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Crop Regulation Studies in guava (*Psidium guajava* L.) cv. L 49 under Ultra High Density Planting

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A field experiment was carried out on 8 years old guava cv L 49 trees to assess the effect of pruning level and growth regulators with different combinations on vegetative growth and fruiting attributes in Ultra High Density Planting. The experiment consisted of 2 factors with 36 combinations viz., factor -1 (pruning level) P_1- pruning of 25 cm of the shoot from the tip, P_2- pruning of 50 cm of the shoot from the tip, P_3- pruning of 75 cm of the shoot from the tip, P_4 – control (without pruning). Factor -2(growth regulators) G_1, G_2- Potassium nitrate (1 ,2%), G_3, G_4- Thiourea (0.1 ,0.2%), G_5, G_6- Ethephon (250, 500 ppm), G_7, G_8- Cycocel (250, 500 ppm) and G_9 – Control. Results showed that among different levels of pruning, 50cm pruning from the tip with

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potassium nitrate spray at 2 different concentrations was found to be the best for promoting early vegetative bud burst, fruit set and fruit yield. The increment in plant height and canopy spread in East-West and North-South were recorded more in 25 cm pruning from the tip. A greater number of shoots are visible in the P_3G_5 combination. When compared to other treatments, the P_3G_2 combination significantly increased the average index number of bud bursts and shoot length under Ultra High Density Planting.

Keywords: Guava; factors; pruning; growth regulators; concentrations.

1. INTRODUCTION

Guava (*Psidium guajava* L.) belongs to the family Myrtaceae, which has more than 80 genera and 3,000 species, distributed in the tropics and subtropics, native to tropical America stretching from Mexico to Peru. Guava is rich in ascorbic acid, calcium, iron, and phosphorus, which has led to it being referred to as the "poor man's apple" or the "apple of the tropics" [1]. It contains 2-5 times more vitamin C as compared to oranges. According to an estimate, 100 g of guava fruit contains approximately 260 mg of vitamin C. Guava is the fifth most important fruit pertaining to area, production, and productivity among different fruit crops grown in India. It contributes 3.4 percent of the area and 3.9 percent of production in total fruit crops grown all over India. The other major states for guava cultivation are Uttar Pradesh, Bihar, and Karnataka. Maharashtra's most common variety is guava L-49 (Sardar). The production of 4.92 million MT of guava fruit has recently been regulated to a 315-thousand-hectare area in India.

Getting an increase in guava production per unit area can be accomplished by increasing the plant population [2,3]. In the initial years, ultra-high-density planting increases yield while simultaneously increasing net economic returns per unit area and allowing for more effective input utilization [4].

Guava fruit is produced on the stalk of the current season and is produced by guava flowers, which appear singly or in cymes of two or three in the axil of leaves. Guava pruning is one of the most important practices that influences the vigor, productivity, and quality of the fruits. To build a strong architecture that can support a heavy crop load, early pruning is done [5].

To maximize the unit area production and keep in mind its good demand, the production of genuine pruning techniques is a pre-requisite. It is always important for the fruit growers to adopt the best pruning technique. Therefore, the experiment was conducted to standardize the pruning technique for distribution to fruit growers. For the above purpose, standardize the pruning techniques needed to obtain good quality fruits. To adopt the correct pruning technique under UHDP, the level of pruning is important. Plant growth regulators like Potassium nitrate, Thiourea, Ethephon, and Cycocel play important roles in guava production by direct or indirect influences on the growth and development of guava. Pruning by different levels and application of growth regulators improve the yield and quality of the guava. In the UHDP system, the study's objective is to standardize the pruning level with the optimal growth regulators.

2. MATERIALS AND METHODS

A field experiment was conducted at Horticultural College and Research Institute, Periyakulam, Theni in March 2023. Eight-year-old guava trees under Ultra High-Density Planting with a spacing of 3 x 1.5 m were selected for a research trial. The treatment includes nine different concentrations of growth regulators (Potassium nitrate @ 1% & 2%, Thiourea @ 0.1% & 0.2%, Ethephon @ 250 ppm & 500 ppm, Cycocel @ 250 ppm & 500 ppm and Control) as well as four various levels of pruning (25, 50, 75 cm of the shoot from the tip, and Control). The 36 treatment combinations in the experiment were set up in a 2-factor Factorial Randomized Block Design (f-RBD) with two replications. Five uniform plants per treatment combination were chosen. The particulars of the treatment are as follows:

2.1 Factor -1 (Pruning level)

P_1– Pruning of 25 cm of the shoot from tip
P_2– Pruning of 50 cm of the shoot from tip
P_3– Pruning of 75 cm of the shoot from tip
P_4– Control

2.2 Factor – 2 (Treatments)

G_1 - Potassium nitrate @ 1%
G_2 - Potassium nitrate @ 2%
G_3 - Thiourea @ 0.1%
G_4 - Thiourea @ 0.2%
G_5 - Ethephon @ 250 ppm
G_6 - Ethephon @ 500 ppm
G_7 - Cycocel @ 250 ppm
G_8 - Cycocel @ 500 ppm
G_9 – Control

List 1. Treatment combinations

P*G	P_1	P_2	P_3	P_4
G_1	P_1G_1	P_2G_1	P_3G_1	P_4G_1
G_2	P_1G2	P_2G_2	P_3G_2	P_4G_2
G_3	P_1G_3	P_2G_3	P_3G_3	P_4G_3
G_4	P_1G_4	P_2G_4	P_3G_4	P_4G_4
G_5	P_1G_5	P_2G_5	P_3G_5	P_4G_5
G_6	P_1G_6	P_2G_6	P_3G_6	P_4G_6
G_7	P_1G_7	P_2G_7	P_3G_7	P_4G_7
G_8	P_1G_8	P_2G_8	P_3G_8	P_4G_8
G_9	P_1G_9	P_2G_9	P_3G_9	P_4G_9

According to the instructions provided for the treatment, the guava trees were pruned and growth regulators were applied immediately after pruning. With the aid of secateurs and a pruning saw, pruning was carried out after entirely defoliating all of the leaves. N-500 g, P_20_5 300 g, K_20 500 g, and 40 Kg FYM per plant per year were applied as a standard fertilizer dose. Plant protection and other cultural activities were consistently provided as needed. Five randomly chosen plants from each replication were subjected to biometrical observations to evaluate their morphological characteristics, i.e. increment in plant height, canopy spread (in both E-W and N-S directions), canopy volume, first vegetative bud burst, bud burst activity, days taken for first flowering, fruit set, fruit yield (kg/plant).

3. RESULTS AND DISCUSSION

3.1 Effect of Pruning Level and Growth Regulators on Growth Characters

3.1.1 Tree height (m)

Plant height increased (1.05 m) in the pruning of 75 cm shoot from tip (P_3) and Thiourea @ 0.2% (G_4), caused the highest increase in plant height (1.05 m). The different levels of pruning and growth regulator application significantly impacted the tree height. The maximum increment in tree height was recorded in the P_2G_3 (1.27 m) combination followed by the P_3G_9 (1.24 m) combination. While the minimum increment in tree height was recorded in the P_4G_1 (0.13 m) combination (Table 1). In the present study was observed that the vegetative growth of guava tends to adjust to modifications in the level of pruning operation. Less plant height increased when the level of the pruning was increased [6,5,7]. Intensive pruning stimulates the regeneration processes and alters the size of tree tops, particularly by reducing excessive tree height [8].

3.2 Canopy Spread (m)

3.2.1 East-West directions

The increased (0.59 m) canopy spread (E-W) was registered in the control (P_0) and In the control (G_0) the canopy spread was increased (0.56 m). The P_1G_2 (1.00 m) combination showed the highest increase in canopy spread under the influence of varying levels of pruning, whereas the P_4G_4 (0.10 m) combination recorded the lowest increase (Table 2). An increase in the canopy spread could be caused by an increase in shoot length. Guava responds very well to pruning, topping, and hedging at various intervals [8]. Pruning removes carbon-starved, fruiting-exhausted shoots, encourages the growth of new leaves to store carbohydrates for the following flowering, and enables the sprouting of lateral buds, all of which have an impact on the plant's height, spread, volume, and other vegetative characteristics. This is consistent with research on guava [9-11].

3.2.2 North – South directions

Data presented in Table (3) showed that the canopy spread was increased (0.66 m) in the control (P_0) and In the control (G_0) recorded more (0.74 m). The P_1G_2 combination (1.50 m) recorded the highest increase in North-South canopy spread whereas the P_4G_2 combination (0.10 m) recorded the lowest increase. The guava tree reacts well to canopy change in terms of spreading, hence pruning the canopy and using some growth regulators in high-density orchards may be techniques to increase production yield (Sah et al., 2015).

3.2.3 Canopy volume (m^3)

Concerning the effect of pruning level and growth regulators on canopy volume Table 4 showed that the canopy volume was higher (32.17 m^3) in the pruning of 25 cm of the shoot from tip (P_1) and as a result of growth regulators application, control (G_0) recorded a significantly higher canopy volume (37.61 m^3). P_1G_4 combination (44.22 m^3) recorded the greatest canopy volume. The lowest canopy volume was recorded in the P_2G_1 combination (21.61 m^3) (Table 4). Canopy volume was at its highest in 25% pruning of previous season growth as compared to 75% pruning of previous season growth [12]. Since pruning eliminates carbon-starved, fruit-exhausted branches and encourages the growth of new leaves to store carbs for the following flowering, it also permits lateral buds to sprout, which in turn affects the canopy volume and other vegetative characteristics of the plants. This is consistent with research on guava [13].

3.2.4 Time taken for first vegetative bud burst (days)

The data on variations in pruning level and growth regulators showed that the Among the pruning level, pruning of 50 cm of the shoot from the tip (P_2) took minimum days (8.43) and Thiourea at 0.2% (G_4) took least amount of time (11.73 days) for the first vegetative bud to burst. P_2G_2 combination had the earliest emergence (5.01 days) and maximal (22.00 days) of vegetative bud burst in the P_4G_8 combination (Table 5). Early pruning caused new branches to sprout early. Similar findings were reported that a rise in pruning severity promotes the early bud burst [5,7,14]. Severe pruning along with potassium nitrate at 4% induced the highest average index number of bud bursts [15].

3.2.5 Number of shoots emerged from the pruned branches

More shoots sprouted from the pruned branches (6.76) in the pruning of 75 cm of the shoot from tip (P_3) and Based on the growth regulators impact, most (5.10) number of shoots were produced from the pruned branches in the potassium nitrate @ 2% (G_2). The P_3G_5 combination (7.50) produced more on average number of new shoots followed by the P_3G_1 combination (7.30), according to the data in Table 6. The lowest number of new shoots was recorded in the P_4G_3 combination (2.00). 75 cm pruning with ethephon at 250 ppm produce the highest number of new shoots compared to others. Pruning enhanced the guava's vegetative development similar these results [15,13].

3.2.6 Length of newly emerged shoots (cm)

The largest length (40.38 cm) was registered in the pruning of 50 cm of the shoot from tip (P_2) and Significantly maximum length (37.10 cm) was recorded in the thiourea at 0.1% (G_3). In terms of substance effect, the P_2G_4 combination had the longest average shoot length (43.50 cm), followed by the P_3G_3 and P_2G_1 combinations (Table 7). With time moderate pruning has given a favorable effect. Interaction between the concentration of growth regulators and pruning level showed that the P_2G_4 combination gave the greatest value of shoot length. On another side, the shortest shoot length was recorded in the P_3G_1 combination (23.80 cm). Shoot length in guava plants increased as a result of pruning, which encouraged vegetative development [16]. When the shoots were pruned three times a year to half of their original length, the maximum gross return was achieved as well [17].

3.3 Effect of Pruning Level and Growth Regulators on Fruiting Characters

3.3.1 Bud burst activity

Flower bud burst activity revealed that the pruning of 75 cm shoot from the tip (P_3) recorded the greatest significant average index number (2.72) and the use of potassium nitrate @ 2% (G_2) recorded the highest mean index number (3.43). Flower bud burst activity data in Table 8 showed that the highest significant average index number was recorded in the P_3G_2 combination (4.90) followed by the P_1G_2 combination (3.60). The lowest average index number was recorded in the P_4G_8 combination (1.40). Meanwhile, 75 cm pruning with KNO_3 at 2% shows the highest average index number of the flower bud burst.

3.3.2 Fruit set (%)

The fruit set percentage was higher (87.67%) in the pruning of 50 cm of the shoot from tip (P_2) and In the potassium nitrate spray at 1% (G_1), the average fruit set percentage was higher (87.07%). Over the control, all interaction effects showed an increase in the fruit set. The average Fruit set percentage was more in the P_2G_1 combination (96.00 %) followed by the P_2G_2 combination (89.00%). Absolute control (P_4G_9 combination) was recorded lowest fruit set (70.00%) (Table 9). A direct relationship was observed between the concentration of chemical substances and the fruit set was recorded with the highest concentrations. Moderate pruning and the application of 4% potassium nitrate were shown to significantly boost the early fruit set [15]. Eugelol and ethephon, when used at higher concentrations, decreased fruit set [18]. Similar outcomes were also obtained in an increase in fruit set and fruit retention in guava by pruning over control [19,13].

3.3.3 Number of fruits/ Plant

In the pruning of 50 cm of the shoot from tip (P_2) produced more fruits per plant (166.74) and the largest number (135.78) was obtained with potassium nitrate treatment at 2% (G_2). The highest number of fruit per plant was recorded in the P_2G_1 combination (192.00) and the least number of fruit per plant was recorded in the P_4G_9 combination (55.80) (Table 10). The interaction between the two factors has a considerable impact on the total amount of fruit. You may control your tree's size and fruit production with the help of shoot pruning. Pruning increases the amount of fruit that a plant produces. Others made similar observations as well. Fruit yield is seen to decline as pruning severity is increased [20-22]. Pruning, which decreased the fruiting area and on the other hand encouraged vegetative growth at the expense of reproductive growth, is the cause of the drop in fruit production per plant [11].

3.3.4 Fruit yield (kg/ Plant)

More fruit (24.56 kg plant^{-1}) was produced per plant in the 25 cm pruning (P_1) and The potassium nitrate treatment at 2% (G_2) produced the highest yield (19.94 kg plant^{-1}). Maximum yield was achieved with a P_2G_2 combination (27.10 kg) followed by a P_1G_8 combination (25.98 kg). The minimum yield was recorded in the P_4G_9 combination (8.37 kg) (Table 11). According to Dutta, foliar spraying of potassium increased the yield and quality and decreased with the pruning intensity in Sardar guava. Pruning increases the fruit weight in guava [23]. Using various crop regulation practices like the pruning of shoots, defoliation, or deblossoming, it is necessary to decrease fruit set during the rainy season and then increase fruit set during the winter season to regulate guava crop, provides support to the present finding [24]. The findings of this study are consistent with 45 cm shoot pruning in May would be ideal for good guava off-season output [9].

Table 1. Effect of pruning level and growth regulators on increment in tree height

Growth regulators	Pruning level				Mean
	P_1	**P_2**	**P_3**	**P_4**	
G_1	0.83	0.63	1.19	0.13	**0.70**
G_2	0.89	0.91	1.21	0.34	**0.84**
G_3	0.74	1.27	1.05	0.41	**0.87**
G_4	1.16	1.19	1.08	0.78	**1.05**
G_5	0.38	0.88	0.92	0.70	**0.72**
G_6	0.87	0.93	0.87	0.42	**0.77**
G_7	0.68	1.00	0.91	0.37	**0.74**
G_8	0.72	0.77	0.99	0.56	**0.76**
G_9	0.71	0.90	1.24	0.58	**0.86**
Mean	**0.78**	**0.94**	**1.05**	**0.48**	
	Pruning		**Growth regulators**		**Interaction (PxG)**
SE(d)	0.008		0.012		0.025
CD(0.05)	0.017		0.025		0.051

Table 2. Effect of pruning level and growth regulators on increment canopy spread (E-W)

Growth regulators	Pruning level				Mean
	P_1	**P_2**	**P_3**	**P_4**	
G_1	0.55	0.35	0.10	0.75	**0.44**
G_2	1.00	0.40	0.25	0.50	**0.54**
G_3	0.60	0.05	0.55	0.70	**0.48**
G_4	0.70	0.15	0.30	0.10	**0.31**
G_5	0.19	0.12	0.30	0.65	**0.29**
G_6	0.85	0.20	0.40	0.50	**0.49**
G_7	0.25	0.45	0.30	0.35	**0.34**
G_8	0.65	0.11	0.45	0.85	**0.52**
G_9	0.05	0.60	0.70	0.90	**0.56**
Mean	**0.53**	**0.26**	**0.37**	**0.59**	
	Pruning		**Growth regulators**		**Interaction (PxG)**
SE(d)	0.025		0.038		0.077
CD(0.05)	0.052		0.078		0.157

Table 3. Effect of pruning level and growth regulators on increment canopy spread (N-S)

Growth regulators	Pruning level				Mean
	P_1	P_2	P_3	P_4	
G_1	0.20	0.91	0.55	0.55	**0.55**
G_2	1.50	0.30	0.15	0.10	**0.51**
G_3	0.05	0.60	0.40	0.35	**0.35**
G_4	0.15	0.25	0.30	0.95	**0.41**
G_5	0.35	0.20	0.50	0.30	**0.34**
G_6	0.45	0.15	0.60	0.90	**0.53**
G_7	0.15	0.40	0.50	0.85	**0.48**
G_8	1.10	0.40	0.60	0.60	**0.68**
G_9	0.25	0.65	0.75	1.30	**0.74**
Mean	**0.47**	**0.43**	**0.48**	**0.66**	
	Pruning		**Growth regulators**		**Interaction (PxG)**
SE(d)	0.024		0.036		0.072
CD(0.05)	0.048		0.073		0.146

Table 4. Effect of pruning level and growth regulators on canopy volume

Growth regulators	Pruning level				Mean
	P_1	P_2	P_3	P_4	
G_1	35.41	21.61	29.32	32.18	**29.63**
G_2	35.29	29.88	29.23	30.43	**31.21**
G_3	32.48	29.07	26.60	29.44	**29.40**
G_4	**44.22**	31.54	28.77	36.34	**35.22**
G_5	27.19	31.58	25.56	33.31	**29.41**
G_6	31.58	27.16	26.60	24.54	**27.47**
G_7	33.31	33.91	25.07	27.16	**29.86**
G_8	33.20	29.39	26.10	32.89	**30.40**
G_9	33.88	41.18	32.16	43.21	**37.61**
Mean	**34.06**	**30.59**	**27.71**	**32.17**	
	Pruning		**Growth regulators**		**Interaction (PxG)**
SE(d)	0.217		0.326		0.653
CD(0.05)	0.441		0.662		1.325

Table 5. Effect of pruning level and growth regulators Time taken for first vegetative bud burst

Growth regulators	Pruning level				Mean
	P_1	P_2	P_3	P_4	
G_1	11.22	9.37	8.00	19.65	**12.06**
G_2	13.50	5.01	11.48	19.22	**12.30**
G_3	13.32	7.46	8.52	23.56	**13.22**
G_4	12.10	7.50	9.33	18.00	**11.73**
G_5	15.67	8.27	7.58	22.59	**13.53**
G_6	15.15	7.00	6.34	19.66	**12.04**
G_7	11.00	10.35	12.29	21.63	**13.82**
G_8	10.08	9.86	11.67	22.00	**13.40**
G_9	9.00	11.07	10.74	20.53	**12.84**
Mean	**12.34**	**8.43**	**9.55**	**20.76**	
	Pruning		**Growth regulators**		**Interaction (PxG)**
SE(d)	0.121		0.181		0.36
CD(0.05)	0.246		0.369		0.738

Table 6. Effect of pruning level and growth regulators Number of shoots emerged from the pruned branches

Growth regulators	Pruning level				Mean
	P_1	P_2	P_3	P_4	
G_1	2.60	5.50	7.30	3.25	**4.66**
G_2	3.10	6.50	6.30	4.50	**5.10**
G_3	2.60	6.60	6.50	2.00	**4.43**
G_4	3.50	6.30	7.00	3.00	**4.95**
G_5	2.10	6.83	7.50	3.00	**4.86**
G_6	2.50	5.83	7.16	4.25	**4.94**
G_7	2.50	6.63	6.16	4.75	**5.01**
G_8	2.80	7.00	6.30	3.50	**4.90**
G_9	2.50	6.00	6.60	4.25	**4.84**
Mean	**2.69**	**6.35**	**6.76**	**3.61**	
	Pruning		**Growth regulators**		**Interaction (PxG)**
SE(d)	0.041		0.062		0.125
CD(0.05)	0.085		0.127		0.255

Table 7. Effect of pruning level and growth regulators Length of newly emerged shoots

Growth regulators	Pruning level				Mean
	P_1	P_2	P_3	P_4	
G_1	29.50	42.10	23.80	27.00	**30.60**
G_2	33.30	41.80	36.20	25.00	**34.08**
G_3	33.30	42.10	42.40	30.60	**37.10**
G_4	29.30	43.50	40.80	32.10	**36.43**
G_5	35.50	41.50	30.40	27.50	**33.73**
G_6	29.60	42.10	32.80	29.50	**33.50**
G_7	32.10	35.80	32.80	33.10	**33.45**
G_8	34.30	38.00	35.60	39.10	**36.75**
G_9	30.80	36.50	32.80	38.80	**34.73**
Mean	**31.97**	**40.38**	**34.18**	**31.41**	
	Pruning		**Growth regulators**		**Interaction (PxG)**
SE(d)	0.331		0.496		0.993
CD(0.05)	0.672		1.008		2.017

Table 8. Effect of pruning level and growth regulators bud burst activity

Growth regulators	Pruning level				Mean
	P_1	P_2	P_3	P_4	
G_1	3.03	3.00	3.30	2.90	**3.06**
G_2	3.60	3.20	4.90	2.00	**3.43**
G_3	2.33	2.42	2.77	2.16	**2.42**
G_4	1.93	2.15	2.31	1.49	**1.97**
G_5	2.01	2.20	2.43	2.50	**2.29**
G_6	1.60	2.28	2.40	1.77	**2.01**
G_7	1.73	1.76	2.41	1.57	**1.87**
G_8	2.03	1.80	1.82	1.40	**1.76**
G_9	1.93	1.95	2.10	1.60	**1.90**
Mean	**2.24**	**2.31**	**2.72**	**1.93**	
	Pruning		**Growth regulators**		**Interaction (PxG)**
SE(d)	0.019		0.028		0.057
CD(0.05)	0.038		0.058		0.116

Table 9. Effect of pruning level and growth regulators on fruit set

Growth regulators	Pruning level				Mean
	P1	P2	P3	P4	
G1	88.00	96.00	78.26	86.00	**87.07**
G2	73.33	89.00	75.75	83.34	**80.36**
G3	83.30	83.63	73.60	75.00	**78.88**
G4	84.84	86.63	82.22	83.73	**84.36**
G5	82.00	87.50	72.41	73.80	**78.93**
G6	81.81	86.50	78.94	86.84	**83.52**
G7	85.71	86.50	74.19	73.07	**79.87**
G8	83.87	84.61	80.00	73.30	**80.45**
G9	76.66	88.70	72.63	70.00	**77.00**
Mean	**82.17**	**87.67**	**76.44**	**78.34**	
	Pruning		**Growth regulators**		**Interaction (PxG)**
SE(d)	0.658		0.988		1.976
CD(0.05)	1.337		2.005		4.011

Table 10. Effect of pruning level and growth regulators on the Number of fruits/ Plant

Growth regulators	Pruning level				Mean
	P1	P2	P3	P4	
G1	162.10	180.67	75.30	93.50	**127.89**
G2	168.40	192.00	82.40	100.30	**135.78**
G3	165.10	172.78	69.80	82.30	**122.50**
G4	153.20	163.11	70.20	85.50	**118.00**
G5	156.50	154.65	63.70	92.20	**116.76**
G6	161.70	150.23	65.50	95.30	**118.18**
G7	171.40	164.50	59.50	97.80	**123.30**
G8	173.20	170.30	63.50	86.30	**123.33**
G9	167.20	152.40	64.50	55.80	**109.98**
Mean	**164.31**	**166.74**	**68.27**	**87.67**	
	Pruning		**Growth regulators**		**Interaction (PxG)**
SE(d)	3.378		5.067		10.134
CD(0.05)	6.858		10.287		20.574

Table 11. Effect of pruning level and growth regulators on Fruit yield

Growth regulators	Pruning level				Mean
	P1	P2	P3	P4	
G1	24.32	25.08	11.30	14.03	**18.68**
G2	25.26	27.10	12.36	15.05	**19.94**
G3	24.77	24.80	10.47	12.35	**18.10**
G4	22.98	23.92	10.53	12.83	**17.57**
G5	23.48	24.47	9.56	13.83	**17.84**
G6	24.26	23.20	9.83	14.30	**17.90**
G7	25.71	22.53	8.93	14.67	**17.96**
G8	25.98	24.68	9.53	12.95	**18.29**
G9	24.32	25.55	9.68	8.37	**16.98**
Mean	**24.56**	**24.59**	**10.24**	**13.15**	
	Pruning		**Growth regulators**		**Interaction (PxG)**
SE(d)	0.158		0.237		0.474
CD(0.05)	0.321		0.481		0.963

This study holds significant scientific relevance due to its contribution to the fields of horticulture, agricultural practices, and sustainable food production. Guava is an important tropical fruit crop with high economic value, and optimizing its cultivation techniques can have far-reaching implications for both farmers and consumers. Ultra High-Density Planting (UHDP) is a modern approach that involves planting crops at much higher densities than traditional methods. This study explores the application of UHDP in guava cultivation, which can lead to increased yield per unit area. The scientific relevance lies in understanding how this technique affects growth

[25], fruit production (Vega et al. 2022); [26], and overall crop health in tropical fruit [27].

Effective crop regulation is essential for ensuring balanced vegetative and reproductive growth, which ultimately impacts fruit quality and yield. This study's focus on crop regulation in guava under UHDP provides insights into managing plant growth, flowering, and fruiting patterns [28]. These findings can be extended to other fruit crops, contributing to the development of improved cultivation practices [29]. As global populations continue to rise, the demand for nutritious and sustainable food sources increases. Guava is known for its nutritional value, and optimizing its cultivation under UHDP can enhance yield while conserving land and resources. This study's findings could aid in meeting food security goals [30,31]. The study addresses the challenges of maximizing agricultural productivity in limited land areas [32-34], a common concern in densely populated countries like India. By investigating guava cultivation in UHDP, the research offers potential solutions to the problem of land scarcity and showcases a strategy to enhance productivity without expanding agricultural land [32]. Climate change poses significant threats to crop production (Parra et al. 2012; Viloria et al. 2023). The study's findings on guava cultivation under UHDP could provide insights into how this planting technique influences the crop's resilience to changing climate conditions [35,36]. This aspect of the study contributes to the broader understanding of crop adaptation to environmental challenges (Zingaretti et al. 2016; Olivares et al. 2020).

4. CONCLUSION

In conclusion the typical flowering and fruiting behavior of the plant required to be controlled in order to produce an enormous crop load and make guava cultivation very profitable under Ultra High density planting. In terms of growth and flowering yield, all crop regulating techniques were determined to be superior to the untreated control. Unpruned guava trees have a tendency to prolong vegetative growth and diminish the bearing area, which reduces fruit size, yield, and quality. Pruning is therefore necessary to achieve a suitable balance between vegetative and reproductive growth**.** According to this study's findings, 50 cm of pruning from the tip using potassium nitrate at 1% and 2% is superior for enhancing vegetative growth and production of guava trees.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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