

# COMPARATIVE STUDY ON NEWLY DEVELOPED GUAVA HYBRIDS WITH COMMERCIAL CULTIVARS UNDER MID-HILLS OF NE INDIA

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## ABSTRACT

Under mid-hills of NE India, guava hybrid RCGH 1 showed upright growth habit, whereas hybrid RCGH 4, Allahabad Safeda and Lalit had semi-spreading and L 49 and RCGH 7 possess drooping growth habit. The fruit yield was recorded significantly highest RCGH 1 (39.05 kg/plant) followed by Allahabad Safeda (31.37 kg/plant), however lowest in L 49 (21.26 kg/plant) and had significantly less than RCGH 7 (24.26 kg/plant). The highest fruit weight was recorded in RCGH 4 (183.52 g). While less number of seeds/100 g fruit weight was recorded in RCGH 7 (111.18). In fruit quality hybrid RCGH 1 recorded highest TSS (10.83°B), ascorbic acid (231.86 mg/100g) and total sugar (8.07%) with lowest acidity (0.50 %) followed by RCGH 7 (10.39°B, 205.26 mg/100g, 8.05% and 0.51%), respectively, and found superior over Allahabad Safeda and L 49 under mid-hills situations

## INTRODUCTION

A wide range of biodiversity in north eastern region of India leads to the consumption of variety of fruit species to supplement nutrient requirement. Among the fruit species after citrus, guava (*Pisidium guajava* L.) belongs to the family Myrtaceae is an important fruit crop of local people preference. Guava fruit is known for its 'vitamin-C', minerals like calcium, iron and phosphorous with pleasant aroma and flavour (Dhaliwal and Dhillion, 2003) and its better adaptability eulogized it as 'the apple of tropics. A suitable agro-climatic condition coupled with variability of guava germplasm of NE India provided opportunity for the commercial cultivation of guava (Chandra and Govind, 1992). But yield and quality of local types grown by the farmers in region is poor and not able to with stand to competition. Introduction of promising guava cultivars in region is an option for increasing the production and productivity. But performance varied significantly with cultivars, location, agro-climate and soil type etc. The variation with regard to growth and bearing habits, yield, colour and quality among different guava cultivars were also reported by Chadha *et al.* (1981) and Ojha *et al.* (1985) in different parts of the country.

The peculiar feature of mid hills of NE India is only one guava crop can be harvested in a year *i.e.* rainy season due to distinct winter (Patel *et al.*, 2011). In rainy season, significant variation with respect to crop yield, number of fruits per tree, fruit weight and fruit quality among guava genotypes were reported by Babu *et al.* (2002) followed by Patel *et al.* (2007) under mid hills of NE India. So that there is need to identify season stable

uniform guava cultivars valuable for local as well as export markets that may prove highly remunerative to the fruit growers. With this objective three guava hybrids were developed by ICAR Research Complex for NEH Region, Umiam, Meghalaya viz., RCGH 1 (Sour type x Red fleshed local), RCGH 7 (Lucknow-49 x Pear shaped) and RCGH 4 (Red fleshed x Allahabad Safeda). Out of these hybrids RCGH-1 and RCGH-7 has white flesh while, RCGH-4 has red flesh (Patel *et al.*, 2011). Therefore, it felt essential to evaluated these hybrids along with commercial cultivars for selection of promising variety under mid hills condition. To study variability among fruit crops, plant growth, yield and fruit quality are the important traits (Aulakh, 2005 and Pandey *et al.*, 2007). That means comparison on various physico-chemical traits associated with the fruit quality of different guava cultivar/hybrids is necessary for identification of promising guava cultivar. With this background, the present study aimed to investigate performance of these newly developed guava hybrids along with commercial cultivars under mid hills situation of NE India.

## MATERIALS AND METHODS

Three newly developed guava hybrids viz., RCGH 1, RCGH 7 and RCGH 4 and three commercial cultivars viz., Allahabad Safeda, L-49 and Lalit planted during 2005 were evaluated with respect to growth, yield and quality traits at ICAR Research Complex for NEH Region, Umiam Meghalaya for two years during 2011 and 2012. The experimental site was situated at 25°41'-413" North latitude and 91° 55'-213" East longitude

at an elevation of 992 above msl. The climate of the site is subtropical with minimum and maximum temperature ranging from 5.4°C to 29.4°C and with average annual rainfall of 2596 mm. Total three replication having three trees per replication of each hybrid and cultivar were selected and data were taken from selected plants with respect to growth, yield and quality traits. Ten fruits were randomly harvested from each plant for recording observations. Growth and yield parameters were taken in terms of plant height (m), plant girth (cm), canopy spread (NS and EW), days to fruit maturity, number of fruits, yield (kg/tree), fruit weight (g), fruit length (cm), fruit diameter (cm) and number of seed/100 g fruit weight. The fruit quality was studied in terms TSS (°B), acidity (%), TSS:acid ratio, ascorbic acid (mg/100g), total sugar (%) and pectin (%). Total soluble solid (TSS) was determined with the help of digital refractometer. Acidity was determined by titrating the juice against N/10 NaOH and expressed as per cent citric acid. Ascorbic acid content of fruit was determined with the help of the method given in A.O.A.C. 1995 and total sugar was analyzed as per method given by Lane and Eynon, 1943. The total pectin content of guava fruit was estimated as per method given by Ranganna, 1997. The data was statistically analysed by method of analysis of variance using RBD as described by Panse and Sukhatme 1985.

## RESULTS AND DISCUSSION

### Growth attributes

The results in Table 1 showed the significant variation among guava hybrids and cultivars with respect to growth attributes. From the mean result (2011 and 2012) plant height was recorded significantly highest in hybrid RCGH 1 (4.55m) showing upright growth habit. The hybrid RCGH 4 (3.36m) followed by Allahabad Safeda (3.20 m) and Lalit (2.97 m) were at par with each other showing semi-spreading. While, L

49 (2.43m) followed by RCGH 7 (2.79 m) recorded lowest plant height showing drooping growth pattern. The presence of strong apical dominance in RCGH 1, RCGH 4, Allahabad Safeda and Lalit may be attributed to maximum plant height. Similar views were expressed by Athani *et al.*, 2007 in their studies. Similarly plant girth was recorded maximum in RCGH 1 (9.88 cm) and minimum in Lalit (7.50 cm). Plant spread (NS and EW) were recorded highest in RCGH 1 (4.49m and 5.20 m), respectively, while lowest in L 49 (3.41m and 3.63 m), respectively. These findings were in contradicted with Reddy *et al.*, 1999 observed maximum stem girth in Allahabad Safeda, plant height in Red Flesh and plant vigour in cv. Lucknow-49 under rainfed sub-humid region of Chhota Nagpur plateau, Bihar. However, analogous with Patel *et al.* (2007) observed maximum tree height in hybrid-2, stem diameter in hybrid-11, while minimum in Allahabad Safeda under mid-hills condition of Meghalaya. Thus, from the above findings it was noticed that prevailing agro-climate coupled with genetic makeup of individual cultivars persuade the responses to particular agro-climatic condition.

### Yield attributes

The yield is known to be a polygenic character, where genetic makeup, distinct growing condition, management practices and fruiting season has influenced. The present study showed significant variation among the guava hybrids and cultivars with respects to days to fruit maturity, number of fruits and fruit yield (kg/plant). The mean result of 2011 and 2012 (Table 2) showed that the days to fruit maturity was recorded earliest in Lalit (121.30 days) followed by RCGH 4 (121.81 days) and RCGH 1 (124.26 days), while late in L 49 (131.02 days). The result revealed that Lalit, RCGH 4 and RCGH 1 were matured early while, L 49, Allahabad Safeda and RCGH 7 were matured late under mid hills situation. The similar observation was reported Man and Suryanarayan (2011) due to genotypes and environmental influence. From the mean results, the

**Table 1: Growth attributes of guava hybrids and cultivars**

Hybrids/cultivars	Plant height (m)			Plant girth (cm)			Plant spread (m)			East-West		
	2011	2012	Pooled	2011	2012	Pooled	North-South	2011	2012	Pooled	2011	2012
RCGH 1	4.20	4.90	4.55	9.12	10.63	9.88	4.11	4.87	4.49	4.97	5.43	5.20
Allahabad Safeda	2.90	3.50	3.20	8.00	9.26	8.63	3.90	4.40	4.15	3.71	4.33	4.02
RCGH 7	2.48	3.09	2.79	7.45	9.17	8.31	3.97	4.63	4.30	3.36	3.83	3.60
L 49	2.10	2.75	2.43	8.05	9.22	8.64	3.16	3.67	3.41	3.45	3.80	3.63
RCGH 4	3.05	3.67	3.36	7.40	9.04	8.22	3.22	4.00	3.61	3.57	4.03	3.80
Lalit	2.56	3.37	2.97	6.79	8.20	7.50	3.75	4.47	4.11	2.89	3.73	3.31
SE m	0.24	0.21	0.16	0.50	0.48	0.37	0.31	0.32	0.22	0.30	0.26	0.27
CD (P=0.05)	0.76	0.66	0.51	1.56	1.52	1.16	0.97	1.00	0.69	0.95	0.82	0.84

**Table 2: Yield attributes of guava hybrid and cultivars**

Hybrids/cultivars	Days to fruit maturity			No. of fruits			Fruit yield (kg/plant)		
	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled
RCGH 1	125.41	123.11	124.26	272.33	233.61	252.97	40.80	37.30	39.05
Allahabad Safeda	132.37	129.11	130.74	224.13	197.45	210.79	34.58	28.16	31.37
RCGH 7	130.41	128.44	129.43	157.67	182.45	170.06	23.82	24.67	24.26
L 49	131.57	130.47	131.02	129.00	141.44	135.22	21.06	21.45	21.26
RCGH 4	122.50	121.11	121.81	131.67	176.00	153.83	25.19	30.93	28.06
Lalit	123.24	119.36	121.30	192.00	215.00	203.50	27.84	28.19	28.01
SE m	1.41	1.27	1.11	3.29	4.51	6.27	0.57	0.51	0.65
CD (P=0.05)	4.45	4.00	3.49	10.36	14.20	19.77	1.79	1.60	2.06

**Table 3: Fruit attributes of guava hybrid and cultivars**

Hybrids/cultivars	Fruit weight (g)			Fruit length (cm)			Fruit dia. (cm)			No. of seed/100 g fruit weight		
	2011	2012	pooled	2011	2012	pooled	2011	2012	pooled	2011	2012	pooled
RCGH 1	149.83	159.67	154.75	6.4	6.11	6.26	6.69	6.26	6.48	136.4	144.22	140.31
Allahabad Safeda	154.3	142.63	148.47	6.35	5.6	5.98	6.58	5.72	6.15	150.47	140.35	145.41
RCGH 7	151.08	135.22	143.15	6.55	5.93	6.24	6.71	6.12	6.42	113.8	108.56	111.18
L 49	163.25	151.68	157.47	6.71	5.79	6.25	6.86	6.03	6.45	145.27	133.15	139.21
RCGH 4	191.3	175.73	183.52	6.61	6.46	6.54	7.06	6.92	6.99	166.68	177.12	171.9
Lalit	145	131.11	138.06	6.13	6.03	6.08	6.31	6.29	6.30	172.36	165.78	169.07
SE m	2.69	3.08	1.95	0.09	0.06	0.08	0.06	0.06	0.10	2.58	3.40	4.23
CD (P=0.05)	8.49	9.70	6.15	0.28	0.19	0.25	0.18	0.18	0.31	8.13	10.70	13.33

**Table 4: TSS, acidity and TSS: acid ratio of guava hybrids and cultivars**

Hybrids/cultivars	TSS (°B)			Acidity (%)			TSS: acid ratio		
	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled
RCGH 1	10.93	10.72	10.83	0.52	0.49	0.50	21.15	21.88	21.52
Allahabad Safeda	10.25	10.03	10.14	0.58	0.63	0.61	17.67	15.92	16.80
RCGH 7	10.53	10.24	10.39	0.45	0.56	0.51	23.40	18.29	20.84
L 49	10.32	10.00	10.16	0.56	0.51	0.54	18.43	19.61	19.02
RCGH 4	9.95	9.78	9.87	0.50	0.63	0.56	20.03	15.52	17.78
Lalit	9.67	9.51	9.59	0.65	0.68	0.67	14.88	13.99	14.43
SE m	0.08	0.08	0.09	0.04	0.04	0.04	1.07	1.09	0.58
CD (P=0.05)	0.25	0.26	0.29	0.12	0.12	0.13	3.38	3.44	1.84

**Table 5: Ascorbic acid, total sugar and pectin content of guava hybrids and cultivars**

Hybrids/cultivars	Ascorbic acid (mg/100g)			Total sugar (%)			Pectin (%)		
	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled
RCGH 1	223.49	240.22	231.86	8.16	7.97	8.07	1.37	1.28	1.33
Allahabad Safeda	174.56	189.56	182.06	7.09	6.85	6.97	0.89	0.95	0.92
RCGH 7	198.05	212.47	205.26	7.96	8.14	8.05	1.29	1.32	1.31
L 49	190.46	201.13	195.80	7.25	7.03	7.14	1.00	0.93	0.97
RCGH 4	181.14	192.22	186.68	6.36	6.47	6.42	0.78	0.86	0.82
Lalit	164.33	173.22	168.78	6.51	6.64	6.58	1.11	1.02	1.07
SE m	10.97	9.14	8.84	0.07	0.12	0.16	0.02	0.01	0.03
CD (P=0.05)	34.57	28.81	27.86	0.22	0.36	0.49	0.07	0.04	0.09

number of fruits per plant and fruit yield were recorded highest in RCGH 1 (252.97 No. and 39.05 kg/plant), respectively, found significantly superior over others. While, fruit yield was recorded second highest in Allahabad Safeda (210.79 No. and 31.37 kg/plant), respectively. Lalit (28.01 kg/plant) and RCGH 4 (28.06 kg/plant) were at par with each other for fruit yield per plant. However lowest yield was recorded L 49 (21.26 kg/plant) followed by RCGH 7 (24.26 kg/plant). This type of variation may be due to phenotypic and genotypic interactions among the hybrids and cultivars under test condition. The variation in number of fruits per tree and fruit yield due to cultivar in guava was also reported by various workers viz., Babu *et al.* (2002), Aulakh (2005), Pandey *et al.* (2007) and Patel *et al.* (2011) in different agro-climatic conditions.

### Fruit attributes

#### Physical attributes

The individual fruit weight, length and diameter were major traits in crop improvement programme. In general wide range of variations was seen for physical attributes among guava hybrids and cultivars. The results depicted in Table 3 revealed that the highest fruit weight was recorded in RCGH 4 (183.52 g) while, lowest in Lalit (138.06 g) followed by RCGH 7 (143.15 g). The cultivar L 49 (157.47 g) and hybrid RCGH 1 (154.75 g)

showed at par value. From the mean results, fruit length was recorded highest in RCGH 4 (6.54 cm) and lowest in Lalit (6.08 cm). Similarly, fruit diameter was recorded highest in RCGH 4 (6.99 cm), while lowest in Allahabad Safeda (6.15 cm). The variation in fruit weight, length and breadth might be due to genetic behavior of different cultivars or genotype with bigger or smaller sizes varying with weight. These observations were in accordance to the Babu *et al.* (2002) and Man and Suryanarayan (2011) in guava.

In guava, if fruit is loaded with high number of hard seeds fails to attract attention as it influences fruit size and shape. The fruits having less number of soft seeds were preferred both in table and processing purpose. In the present investigation wide variation with respect to number of seeds/100 g fruit weight were recorded among the hybrids and cultivars and these differences were statistically significant. The number of seeds/100 g fruit weight was recorded minimum in RCGH 7 (111.18) while maximum was recorded in Lalit (169.07), L 49 (139.21) followed by RCGH 1 (140.31) and Allahabad Safeda (145.41) showed at par value. This might be due to different hybrids and cultivars had significant variations in their genetic makeup. The analogous findings were also reported by Babu *et al.* (2002) and Patel *et al.* (2007) in different agro-climatic conditions

### Quality attributes

Among the factors influencing the fruit quality, bio-chemical traits are most precious for selecting the variety for table, processing or both purposes. High sugar content in the fruits can primarily be estimated by total soluble solids content of the fruits. The results for fruit quality in terms of TSS, acidity and TSS: acid ratio depicted in Table 4. The hybrid RCGH 1 recorded highest TSS (10.83°B) while lowest in Lalit (9.59°B). From the mean results, lowest acidity was recorded in RCGH 1 (0.50 %) followed by RCGH 7 (0.51 %) and L 49 (0.54 %). However highest acidity was observed in Lalit (0.67 %). Among the hybrids and cultivars TSS: acid ratio was recorded highest in RCGH 1 (21.52) followed by RCGH 7 (20.84), While lowest in Lalit (14.43). The phenotypic and genetic constituents of the hybrids and cultivars might have enhanced the utilization of nutrients and accumulation of more carbohydrates into the fruits, which may be responsible for developing high value for above traits. Also the prevailing agro-climatic conditions of mid-hills were more favorable for quality fruit development. The similar trends were also observed by Ram *et al.* (1997) and Marak and Mukunda (2007).

The results with respect to ascorbic acid content, total sugar and pectin content are depicted in Table 5. The guava fruit is known for its nutritive value offered by ascorbic acid. It was noticed from mean results that the ascorbic acid content was recorded highest in RCGH1 (231.86 mg/100g) followed by RCGH 7 (205.26 mg/100g) and minimum in Lalit (168.78 mg/100 g). The larger variation in ascorbic acid content may be attributed as a varietal character and due to favorability of seasonal conditions. Similar findings was also reported by Pandey *et al.* (2007), Biradar and Mukunda (2007). The sugar is one of the important ingredients for the preparation of value added product form guava and its high content offer pleasant taste to the fruit. In our study, highest total sugar was recorded in RCGH 1 (8.07%) followed by RCGH 7 (8.05%) while minimum in RCGH 4 (6.42 %) followed by Lalit (6.58 %). While the pectin content was recorded highest in RCGH 1 (1.33%) followed by RCGH 7 (1.31%). The total sugar and pectin content showed significant variations among hybrids and cultivars. From the study it was noticed that high pectin content leads to high production of ascorbic acid in guava. These results are in line with the finding of Yan *et al.* (2006). They reported that pectin degradation is linked with ascorbic acid production and postulated that the galacturonic acids are substrate needed in synthesis of ascorbic acid and period of ascorbic acid accumulation corresponded with falling of pectin content in fruit.

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