maximum TA (0.8%) was found in T0 (Control) followed by T3 (Amino acids) (0.7%), while minimum Total acidity (0.6%) in T1 (Amino acids + Micronutrients) and (Amino acids + Organic matter + NPK) which were statistically similar (table 2). The differences in acid content may be lead to genetic variation in peach cultivars. Current results are in contrast with the results of Khan and Ali (1988) who noted minimum acidity

content in Early Grand.

Decrease in TA may be related with sugar acid ratio and TSS because when it increase then its total acidity will be decreases. These result are similar with findings of Mouco et al. (2006) who reported that the foliar application of amino acid has no significant effect on acidity. These result are line with (Taiz and Zeiger, 2002) who noted that After testing the use of amino acids in plants from the Benitaka cultivar, Albuquerque and Dantas have observed that two sprayings of a solution with 4.15 mg L<sup>-1</sup> of amino acids, applied on the fruit growth phase were enough to reduce the acidity in grapes.

#### TSS: Acid ratio

Mean data of peach cultivar represented that highest TSS acidic ratio (13.0) was recorded in Tex-y4-55 cultivar followed by Florida King (12.7) which is statistical similar with Tex-y4-55, while lowest TSS acidic ratio was observed in Early Grand (8.6) (table 1)

Mean value for tonics revealed that highest TSS acidic ratio of (12.5) was observed in T2 (Amino acids + Organic matter + NPK), followed by T1 (Amino acids + Micronutrients) (11.4) and T3 (Amino acids) (11.1), while minimum TSS acid ratio (10.6) was recorded in T0 (Control) (Table 2)

**Table 1: Total soluble solid (°Brix), titratable Acidity (%), TSS acid ratio, reducing sugar (%) and non reducing sugar (%) as affected by the foliar application of plant tonics.**

Plant Tonics	Total soluble solid (°Brix)	Titratable Acidity (TA) %	TSS acid ratio	Reducing sugar (%)	Non reducing sugar (%)
T0 (Control)	6.7 a	0.8 a	10.6 c	1.4 c	1.5 d
T1 (Amino acids + Micronutrients)	8.0 a	0.6 c	11.4 a	1.7 a	1.8 a
T2 (Amino acids + Organic matter + NPK)	8.0 a	0.6 c	12.5 a	1.7 a	1.6 c
T3 (Amino acids)	7.3 b	0.7 b	11.1 b	1.6 b	1.7 b
LSD for plant tonics	0.6	0.1	1.1	0.1	0.1

**Table 2: Total soluble solid (°Brix), titratable Acidity (%), TSS acid ratio, reducing sugar (%) and non- reducing sugar (%) as affected by the peach cultivars.**

Cultivars	Total soluble solid (°Brix)	Titratable Acidity (%)	TSS acid ratio	Reducing sugar (%)	Non- reducing sugar (%)
Early Grand	6.7 c	0.8 a	8.6 b	1.5 c	1.5 c
Florida King	7.6 b	0.6 b	12.7 ab	1.6 b	1.7 a
Tex-y4-55	8.2 a	0.6 b	13.0 a	1.8 a	1.8 a
LSD for Cultivars	0.3	0.1	1.7	0.1	0.2

Difference in sugar acid ratio might be due to increase in total soluble solid and decrease in percent acidity. These results are in line with the work of Sourour (2000) who reported that increment in the TSS acid ratio of pear may be due to increase in TSS and lower percent acidity.

Micro nutrients are involved in sugar metabolism and accumulation of carbohydrates (Sourour 2000). While amino acids are involved in the production of various proteins, and sugars (Khan et al. 2012). Current results are in line with (Razek et al. 2012). They reported that all the treatments of amino acid (Peptone as a product) that are applied as a soil or foliar application significantly affected the TSS/TA ratio of peach fruit as compared to T0 (Control) treatment.

#### Reducing sugar (%):

Mean value of peach cultivars revealed that the highest reducing sugar (1.8 %) was recorded in Tex-y4-55 cultivar followed by Florida King (1.6 %), while the lowest reducing sugar (1.5 %) was recorded in Early Grand (table 1).

In case of tonics application, a higher value of reducing sugar (1.7 %) was recorded for T1 (Amino acids + Micronutrients) which was statistically similar with T2 (Amino acids + Organic

matter + NPK) (1.7 %) followed by reducing sugar (1.6 %) observed in T3 (Amino acids), while the minimum reducing sugar (1.4 %) was recorded in T0 (Control) (table 2).

The interaction between peach cultivars and tonics indicated that the maximum reducing sugar (2.1 %) was observed in Tex-y4-55 when treated with T1 (Amino acids + Micronutrients) treatment, while the lowest reducing sugar (1.3 %) was observed in Early Grand when treated with T0 (Control) (figure 2).

Every cultivar has its own genetic makeup and chemical status. Similar results are noted by Khan et al. (1988) who noted less reducing sugar content in Camden. Current results are similar with Khan et al. (2012) who stated that the level of reducing sugar of berry juice is significantly ( $P \leq 0.5$ ) induced by the use of foliar application of amino acids. They reported that high levels of reducing sugar (1.3-fold) were observed in the berries harvested from grapevines sprayed with foliar application of amino acid.

#### Non-Reducing sugar (%):

The data relating to Non-Reducing sugar (%) are shown in Table 13. Mean value of peach cultivars indicated that the highest non-reducing sugar (1.8 %) was recorded in Tex-y4-55 cultivar followed by

Florida king (1.7%), while less non-reducing sugar (1.5 %) was recorded in Early Grand (table 1).

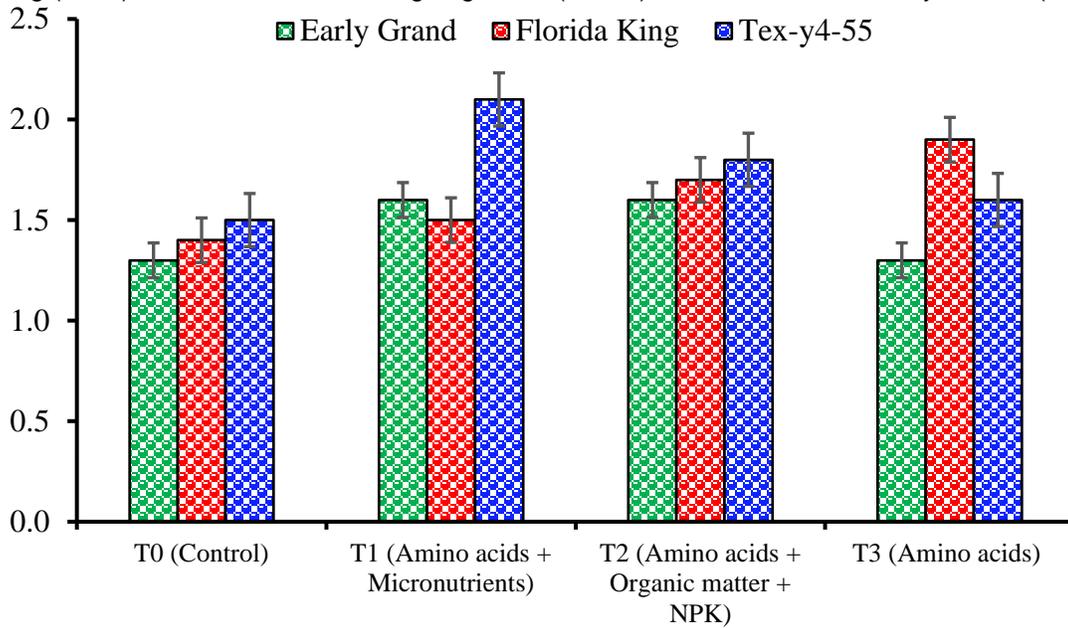


Figure 2: Interactive effect of plant tonics and cultivars on reducing sugar (%) of peach

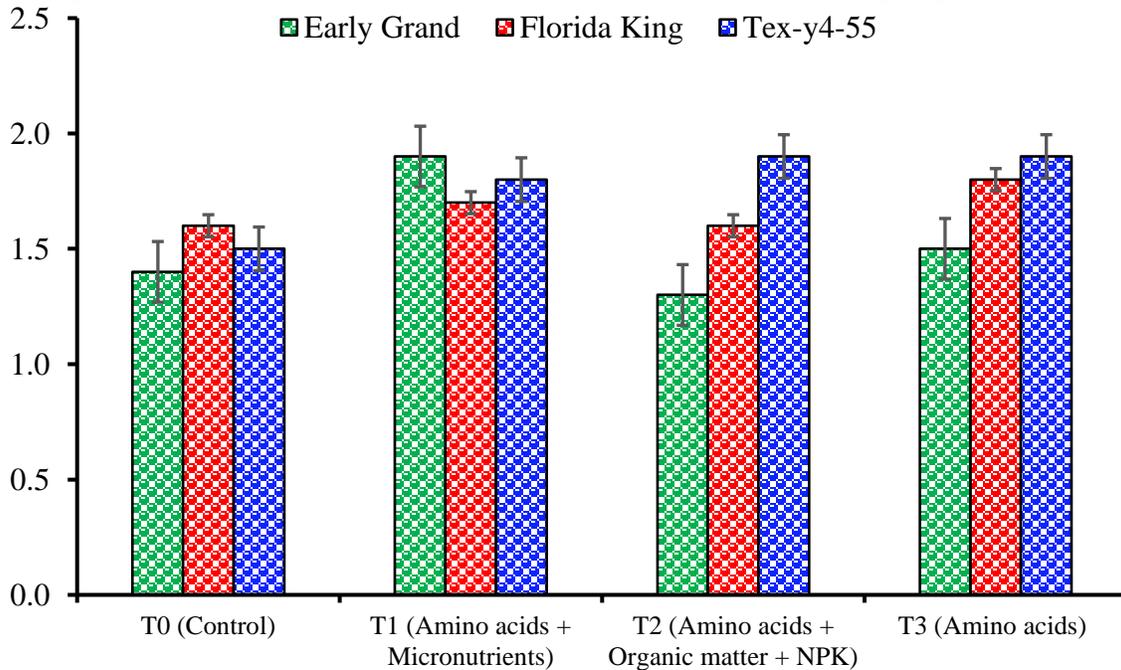


Figure 3: Interactive effect of plant tonics and cultivars on non-reducing sugar (%) of peach

Mean value of tonics revealed higher non-reducing sugar of (1.8 %) was observed in T1 (Amino acids + Micronutrients) followed by non-reducing sugar (1.7 %) observed in T3 (Amino acids) while less (1.5 %) was recorded in T0 (Control) (table 2).

Peach cultivars and tonics interaction showed that highest non-reducing sugar (1.9 %) was observed in Tex-y4-55 when treated T1 (Amino acids + Micronutrients), while lowest reducing sugar of (1.5 %) was observed in Early Grand when treated with no application of plant tonics (figure 3).

Variation among peach cultivars in non-reducing sugar might be due to varietal characteristics, climatic condition or their genetic differences. These findings are same with Khan et al. (1988) who reported the sucrose content of Early Grand, Camden, Florida King and Floridasun is almost in same range. The non-reducing sugar increases due to the foliar application of T1 (Amino acids + Micronutrients) is because of the reason that foliar application of amino acid and micronutrients improve leaf chlorophyll content which results in increased rate of photosynthesis and accumulation of carbohydrate reserves. These results are in line with Khan et al. (2012) who stated that a mixture of amino acids sprayed at the time of flowering, fruit setting stages of grapevines produced 1.3-fold higher level of non-reducing sugars in the berry juice as compared to all other treatments.

## CONCLUSION

Based on results of the experiment it is concluded that

The tree treated with T1 (Amino acids + Micronutrients) produced comparatively higher Total Soluble solid, Percent acidity, TSS: acid ratio, Reducing sugar and Non-reducing sugar.

Cultivar Tex-y4-55 had more Total soluble solid, TSS: acid ratio, Reducing sugar and Non-reducing sugar as compared to other cultivars.

Recommendation

On the basis of conclusion following recommendations are made.

It can be recommended on the basis of the present experiment that Peach cultivar Florida King could be sprayed with 5 ml T1 (Amino acids + Micronutrients) to obtain better fruit quality in Peshawar climate.

## CONFLICT OF INTEREST

The authors declared that present study was

performed in absence of any conflict of interest.

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## AUTHOR CONTRIBUTIONS

Add contribution of each author (with abbreviated name) here. For example, MA, MNK designed and performed the experiments and. SK, MTD, I, and N wrote the manuscript, MB, NK, HB and S analyzed the data. MA, SK and S designed experiments and reviewed the manuscript. All authors read and approved the final version.

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