Journal of Crop and Weed, 16(2): 139-146 (2020) ISSN- O : 2349 9400 ; P : 0974 6315

http://cwssbckv.org
www.cropandweed.com

Vegetative and quality parameters of custard apple as affected by pruning intensities and time

K. CHOUDHARY, [1]B. B. DHAKARE AND N. K. MEENA

Department of Fruit Science, College of Horticulture & Forestry
Jhalawar, AU, Kota-326023, Rajasthan
[1] Department of Horticulture, MPKV Rahuri, Maharashtra

Received : 10.01.2020 ; Revised : 16.08.2020 ; Accepted : 18.08.2020

DOI : https://doi.org/10.22271/09746315.2020.v16.i2.1328

ABSTRACT

The experiment was aimed to investigate the effect of pruning intensities on custard apple growth and quality. The eight year old custard apple trees selected. The pruning was done at 30, 45, 60 and 75 days after leaf fall and on main shoot, subsequent secondary and tertiary shoots on whole plant from top to end with different intensities i.e. tip pruning, pruning at 30 , 45, 60, 75, 90 cm and control. Among the treatments significantly maximum shoot length at last harvest (55.58 cm) was recorded in 90 cm pruning intensity at 45 days after leaf fall (D_2P_6). Among the treatments significantly maximum number of flowers shoot^{-1} (9.12), maximum fruit set (73.5 %), average number of fruits (98.27) and fruit yield (23.75 kg tree^{-1}) were found in 30 cm pruning intensity at 45 days after leaf. Maximum fruit size at polar (10.04 cm) and equatorial diameter (10.32 cm), average weight of fruit (333.67 g) and minimum stony fruit per cent (7.72 %) were found in treatment combination D_2P_6. In case of quality contributing characters maximum pulp (55.68 %), minimum seed (6.34 %), and seed: pulp ratio (0.13) was found in treatment combination D_2P_6. As compared to other treatments higher TSS content (25.07 %) was recorded in in treatment combination D_2P_4.

Keywords: Custard apple, flowering, pruning intensities, quality and yield

Among annonaceous fruits crops, custard apple gained the most important position in India. Custard apple is known by different names, such as *Sitaphal* or *Sharifa* in India. Custard apple is grown small scale and mainly marketed in local or national trade in the country (George and Nissen, 1987). It has been performing well under dry land conditions where other fruit crops do not survive well. It is a hardy fruit crop, which can tolerant drought, salinity and saline irrigation water to certain extent. It can grow well even on shallow soils (Kumar *et al.*, 2018). Generally, it is classified as a semi-wild fruit (due to its spontaneous growing habit in forest). The edible portion of fruit is pulp, which is creamy, granular with an excellent blend of sweetness and acidity. The pulp of the fruit can be used in pharmaceutical industries because of high phenolics and anti-oxidant properties. It is usually eaten as a dessert fruit and finds a huge application in the preparation of different value added products such as jam, nectars, ice creams *etc*. (Singh *et al.*, 2006, Shrivastava *et al.*, 2013 and Yadav *et al.*, 2010). Its immature fruits, seeds, leaves, bark and roots are used for making medicines (Dutta, 2017).

Pruning is a basic tool to manipulate fruit tree architecture and provide the proper sun light and temperature in order to increase crop yield and improve fruit quality. In many deciduous and semi- deciduous species pruning is essential practice such as ber (Kumar *et al.*,2014), guava (Lakpathi and Rajkumar, 2018), pomegranate (Hiremath *et al.*, 2018), grape (Porika *et al.*, 2015), peach (Ikinci, 2014), plum (Kumar and Thakur, 2012) *etc*. which influence the vigour, productivity and quality of fruits. Due to its deciduous nature custard apple sheds leaves during stress period to avoid moisture losses from plant through transpiration and therefore it is most appropriate fruit crop for rainfed region (Kumar *et al.*, 2018). The flowers are borne on current season growth (new emerging young shoots). Therefore it require little pruning for new growth better flowering and yield. Pruning on custard apple may influence the vigour, productivity and quality of fruits. Thus regular annual pruning at bearing stage may help to induced good healthy shoots which will provide maximum fruit bearing area and good quality fruits. (Bajpai *et al.*, 1973). Pruning is essential to develop a good crown and better yields over a long period of time. Without pruning, the plants become bushy and their bearing efficiency comes down. Hence, timely removal of misplaced limbs is necessary to build a strong framework. Selective and mild pruning of deadwood and very old branches is necessary to avoid congestion and encourage well-spaced branching. Yellowing of leaves starts as the harvesting season of fruits ends. The leaves begin to drop with the onset of winter and fresh growth occurs in spring. Therefore, we have carried out the present investigation to find out the influence of pruning intensities and time on growth, yield and quality of custard apple.

Email: kalpanachoudhary.cr@gmail.com

MATERIALS AND METHODS

The present research programme 'Influence of pruning intensities and time on growth, yield and quality contributing characters of custard apple' was carried out at Research Farm, Horticulture section, College of Agriculture, Dhule during the year 2016-2017. The research programme was laid out in Split Plot Design consisting three replications allocating time of pruning (4) in the main plot and pruning intensities (7) in the sub-plot. The eight year old custard apple trees cv. Balanagar spaced at 5×5m were used for research programme. Different levels and time of pruning was done on main shoot and subsequent secondary and tertiary shoots on whole plant at 15 days intervals from 16th January to 1st March 2016. Healthy trees of uniform growth and vigour were selected for the experiment. The soil of experimental plot was light to medium with good drainage capacity and well leveled topography. The rainfall continues during July-August months and continues till the first week of September. High humidity *i.e*. up to 92 per cent prevails during rainy season. Maximum temperature range during the peak summer is 43-46ºC and minimum 6ºC during winter. The soil texture of experimental field was clay loam.

Treatment details

Main Treatment- Time of Pruning
D_1 Pruning at 30 days after leaf fall
D_2 -Pruning at 45 days after leaf fall
D_3 -Pruning at 60 days after leaf fall
D_4 -Pruning at 75 days after leaf fall
Sub Treatment –Pruning levels
P_1-Tip pruning
P_2 -Pruning at 30 cm.
P_3-Pruning at 45 cm.
P_4 -Pruning at 60 cm.
P_5-Pruning at 75 cm
P_6-Pruning at 90 cm
P_7-Control (No pruning)

To observe the effect of pruning intensities and time on length of shoot (cm) and number of internodes, average length of shoots (cm) and number internodes emerged from the date of pruning till the date of last harvesting were recorded. The average number of days from the date of pruning till the date of appearance of flowers were counted and recorded as the period required for appearance of flowers. For calculating the number of flowers shoot^{-1}, from onset of flowering, the total numbers of flowers shoot^{-1} were counted from the tagged shoots. For fruit set per cent, random five shoots of 1 mater length form each tree were tagged and their flowers were counted during the full bloom. Fruits of same tagged shoots were also counted and recorded at the time of fruit setting. Fruit set was calculated in percentage using following formula :

$$\text{Fruit set (\%)} = \frac{\text{Total number of fruits set shoot}^{-1}}{\text{Total number of flowers shoot}^{-1}} \times 100$$

Total numbers of fruits plant^{-1} were counted at the time of harvesting during the season.

The fruit yield (kg tree^{-1}) was recorded by weighing the fruits on a physical balance at each harvesting form each observational tree. Size of fruits (diameter) at both polar and equatorial was measured with the help of Digital Vernier Calliper. The fruit weight was calculated by dividing the total weight of fruits.tree^{-1} (yield) by the total number of fruits tree^{-1} in each harvesting. The percentage pulp was calculated by dividing actual weight of pulp by total weight of fruit and multiplied by 100. Pulp sample was taken from selected fruits and used for recording TSS in degree brix. Total soluble solids (TSS) were recorded by Automatic Hand Refractometer (Erma Tokyo A032) by taking a drop of pulp on prism of the Refractometer and the readings were recorded. The seed percentage was calculated by dividing total weight of seed by total weight of fruit multiplied by 100.

$$\text{Stony fruits (\%)} = \frac{\text{Number of stony fruits}}{\text{Number of total fruits (healthy and stony)}} \times 100$$

The statistical analysis was performed as per the method suggested by Panse and Sukhatme (1995).

RESULTS AND DISCUSSION

The data on effect on length of shoot at last harvest presented in. Maximum length of shoots at last harvest was recorded in treatment combination D_2P_6 (55.58cm) which was significantly superior to rest of the treatments (Table 1). It might be attributed due to relatively less number of shoots in severely pruned trees and availability of more nutrients per shoot (Bhagawati *et al.* 2015). The length of new shoots of guava on severely pruned shoots was found to be longer than moderate pruning or the control (Shaban and Haseeb, 2009).

Maximum number of internodes at last harvest (Table 1.) were recorded in treatment D_2P_6 *i.e*., pruning on 45 days after leaf fall with 90 cm pruning intensity (17.23) which was significantly superior than all other treatments. However, the minimum number of internodes at last harvest was noticed in the treatment D_4P_7 *i.e*. pruning at 75 days after leaf fall with control pruning (6.55). Bhonsle (1972) reported almost similar results that with lighter pruning, number of internodes per vine were decreased in grapes.

The total number of days required for flower initiation was significantly influenced by pruning time and intensity (Table 1.). The early flowering *i.e*. minimum number of days required for flowering (93.83) was registered in treatment D_2P_7 followed by the treatments D_2P_1 (94.33), D_3P_7 (94.83), D_2P_2 (95.17) and D_3P_1 (95.17). Late flowering *i.e*. maximum number of days for flowering (112.00) was observed in the treatment D_4P_6. Delayed pruned trees initiate flowering later as comparison to unpruned trees and the new vegetative start late. Pruned trees started new vegetative growth immediately after pruning and almost the entire amount of carbohydrates, which otherwise would form flower buds, might have been utilized in the vegetative growth of trees resulting in a late start of flowering in pruned trees in guava (Dhaliwal and Singh 2004). Hiremath *et al.* (2018) observed that among the different levels of pruning, maximum days taken for initiation of flowering (17.18) was recorded in severe pruning (T_3- 30 cm pruning) followed by T_2 (16.14 days) whereas, unpruned trees (control) produced flowering earlier.

Number of flowers shoot^{-1} was significantly influenced by time of pruning and different pruning intensities (Table 1). Maximum number of flowers per shoot was observed (9.12) were noticed in treatment D_2P_2 which followed the treatment D_3P_2 (8.30). However, it was minimum (3.23) in treatment D_4P_6. Severe pruning intensity had adverse effect on flowering than light pruning. The less number of flowers in severely pruned shoots might be due to loss of potential bearing wood of tree (Dahapute *et al.,* 2019). The number of flower buds was significantly increased with one leaf pair pruning during winter season crop and maximum number of flower buds (62.2) was found in one leaf pair pruning in guava (Pratibha *et al.,* 2013).

Data presented in table 2 showed that the per cent fruit set significantly influenced due to different time and intensities of pruning. The maximum percentage of fruit set (73.50 %) was recorded in treatment D_2P_2 which was significantly superior among other treatments and minimum fruit set percentage (47.57 %) in treatment D_4P_6. It was found that in custard apple the treatment of heading back by pruning 10 cm of shoot gave the highest values of fruit set percentage, 14.6 per cent and 14.8 per cent (Shahein *et al.,* 2010).

The effect due to time of pruning and intensities showed significant results on average number of fruits per tree (Table 2). Significantly maximum number of fruits per tree (98.27) were noticed in treatment D_2P_2 while, the minimum number of fruits per tree (39.94) were recorded in treatment D_4P_6. The moderate pruning intensity gives highest number of fruits per plant, it might be due to the effect that, moderate pruning intensity increased the efficiency of metabolic and physiological processes and that is the reason of higher number of fruits and yield of the fruit (Kumar and Rattanpal 2010). The maximum average number of fruits (83.10) recorded in treatment T_6 *i.e*. pruning 20 cm without thinning in pomegranate cv. Bhagava, (Anon., 2010).

The effect due to time of pruning and different pruning intensities (Table 2) showed the significant results among the different treatment combinations. Maximum yield per tree (23.75 kg tree^{-1}) was recorded in treatment D_2P_2, which was significantly superior to other treatments. While, the minimum yield per tree (8.0 kg tree^{-1}) was observed in treatment D_4P_7. It might be due to that the moderate or lighter pruning intensity improves the efficiency of metabolic processes which is the reason of higher yield (Kumar and Rattanpal, 2010). The trees produced significantly higher yield (902 fruit tree^{-1} year^{-1}) of superior quality with medium pruning (removal of terminal shoots up to 45 cm) (Ingle *et al.,* 2005).

Maximum average weight (333.67g) was recorded in treatment D_2P_6 which was significantly superior to other treatments and it was minimum (128.67g) in treatment D_4P_7. The crop load was reduced by increasing the intensity of pruning. Mean fruit weight and diameter were correlated with crop load, pruning decreased the fruit load and as the number of fruits was less, the food material is available in the sufficient quantity to the individual fruit (Hiremath *et al.,* 2018). It was observed that the maximum fruit weight and fruit size in terms of fruit length and fruit breadth of ber was obtained in trees pruned at 8th bud level followed by the trees pruned at 10th level and minimum in the trees kept under control (Gupta and Gill, 2015).

The interaction effect due to time and intensities of pruning showed significant results in respect polar diameter and equatorial diameter of fruit (Table 2). The maximum polar diameter of fruit (10.04 cm) was registered in treatment D_2P_6 which was significantly superior over all other treatments and minimum (6.00 cm) in treatment D_4P_7. The highest equatorial diameter of fruit (10.32 cm) was recorded in treatment D_2P_6 and minimum (6.35cm) in treatment D_4P_7 *i.e.* pruning at 75 days after leaf fall with control pruning. The fruit diameter increased in severe pruning intensity might be due to more nutrient supply (food) to lesser number of fruits in case of severe pruning. Lesser number of fruit reduces the competition for resources between fruit allowing individual fruit to has a greater share of resources which allowing the size of the cell and cell elongation, resulted in maximum accumulation of the food materials in the developing fruits, therefore improving the fruit size in litchi (Patel *et al.,* 2014). The

Table 1: Influence of pruning intensities and time (D×P) on growth parameters

Treatments		D_1	D_2	D_3	D_4	SEm (±)	LSD (0.05)
1.	**Length of shoot at last harvest**						
	P_1	17.45	22.30	20.68	15.18	1.36	3.87
	P_2	20.48	28.48	25.92	20.08		
	P_3	25.72	33.33	28.27	24.13		
	P_4	30.33	44.93	35.70	26.10		
	P_5	35.30	48.92	42.75	31.92		
	P_6	41.30	55.58	50.88	37.10		
	P_7	14.47	16.70	14.37	13.90		
2.	**Number of internodes at last harvest**						
	P_1	11.68	13.80	12.98	10.30	0.13	0.39
	P_2	13.10	15.15	13.32	13.12		
	P_3	14.03	15.40	14.12	13.75		
	P_4	14.47	15.90	14.67	14.05		
	P_5	15.05	16.50	15.10	14.42		
	P_6	16.00	17.23	16.28	15.27		
	P_7	7.91	8.02	7.45	6.55		
3.	**Days required for initiation of flower**						
	P_1	95.83	94.33	95.17	98.67	0.60	1.70
	P_2	97.33	95.17	95.83	99.83		
	P_3	98.83	95.83	96.67	103.17		
	P_4	100.83	96.50	97.83	105.50		
	P_5	102.17	97.17	99.17	109.33		
	P_6	104.33	99.83	100.50	112.00		
	P_7	95.50	93.83	94.83	99.00		
4.	**Number of flowers shoot^{-1}**						
	P_1	6.33	7.02	7.61	5.44	0.31	0.89
	P_2	7.25	9.12	8.30	6.22		
	P_3	7.17	7.83	6.82	5.08		
	P_4	4.78	7.85	5.61	4.36		
	P_5	4.87	6.77	4.79	4.10		
	P_6	4.32	6.15	4.36	3.23		
	P_7	4.86	6.83	6.39	4.82		

size of mango fruits was improved with the severity of pruning treatment under high density planting (Pratap *et al.*, 2009). The interaction effect due to different time and intensities of pruning revealed significant results in respect of pulp per cent (Table 2). The maximum pulp per cent (55.68%) was noticed in treatment D_2P_6, which followed the treatment combination D_3P_6 (54.91%), while, minimum pulp per cent (45.31%) was recorded in treatment combinations D_4P_7. This might be due to the maximum fruit size and fruit weight and minimum stone weight under the treatment D_2P_6. Ghum (2011) revealed that, maximum pulp (63.95 %) was recorded by pruning after 75 days of previous harvesting with 50 per cent intensity and was minimum (40.53 %) due to early pruning (45 days) with light pruning (25 %) in custard apple. Fruit total soluble solid content was non-significantly affected due to the different pruning time and intensities (Fig. 1). The maximum TSS (25.07°B) was found in treatment D_2P_4 and while it was noted minimum (17.80 ^{0}B) in D_4P_6 treatment.

Table 2: Influence of pruning intensities and time (D×P) on yield and quality contributing parameters

Treatments	D_1	D_2	D_3	D_4	SEm (±)	LSD (0.05)
1. Fruit set (%)						
P_1	58.81	62.37	60.90	57.64	0.69	1.96
P_2	69.89	73.50	71.18	63.29		
P_3	64.58	67.00	66.13	62.90		
P_4	62.97	65.16	64.53	59.73		
P_5	53.04	59.86	55.28	52.23		
P_6	49.32	51.18	50.25	47.57		
P_7	57.12	60.41	58.02	55.33		
2. Size of Fruit						
A) Polar diameter (cm)						
P_1	6.62	7.01	6.79	6.08	0.11	0.31
P_2	7.05	7.59	7.31	6.51		
P_3	7.40	8.03	7.45	7.42		
P_4	7.65	8.30	7.88	7.29		
P_5	8.13	9.11	8.17	7.64		
P_6	8.65	10.04	9.04	8.36		
P_7	6.16	6.47	6.31	6.00		
B) Equatorial diameter (cm)						
P_1	6.82	7.31	6.99	6.35	0.10	0.28
P_2	7.29	7.91	7.52	6.79		
P_3	7.64	8.35	7.61	7.39		
P_4	7.88	8.55	8.13	7.63		
P_5	8.41	9.41	8.35	7.99		
P_6	8.89	10.32	9.27	8.63		
P_7	6.41	6.59	6.50	6.35		
3. Number of fruits tree^{-1}						
P_1	77.76	84.67	82.06	65.47	1.54	4.39
P_2	89.23	98.27	91.51	76.88		
P_3	70.82	78.26	76.37	61.95		
P_4	62.06	67.86	66.01	52.84		
P_5	53.24	57.23	53.43	50.81		
P_6	37.96	49.15	43.10	39.94		
P_7	79.30	90.26	86.01	74.56		
4. Average weight of fruits (g)						
P_1	171.17	187.33	179.83	162.83	3.13	8.89
P_2	195.17	207.00	198.83	180.83		
P_3	228.33	247.50	235.33	195.00		
P_4	249.50	275.67	260.50	224.50		
P_5	265.67	298.83	287.17	237.00		
P_6	299.17	333.67	307.17	280.83		
P_7	145.67	151.67	146.00	128.67		
5. Yield (kg plant^{-1})						
P_1	13.12	18.56	15.54	12.87	0.77	2.20
P_2	16.46	23.75	19.37	15.71		
P_3	13.87	19.83	17.91	12.21		
P_4	12.87	19.50	16.75	10.29		
P_5	10.75	17.50	14.04	10.47		
P_6	11.83	13.08	12.46	8.62		
P_7	11.32	16.50	13.44	8.00		

Contd….

Table 2 Contd….

Treatments		D_1	D_2	D_3	D_4	SEm ()	LSD (0.05)
6.	**Pulp percentage**						
	P_1	47.70	48.60	49.31	47.39	0.39	1.11
	P_2	48.35	49.79	50.91	48.42		
	P_3	49.02	51.28	50.71	48.68		
	P_4	51.74	52.57	51.27	49.28		
	P_5	52.35	54.49	53.84	50.02		
	P_6	54.06	55.68	54.91	52.70		
	P_7	46.09	48.17	47.81	45.31		
7.	**Seed percentage**						
	P_1	11.01	9.27	10.14	11.94	0.14	0.40
	P_2	10.56	8.97	9.89	11.00		
	P_3	10.44	8.23	9.80	10.73		
	P_4	9.58	7.61	9.07	10.67		
	P_5	8.70	7.00	8.13	9.71		
	P_6	8.09	6.34	7.32	8.96		
	P_7	11.18	10.72	11.13	12.89		
8.	**Seed :pulp ratio**						
	P_1	0.22	0.18	0.19	0.24	0.004	0.013
	P_2	0.19	0.15	0.18	0.21		
	P_3	0.20	0.15	0.18	0.21		
	P_4	0.18	0.14	0.18	0.21		
	P_5	0.17	0.14	0.16	0.20		
	P_6	0.17	0.13	0.14	0.19		
	P_7	0.24	0.21	0.21	0.26		
9.	**Stony fruits percentage**						
	P_1	22.71	18.85	21.00	24.64	0.96	2.73
	P_2	21.42	16.26	19.18	23.03		
	P_3	18.97	14.33	17.37	19.77		
	P_4	17.12	13.71	16.67	17.72		
	P_5	15.19	12.37	14.58	14.43		
	P_6	13.23	7.72	11.51	15.20		
	P_7	19.83	21.68	23.14	25.96		

Notes: D_1: 30 days after leaf fall, D_2: 45 days after leaf fall, D_3: 60 days after leaf fall, D_4: 75 days after leaf fall. P_1: Tip pruning, P_2: Pruning at 30 cm, P_3: Pruning at 45 cm, P_4: Pruning at 60 cm, P_5: Pruning at 75 cm, P_6: Pruning at 90 cm, P_7: No pruning (Control).

The effect due to time and intensity of pruning among different treatments combinations had significant effect on seed percentage (Table 2). The minimum percentage of seed (6.34%) was registered in treatment D_2P_6 which was significantly superior than all other treatments, however the maximum percentage of seed (12.89 %) was noticed in treatment D_4P_7. The effect due to time and intensity of pruning among different treatments combinations had significant effect on seed: pulp ratio (Table 2). Lowest seed: pulp ratio (0.13) found in treatment D_2P_6 which followed the treatments D_2P_4 (0.14), D_2P_5 (0.14) and D_3P_6 (0.14). The highest seed: pulp ratio (0.26) was registered in treatment D_4P_7. The lower seed content per fruit in guava with the increased severity of pruning (Teaotia and Singh 1971).

The effect due to the time and different pruning intensities revealed significant results (Table 2). The minimum stony fruit per cent (7.72 %) were noticed in treatment D_2P_6 *i.e.* pruning at 45 days after leaf fall with 90 cm pruning intensity, which was statically superior than other treatments, while, maximum stony fruit per cent was recorded (25.96 %) in treatment D_4P_7 *i.e.* no pruning at 75 days after leaf fall.

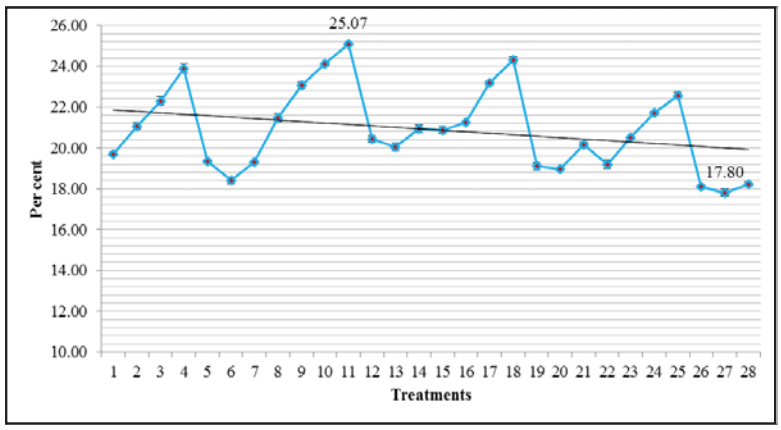

Fig. 1: Influence of pruning intensities and time (D×P) on TSS of fruit

The present investigation concluded by considering all aspects that the different time interval and pruning intensities influence the growth yield and quality parameters of custard apple significantly. Pruning time and intensities can be followed in custard apple to improve the growth, flowering and fruit setting parameters, yield and yield contributing characters, quality contributing characters. It was observed among the different intensities and time of pruning that pruning of trees at 45 days after leaf fall with 30 cm pruning intensity give highest yield with highest number of fruits, whereas the pruning of trees at 45 days after leaf fall with 90 cm pruning intensity gives best quality fruits as compared to other treatments.

REFERENCES

Anonymous 2010. Effect of different pruning levels on yield and quality of pomegranate cv. Bhagava. *Ann. Report*, AICRP on Arid Fruits, pp. 99.

Bajapai, P. N., Shukla, H.S. and Chathurvedi, A.M. 1973. Effect of pruning on growth, yield and quality of guava (*Psidium guajava* L.) cv. Allahabad Safeda. *Prog. Hort.*, **5**(1):73-79.

Bhagawati, R., Bhagawati, K., Choudhary, V. K., Rajkhowa, D.J. and Sharma, R. 2015. Effect of pruning intensities on the performance of fruit plants under mid-hill condition of Eastern Himalayas: Case study on guava. *Int. Letters Nat. Sci.*, **46**: 46-51.

Bhonsle, V. A. 1972. Pruning studies in grapes (*Vitis vinifera* L.). *M. Sc. (Agri.) Thesis*, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India.

Dahapute, V. M., Joshi, P. S., Tayade, S.A. and Nagre, P. K. 2019. Effect of severity of pruning on growth, yield and quality of custard apple. *Int. J. Chem. Stud.*, **6**(2) : 1606-1609.

Datta, A.K. 2017. Review on the uses and good side of custard apple from the tribal area of Chhattisgarh. *World J. Pharm. Pharma. Sci*., **6**(2):1397-1403.

Dhaliwal, G. S. and Singh, R. 2004. Effect of different pruning levels on vegetative growth, flowering and fruiting in Sardar guava. *Haryana J. Hort. Sci*., **33**(3-4) : 175-177.

George, A.P. and Nissen, R.J. 1987. Effects cincturing, defoliation and summer pruning on vegetative growth and flowering of custard apple in subtropical Queensland. *Australian J. Exp. Agric*., **27**: 915-918.

Ghum, S.S. 2011. Standardization of time and intensity of pruning in custard apple (*Annona squamosa*) cv. Balanagar. M. Sc. (Agri) Thesis, submitted to the MPKV, Rahuri, Maharashtra India.

Gupta, N. and Gill, M.S. 2015. Effect of intensity of pruning on yield and fruit quality of ber (*Ziziphus mauritiana* L.) cv. Umran. *Int. J. Agric., Env. Biotech.*, **8**(1): 69-73.

Hiremath, A., Patil, S.N., Hipparagi, K., Gandolkar, K. and Gollagi, S.G. 2018. Influence of pruning intensity on growth and yield of pomegranate (*Punica granatum* L.) cv. super Bhagwa under organic conditions. *J. Pharma. Phytochem.*, **7**(2) :1027-1031.

Ikinci, A. 2014. Influence of pre- and postharvest summer pruning on the growth, yield, fruit quality, and carbohydrate content of early season peach cultivars. *The Scien. World J.* ID 104865, 8 pages http://dx.doi.org/10.1155/2014/104865

Ingle, S.G., Zambre and Shinde, B.B. 2005. Effect of severity of pruning on growth, yield and quality of old acid lime trees. *Agric. Sci. Digest* , **25**(2): 127-129.

Kumar, H., Katiyar, P. N., Kumar, A. S. and Rajkumar, B. V. 2014. Effect of different pruning severity on growth and yield of ber (*Zizyphus mauritiana* Lamk), cv. Banarsi Karaka. *Int. J. Curr. Microbiol. Appl. Sci*., **3**(5) : 935-940.

Kumar, J. and Thakur, D. 2012. Effect of different pruning intensities on growth, yield, fruit quality and leaf macronutrient content of plum cv. Santa Rosa. *The Asian J. Hort*., **7(**2) : 484-487.

Kumar, V., Kumar, R., Gupta, N., Khajuria, S. and Singh, V.B. 2018. Scope and importance of custard apple cultivation under rainfed areas. *Rashtriya Krishi*, **13**(1) : 115-117.

Kumar, Y. and Rattanpal, H.S. 2010. Effect of pruning in guava planted at different spacings under Punjab conditions. *Indian J. Hort*., **67** (Spl. Issue):115-119.

Lakpathi, G. and Rajkumar, M. 2018. Effect of pruning intensities and fruit load on yield and quality of guava under high density planting system. *Int. J. Curr. Microbiol. Appl. Sci*., **7**(5):1853-1860.

Panse, V.G. and Sukhatme, P.V. 1995. Statistical Methods for Agricultural Workers, 4th Edn. ICAR, New Delhi, pp. 58-152.

Patel, R.K., Meitei, S.B., Kumar, A., Srivastava, K., Deka, B.C., Deshmukh, N.A. and Verma, V.K. 2014. Effect of leaf and fruit thinning on yield and quality of peach cv. Flordasun. *Ecoscan*, **6**: 467-471.

Porika, H., Jagadeesha, M. and Suchithra, M. 2015. Effect of pruning severity on quality of grapes cv. Red Globe for summer season. *Adv. Crop Sci. Tech*., doi:10.4172/2329-8863.S1-004

Pratap, B., Singh, S.K., Singh. H.K., Gaurav, S.S. and Bala, S. 2009. Effect of pruning on physico-chemical properties of mango cv. Amrapali under high density orcharding. *Ann. Hortic*., **2**(1) : 62-64.

Pratibha, Lal, S. and Goswami, A. K. 2013. Effect of pruning and planting systems on growth, flowering, fruiting and yield of guava cv. Sardar. *Indian J. Hortic*., **70**(4) : 496-500.

Shaban, A. E. A. and Haseeb, G. M. M. 2009. Effect of pruning severity and spraying some chemical substances on growth and fruiting of guava trees. Ame. *Eur. J. Agric. Environ. Sci*., **5**(6) : 825-831.

Shahein, Mohamed, F.M., Abd El- Motty, E.Z. and Fawzi, M.I.F. 2010. Effect of pruning, defoliatioin and nitrogen fertilization on growth, fruit set and quality of Abdel-Razik *Annona* cultivar. *Nat. Sci*., **8**(12): 281-287.

Shrivastava, R., Dubey, S., Dwivedi, A.P., Pandey, C. S. and Banafar, R.N.S. 2013. Effect of recipe treatment and storage period on biochemical composition of custard apple (*Annona squamosa* L.) nectar. *Progr. Hort*., **45**(1) : 110-114.

Singh, P., Patel, D., Agrawal, S. and Panigrahi, H. 2006. Value addition of custard apple through jam for year round availability. Proceedings of the national symposium on production, utilization and export of underutilized fruits with commercial potentialities. Kalyani, Nadia, West Bengal, India, pp. 262-265.

Teaotia, S.S. and Singh, R.D. 1971. The effect of training on growth, cropping and physico-chemical properties of guava cv. Allahabad Safeda. *Prog. Hort*., **2**: 5-20.

Yadav, C. M., Karanjkar, L. M. and Kashid, U. B. 2010. Effect of assimilation of custard apple (*Annona squamosa*) pulp on chemical quality and cost of ice-cream. *J. Dairy, Foods Home Sci*., **29**(2):86-91.