Indian J. Hort. 69(2), June 2012: 181-184

Growth, yield and quality of guava as influenced by varying rejuvenation periods

N.K. Singh, D.C. Shrivastava and A.P. Bhandarkar
Jawaharlal Nehru Krishi Vishwavidyalaya, Krishi Vigyan Kendra Seoni 480 661, Madhya Pradesh

ABSTRACT

A field experiment was conducted to study the response of varying rejuvenation periods of an old guava orchards (cv. Allahabad Safeda) at the Demonstration Farm of Krishi Vigyan Kendra of Jawahar Lal Nehru Krishi Vishwa Vidyalaya as well as farmer's field during 2008-09. Fifteen-year-old guava plants were severely pruned leaving only four scaffold branches per tree at monthly interval from April to June, 2008. The tree height, tree spread and canopy volume were affected significantly by different periods of rejuvenation. Only winter season crop was obtained in first year after pruning. Time of pruning had significant effect on fruit set. Fruit yield and physico-chemical characters of mature fruits were found to be best in fruits obtained from trees pruned during May. Maximum number of fruits and yield was obtained from May rejuvenated trees (272 fruits and 46.22 kg/tree) and minimum in control (104 fruits and 27.12 kg yield/tree). Pruning proved to be successful in rejuvenating old guava orchards and the economics also suggested gain in returns compared to senile orchards.

Key words: Guava, rejuvenation, time of pruning, vegetative growth, fruit quality, economics.

INTRODUCTION

Guava (*Psidium guajava*) is a popular fruit grown successfully throughout tropical and subtropical climatic regions of India. A guava fruit is also termed as poor man's apple because it is nutrient rich and cheap and; easily available to the common man in the plains of northern and central India. Guava is one of the richest natural sources of vitamin C containing two to five times more than oranges and ten times more than tomato. It is a rich source of calcium, phosphorous and iron which are necessary for human health.

In India, guava is well adopted in an area of 0.220 m ha of land with annual production of 2.57 million tones, having productivity of 11.7 t/ha (NHB, 5) out of which 92.4 thousand hectare area comes under Madhya Pradesh with annual production of 2372.5 million tonnes having productivity of 25.7 t/ha. In Madhya Pradesh the major guava production belts are Jabalpur, Rewa, Katni and Seoni, but the productivity of guava is low due to old and dense orchards. Thickly shaded guava orchards have brought down the average productivity. It has been observed that after 15 to 20 years of age guava orchards generally begin to lose vigour and bearing potential. Low productivity of guava is primarily due to small size of holdings, preponderance of old and senile orchard and poor management of inputs such as water, nutrients and pesticide. Hence, the present experiment was conducted to assess the response of rejuvenation time on old and senile guava orchards.

*Corresponding author's E-mail: nikhilsingh478@gmail.com

MATERIALS AND METHODS

The field experiment was conducted at Demonstration Farm of Krishi Vigyan Kendra, Seoni under Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur during the year 2008-09 & 2009-10 as well as at farmer's field. Fifteen-year-old guava plants were pruned drastically at monthly interval from April to June 2008 leaving only four scaffold branches per tree. The rejuvenation method involved the heading back of trees to the extent of 1.5 m height above the ground level. The treatments consisted of rejuvenation of current season growth, *i.e.* unrejuvenated, rejuvenated in the month of April, rejuvenated in the month of May and rejuvenated in the month of June at 7 m × 7 m spacing of trees. Each treatment was replicated thrice with single tree as experimental unit in randomized block design. The selected trees were maintained under uniform cultural practices and growth was recorded in terms of plant height and plant spread. Canopy spread in the N-S and E-W directions were measured during September by the formula given by Roose *et al.* (7).

The fruiting characteristics of winter season crop were recorded from September to January. The data were noted in terms of fruit number and yield kg per tree. Physical characteristics of fruits were recorded in the month of December. The length and diameter of ten randomly selected fruits from each treatment was recorded with the help of Vernier callipers. The quality characters of fruits were determined in terms of total soluble solids content of juice was

determined with the help of Bausch and Lamb's hand refractometer and expressed in terms of degrees Brix at 20°C (AOAC, 1). Other parameters were calculated following standard methods. True density was calculated by toluene displacement method and percentage moisture content was determined by gravimetric method. Titrable acidity was determined as percent citric acid by the method outlined by Ranganna (6). Free soluble sugars were estimated by the procedure of Dubois *et al.* (3). The economics of cost of cultivation of rejuvenated guava orchard was also calculated in terms of total cost of cultivation, gross return etc.

RESULTS AND DISCUSSION

The tree height, tree spread and canopy volume were affected significantly by different periods of rejuvenation pruning. Pruning resulted in decrease of tree height, tree spread and tree canopy volume (Table 1). Maximum tree height was found in control and minimum due to rejuvenation pruning during May. The canopy spread was significantly affected by various pruning intervals. The tree spread was found maximum in June and minimum in May. Only winter season crop was obtained one year after pruning and pruned plants flowered one month ahead of unpruned (control) plants. Time of pruning had significant effect on fruit set. Maximum number of fruits and yield was obtained from May rejuvenated trees (272 fruits and 46.22 kg /tree) and minimum in control (104 fruits and 27.12 kg yield/tree). Maximum fruit size was recorded in T_3 (7.0 cm length and 6.3 cm diameter, respectively). It might be due to the availability of metabolites and water in abundance to a relatively fewer fruits. The results obtained by Dubey (3), and Singh and Dhaliwal (8) in guava are in aggreement with the present investigation. The fruit produced from pruned trees had better quality as compared to control (Table 2). The results of this experiment provide insight into the interaction effect of rejuvenation pruning and cropping pattern on guava trees. The net returns corresponding to the gross return was high after three years (Tables 3 & 4).

Fruit size increase was low during ripening in unrejuvenated (143.63 to 186.72 g) as compared to rejuvenated (169.12 to 210.75 g) trees. This may be due to the fact that the moisture content also increases with advancing stage of ripening. The true density reduced with the advance of ripening stage as compared with unrejuvenated guava (1.01 to 0.92) and

Table 1. Vegetative growth and fruit yield of Allahabad Safeda guava under different rejuvenation time.

Treatment	Tree height (m)			Tree spread (m^3)	Tree canopy (m^3)	No. of fruits/ tree	Fruit yield/tree (kg)	
	2008	2009	2010		2008		2009	2010
T_1 = Rejuvenation in the month of April + RDF	1.5	2.6	3.7	6.5	78.1	206.0	26.11	38.11
T_2 = Rejuvenation in the month of May + RDF	1.5	2.5	3.6	5.2	82.4	272.7	22.76	46.22
T_3 = Rejuvenation in the month of June + RDF	1.5	2.6	3.7	5.3	79.1	266.7	29.45	43.78
T_4 = control (Un-rejuvenated guava)	7.2	7.3	7.3	6.1	118.8	104.3	26.27	27.12
$CD_{(P=0.05)}$	0.63	0.84	0.77	0.91	5.23	13.50	1.52	2.78

Table 2. Fruit size and quality of fruits of Allahabad Safeda guava due to rejuvenation.

Treatment	Fruit length (cm)	Fruit dia. (cm)	Fruit wt. (g)	TSS (°Brix)	Vit. C (mg/100 g pulp)
T_1 = Rejuvenation in the month of April + RDF	5.9	6.0	163.3	11.42	161.23
T_2 = Rejuvenation in the month of May + RDF	6.0	6.1	175.3	12.08	142.47
T_3 = Rejuvenation in the month of June + RDF	7.0	6.3	202.0	11.91	192.33
T_4 = control (un-rejuvenated guava)	5.1	4.3	129.7	10.92	118.10
$CD_{(P=0.05)}$	0.47	0.56	15.66	0.81	17.61

Table 3. Cost of rejuvenation of one ha senile guava orchard (at 7 m × 7 m).

Operation	Amount (Rs.)
Charges for pruning (80 man days @ Rs. 80 and 20 skilled man days @ 150/day)	9,400.0
Cost of ploughing, leveling and cleaning	1,200.0
Cost of manures and fertilizers	14,900.0
Cost of ring making and fertilizer application	3,050.0
Cost of irrigation	2,060.0
Cost of chemical, insecticide and spraying	3,150.0
Miscellaneous (saw, blade, rope etc.) @10% of variable cost	3,376.0
Total	37,136.0

Table 4. Economics of rejuvenation of one hectare old senile guava orchard (2008-10).

Operation	2008	2009	2010
Sale of fruits before rejuvenation	24,480	0.00	0.00
Cost of rejuvenation	(-) 37,136	0.00	0.00
Sale of pruned woods	2,8176	0.00	0.00
Cost of intercropping	(-)10,176	0.00	0.00
Profit from intercrop	22,319	0.00	0.00
Sale of fruits from rejuvenated trees	0.00	46,512	76,500
Gross income	27,663	46,512	76,500

rejuvenated guava (1.03 to 0.91) of different stage in unrejuvenated and rejuvenated trees (Table 5). The variation of biochemical parameters with ripening is shown in Table 6. It was observed that the total soluble solids and ascorbic acid content in fruits increased with ripening stage. In rejuvenated guava, the highest value of 12.32°Brix was observed when 100% yellow fruit was taken, whereas the lowest 10.92°Brix was observed in 100% green fruits. In unrejuvenated trees, the lowest TSS (10.72°Brix) was observed when the fruits were harvested at 100% green and 11.68°Brix when 100% yellow fruits were taken. This data indicated significantly higher TSS value in 100% yellow fruits. A positive correlation was exists between pigmentation and other biochemical changes responsible for increasing the total soluble solids.

Titrable acidity decreased with ripening of rejuvenated and un-rejuvenated guava. Highest acidity (0.80%) was observed at 100% green stage of fruits and least of acidity (0.52%) was recorded in 100% yellow fruit stage in un-rejuvenated guava. In rejuvenated guava, 100% yellow fruits gradually decreased with the ripening of fruits up to 0.61. Higher ascorbic acid content in fruits (142.42 and 162.21 mg/100 g, respectively in un-rejuvenated and rejuvenated trees) was recorded in 100% yellow fruits. Ascorbic acid content in rejuvenated guava increased with the advancement of ripening of fruits in comparison to un-rejuvenated guava. Lowest ascorbic acid content among all the stage of maturity was observed in 100% green fruits of un-rejuvenated and rejuvenated guava (107.93 and 117.53 mg/100 g). Significantly higher percentage of free soluble sugars (11.3%) was estimated in fruits obtained from rejuvenated trees as compared with control (10.62%). Free soluble sugar contents differed from each other significantly with increased ripening of fruits. Flesh and seed ratio in fruits increased with advanced stages of ripening of rejuvenated and un-rejuvenated trees. In rejuvenated guava 3.5:1 (flesh: seed) were recorded as compared with un-rejuvenated guava (3.2:1) at 100% yellow stage.

REFERENCES

1. A.O.A.C. 1965. *Official Methods of Analysis*. Association of Official Analytical Chemists (14 Edn.), Washington, D.C., USA.

2. Dubey, A.K., Singh, D.B. and Dubey, N. 2000. Deblossming of summer season flowering of guava (*Psidium guajava* L.) by shoot pruning. *Progr. Hort.* **33**: 165-68.

Table 5. Physical properties of fruits with respect to stage of ripening in unrejuvenated and rejuvenated guava orchards.

Stage of harvest	Un-rejuvenated				Rejuvenated			
	Fruit wt. (g)	Fruit size (cm)	Moisture (%)	True density (g/cc)	Fruit wt. (g)	Fruit size (cm)	Moisture (%)	True density (g/cc)
100% Green	143.63	4.84	79.16	1.01	169.12	5.8	80.12	1.03
60% Yellow	162.12	5.12	81.42	1.02	175.03	6.0	83.10	1.02
80% Yellow	176.64	5.82	82.44	0.96	182.12	7.2	84.35	0.92
100% Yellow	186.72	6.72	84.12	0.92	210.75	8.2	85.36	0.91
$CD_{(P=0.05)}$	12.36	0.55	NS	NS	11.63	0.62	4.07	NS

Table 6. Bio-chemical properties of fruits with respect to stage of ripening of unrejuvenated and rejuvenated orchards.

Stage of harvest	Unrejuvenated					Rejuvenated				
	Pulp: seed	TSS (°Brix)	Acidity (%)	Vitamin C (mg/100 g pulp)	Total sugars (%)	Pulp: seed	TSS (°Brix)	Acidity (%)	Vitamin C (mg/100 g pulp)	Total sugars (%)
100% Green	2.3:1	10.72	0.80	107.93	7.06	2.6:1	10.92	0.70	117.53	9.23
60% Yellow	2.4:1	11.08	0.72	118.92	8.02	2.8:1	11.82	0.68	142.58	10.21
80% Yellow	2.8:1	11.56	0.68	136.46	9.12	3.1:1	12.08	0.64	155.58	10.75
100% Yellow	3.2:1	11.68	0.52	142.42	10.62	3.5:1	12.32	0.61	162.21	11.30
$CD_{(P=0.05)}$	-	NS	0.07	16.44	0.93	-	1.06	NS	13.08	0.98

3. Dubois, M., Gilles K.A., Hamilton, J.K., Roebers, P.A. and Smith, F, 1956. Colorimetric method for determination of sugars and related substances. *Anal. Chem*. **28**: 350-56.

4. Kumar, Y. and Rattanpal, H.S. 2010. Effect of pruning in guava planted at different spacings under Punjab conditions. *Indian J .Hort.* **67**: 115-19.

5. Natiinal Horticulture Board 2010. *National Horticulture Board. Indian Horticulture Database 2010*. Ministry of Agriculture, Govt. of India.

6. Ranganna, S. 1986. *Handbook of Analysis and Quality Control for Fruit and Vegetable Products* (2nd Edn.), Tata McGraw Hill Pub. Co., pp. 9-10, 105-6.

7. Roose, M.L., Cole, D.A., Atkin, D. and Kuper, R.S. 1986. Yield and tree size of four citrus cultivars on 21 rootstocks in California. *J. American Soc. Hort. Sci.* **114**: 135-40.

8. Singh, Ajitpal and Dhaliwal, G.S. 2004. Influence of radiation interception and canopy temperature on fruit quality of Sardar guava at different planting distance. *Indian J. Hort.* **61**: 118-21.

Received: October, 2011; Revised: November, 2011; Accepted: February, 2012