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Influence of bio-regulators on quality of guava (*Psidium Guajava* L.) Cv. Arka Mirdula and Arka Amulya

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Abstract
The experiment was conducted at Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai Nagar, Tamil Nadu, during 2013 to 2015 to find out the effect of bio-regulators on quality of guava cv. Arka Mirdula and Arka Amulya was conducted in Factorial Randomized Block Design with nine treatments and three replications in two seasons *viz.,* June to July and January to February. The treatments consisted of T_1- GA_3 50 ppm, T_2- GA_3 100 ppm, T_3- NAA 100 ppm, T_4- NAA 500 ppm, T_5- Brassinosteroids 0.5 ppm, T_6- Brassinosteroids 1.0 ppm, T_7- Ethrel 500 ppm, T_8- Ethrel 1000 ppm and T_9- Control (Water spray). The effect of different treatments and varieties were evaluated based on their influence on the quality attributes *viz.,* total soluble solids, ascorbic acid and total sugars. The results of the present study revealed that GA_3 50 ppm proved to be the best in increasing the quality characters like TSS, ascorbic acid and total sugars in both the cultivars in both seasons.

Keywords: Bio-regulators, fruit quality characters

Introduction
Guava (*Psidium guajava* L.), the apple of the tropics, is one of the most common fruits in India. It is belongs to the family Myrtaceae. It is the fourth most important fruit in area and production after mango, banana and citrus. Currently Brazil, USA and China are the leading guava producing countries in the world. It is one of the most important fruit trees grown in India in an area of 2.19 lakh hectares with a production of 25.71 lakh tonnes. In Tamil Nadu, it is cultivated in an area of 10,045 hectares with a production of 92,500 tonnes (NHB Database, 2014). Plant growth regulators as foliar applications are the most powerful tools for manipulating tree growth, flowering, yield and fruit quality particularly fruit size, as well as, controlling fruit maturation. There are a number of different types of phytohormones like auxins, gibberellins, cytokinins and inhibitors, resulting in cell growth or division and which are further more involved in all the various aspects of development. The use of bio-regulators has resulted in outstanding achievements in several crops with regard to improvement in quality and yield. Hence the present investigation was conducted to study the effect of bio-regulators on quality of guava cv. Arka Mirdula and Arka Amulya.

Materials and methods
Twelve years old trees of guava cv. Arka Mirdula and Arka Amulya planted at 6 X 6 m apart at orchard of the Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai Nagar during 2013-2015 were utilized for studying the effect of various bio-regulators on the fruit quality. The experiment was conducted in factorial randomized block design with three factors, growth regulators with nine treatments comprising of GA_3 (50 and 100 ppm), NAA (100 and 500 ppm), BRs (0.5 and 1.0 ppm), ethrel (500 and 1000 ppm) and control (water spray) and two varieties and two season *viz.,* Arka Mirdula and Arka Amulya and in two seasons *viz.,* June to July and January to February, which were replicated thrice. The trees were sprayed thrice i.e. before flowering, after fifty percent flowering and at pea stage. After harvesting, five fruit are taken for each replication for quality analysis. TSS was determined with the help of hand refractometer. Ascorbic acid was analyzed by using the standard method recommended by Anon (1970) [1]. Total sugar content was determined by using anthrone reagent method (Ranganna, 1977) [6]. Statistical analysis was carried out as per the methods prescribed by Panse and Sukhatme (1978) [5].

Results and discussion

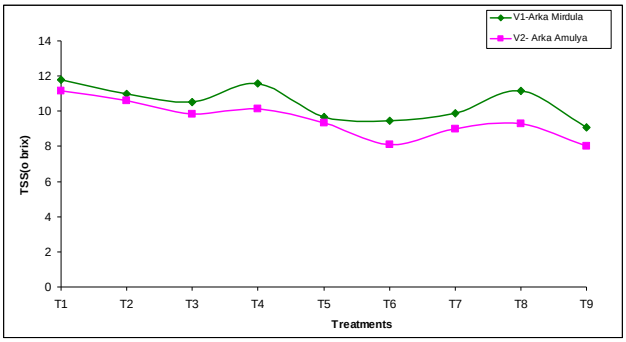
The observations related to TSS increased under all the treatments over control (Fig 1). Among the varieties, maximum TSS (10.46 ^{0} brix and 8.06 ^{0} brix) was observed in Arka Mirdula in season I and season II, while Arka Amulya recorded the lowest TSS (9.49 ^{0} brix and 7.28 ^{0} brix) in both the seasons respectively. T_1 (GA_3 50ppm) registered the highest TSS (11.47 ^{0} brix and 9.60 ^{0} brix) in both the seasons. T_9 (control) recorded the lowest TSS in both seasons (8.54^0 brix and 5.45^0 brix). Significant effects were observed with regard to interaction between the varieties and treatments. The highest TSS (11.79 ^{0} brix) in season I and (9.98 ^{0} Brix) in season II was recorded in T_1V_1. The lowest TSS (8.03^0 brix and 4.98 ^{0} brix) was observed in T_9V_2 in season I and season II. GA_3 application resulted in an increase in TSS content which might be due to the quick metabolic transformation of starch into soluble sugars and rapid mobilization of photosynthetic metabolites and minerals from other parts of the plant. Similar findings have been reported by Singh *et al.*, (2009) [9, 10] in guava, Vijyakumar and Shanmugavelu (1983) [11] in banana and Shinde *et al.* (2008) [7] in acid lime.

The ascorbic acid content in guava fruit was significantly increased with the application of bio-regulators (Table 1). Arka Mirdula fruits had the maximum ascorbic acid content (224.24 mg/100 g and 217.83 mg/100 g) in season I and II respectively. The lowest ascorbic acid content was observed in Arka Amulya (220.31 mg/100 g and 207.09 mg/100 g) in both the seasons respectively. Maximum ascorbic acid content was observed in T_1 (270.13 mg/100 g and 263.66 mg/100 g), while the lowest ascorbic acid content was observed in T_9 (control) which registered 164.32 mg/100 g and 156.50 mg/100 g in season I and II respectively. The interaction effect of varieties and treatments was significant for this trait. Maximum ascorbic acid content was observed in T_1V_1 (271.20 mg/100 g and 267.21 mg/100 g) in season I and II respectively, while the least ascorbic acid content (162.80 mg/100 g and 152.90 mg/100 g) was observed in T_9V_2 in both the seasons. Earlier observations revealed that higher ascorbic acid contents with application of GA_3 might have been due to the inhibitive influence of these growth regulators on the oxidative enzymes (Mc-Cune and Galaston, 1959) [2] and Singh *et al.* (2009) [9, 10] in ber.

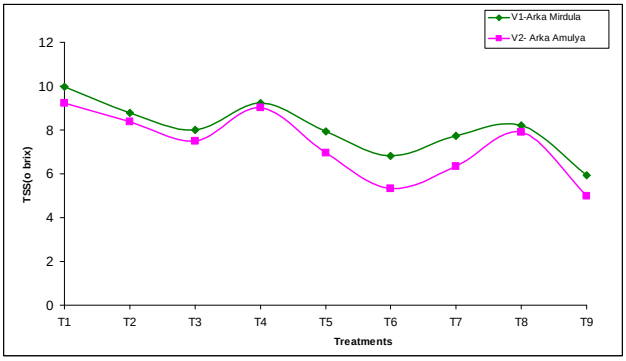
Total sugar content showed significant differences among the varieties (Table 2). In Arka Mirdula, it was significantly higher (6.93% and 6.10%) when compared to Arka Amulya which recorded 6.08% and 5.70% in both the seasons respectively. Comparing two seasons, season I recorded highest total sugar content, while the least total sugar content was observed in season II. However among all the bio-regulators, GA_3 50 ppm registered the highest total sugars (8.43% and 8.05%), while the control registered lowest sugar content (4.34% and 3.86%) in season I and season II respectively. Significant effects were observed with regard to the interaction between varieties and treatments. The highest total sugar content (8.65% and 8.12%) was recorded T_1V_1 in season I and II, while T_9V_2 registered the least total sugar content (3.89%) in season I and 3.69% in season II. The increased sugar content due to GA_3 application might be due to its active role in diverting the translocation of soluble solids to fruits (Paleg, 1961) [4], Yadav (2006) [12] in guava and Shrivastava and Dinesh (2006) [8] in mango.

Thus it can be concluded from the results of the present study that Arka Mirdula showed a better performance than Arka Amulya with regard to the quality characters in both the seasons. Among the two seasons, the performance of Arka Mirdula was better in season I when compared to season II. Among the various bio-regulator treatments, GA_3 50 ppm proved to be the best in increasing the quality characters of both cultivars in both seasons.

Season I



Season II



T1-GA3 50 ppm
T2- GA3 100 ppm
T3- NAA 100 ppm
T4- NAA 500 ppm
T5- Brassinosteroids 0.5 ppm
T6- Brassinosteroids 1.0 ppm
T7- Ethrel 500 ppm
T8- Ethrel 1000 ppm
T9- Control

Fig 1: Effect of bio-regulators on TSS (^{O} brix) in guava cv. Arka Mirdula and Arka Amulya

Table 1: Effect of bio-regulators on ascorbic acid (mg/100 g) in guava cv. Arka Mirdula and Arka Amulya

Treatments	Ascorbic Acid (mg/100 g)					
	Season I			Season II		
	V_1-Arka Mirdula	V_2- Arka Amulya	T-Mean	V_1-Arka Mirdula	V_2- Arka Amulya	T-Mean
T_1-GA_3 50 ppm	271.20	269.06	270.13	267.21	260.12	263.66
T_2- GA_3 100 ppm	262.42	260.21	261.31	260.00	251.33	255.66
T_3- NAA 100 ppm	244.86	239.06	241.96	236.16	210.21	223.18
T_4- NAA 500 ppm	252.50	252.64	252.57	250.26	233.23	241.74
T_5- Brassinosteroids 0.5 ppm	209.74	200.66	205.20	198.21	199.69	198.95
T_6- Brassinosteroids 1.0 ppm	236.08	221.61	228.84	216.03	200.23	208.13
T_7- Ethrel 500 ppm	183.40	181.20	182.30	180.88	176.03	178.45

T_8- Ethrel 1000 ppm	192.18	195.63	193.90	191.63	180.10	185.86
T_9- Control	165.84	162.80	164.32	160.10	152.90	156.50
V- Mean	224.24	220.31	222.28	217.83	207.09	212.46

Factor	S. Ed.	CD(p=0.05)	Factor	S. Ed.	CD(p=0.05)
T	1.06	2.13	T	1.00	2.00
V	1.00	2.01	V	0.96	1.92
T X V	2.03	4.07	T X V	1.88	3.76

Table 2: Effect of bio-regulators on total sugar content (%) in guava cv. Arka Mirdula and Arka Amulya

Treatments	Total sugar content (%)					
	Season I			Season II		
	V_1-Arka Mirdula	V_2- Arka Amulya	T-Mean	V_1-Arka Mirdula	V_2- Arka Amulya	T-Mean
T_1-GA_3 50 ppm	8.65	8.21	8.43	8.12	7.98	8.05
T_2- GA_3 100 ppm	8.30	7.63	7.96	7.59	7.12	7.35
T_3- NAA 100 ppm	7.24	6.63	6.93	6.54	6.32	6.43
T_4- NAA 500 ppm	7.95	7.34	7.64	7.26	7.06	7.16
T_5- Brassinosteroids 0.5 ppm	6.54	5.42	5.98	5.21	5.91	5.56
T_6- Brassinosteroids 1.0 ppm	6.90	5.69	6.29	5.71	6.02	5.86
T_7- Ethrel 500 ppm	5.83	4.92	5.37	4.93	4.98	4.95
T_8- Ethrel 1000 ppm	6.20	5.00	5.60	5.01	5.36	5.18
T_9- Control	4.80	3.89	4.34	4.03	3.69	3.86
V- Mean	6.93	6.08	6.50	6.10	5.70	5.90

Factor	S. Ed.	CD(p=0.05)	Factor	S. Ed.	CD(p=0.05)
T	0.003	0.006	T	0.002	0.005
V	0.002	0.004	V	0.001	0.002
T X V	0.005	0.01	T X V	0.003	0.007

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