



Fruit yield and quality attributes of rejuvenated guava trees headed back and pruned at different intensities

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Abstract: In order to rejuvenate the senile guava orchard, 20 year old guava cv. 'Allahabad Safeda' trees were headed back at the height of 1.5 m, 2.0 m and 2.5 m from ground level keeping the senile trees as a control in the month of March. These headed back trees were again subjected to pruning intensity of 0 %, 25 %, 50 % and 75 % of total length of these newly emerged shoots after 5 months of heading back. The un-pruned headed back trees were treated as control. The observations revealed that there was significant improvement of number of fruits and fruit yield per tree with the age of heading back of senile trees. Although, the mean number of fruits per tree was lesser in headed back tree than senile tree during the period of 2010 to 2014, but, among headed back trees highest mean number of fruits per tree was recorded in plants headed back at 1.5 m. Similarly, fruit weight and yield per tree was also significantly higher in headed back trees than senile trees. Among headed back trees maximum average fruit weight and fruit yield was observed in 1.5 m headed back trees. Intensity of pruning also influenced the fruit yield and quality. The headed back trees pruned at 50 per cent level performed comparatively better than other pruning levels. Fruiting density was almost 2.5, 1.8 and 1.5 times higher in trees headed back at 1.5 m, 2.0 m and 2.5 m, respectively than senile trees. Total soluble solids and acidity of fruits was also improved with heading back of senile guava trees.

Key words: Guava, Quality, Rejuvenation, Heading back, Pruning

Introduction

Guava (*Psidium guajava* L.) is one of the most important fruit crop of India having wider adaptability to soil and climatic conditions. It ranked next to mango, banana and citrus with respect of area and production. Presently, the total area under guava in India is 2, 68,500 ha with the production of 3.668 million tons as per Anonymous (2014) report. In Punjab state it is also the second most important fruit crop after kinnow with area of 8205 hectare with production of 1, 80, 775 tons, the figures given by Anonymous (2014). Its average productivity in India is 13.68 ton per hectare while, under Punjab conditions it is 22.03 ton per hectare. However, the productivity of guava is quite less than its productive potential. One of the reasons for the low productivity is a large number of old guava orchards in the age group of more than 20 years, have either gone unproductive or showing marked decline in productivity. The commonly occurring senile orchards, is one of the prominent factors relating to the declining trends in production and productivity of guava as elaborated by Singh (2005) and Singh *et al.* (2005). This is attributed to overcrowded and intermingling of branches, sparse foliage and poor light and air penetration within the tree canopy. The canopies of such plants become very large, unmanageable, un-productive and the inner canopy areas of plants become totally barren. The yield, fruit size and quality become poor; hence the orchards become unproductive and uneconomical. Several issues related to the production technology in guava have remained unfocused so far. Therefore, rejuvenating the old and senile orchards for sustaining the fruit production may be helpful to meet the present need and optimize the fruit potential of our country (Baba *et al.*, 2011). The fruiting potential of guava trees is governed by its architecture, canopy density, photosynthetic efficiency (Kalloo *et al.* 2005, Singh and Singh, 2007). Hence, rejuvenation may be the best possible option to modify the tree structure and maintain canopy size to restore the productive potential of unproductive and uneconomical trees. Moreover, this

technology also helps in maintaining the manageable plant canopies which facilitates the interception of proper sunlight and air in the orchards, ease in spraying, pruning and harvesting operations. Singh *et al.* (2007) explained that pruning out of profusely emerging shoots in the inner canopy also promote branching which ultimately resulted increase in fruit bearing area. Keeping in view the same, the old and senile guava orchard at Regional Station Bathinda (Punjab) was subjected to rejuvenation technology to increase the fruit yield and quality along with restoration of manageable canopies.

Materials and Methods

The guava orchard planted at Regional Research Station Bathinda in the year of 1991 was subjected to rejuvenation technology in the year of 2010. The guava cv. 'Allahabad Safeda' trees were headed back at the height of 1.5 m, 2.0 m and 2.5 m from ground level keeping the old and senile trees as a control in the month of March. The Bordeaux paste was applied to the cut ends immediately after heading back. These headed back trees were again subjected to pruning intensity of 25 %, 50 % and 75 % of total length of these newly emerged shoots after 5 months of heading back. The un-pruned headed back plants were treated as control. The trees were supplemented with well rotten farm yard manure and inorganic fertilizers. The observations of fruit yield in terms of fruit number, yield per tree, fruiting density and quality in terms of fruit size, fruit weight TSS and acidity were recorded for both rainy as well as winter season crops. The number of fruits from each experimental tree was counted before harvest and average was worked out. A random sample of 10 fruits was taken from each experimental tree during harvesting season and the average fruit weight was worked out. Total yield per kilograms was calculated by dividing the total number of fruits on a tree by the number of fruits per kilogram of fruit. The length and diameter of ten randomly selected mature fruits were recorded with the help of a Vernier's Caliper and the means were worked out. The total soluble solids content of juice

were recorded with the help of Baush and Lamb hand refractometer (0-32 per cent). Two ml of strained juice was diluted to 20 ml with distilled water and then titrated with 0.1 N NaOH solution using phenolphthalein as an indicator. The appearance of pink colour marked the end point. The acidity was expressed in terms of anhydrous citric acid by using following formula (A.O.A.C., 2000).

$$\text{Acidity (\%)} = \frac{0.0064 \times \text{Volume of NaOH used}}{\text{Weight of sample}} \times 100$$

Results and Discussion

Number of fruits: During the first year of rejuvenation the mean number of fruits was significantly reduced in headed back trees with maximum fruits (106) in 1.5 m level of heading back. The number of fruits (358) in control trees was maximum during this year (Table 1) During rainy season fruiting of second year of rejuvenation, there was significant improvement in number of fruits in all headed back plants, although remained maximum (447) control trees. Among headed back plants, maximum mean number of fruits (229) was counted in trees headed back at 1.5 m height. In winter season of second year, the difference between number of fruits in headed back and control trees was reduced. The number of fruits of trees headed back at 1.5 m level (292) and un-headed back trees (298) were significantly same (Table-2). Likewise, during third year of rejuvenation the number of fruits during rainy season in control trees (477) was statically higher than headed back trees. However, in winter season of the same year the mean number of fruits in headed back trees was higher than control trees (Table 3). Significantly higher (379) fruits were counted in 1.5 m level plants than control trees (279). While, in next rainy season i.e. in fourth year of rejuvenation, the number of fruits (513) were again significantly higher in control trees than all headed back trees, but, contrarily in winter season of the same year the fruit numbers were significantly higher in headed back trees than control (Table 4). Consequently in next rainy season (Table 5) the number of fruits was highest (501) in trees headed back at 1.5 m level and minimum (307) in control trees.

Although the number of fruits in control trees was significantly higher than all treatments of heading back and pruning intensity during first four crops of winter and rainy season, but, among headed back trees, the number of fruits in trees pruned at 50 cm intensity in 1.5 m level was maximum (121) in first fruiting after rejuvenation. The number of fruits exhibited increasing trend with severity of pruning during rainy and winter season cropping of second year. In rainy season crop, the fruit numbers per tree was highest (265) in same level of treatments, but, in winter season, the number of fruits were maximum (311) in 2.0 m level headed back trees pruned at 50 per cent intensity. Likewise, in rainy and winter season fruit numbers were highest 1.e. 429 and 425, respectively in 1.5m level trees pruned at 50 % intensity. However, in next year, the 2.0 m (521) followed by 1.5 m (511) headed back trees pruned at 25 % intensity produced maximum fruit in rainy season, however, in winter season of the same year and next rainy season number of fruits were maximum 1.e. 507 and 537 in 1.5m/50 per cent treatment, respectively.

Fruit size and weight: Rejuvenation of guava results significant improvement in fruit size and weight (Table-1 to 5). During first fruiting of rejuvenated guava more than 30 per cent increase in fruit size and weight was observed in all headed back treatments with maximum fruit weight (129.67 g) and fruit size (6.61 cm fruit length and 6.36 cm

fruit breadth) in 2.5 m level of heading back. In second year of rejuvenation, rainy season the fruit was significantly smallest with 5.17 cm and 5.09 cm in control trees and largest in 1.5 m level of heading back with 6.06 cm and 5.95 cm fruit length and breadth, respectively. Similarly, observations of maximum fruit weight (113.38 g) in 1.5 m level and minimum (73.45 g) control trees were recorded in the same season. Similar results of increased size and weight were obtained in winter season of the same year with maximum fruit length (6.75 cm), fruit breadth (6.47 cm) and fruit weight (133.59 g) in 1.5 m level and minimum in control trees. In third year of rainy season fruiting fruit size and weight was again significantly higher in all treatments than control trees with maximum fruit size and weight in 1.5 m level, but, in winter season fruiting of this year fruit weight was maximum (130.01 g) in 2.0 m level. Similar trend of increased fruit weight during fourth year of fruiting was recorded during rainy as well as winter season and concomitantly in next rainy season also.

Intensity of pruning also influenced the size and weight of fruits was influenced significantly with. In first fruiting, although there was no definite trend with intensity of pruning, but, fruit length was maximum (6.76 cm) in 1.5 m/ 25 per cent treatment followed by 6.74 in 2.5 m/ 75 per cent treatment. However, fruit breadth was not altered significantly with intensity of pruning. Similarly, fruit weight was also significantly at par under all pruning levels. Fruits of next rainy season were larger and heavier in all headed back trees pruned at 50 per cent level except in 2.5 m headed back trees. Fruit weight was maximum (117.96 g) in 1.5m/ 50 per cent treatment. However, in winter crop, increment in fruit size and weight was observed with the intensity of pruning with maximum size (7.12 cm length and 6.87 cm breadth) and weight (152.78 g) in plants pruned at 50 per cent level in 2.0 m headed back treatment. In third year of rejuvenation, intensity of pruning had significant effect on fruit size and weight. Un-pruned trees exhibited smallest fruit size and least fruit weight in all headed back treatment. Maximum weight was recorded in 1.5 m/ 25 per cent (122.87 g) followed by 2.0 m/50 per cent (121.57 g) treatment in rainy season. In winter season, fruits of 1.5 m/ 75 per cent treatment was heaviest (147.11 g) followed by 145.50 g in 2.0 m/ 50 per cent treatment. Similarly, in next year, the intensity of pruning had significant effect on fruit size and weight. Maximum fruit size and weight was recorded in medium pruning intensities (25 and 50 per cent) in 1.5 m and 2.0 m heading back treatments, while, it was minimum in severe pruning intensity and un-pruned trees during rainy season. However, in winter season, the size and weight of fruit was more in 50 and 75 per cent pruning intensities except in 2.5 m/25 per cent treatment. Likewise, in rainy season fruits of fifth year, size and weight of fruits were increased in medium levels of pruning intensities. Maximum fruit size (136.53 g and 128.16 g) was obtained in 1.5m/50 and 2.0 m/50 per cent treatments, respectively.

Yield per tree: During the first year of rejuvenation the mean yield was significantly reduced in headed back trees with maximum yield (13.64 kg) in 1.5 m level of heading back. The yield of control trees was maximum (34.29 kg) during first fruiting. In second year of rejuvenation, rainy season fruiting was again significantly higher (32.91 kg) in control trees but, significant improvement in number of fruits in all headed back trees was observed. Among headed back trees, maximum mean fruit yield (26.04 kg) was recorded in 1.5 m level. Although, the number of fruits in all the headed back plants was lesser

Table-1: Fruit yield and quality of rejuvenated trees under different levels of heading back and pruning intensity during first year of rejuvenation (Winter season, 2010)

Heading back from ground level (m)	Pruning intensity (%)	Fruit/tree (numbers)	Fruit length (cm)	Fruit breadth (cm)	Fruit weight (g)	Yield per tree (kg)	TSS (%)	Acidity (%)
1.5m	0	108	6.42	6.28	118.57	12.81	10.90	0.195
	25	106	6.76	6.43	138.67	14.65	10.98	0.170
	50	121	6.68	6.40	133.00	16.09	11.34	0.160
	75	89	6.46	6.27	123.67	11.02	11.22	0.181
Mean	-	106	6.58	6.35	128.48	13.64	11.11	0.177
2.0m	0	101	6.67	6.50	136.00	13.69	11.13	0.194
	25	104	6.22	6.13	121.67	12.61	11.23	0.169
	50	92	6.46	6.28	122.67	11.33	11.37	0.159
	75	96	6.63	6.40	132.67	12.75	11.52	0.164
Mean	-	98	6.50	6.33	128.25	12.60	11.31	0.172
2.5m	0	75	6.50	6.25	124.33	9.28	10.97	0.198
	25	82	6.55	6.35	126.33	10.32	11.23	0.172
	50	112	6.64	6.44	131.00	14.63	11.28	0.154
	75	92	6.74	6.41	137.00	12.65	11.00	0.158
Mean	-	90	6.61	6.36	129.67	11.72	11.12	0.171
Control(No Heading Back)	0	343	5.67	5.36	90.33	30.98	10.57	0.130
	25	363	5.65	5.40	93.83	34.06	10.23	0.119
	50	378	5.68	5.38	97.07	36.69	10.33	0.125
	75	348	5.68	5.42	101.83	35.44	10.18	0.165
Mean	-	358	5.67	5.39	95.77	34.29	10.33	0.135
CD (p<0.05)	-	A: 21.70	A: 0.17	A: 0.04	A: 11.33	A: 2.38	A: NS	A: NS
	-	B: 19.06	B: 0.06	B: NS	B: NS	B: 2.51	B: 0.24	B: 0.07
	-	AxB: 38.13	AxB: 0.13	AxB: 0.08	AxB: 8.26	AxB: 3.83	AxB: NS	AxB: 0.01

Table-2: Fruit yield and quality of rainy and winter season crops of rejuvenated trees under different levels of heading back and pruning intensity during second year (2011) of rejuvenation

Heading back from ground level (m)	Pruning intensity (%)	Rainy season (2011)							Winter season (2011)						
		Fruit /tree (No.)	Fruit length (cm)	Fruit breadth (cm)	Fruit weight (g)	Yield per tree (kg)	TSS (%)	Acidity (%)	Fruit No.	Fruit length (cm)	Fruit breadth (cm)	Fruit weight (g)	Yield per tree (kg)	TSS (%)	Acidity (%)
1.5 m	0	223	6.19	6.08	116.79	26.05	10.00	0.221	284	6.68	6.47	121.64	34.54	11.50	0.150
	25	198	5.97	5.87	111.70	22.12	10.05	0.228	265	6.81	6.53	127.92	33.90	11.25	0.166
	50	265	6.16	6.05	117.96	31.26	10.25	0.235	311	6.81	6.45	139.61	43.42	11.33	0.145
	75	231	5.92	5.78	107.05	24.73	10.25	0.231	306	6.70	6.44	145.20	44.43	11.33	0.150
Mean	-	229	6.06	5.95	113.38	26.04	10.14	0.229	292	6.75	6.47	133.59	39.07	11.35	0.153
2.0 m	0	211	5.72	5.60	94.70	19.98	10.20	0.265	265	6.56	6.34	114.95	30.46	11.50	0.165
	25	184	5.75	5.71	96.60	17.78	10.04	0.245	250	6.41	6.30	115.83	28.96	11.25	0.145
	50	168	5.99	5.81	106.76	17.94	10.50	0.247	246	7.12	6.87	152.78	37.58	11.25	0.166
	75	212	6.00	5.92	101.21	21.46	10.60	0.230	218	6.26	5.97	133.24	29.05	11.30	0.187
Mean	-	194	5.87	5.76	99.82	19.29	10.34	0.247	245	6.58	6.37	129.20	31.51	11.33	0.166
2.5 m	0	163	5.90	5.82	98.16	16.00	9.87	0.235	240	6.66	6.42	117.23	28.13	11.00	0.166
	25	182	6.14	5.99	109.03	19.84	10.20	0.245	243	6.32	6.11	126.81	30.81	11.25	0.160
	50	156	5.93	5.79	108.21	16.88	10.20	0.266	197	6.15	5.95	126.53	24.93	11.50	0.187
	75	166	6.22	6.08	117.92	19.58	10.30	0.250	212	7.12	6.87	134.86	28.59	11.50	0.160
Mean	-	167	6.05	5.92	108.33	18.08	10.14	0.249	223	6.56	6.34	126.36	28.12	11.31	0.168
Control (No Heading Back)	0	385	4.97	4.92	69.51	26.76	10.00	0.233	289	5.12	4.94	67.80	19.59	11.33	0.175
	25	402	5.25	5.14	75.06	30.17	9.87	0.235	310	5.50	5.31	76.89	23.84	11.25	0.150
	50	508	5.30	5.24	75.32	38.26	9.87	0.245	325	5.47	5.29	72.73	23.64	10.87	0.166
	75	493	5.16	5.07	73.91	36.44	9.87	0.250	268	5.66	5.51	81.70	21.90	11.00	0.187
Mean	-	447	5.17	5.09	73.45	32.91	9.90	0.241	298	5.44	5.26	74.78	22.24	11.11	0.170
CD (p<0.05)	-	A: 25.31	A: 0.04	A: 0.10	A: 5.10	A: 3.48	A: NS	A: NS	A: 25.87	A: 0.05	A: 0.05	A: 3.11	A: 4.0	A: NS	A: NS
	-	B: 23.18	B: 0.05	B: 0.08	B: 5.28	B: 3.65	B: NS	B: NS	B: 21.58	B: 0.04	B: 0.04	B: 5.66	B: 4.2	B: NS	B: NS
	-	AxB: 45.66	AxB: 0.12	AxB: 0.11	AxB: 10.47	AxB: 7.56	AxB: NS	AxB: NS	AxB: 46.41	AxB: 0.09	AxB: 0.08	AxB: 9.26	AxB: 8.3	AxB: NS	AxB: NS

Table-3: Fruit yield and quality of rainy and winter season crops of rejuvenated trees under different levels of heading back and pruning intensity during third year (2012) of rejuvenation

Heading back from ground level (m)	Pruning intensity (%)	Rainy season (2012)							Winter season (2012)						
		Fruit /tree (No.)	Fruit length (cm)	Fruit breadth (cm)	Fruit weight (g)	Yield per tree (kg)	TSS (%)	Acidity (%)	Fruit No.	Fruit length (cm)	Fruit breadth (cm)	Fruit weight (g)	Yield per tree (kg)	TSS (%)	Acidity (%)
1.5 m	0	273	6.33	6.18	112.40	30.69	9.99	0.231	354	6.40	6.34	109.77	38.86	11.11	0.162
	25	360	6.42	6.30	122.87	44.23	9.97	0.228	393	6.55	6.28	123.00	48.34	10.93	0.150
	50	429	6.35	6.24	118.83	50.98	10.18	0.242	425	6.76	6.40	138.50	58.86	11.17	0.171
	75	366	6.15	6.07	103.80	37.99	10.03	0.203	342	6.79	6.52	147.11	50.31	11.31	0.174
	Mean	-	357	6.31	6.20	114.48	40.97	10.04	0.226	379	6.63	6.39	129.60	49.09	11.13
2.0 m	0	290	6.15	6.02	101.83	29.53	9.87	0.263	238	6.43	6.22	112.70	26.82	11.15	0.145
	25	321	6.12	6.07	102.77	32.99	10.02	0.227	310	6.47	6.36	117.00	36.27	11.29	0.138
	50	361	6.41	6.27	121.57	43.89	10.06	0.229	315	6.78	6.54	145.50	45.83	11.41	0.160
	75	235	6.40	6.25	115.73	27.20	10.03	0.214	291	6.80	6.49	144.83	42.15	11.15	0.191
	Mean	-	302	6.27	6.15	110.48	33.40	10.00	0.233	289	6.62	6.40	130.01	37.77	11.25
2.5 m	0	331	6.08	6.00	101.20	33.50	9.84	0.230	275	6.53	6.29	114.93	31.61	11.03	0.141
	25	375	6.41	6.30	121.03	45.39	10.18	0.233	311	6.72	6.50	134.90	41.95	11.16	0.160
	50	347	6.34	6.19	115.73	40.16	10.19	0.222	357	6.69	6.47	137.53	49.10	10.89	0.206
	75	267	6.36	6.17	113.33	30.26	10.02	0.227	257	6.59	6.36	124.87	32.09	11.00	0.200
	Mean	-	330	6.30	6.17	112.82	37.33	10.06	0.228	300	6.63	6.41	128.06	38.69	11.02
Control (No Heading Back)	0	477	5.30	5.24	74.10	35.35	9.84	0.229	258	5.53	5.34	73.22	18.89	10.92	0.197
	25	497	5.33	5.22	76.20	37.87	9.68	0.229	292	5.57	5.38	77.90	22.75	10.92	0.159
	50	483	5.33	5.27	75.70	36.56	9.82	0.237	292	5.53	5.34	73.46	21.45	10.68	0.159
	75	452	5.32	5.23	76.20	34.44	9.81	0.235	274	5.55	5.40	80.10	21.95	10.62	0.200
	Mean	477	5.32	5.24	75.55	36.06	9.79	0.233	279	5.55	5.37	76.17	21.26	10.79	0.179
CD (p<0.05)	-	A: 38.87 B: 27.24 AxB: 54.49	A: 0.04 B: 0.06 AxB: 0.13	A: 0.08 B: 0.05 AxB: 0.09	A: 5.05 B: 4.94 AxB: 9.88	A: NS B: 3.3 AxB: 6.74	A: NS B: 0.24 AxB: NS	A: NS B: NS AxB: NS	A: 33.32 B: 27.48 AxB: 54.96	A: 0.04 B: 0.05 AxB: 0.09	A: 0.04 B: 0.04 AxB: 0.08	A: 2.92 B: 4.85 AxB: 9.70	A: 3.8 B: 3.6 AxB: 7.23	A: NS B: NS AxB: 0.38	A: 0.02 B: 0.01 AxB: 0.02

Table-4: Fruit yield and quality of rejuvenated trees under different levels of heading back and pruning intensity during fourth year of rejuvenation

Heading back from ground level (m)	Pruning intensity (%)	Rainy season (2013)							Winter season (2013)						
		Fruit /tree (No.)	Fruit length (cm)	Fruit breadth (cm)	Fruit weight (g)	Yield per tree (kg)	TSS (%)	Acidity (%)	Fruit No.	Fruit length (cm)	Fruit breadth (cm)	Fruit weight (g)	Yield per tree (kg)	TSS (%)	Acidity (%)
1.5 m	0	435	6.17	6.03	96.97	42.18	10.00	0.246	402	6.72	6.66	115.26	46.33	10.00	0.246
	25	511	6.21	6.12	107.97	55.17	10.08	0.239	363	6.03	5.78	113.16	41.08	10.08	0.239
	50	362	6.41	6.30	125.13	45.30	10.07	0.210	507	6.90	6.53	139.80	70.88	10.07	0.210
	75	412	6.21	6.10	99.93	41.17	10.03	0.204	478	6.38	6.13	138.28	66.10	10.03	0.204
	Mean	-	430	6.25	6.14	107.50	45.96	10.05	0.225	438	6.51	6.28	126.63	56.10	10.05
2.0 m	0	489	6.25	6.20	112.20	54.87	9.65	0.225	487	5.92	5.72	103.68	50.49	9.65	0.225
	25	521	6.33	6.26	124.43	64.83	10.03	0.213	469	6.99	6.87	126.36	59.26	10.03	0.213
	50	364	6.38	6.25	118.57	43.16	10.05	0.193	425	6.28	6.06	134.73	57.26	10.05	0.193
	75	438	6.13	6.00	99.27	43.48	9.88	0.192	398	6.71	6.41	142.95	56.89	9.88	0.192
	Mean	-	453	6.27	6.18	113.62	51.59	9.90	0.206	445	6.48	6.27	126.93	55.98	9.90
2.5 m	0	508	6.40	6.30	125.87	63.94	10.11	0.217	410	6.46	6.23	113.78	46.65	10.11	0.217
	25	504	6.35	6.20	116.63	58.78	10.02	0.207	395	6.85	6.63	137.60	54.35	10.02	0.207
	50	387	6.36	6.23	119.13	46.10	9.58	0.223	439	7.02	6.79	144.41	63.39	9.58	0.223
	75	543	5.37	5.26	79.03	42.91	9.89	0.242	412	6.85	6.61	129.86	53.50	9.89	0.242
	Mean	-	486	6.12	6.00	110.17	52.93	9.90	0.222	414	6.80	6.57	131.41	54.47	9.90
Control (No Heading Back)	0	529	5.38	5.28	77.13	40.80	9.97	0.213	368	5.57	5.38	73.81	27.16	9.97	0.213
	25	543	5.46	5.33	84.33	45.79	9.95	0.223	402	5.50	5.31	76.89	30.91	9.95	0.223
	50	544	5.43	5.34	83.83	45.60	9.84	0.245	380	5.64	5.45	74.93	28.47	9.84	0.245
	75	435	6.17	6.03	96.97	42.18	9.72	0.237	342	5.49	5.35	79.30	27.12	9.72	0.237
	Mean	-	513	5.61	5.50	85.57	43.59	9.87	0.230	373	5.55	5.37	76.23	28.42	9.87
CD (p<0.05)	-	A: 53.48 B: 32.48 AxB: 64.97	A: 0.05 B: 0.05 AxB: 0.09	A: 0.05 B: 0.04 AxB: 0.09	A: 3.19 B: 3.14 AxB: 6.28	A: 6.6 B: 3.8 AxB: 7.79	A: 0.17 B: NS AxB: NS	A: NS B: 0.01 AxB: 0.03	A: 3.28 B: 3.34 AxB: 6.59	A: 47.5 B: 26.3 AxB: 53.21	A: 0.04 B: 0.05 AxB: 0.08	A: 0.05 B: 0.05 AxB: 0.10	A: 8.3 B: 4.1 AxB: 10.56	A: 0.2 B: NS AxB: NS	A: NS B: NS AxB: NS

Table-5: Fruit yield and quality of rejuvenated trees under different levels of heading back and pruning intensity (Rainy season, 2014)

Heading back from ground level (m) (A)	Pruning intensity (%) (B)	Fruit/tree (numbers)	Fruit Weight (g)	Fruit Yield (kg/tree)	Fruit length (cm)	Fruit Breadth (cm)	TSS (%)	Acidity (%)
1.5m	0	505	100.20	50.60	6.18	6.11	10.08	0.21
	25	510	111.63	56.97	6.21	6.21	10.12	0.22
	50	537	136.53	72.97	6.40	6.37	10.15	0.23
	75	450	108.63	48.73	6.21	6.17	10.11	0.21
	Mean	-	501	114.25	57.32	6.25	6.22	10.12
2.0 m	0	499	116.67	58.16	6.24	6.26	9.75	0.23
	25	498	127.33	63.30	6.34	6.31	10.15	0.20
	50	415	128.16	53.11	6.38	6.30	10.09	0.21
	75	472	109.00	51.58	6.14	6.09	10.02	0.21
	Mean	-	471	120.29	56.54	6.28	6.24	10.00
2.5 m	0	488	127.50	62.18	6.39	6.36	10.18	0.22
	25	502	119.86	60.29	6.34	6.27	10.14	0.20
	50	423	126.67	53.34	6.35	6.28	9.71	0.21
	75	503	91.36	45.93	5.38	6.08	10.02	0.21
	Mean	-	479	116.35	55.44	6.12	6.25	10.01
Control(No Heading Back)	0	353	86.77	30.73	5.39	5.33	10.10	0.20
	25	352	94.77	33.55	5.46	5.40	10.05	0.22
	50	284	98.87	28.48	5.43	5.37	9.93	0.24
	75	240	103.27	24.49	6.17	5.44	9.84	0.21
	Mean	-	307	95.92	29.31	5.61	5.39	9.98
CD (p-0.05)	-	A:27.6	A:8.05	A:4.08	A:0.02	A:0.01	A:0.02	A:NS
	-	B:26.7	B:5.08	B:4.00	B:0.02	B:0.02	B:0.01	B:NS
	-	AXB:55.29	AXB:16.11	AXB:8.17	AXB:0.04	AXB:0.05	AXB:0.04	AXB:NS

than control trees, but, the fruit yield was significantly higher in all treatments of heading back with maximum yield of 39.07 kg in 1.5 m level and minimum yield of 22.24 kg was recorded in control. This was due to increased fruit weight in rejuvenated trees. Similarly, during third year of rejuvenation although the yield in all experimental plants during rainy season was significantly same but, it was maximum (40.97 kg) in 1.5 m level of heading back. However, in winter season of the same year it was spastically higher in all rejuvenation treatments with maximum yield (49.09 kg) in 1.5 m level. The fruit yield of rainy season during fourth year of rejuvenation was significantly higher in trees headed back at 2.0 m and 2.5 m levels than un-headed back and 1.5 m level of heading back. However, during winter season of this year, the yield was almost double in headed back plants than control trees. Similar trend of increment in yield was recorded in rainy season crop of fifth year of rejuvenation (Table-1 to 5).

Fruit yield was significantly affected by the intensity of pruning in all experimental plants. During first year of rejuvenation, 50 per cent intensity of pruning exhibited maximum fruit yield in 1.5 m (16.09 kg) and 2.5 m (14.63 kg) level among headed back plants. In second year's observations, although the yield of control trees was higher in rainy season but, in headed back trees, maximum fruit yield (31.26 kg) was recorded in 1.5 m/ 50 cm treatments. Similarly, in winter season fruit yield was significantly higher in trees pruned at 25 and 50 per cent intensity. Maximum yield was recorded in 1.5 m/75 per cent (44.43 kg) treatment followed by 1.5 m/50 per cent (43.42 kg) treatment. The yield exhibited increasing trend with the severity of pruning up to 50 per cent but then declined on 75 per cent level during third year of rainy season fruiting. Maximum yield of 50.98 kg was obtained from 1.5 m/ 50 per cent treatment. Similarly, in winter season of the same year, the highest fruit yield was recorded in 50 per cent pruning level in all headed back trees. However, in rainy season of fourth year of rejuvenation, trees un pruned at 25 per cent level exhibited maximum

yield of 64.83 kg in 2.0 headed back trees while, in winter season it was maximum at 50 per cent pruning in 1.5 m headed back trees. Rainy season crop of fifth year also exhibited highest yield in 1.5 m / 50 per cent level of pruning (Table-1 to 5).

Total soluble solids: Total soluble solid content of fruits during first year of rejuvenation was not influenced significantly but in headed back trees it was minimum (10.33 %) in control trees. Maximum TSS (11.31 %) was recorded in 1.5 m level of heading back. During rainy and winter season fruits of second year of rejuvenation, TSS of fruits was least in fruits of control trees and maximum in trees headed back at 2.0 m (10.34 %) and 1.5 m (11.35 %), respectively, although it was not differ significantly. In third year, TSS was again statistically at par in all experimental trees; however, it was increased with heading back treatments. However, in fourth year, the rainy as well as winter season fruits exhibited significantly higher TSS in headed back plants than control trees. Maximum TSS was recorded in plants headed back at 1.5 m level during rainy (10.05 %) as well as winter (11.00 %) season. In fifth year of rejuvenation TSS of rainy season fruits was also maximum (10.12 %) in 1.5 m level of heading back and minimum (9.98 %) in control trees. Severity of pruning also affects the TSS content of fruit to a significant level. Fruit obtained from plants pruned at 50 per cent level exhibited significantly higher TSS content in first year fruiting of rejuvenated guava. Maximum TSS (11.52 %) was recorded in 2.0 m/75 per cent treatment. During second year, TSS of fruits was statistically at par in all the treated and control tree. However, in third year, there was increase in TSS with severity of pruning of pruning up to 50 per cent with maximum TSS content of 10.19 and 10.18 per cent in 50 per cent pruning level in 2.5m and 1.5 m, respectively in rainy season fruits. In winter season there was no significant difference between TSS of all the rejuvenated and control plants. Highest TSS content (11.41 per cent) was recorded in 2.0 m/ 50 per cent treatment. The TSS content of fruits of both rainy as well as winter season was

significantly same in fourth year of rejuvenation. However, in next year rainy season crop, trees pruned at varied intensity exhibited significantly different TSS content, although, there was no specific trend of effect on TSS with severity of pruning (Table-1 to 5).

Acidity: In first fruiting season, acid content of fruits, there was no significant difference between fruits of headed back and control trees but it was comparatively lower in headed back trees (Table 1 to 5). Similarly, during second year, the acidity in fruits was almost same in fruits of rainy season, but in winter season it showed reducing trend with severity of heading back. In third year of rejuvenation, the fruits of rainy season exhibited significantly same acid content in all experimental trees, but, in winter season the fruits of trees headed back at 2.0 m (0.159 %) and 1.5 m (0.164 %) exhibited significantly less acid content. In fourth year of rejuvenation the acid content in fruits of rainy and winter season fruits was significantly at par in all headed back and control trees. Similarly, in next rainy season acidity in fruits was also significantly same in all experimental plants. The intensity of pruning significantly affects the acid content in fruits in first year. Although, the acid content of fruits was minimum in control trees but, it was decreased with severity of pruning in headed back trees with minimum acid content of 0.154 per cent in 2.5 m/ 50 per cent treatment. In second year, there was no significant difference in acidity of fruits in rainy as well as winter season crop. In third year, acidity in rainy season fruits was not altered significantly, but in winter season it showed increasing trend with severity of pruning.

Although, the mean number of fruits per tree was lesser in headed back tree than senile tree during the period of 2010 to 2014, but, there was significant improvement of number of fruits and fruit yield per tree with the age of heading back of senile trees. Among all the rejuvenated trees maximum average fruit weight and fruit yield was observed in 1.5 m headed back trees pruned at 50 % level.

In the present study, although the fruit numbers on rejuvenated trees were decreased in the initial years due to less vegetative shoots and fruiting area in preliminary phase of rejuvenation, but, it was increased with increment in growth and after four crop seasons, there was equilibrium in rejuvenated and senile trees w. r. t fruit numbers. After this, significant increase in fruit numbers was recorded in all rejuvenated trees as compared to unrejuvenated trees. The aspects like architecture, density of plant canopy and photosynthetic efficiency govern the productive potential of guava trees (Kalloo *et al.*, 2005). As the guava fruit bears on current season growth, the profuse growth on rejuvenated trees lead to more flowering and fruiting. The pruning in guava trees lead to emergence of new auxiliary shoots in the inner canopy of which results more fruit bearing area, hence; fruit numbers and yield as observed by Singh *et al.* (2007). New growth and emergence of fruit bearing shoots are stimulated in the inner canopy in the same way, the hedging and topping encourages new growth on the outer side of the canopy as described by Burondkar and Gunjate (1993).

The increment of fruit size and weight in rejuvenated trees may be due to lesser fruit numbers, resulting poor competition between developing fruits and increased vegetative growth resulting higher availability photosynthates to the fruits. Likewise, Luiz and Lopes (2008) also reported that the plants submitted to heavy pruning produced the smallest numbers of buds, established branches and fruits per plant, as well as the smallest index of fruit sets and yield;

however they produced higher fruit weight. However, Brar *et al.* (2007) reported maximum number of fruits and yield per tree when the plants were subjected to light pruning at 15 cm level. Yunus (1992) also reported similarity in the average fruit weight in different pruning intensities in guava. More light interception in the plant canopies of rejuvenated plants during fruit growth might lead to increased yield as described by Singh and Dhaliwal (2003). The multiple shoots developed as a result of second pruning led to flowering and fruiting in the following season and the yield enhancement was 70–90% over un-pruned trees in the second year after rejuvenation in guava (Anon, 2008). Joshi *et al.* (2014) also studied that three fourth shoot pruning proved significantly superior over other pruning treatments for emergence of new shoots and number of flower buds per plant for winter season crop. Plants under light pruning had significantly higher yields than those under medium or heavy pruning, both in terms of total fruit weight and total fruit number (Yunus, 1992). An enhancement of yield in Allahabad Safeda and Sardar guava as against un-pruned trees after the first and second year of topping and hedging was recorded by Singh *et al.* (2007). Rao *et al.* (1971) also reported increase in productivity of old orchard in South India by pruning in mango. Brar *et al.* (2007) also reported that the total soluble solids of guava fruits was higher in the fruits of pruned trees as compared to the unpruned ones. The fruit produced from pruned trees had better quality as compared to control trees in 'Allahabad Safeda' and 'Sardar' guava as reported by Singh *et al.* (2007).

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