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Effect of pruning intensity and nutrition on quality of guava fruit *cv.* Allahabad Safeda

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Abstract
An experiment was conducted to see the effect of different combinations of Pruning intensity and Nutrition (organic, inorganic and bio-fertilizers) on quality of guava fruit at Horticulture Nursery, JNKVV, Jabalpur during year 2016-17. The highest TSS (10.96^{0}Brix), Ascorbic acid (241.0mg/100g), Total Sugar (8.07%), Reducing Sugar (4.68%) and Non-Reducing Sugar (3.39%) was found in pruning at 40cm, while minimum was observed in unpruned plants. Different sources of nutrition also affected fruit quality. The highest TSS (12.07^{0}Brix), Ascorbic acid (244.4mg/100g), Total Sugar (8.45%), Reducing Sugar (4.91%) and Non-Reducing Sugar (3.54%) was recorded in F_6 treated with [5 kg FYM + 2 kg VC + 75% RDF {225:150:150g NPK} + *Azotobactor* 150gm + PSB 100gm / Plant] and lowest was found in F_4. The highest acidity (0.508%) was recorded in F_4 treated with (*Azotobactor* 150gm + PSB 100gm / Plant) and lowest was observed in F_6.

Keywords: Pruning, Nutrition, Quality, FYM, *Azotobactor*, PSB

1. Introduction
Guava (*Psidium guajava* L.) is one of the most important fruits of the tropics and sub-tropics of the world. It belongs to family Myrtaceae and is aptly called as 'Apple of the tropics'. It was introduced to India during the 17th century by the Portuguese explorers brought the fruit and many others to Goa (Menzel and Paxton, 1985) [17]. This fruit occupies an important place in the horticultural wealth of our nation and ranks fifth with respect to area and production. In, Madhya Pradesh guava is cultivated some district Rewa, Satna, Balaghat, Panna, Seoni, Umaria, Katni, Sheopur, Gwalior, Shivpuri, Betul, Chhindwara, Guna, Ratlam, Ujjain, Jhabua, Dhar, Indore, Dewas etc. The fruit of rainy season crop are rough, insipid, poor in quality due to high temperature, rainfall and humidity which leads attacked by several insect-pest and pathogens so that, rainy season crop should be avoided. On the other hand, winter season crop is superior in quality, free from diseases and fetches high price as compared to rainy season crop (Prakash *et al.,* 2012) [19]. Pruning helps in balance between vegetative and reproductive growth of the plant. A light pruning is considered necessary to encourage new shoots after the harvest. Shoot pruning is helpful in reducing the tree size and improving the fruit quality and provide opportunity to increase the number of tree per unit area. (Lal *et al.,* 2000) [13]. Use of organic manures along with bio-fertilizers and inorganic fertilizers as a cheap source of available nutrient to plants has resulted in beneficial effects on growth, yield and quality of various fruit crops (Ram and Rajput, 2000) [20]. Keeping in view the above mentioned facts, the present investigation was conducted to study how physico-chemical qualities of fruits are being changed after pruning and fertilizers application.

2. Material and Methods
The present investigation was carried out at Demonstration Farm, Horticulture Nursery, Department of Horticulture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur during 2016- 2017. The experimental material consisted of six year old uniform plants of Guava *cv.* Allahabad Safeda. The trees were maintained under uniform cultural practices during the entire course of investigation. The pruning was done on 24th of May 2016 and treatment consisted of three pruning levels, *i.e.* unpruned (P_1), pruning at 20cm from shoot apex (P_2), pruning at 40cm from shoot apex (P_3) and six fertilizers doses *i.e.* F_1Check (5 kg FYM + 2 kg

Vermicompost / Plant), F_2 (5 kg FYM + 2 kg VC + *Azotobactor* 150gm /Plant), F_3 (5 kg FYM + 2 kg VC + PSB 100gm / Plant), F_4 (*Azotobactor* 150gm + PSB 100gm / Plant), F_5 [5 kg FYM + 2 kg VC + 100% RDF {300:200:200 g NPK} / Plant], F_6 [5 kg FYM + 2 kg VC + 75% RDF{225:150:150g NPK} + *Azotobactor* 150gm + PSB 100gm / Plant]. The experiment was conducted under factorial randomized block design with three replications and six plants were kept in each treatment. The balanced pruning was performed in all directions of the canopy, which were dense and overcrowded. The (P_1) plants were left as such without pruning. As per treatments the full dose of phosphorus, potassium and organic sources i.e. FYM, Vermicompost and bio-fertilizer were applied as a basal dose in the 1st week of July, while nitrogen was applied in two split doses, one with basal dose (1st week of July) and another after one month (1st week of August) through basin method.

For chemical analysis of the fruit, five fruits were randomly selected from the harvested bulk in each treatments and pulp of five randomly selected fruits was crushed for extracting juice. TSS of filtered juice was measured by Hand Refractrometer range of 0-32^{0}Brix. The percent titrable acidity was estimated by simple acid / alkaline titration method as described in A.O.C.C (1984) [2]. The ascorbic acid content was estimated as per Assay method given by (Ranganna, 1986) [22]. The reducing sugar, total sugar per cent in fruit juice was estimated by the method as suggested by (Nelson, 1944) [18] and non-reducing sugar is estimated by subtracting of reducing sugar in total sugar.

3. Results and Discussion

The data presented in the (Table 1&2) recorded that there was enhancement in fruit quality with the increasing in pruning intensity and Fertilizer levels. The parameters namely total soluble solid (^{0}Brix), ascorbic acid (mg/100g), total sugar (%), reducing sugars (%) and non-reducing sugar (%) were found to be higher, while the parameter titrable acidity (%) was low with increasing pruning intensity and fertilizer doses. The result revealed that highest TSS (10.96^{0}Brix), Ascorbic acid (241.0mg/100g), Total Sugar (8.07%), Reducing Sugar (4.68%) and Non-Reducing Sugar (3.39%) was found in pruning at 40cm from the shoot apex, while minimum was observed in unpruned plants. But in case of titrable acidity, maximum value (0.473%) was recorded in unpruned plants and minimum was found in pruning at 40cm from the shoot apex.

The beneficial effect of organic, inorganic fertilizer along with bio-fertilizer on fruit quality was also observed. Data presented in (Table 1&2) revealed that different levels of organic, inorganic fertilizers along with bio-fertilizer significantly increased the total soluble solid (^{0}Brix), ascorbic acid (mg/100g), total sugar (%), reducing sugars (%) and non-reducing sugar (%) of the guava fruits. The highest TSS (12.07^{0}Brix), Ascorbic acid (244.4mg/100g), Total Sugar (8.45%), Reducing Sugar (4.91%) and Non-Reducing Sugar (3.54%) was recorded in F_6 treated with [5 kg FYM + 2 kg VC + 75% RDF {225:150:150g NPK} + *Azotobactor* 150gm + PSB 100gm / Plant] and lowest was found in F_4.The highest acidity (0.508%) was recorded in F_4 treated with (*Azotobactor* 150gm + PSB 100gm / Plant) and lowest was observed in F_6. The interaction effect between pruning intensity and fertilizer level was found to be significant with parameters total soluble solid, total sugar (%) and reducing sugars (%), while the titrable acidity (%), ascorbic acid (mg/100g) and non-reducing sugar (%) was found to be non- significant.

Physico-chemical qualities of the guava fruit significantly increases with increasing pruning intensity. The improvement in fruit quality might be due to increased accumulation of metabolites and rendered better fruit quality of winter crop due to diversion of synthesized food materials of spring flushed crop to monsoon flushed crop (Chandra and Govind, 1995) [6]. Increase in TSS might be due to the pruned plants had relatively higher leaves/fruit ratio as compared to the unpruned plants, which might have contributed for increased TSS concentration due to more metabolites synthesis **(**Adhikari and Kandel, 2015) [1]. Hiwale and Raturi (1993) [11] reported that increase the TSS may be due to increased severity of the pruning which result into a more open tree canopy and this allowing more light and less competition for the growth of individual fruit compared to unpruned plants. These results are in agreement with the findings of (Bajwa *et al.,* 1986) [3] in ber. Titrable acidity decrease with increase pruning intensity. This might be attributed to deposition of higher quantum of acid that is synthesized in leaves during fruit development (Bhagawati *et al.,* 2015) [4]. The increase titrable acidity in the unpruned plants is due to lower rate of reduction of starch to sugars, more competition and light unavailability (Mahadevan and Kumar, 2014) [14]. These results are in agreement with the findings of (Kumar and Rattanpal, 2010) [12] in guava. Dhaliwal and Kaur (2003) [8] indicated that there was an increase in ascorbic acid content with increasing pruning intensity. This result is in conformity with the earlier report by (Sharma *et al.,* 2016) [23] in guava and (Prakash *et al.,* 2012) [19] in guava. Total sugar, reducing and non-reducing sugars increased significantly with the increasing severity of pruning (Singh and Chauhan, 1998) [25]. Similar results were also reported by (Dubey *et al.,* 2001) [9] in guava and (Kumar and Rattanpal, 2010) [12] in guava.

Superior fruit quality might be due to fact that, application of nitrogen fixing bacteria with organic manures and lower dose of inorganic fertilizers enhances the nutrient availability by enhancing the capability of plants to better solute uptake from rhizosphere, also these nitrogen fixers are known for accumulation of dry matter and their translocation as well as favour synthesis of different growth regulators and exhibited regulatory role on the absorption and translocation of various metabolites. The results are in accordance with (Ram *et al.,* 2007) [21]. The highest fruit quality might be due to nitrogen stimulates the functioning of enzymes in the physiological processes, which have improved the total soluble solids content of the fruits. The maximum total soluble solids, ascorbic acid, reducing sugars, non-reducing sugars, total sugars by application of NPK and bio-fertilizers may be explained by the fact that phosphorus enters into the composition of phospho-lipids and nucleic acid, the latter combination with proteins and results in the formation of nucleo-proteins which are important constituents of the nuclei of the cell. Potassium acts as a catalyst in the formation of more complex substances and in the acceleration of enzyme activity. These carbohydrates and coenzymes are beneficial in the improvement of fruits quality and nitrogen enhances the uptake of phosphorus and potassium due to the chain reaction in these components might have possibly caused important in quality of fruits (Ram *et al.,* 2007) [21]. Similar results were also reported by (Binepal *et al.,* 2013) [5] in guava and (Shukla *et al.,* 2009) [24] in guava. The highest ascorbic acid may be due to catalytic activity of several enzymes, which participate in the biosynthesis of ascorbic acid. Carbohydrates are most important which affects the quality of fruits and during ripening of fruits the carbohydrates reserves of the root and

stem are drawn upon heavily and hydrolyzed into sugars hence, results more sugar content in fruit (Dey *et al.*, 2005) [7]. The highest total sugar was attributed to the involvement of nitrogen in various energy sources like amino acids and amino sugars (Dutta, *et al.*, 2009) [10]. The above findings are in accordance with (Meena *et al.,* 2014) [16] in guava and (Mamnindla *et al.*, 2014) [15] in guava.

Table 1: Effect of pruning intensity and Nutrition on TSS (^{0}Brix), Titrable Acidity (%) and Ascorbic acid (mg/100g) of guava fruits

Fertilizers (Factor B)	Pruning (Factor A)											
	TSS (^{0}Brix)				Titrable Acidity (%)				Ascorbic acid (mg/100g)			
	P1 (0 cm)	P2 (20 cm)	P3 (40 cm)	Mean	P1 (0 cm)	P2 (20 cm)	P3 (40 cm)	Mean	P1 (0 cm)	P2 (20 cm)	P3 (40cm)	Mean
F_1 Check (5 kg FYM + 2 kg Vermicompost/Plant)	9.33	9.60	9.87	9.60	0.523	0.480	0.459	0.487	232.5	234.2	235.8	234.2
F_2 (5 kg FYM + 2 kg VC + *Azotobactor* 150gm/Plant)	9.53	10.13	10.40	10.02	0.448	0.416	0.395	0.420	236.7	239.2	242.5	239.4
F_3 (5 kg FYM + 2 kg VC + PSB 100gm/Plant)	9.47	9.80	10.27	9.84	0.480	0.448	0.416	0.448	233.3	238.3	240.8	237.5
F_4 (*Azotobactor* 150gm + PSB 100gm/Plant)	9.27	9.47	9.67	9.47	0.544	0.512	0.469	0.508	230.0	232.5	234.2	232.2
F_5 (5 kg FYM + 2 kg VC + 100% RDF 300:200:200 g NPK /Plant)	10.33	12.13	12.67	11.71	0.437	0.405	0.373	0.405	239.2	242.5	245.0	242.2
F_6 (5kg FYM + 2 kg VC +75% RDF 225:150:150 g NPK + *Azotobactor* 150gm + PSB 100gm/Plant)	10.80	12.53	12.87	12.07	0.405	0.395	0.352	0.384	241.7	244.2	247.5	244.4
Mean	9.79	10.61	10.96		0.473	0.443	0.411		235.6	238.5	241.0	
	Pruning	Fertilizer	Interaction		Pruning	Fertilizer	Interaction		Pruning	Fertilizer	Interaction	
SEm ±	0.04	0.06	0.10		0.007	0.010	0.017		0.63	0.89	1.54	
CD at 5%	0.11	0.16	0.28		0.020	0.028	NS		1.80	2.55	NS	

Table 2: Effect of pruning intensity and Nutrition on Total Sugar (%), Reducing Sugar (%) and Non-Reducing Sugar (%) of guava fruits

Fertilizers (Factor B)	Pruning (Factor A)											
	Total Sugar (%)				Reducing Sugar (%)				Non-Reducing Sugar (%)			
	P1 (0 cm)	P2 (20 cm)	P3 (40 cm)	Mean	P1 (0 cm)	P2 (20 cm)	P3 (40 cm)	Mean	P1 (0 cm)	P2 (20 cm)	P3 (40cm)	Mean
F_1 Check (5 kg FYM + 2 kg Vermicompost/Plant)	7.31	7.53	7.72	7.52	4.17	4.31	4.47	4.32	3.14	3.22	3.25	3.20
F_2 (5 kg FYM + 2 kg VC + *Azotobactor* 150gm/Plant)	7.70	7.96	8.12	7.93	4.47	4.63	4.72	4.61	3.23	3.33	3.40	3.32
F_3 (5 kg FYM + 2 kg VC + PSB 100gm/Plant)	7.50	7.76	7.91	7.73	4.31	4.47	4.55	4.44	3.19	3.30	3.36	3.28
F_4 (*Azotobactor* 150gm + PSB 100gm/Plant)	6.94	7.23	7.40	7.19	3.97	4.10	4.24	4.10	2.97	3.13	3.16	3.09
F_5 (5 kg FYM + 2 kg VC + 100% RDF 300:200:200 g NPK /Plant)	8.01	8.28	8.56	8.28	4.63	4.81	5.00	4.81	3.38	3.47	3.56	3.47
F_6 (5kg FYM + 2 kg VC +75% RDF 225:150:150 g NPK + *Azotobactor* 150gm + PSB 100gm/Plant)	8.17	8.45	8.74	8.45	4.72	4.90	5.10	4.91	3.45	3.54	3.64	3.54
Mean	7.61	7.87	8.07		4.38	4.54	4.68		3.23	3.33	3.39	
	Pruning	Fertilizer	Interaction		Pruning	Fertilizer	Interaction		Pruning	Fertilizer	Interaction	
SEm ±	0.007	0.010	0.017		0.009	0.013	0.023		0.014	0.019	0.034	
CD at 5%	0.021	0.029	0.050		0.027	0.038	0.066		0.039	0.056	NS	

4. Conclusion

On the basis of present investigation, it can be concluded that pruning at 40cm from the shoot apex is beneficial to improve the fruit quality *viz.* TSS, Ascorbic acid, Total sugar, reducing sugar and non-reducing, while the maximum acidity was found in unpruned plants. All the quality parameters was found to be highest in F_6 [5 kg FYM + 2 kg VC + 75% RDF {225:150:150g NPK} + *Azotobactor* 150gm + PSB 100gm / Plant] except titrable acidity.

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