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The Effect of Some Growth Regulators and Ascorbic Acid to Improve Fruit Quality of Balady Guava Trees Growing in Sandy Soils

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ABSTRACT

The present study was carried out during 2017and 2018 seasons on 10 years old Balady guava trees (*Psidium guajava* L.) grown at private orchard located on "Cairo-Alexandria Desert" road about 49 Km from Cairo, Egypt. Trees planted at 4 × 4 meters apart in sandy soil under drip irrigation system. The aim of this work was improving fruit quality of Balady guava trees by gibberellic acid (GA_3), benzyladinine (BA) and ascorbic acid. Gibberellic acid and benzyladinine were used as a spray at rate (50 and 100 ppm) were applied twice the first one after 80% at full bloom, and the second time after 10 days later, ascorbic acid at rate (200 and 400 ppm) spraying twice in June and before collected with a month. The experimental treatments were arranged in Randomized Block Design with three replications for each. The results were summarized that: All treatments significantly improved characteristics of vegetative growth, physical parameters, biochemical characteristics and yield. The results cleared that gibberellic acid (GA_3) and benzyladinine (BA) foliar spray induced a positive effect on leaf characteristics (leaf area and total chlorophyll content), Shoot length, number of fruits / tree, yield, fruit weight, pulp %, fruit length, fruit diameter and reduced seed %. The highest values were recorded under foliar application of 100 ppm gibberellic acid or benzyladinine. Quality parameters namely total soluble solids, total acidity content, total sugar (%) and fruit ascorbic acid content than the control treatments were also found to be improved with ascorbic acid at 400 ppm. It may be recommended the application of gibberellic acid or benzyladinine at 100 ppm and 400 ppm Ascorbic acid in order to enhance yield, fruits quality, high suitable for marketability in local or export markets comparison to untreated plants (control) and other application.

Keywords: Gibberellic acid, Benzyladinine, Ascorbic acid, Balady guava, vegetative growth, fruit quality yield.

Introduction

Guava (*Psidium guajava* L.) is one of the most popular fruits in Egypt, grown commercially in tropical and subtropical areas of the world (Das, 2020). In Egypt, guava is a popular cultivar, considered one of the most important fruit crop either for local consumption or export, because of low price, taste and health benefits. According to the recent and the latest statistic of Ministry of Agriculture (2021), the total cultivated area of guava in Egypt reached about (39.057) feddans with annual production about (357.787) tons of fruits. It is rich in vitamins and antioxidants, a high levels of pectin, minerals as well as fiber, antioxidant, the pulp contains vary number and hardness of seeds and it is off white to deep pink depending on the variety (Tanishka, 2020). However, fruits guava are eaten fresh or juice as well as making many products such as jam, jelly and juice concentrate, cheese, dehydrated slices, toffee, freeze -dried guava and canned guava. Also, used in the cosmetic industry and seeds have been explored as a source of biofuel. Also, leaves, roots and bark are used in local medicines (Cavalcanti *et al.,* 2022).

The guava orchard increased, especially in the newly reclaimed lands, and it is a highly profitable economic crop. Called a hardy plant, it can grow under a wide range of soil types and climatic conditions due to its tolerance to moisture stresses.

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Most of guava trees are cultivated from seeds causing genetic variability (Elsisy 2013), there are several varieties with differences in shape, size and flesh color in Egypt. In the commercial farming of guava, many efforts that could be done to regulation crop has leading to healthier plants and better quality fruits for competitiveness in global markets. The market value of guava is based on characterizations its desirable appearance size, shape, color, and taste for consumer demands (Ali *et al.,* (2020).

Many problems in recent years affect on productivity in guava guava fruits which it different nutrients deficiency resulting the loss in quality and storage life i.e. large variability in size and shapes of fruit and color of pulp, high percentage of seeds in the fruit, the low percentage of pulp, vitamin C, sugars and some physiological disorders like the pest and fruit fly are the deterioration of the tree growers and large of fruit is lost after harvest due to bio-chemical changes increase Manish and Devi (2018).

Guava fruits marketing depend on characteristics such as mass of the fruit flesh, sweet taste, fruit size, sweetness, lowest number of seed per fruit, good firmness, juice quantity, aroma, texture, colour uniformity of fruits, free from the pest and diseases, having long storage life, fruits contents highest values of soluble solid and ascorbic acid. Therefore, necessity to search for technologies to improve the marketing are important (Rajesh *et al.,* 2018). Producing guava fruits with the best external and internal quality is an important factor during marketing. So, guava crop regulation practice can be achieved enhancing balance between yield and quality and sustainability of production (Yadav *et al.,* 2023). Are needed strategies to quality guava crop, make guava cultivation highly sustainable, profitable, export marketing value European markets and gives more price to growers.

Levels of hormones will change over the lifespan of a plant and are dependent upon season and environment. Hence, the cultural practice that most influences the quality fruits depending on the application of natural or synthetic phytohormones as plant growth regulators (PGRs) preharvest has been successfully on fruit crops to environmental factors such as drought conditions, light, and temperature, chemical or physical stress, regulating fruit growth, correcting the rapid changes in physiological disorders, decrease post-harvest losses and improving quality and production (Kumar 2021 and Keshav *et al.,* 2023).

Strategy is to use of some plant growth regulators (PGRs) including Gibberellic acid (GA_3), benzyladenine (BA), led to increase commercial use on fruit crops for enhancing tree led to improve fruit qualities, such as size and color, firmness and shape, decrease seed number, increased consumer value through blemish-reduction and prevent the storage and produce superior fruit (Bhavana *et al.,* 2022).

Phytohormones, like gibberellic acids (GA), that protect plants from environmental stresses. Gbberellins a growth-promoter, a deficiency in bioactive Gibberellic acid during the development of fruit resulted in severe developmental disorders and constrained fruit characteristics (Khan *et al.,* 2020).

Using the foliar application with cytokinins may modify plant morphological and physiological characteristics and adaptation to environmental conditions by improving vegetative growth, fruit set, yield, fruit number, size and enhance productivity (Rademacher, 2015). physiological responses to BA application may be associated with increasing endogenous cytokinins concentrations and regulates growth processes in plant (Mostafa *et al.,* 2018).

Meanwhile, using natural and organic compounds (antioxidants) such as ascorbic acid (vitamin C), as well as it is considered bio-regulator compounds, play an important role in regulating fruit quality and plant defense of diseases and pest (Smirnoff, 2018). These compounds safe for human, animals, environment and can be considered as good alternatives to chemicals in agricultural production and play an important role in encourg the vegetative and fruiting growth (Bhiah and AL-Zurfi, 2020). Its helps to improve the nutritional value of the fruit, played an important role in abiotic stress resistance, protecting cells from damage and promote plant growth and fruit quality improvement (Xianzhe Zheng *et al.,* 2022).

Therefore, the aim of this work was to overcome the problem of Banati guava trees grown under sandy soil conditions through studying the effect of spraying gibberellic acid, benzyle adenine and ascorbic acid at different concentrations in order to enhance vegetative growth, fruits quality and high marketability in local or export markets and help farmers to good income.

2. Materials and Methods

2.1. Field Experiment

This experiment was done at a private orchard, Cairo-Alexandria desert Road, 49 km from Cairo-Alexandria, Egypt. Throughout the two seasons of 2017 and 2018 on ten years old Balady guava to improve yield and fruit quality. Ten- years- old Balady guava trees (*Psidium guajava,* L) were almost uniform in shape with 4 × 4 m plant spacing were selected for investigation and grown beneath a drip irrigation system in sandy soil and received the standard agricultural practices that were used in the orchard inclusive fertilization, irrigation and pest management were devoted for this study.

2.2. Experimental Design

This experiment was laid out in a simple randomized block design (RBD) with 7 treatments each had three replicates. The treatment consists of plant growth regulators gibberellic acid (GA_3) at 50 and 100 ppm, benzyladenine (BA) at 50 ppm and 100 ppm and ascorbic acid (VC) at 200 ppm and 400 ppm, comparing to tap water sprayed (control). The data were subjected to analysis of variance and Duncan's multiple range test were used to study the differentiate between means as described by Duncan (1955).

The seven treatments evolved in this investigation were outlined as follows

1- Control (water spraying).
2- Spraying with gibberellic acid (GA_3) at 50 ppm.
3- Spraying with gibberellic acid (GA_3) at 100 ppm.
4- Spraying with benzyladenine (BA) at 50 ppm.
5- Spraying with benzyladenine (BA) at 100 ppm.
6- Spraying with Ascorbic acid (AsA) at 200 ppm.
7- Spraying with Ascorbic acid (AsA) at 400 ppm.

The trees were sprayed Two times, with gibberellic acid and benzyladenine: the 1st date at 80% of flowering, the 2nd date at after 10 days, spraying with Ascorbic acid on two dates, the 1st date in beginning mature fruits and the 2nd date before collected with month.

2.3. The following parameters were recorded for both seasons

Leaf area, Leaf total chlorophyll content and shoot length (cm)

- In mid-September of both seasons, samples of twenty leaves (the third leaf from the base of the previously tagged non fruiting shoots) were collected. The average leaf area (cm^2) was determined using the following equation as reported by Demirsoy (2009).

$$LA = 0.70\ (L\ x\ W) - 1.06$$

where LA is a leaf area (cm^2), L is the maximum length of leaf (cm), and W is the maximum width of the leaf (cm).

- Leaf chlorophyll content in fresh leaves was assessed by chlorophyll meter (SPAD-502; Konica Minolta, Osaka, Japan) and the results were expressed in SPAD units.

2.4. Fruit quality parameters

2.4.1. Fruiting Physical parameters

At harvest time (September), for each season sample of ten fruit / tree/ replicate were randomly taken from all sides of the trees under treatments to measure the physical and chemical fruit properties:

2.4.2. Fruit Physical properties:

(a) Fruit dimensions (length and diameter cm),
(b) fruit weight (g)
(c) Pulp (%) =Weight of fruit pulp/Total fruit weight × 100.
(d) Seed weight (%) = Seed weight per fruit / average fruit weight × 100.

- Number fruits/tree were counted and estimated Yield (kg/tree),

2.4.3. Fruit chemical properties

(a) Total soluble solids were estimated by using the hand refractometer.
(b) Total acidity was determined according to A.O.A.C (2000).
(c) Total sugars percentage were determined as outline in A.O.A.C (2000)
(d) Ascorbic acid content of the juice (Vitamin C mg/100 mg juice) was estimated by titration with 2,6 dichloro phenol-indo-phenol (Nielsen 2017) and calculated as mg/100 mL of juice.

3. Results

3.1. Some vegetative growth characteristics

3.1.1. Effect of foliar application with gibberellic acid, benzyladenine and ascorbic acid on leaf area, leaf total chlorophyll content SPAD and shoot length.

With respect to leaf area, Total chlorophyll and Shoot length of Balady guava trees in response to the effect of different treatments under study, data in Table (1) clearly that, all spraying treatments increased significantly leaf area, Chlorophyll and shoot length as compared to the - control during the first and second seasons of study. Moreover, the obtained results showed that gibberellic acid at (100 ppm) treatment induced maximum values of leaf area (61.38 -60.51). On the other hand, the control treatment gave the lowest values (36.17 and 35.21) in the two seasons.

Regarding the effect of different studied treatments on total chlorophyl of Balady guava trees, data represented in the same Table (1) showed obviously that, gave the maximum chlorophyll values (SPAD value) in leaves with BA at 100 ppm (0.57) and GA_3 at 100 ppm (0.52), respectively in the first season. While, in the second season spraying guava trees with gibberellic acid at each at 50 or100 ppm and BA at 100 ppm gave highest total chlorophyll (0.51, 0.51 and 0.54) than the other used treatments

Furthermore, the data obtained were subjected to statistical analysis. The GA_3 at 100 ppm concentration significantly maximized (24.69 and 25.71 cm) shoot length. But a significantly lowest (11.0 and 11.26 cm) shoot length were noted under control in both seasons, respectively.

Table 1: Effect of foliar application of gibberellic acid, benzyladenine and ascorbic acid on Leaf area, Total chlorophyll and Shoot length in Balady guava during 2017 and 2018 seasons.

Treatments	Leaf area (cm^2)		Total chlorophyl SPAD		Shoot length (cm)	
	2017	2018	2017	2018	2017	2018
Control	36.17 E	35.21 D	0.41 D	0.43 B	11.0 E	11.26 E
GA_3 50	37.51 E	39.31 D	0.49 BC	0.51 A	16.98 C	17.17 C
GA_3 100	61.38 A	60.51 A	0.52 AB	0.51 A	24.69 A	25.71 A
BA 50	44.15 D	45.92 C	0.45 CD	0.44 B	21.56 B	22.45 B
BA 100	57.33 B	56.33 AB	0.57 A	0.54 A	16.48 CD	16.26 D
ASA 200	45.58 D	45.00 C	0.42 D	0.42 B	15.51 D	15.83 D
ASA 400	52.31 C	51.52 B	0.42 D	0.41 B	16.01 CD	16.10 D

Means followed by the same letter(s) in each column are not significantly different at 5% level.

3.2. Fruit physical properties

3.2.1. Effect of foliar application with gibberellic acid, benzyladenine and ascorbic acid on average No fruits/tree, fruit weight and yield

Table (2) showed that the data obtained in 2017 and 2018 tow experimental seasons. In general, the response of the measurements taken on the trees such as the No fruits/tree. The average No. fruit were positive for the different treatments that were compared to the control. The number of fruits per tree was significantly affected by all treatments during two seasons. Spray application with GA_3 at 100 ppm produced a highest number of gugava fruits/tree, which were (216.7, 214.0). This was followed by treatment of BA at 100, which were (202.0 and 205.0) during two seasons, respectively.

Furthermore, the increase in the weight of the fruits showed significantly where the height value (123.1 & 123.1 g) from the treatment BA at 100 ppm .On the other hand,the higher value of the fruit weight (117.9 & 118.2 g) with the treatment GA_3 at 50ppm in comparison with control treatment (95.69 and 94.39 g) in both seasons respectively

Data in table (2) showed that average yield per tree (kg) significantly increased by using all studied treatments compared under the control in both seasons. The maximum yield was recorded in the trees received foliar application of GA_3 at 50 ppm and BA at 100ppm (25.00 -25.04 & 24.86 -25.23 kg) . Meanwhile, the lowest yield recorded for trees untreated trees (11.39 &11.61 kg) in both seasons, respectively.

Table 2: Effect of foliar application of gibberellic acid, benzyladenine and ascorbic acid on No fruits/tree, fruit weight and yield in Balady guava during 2017 and 2018 seasons.

Treatments	No fruits /tree		Fruit weight (g)		Yield (kg/tree)	
	2017	2018	2017	2018	2017	2018
Control	119.0 G	123.0 F	95.69 F	94.39 E	11.39 F	11.61 F
GA_3 50	176.0 E	177.0 E	117.9 B	118.2 B	25.00 A	25.04 A
GA_3 100	216.7 A	214.0 A	112.3 D	115.5 C	20.66 C	21.36 C
BA 50	168.0 F	174.0 E	107.4 E	108.6 D	19.80 D	20.56 D
BA 100	202.0 B	205.0 B	123.1 A	123.1 A	24.86 A	25.23 A
ASA 200	192.0 C	193.0 C	117.4 B	115.6 C	22.53 B	22.99 B
ASA 400	184.0 D	185.0 D	115.4 C	115.6 C	18.90 E	19.23 E

Means followed by the same letter(s) in each column are not significantly different at 5% level.

3.2.2. Effect of foliar application with gibberellic acid, benzyladenine and ascorbic acid on fruit length, fruit diameter, Pulp (%) and Seed weight

Regarding fruit physical properties (fruit length, fruit diameter, Pulp (%) and Seed weight), the results revealed that these fruit quality parameters were significantly affected by all applications compared to the control. It can be stated from the obtained data in Table (3) that, Maximum values of fruit length were obtained when trees were treated with GA_3 at 100 ppm (7.20, 7.23 cm) in both seasons respectively when compared with untreated control (5.40 and 5.40 cm) in the two seasons, respectively.

On fruit diameter, the highest values were obtained by treatment of GA_3 at100 ppm, BA at 50 ppm and AS200 ppm in both seasons, respectively (6.97-7.23, 7.00 - 6.80 and 6.67 - 6.80).

Results presented in Table (3) cleared that fruit pulp (%) increased significantly affected by differed treatments as compared with control. The highest fruit Pulp (%) was detected by foliar spray with the GA_3 and BA at 100 each of them it was recorded (94.56 & 94.50 %) in the first, while in the second season foliar spray with GA_3 at 100 ppm (94.86%) gave the highest fruit Pulp (%) under study, respectively. The lowest values were obtained from control (90.37&91.27) in both seasons. Additionally, the effect of treatments.

Our data in Table (3) suggest that Seed weight (%) of Balady guava fruits was decreased significantly affected by different treatments in both seasons. The highest value of Seed weight percentages was recorded (9.64 & 8.73 %) in the two seasons respectively. Meanwhile, decreased the number of seeds produced per fruit was recorded (5.44 - 5.50 & 5.07 %) as a result of spraying tress with GA_3 and BA at 100ppm in the first or GA_3 at 100pp in the second seasons, respectively.

Table 3: Effect of foliar application of gibberellic acid, benzyladenine and ascorbic acid on fruit length, fruit diameter, Pulp (%) and Seed weight (%) in Balady guava during 2017 and 2018seasons

Treatments	Fruit length (cm)		Fruit diameter (cm)		Pulp (%)		Seed weight (%)	
	2017	2018	2017	2018	2017	2018	2017	2018
Control	5.40 D	5.40 D	5.53 D	5.37 D	90.37 E	91.27 E	9.64 A	8.73 A
GA_3 50	6.07 C	6.27 C	6.03 CD	6.03 C	92.05 D	91.61 DE	8.43 B	8.39 AB
GA_3 100	7.20 A	7.23 A	6.97 A	7.23 A	94.56 A	94.86 A	5.44 E	5.07 E
BA 50	6.87 AB	6.73 B	7.00 A	6.80 AB	92.48 CD	92.13CD	7.40 C	7.85 BC
BA 100	6.37 BC	6.40 BC	6.20 BC	6.30 BC	94.50 A	93.87 B	5.50 E	6.08 D
ASA 200	6.77 AB	6.77 B	6.67 AB	6.80 AB	93.05 BC	92.79 C	6.95 CD	7.21 C
ASA 400	6.23 C	6.23 C	6.17 BC	6.57 BC	93.70 AB	92.16 CD	6.30 DE	7.84 BC

Means followed by the same letter(s) in each column are not significantly different at 5% level.

3.3. Fruit chemical properties

3.3.1. Effect of foliar application with gibberellic acid, benzyladenine and ascorbic acid on T.S.S, Total acidity, Total sugars and Ascorbic acid

Data concerning the effect of GA_3, BA and AS on fruit chemical properties of Balady guava trees, during 2017 and 2018 seasons are illustrated in Tables (4). Concerning fruit total soluble solids (TSS %), results indicated that the best treatment for causing the maximum averages through the two times of applications was 400 ppm AS (13.52, 14.10) followed by 200ppm AS (13.00, 13.17 %) during the two seasons**,** respectively. while, the lowest values was obtained with control treatment (8.96, 10.13%) in the two studied seasons.

Table 4: Effect of foliar application of gibberellic acid, benzyladenine and ascorbic acid on TSS, acidity, sugar and in Balady guava during 2017 and 2018 seasons.

Treatments	T.S.S (%)		Total acidity (%)		Total sugars (%)		Ascorbic acid (mg/100 ml juice)	
	2017	2018	2017	2018	2017	2018	n2017	2018
Control	8.96 C	10.13 DE	0.48 A	0.47 AB	7.10 E	7.16 G	161.2 G	164.3 E
GA_3 50	11.93 B	12.33 BC	0.28 CD	0.30 CD	8.85 C	8.98 C	174.5 C	172.3 C
GA_3 100	9.42 C	9.71 E	0.49 A	0.49 A	7.31 E	7.35 F	164.1 F	163.6 E
BA50	10.22 C	11.21 CD	0.42 B	0.42 B	7.81 D	7.85 E	169.7 E	168.8 D
BA100	12.69 AB	12.15 BC	0.33 C	0.34 C	8.61 C	8.63 D	172.6 D	170.8 CD
ASA200	13.00 AB	13.17 AB	0.30 CD	0.30 CD	9.46 B	9.48 B	196.9 B	196.7 B
ASA400	13.52 A	14.10 A	0.26 D	0.25 D	11.30 A	11.30 A	203.0 A	203.0 A

Means followed by the same letter(s) in each column are not significantly different at 5% level.

Concerning to total fruit acidity percentage, as shown in Table (4) data revealed that the untreated dates (control) contained significantly highest acidity content percentages in the guava fruits during 2017 and 2018 seasons than those treated by all treatments (0.49 and 0.49 %) in the two seasons. while, the lowest values was obtained with 400ppm AS treatment (0.26 and 0.25 %) in the two studied seasons.

As for total sugar contents, resulted in the same table show that foliar application of gibberellic acid, benzyladenine and ascorbic acid showed significant increase in sugar content of fruits in the two seasons. Maximum percentage of total sugars was recorded in AS at 400ppm (11.30, 11.30).

With respect to Vitamin C (ascorbic acid), during the two growing seasons the least significant values were obtained by control (161.2 and 164.3). On the other hand, the highest significant values was recorded by AS at 400 ppm (203.0 and 203.0) followed by was obtained in fruits from trees sprayed with 200 ppm AS (196.9and 196.7) during the two experimental seasons.

4. Discussion

The obtained results regarding the effect GA_3 treatment has a positive effect on improve plant growth of guava trees, in agreement with this increased shoot length, leaf area and chlorophyll was observed by in guava (Narayanlal *et al.,* (2013) and Singh *et al.,* 2017), in acid lime Arunadevi (2019) and Sweet Cherry Askarieh *et al.,* (2021). Similarly, application of GA_3 at 10, 20 and 30 mg/L on pear tree increased shoot length, leaf area noticed by Al-Doori *et al.* (2020).

Regarding benzyl adenine and gibberellic acid, there are significant positive effect the most parameters may be its beneficial effect on increasing cell division and cell elongation it increased fruit and flesh weight, fruit length and role in activating the biosynthesis of proteins, RNA, and DNA (Ashour *et al.,* 2018). Also, application of cytokinin such as sitofex and GA_3 individually or in combinations twice at the full bloom and after two weeks from full bloom aimed to ensure economical yield with a good quality for "Kelsey" plum trees (Ennab and Abo Ogiela, 2019).

Several studies have reported improvements in yield and and physiochemical characteristics by GA_3 treatments (Narayanlal *et al.,* 2013 and Singh *et al.,* 2017) in guava. These results are in agreement with Jasim (2018) who indicate that foliar spray with GA_3 recorded the increase in fruit date dimensions. In addition to Kheder *et al.* (2019) showed that effect of GA_3 increase yield, fruit quality, decreased the number of seeds produced per fruit and reduced the weight loss % and decay loss % during shelf life in the 'Balady' mandarin fruit.

In addition, on date palm fruits cv. Braim Al-Samaraie and Al-Falahy (2020) spray with GA_3 at 150 mg.L was affected in most of physical chracteristics and yield. On the other hand, the obtained results in the same line with these reported by Ashour *et al.* (2018) on Barhee Date Palm who mentioned that GA_3 treatment has a positive effect on fruit quality and more effective in reducing acidity.

With regard to the effect of benzyladenine on Barhee Date Palm, their significant positive effect on the most parameters may be due to application of benzyladenine increasing cell division and cell elongation it increased fruit and flesh weight, fruit length and role in activating the biosynthesis of proteins, RNA, and DNA (Ashour *et al.,* (2018). The results of the effect of benzyladenine are in agreement with those found by Al-Shammari and Abdulhadi (2019) they reported that Spraying with benzyladenine(BA) has a concentration of 100 mg. L was effect of characteristics of Date of Palm Phoenix dactylifera L. c.v Khidrawi and Mekkawy fruits. Additionally, the application of 40 ppm at benzyladenine recorded the high values in fruit weight, pulp weight, number of fruit/trees and fruit yield onValencia orange trees found by El-Tanany and Shaimaa (2016).

Several researchers, mentioned that GA_3 and benzyl adenine (BA) each one alone or in combination affected the physical and biochemical quality, such as Tri *et al.,* (2016) on pineapple fruits. Maha *et al.,* (2022) on Sewy and Hayany cultivars affected by all growth regulators applications on parameters, Suman *et al.,* (2023) on guava cv. Allahabad Safeda in semi-arid regions of Rajasthan when using plant growth regulators sole or in combination with micro-nutrients the ability to enhance quality parameters i.e TSS, sugars, ascorbic acid content, sugar acid ratio.

With regard to the effect of ascorbic acid for enhancing growth, yield and fruit quality of gugava trees.

Ascorbic acid improving leaf characteristics may be increases the rate of absorption of nutrients, can prevent chlorophyll degradation, catching free radicals (Bybordi, 2012). Also, it is enhancing cell division and cell enlargement which increases chlorophyll pigment in leaves content (Mahmoud 2016), that reflected in induce more photosynthetic rates led to give more carbohydrates to trees reflected to improved yield. On the other hand, the results obtained concerning the effect of fruiting parameters improved by ascorbic acid application go in line by El-Khayat, (2018) sprayed "Washington navel" orange trees with ascorbic acid at 400 mg/l increase in fruit yield.

Other study indicate that ascorbic acid have improved yield and fruit characteristics of many crops

Mahmoud (2016) on orange trees. In the same trend, it was noticed by Hagagg *et al.* (2020) mentioned that ascorbic acid foliar spray improve fruit yield and fruit physical and chemical properties of olive trees of Picual cv.. In this manner, El Refaey *et al.* (2022) reported that foliar spraying by ascorbic at 100 mg/L recorded the highest on trees growth, yield, and fruit quality of olive variety "Picual" under water stress conditions.

5. Conclusion and Recommendations

The results of the present study proved that using gibberellic acid, benzyladenine and ascorbic acid at different levels as foliar spray on the adult Balady guava trees showed significant positive effect on growth parameters as well as improving yield and fruit quality.

However, gibberellic acid (GA_3) and benzyladinine (BA) foliar spray induced a positive effect on leaf characteristics (leaf area, total chlorophyll content and Shoot length), number of fruits / tree, yield, fruit weigh, pulp % and seed % recorded the highest values with gibberellic acid or benzyladinine at 100 ppm. Meanwhile, fruit length, diameter, recorded the highest values at 100 or 50 ppm with gibberellic acid, Benzyladinine respectively. Fruit chemical properties such as T.S.S, Total acidity, Total sugars and Ascorbic acid recorded the highest values at 400 ppm with ascorbic acid. It could be recommended to use concentrations of gibberellic acid, Benzyl adinineand and ascorbic acid at 50, 100 and 400 ppm to improved characteristics of vegetative growth, enhance physical properties fruits, yield, fruits of good quality, high suitable for marketability in local or export markets and help farmers to good income in comparison to untreated plants (control) and other application.

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