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Influence of different levels of pruning and GA_3 on economics and yield of custard apple cv. Arka Sahan

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Abstract
Custard apple requires more corrective pruning. Initially, it is essential to develop a good growth and better yield over a long period of time. A trail was conducted to standardize the pruning level and GA_3 spray on economics and yield of custard apple cv. Arka Sahan. The maximum number of fruits per plant (108.35) was recorded in the treatment (T_1) control. While, the minimum number of fruits per tree (51.11) was recorded in the treatment T_4. The maximum fruit yield per plant (25.51 kg) was recorded in the treatment (T_1) with control. While, the treatment (T_4) with 75% of canopy removal gave the minimum fruit yield per tree (14.23 kg). The maximum fruit yield per hectare (10.20 t/ha) was recorded in the treatment (T_1) control. While, the treatment T_4 with 75% of canopy removal gave the minimum fruit yield tonnes per hectare (5.69 t/ha). In case of economic attributes, the highest cost of cultivation (Rs 22,900/ha) was recorded in the treatment (T_6) 25% of canopy removal + 2000 ppm GA_3. The highest gross monetary returns per hectare (Rs 7,72,800) was recorded in the treatment (T_8) 75% of canopy removal + 500 ppm GA_3. The highest net monetary returns per hectare (Rs 7,53,050) was obtained in the treatment (T_8) 75% of canopy removal + 500 ppm GA_3. The results revealed that, the highest benefit to cost ratio (39.13:1) was recorded in the treatment (T_8) 75% of canopy removal + 500 ppm GA_3.

Keywords: Custard apple, Arka Sahan, pruning, GA_3, yield, economics

1. Introduction
The custard apple (*Annona squamosa* L.), is one of the important tropical fruit crops belonging to the family Anacardiaceae. Arka Sahan is a progeny of Island Gem (*Annona atemoya* Hort.) X Mammoth (*A. squomosa* L.). It is a hardy and drought tolerant fruit crop, it require less amount of water. It has been performing well under dry land conditions where other crops do not come well. The custard apple tree is small, more or less shrub or tree, in winter it sheds the leaves. In custard apple, the flowering is observed mostly on new shoots as well as on old shoot. Pollination as well as fruit set is a major problem in custard apple. Flowering is highly correlated with defoliation and there after emergence of new growth. Fruit set after the onset of monsoon, however late vegetative growth delays flowering and fruit set. Setting of fruit early in the season is important from the marketing point of view. Influence of pruning and GA_3 treatment resulted in the maximum fruit size, fruit set percentage, quality fruits and benefit to cost ratio. Pruning fruit trees is very important for their longevity and fruit yield. Pruning accomplishes several aims, all of which increase fruit production. Pruning will expose the tree more evenly to light, get rid of excess leaders and create a balanced tree that will bear weight well. Pruning of most fruit trees is generally carried out in early spring, when winter-related damage has passed, but the tree has not yet started to bud in earnest. Also cut away low branches, leaving space beneath the tree for light and air. The gibberellins are known for their ability to increase cell enlargement, thus enhancing fruit growth in certain species such as citrus, litchi, guava and pear. In all species so far studied, gibberellins had the potential for increasing fruit size. With this objective to study the standardization of pruning level and GA_3 spray on yield and economics of custard apple cv. Arka Sahan.

2. Material and Methods
2.1 Yield parameters
2.1.1 Number of fruits per plant
The matured fruits were harvested and counted at each harvesting from each observational plant. The total number of fruits harvested during the entire harvesting period of each is referred as total number of fruits per plant.

2.1.2 Fruit yield /plant (kg)
The total weight of fruits harvested during the entire harvesting period was considered as total weight of fruits per plant.

2.1.3 Fruit yield (t/ha)
The yield per hectare was calculated by multiplying the value of yield per tree (kg) by total number of plants per hectare.

2.2 Economics
2.2.1 Cost of cultivation (Rs/ha)
The cost of cultivation of each treatment was worked out by considering the expense incurred for cultural operation right from preparatory tillage to harvesting including PGR's, manures fertilizers, weeding, irrigation, labour *etc*. The total cost of cultivation was worked out by adopting recommended procedure followed for calculating the cost of cultivation of other crops.

2.2.2 Gross monetary returns (Rs/ha)
The gross monetary returns received from the produce of each treatment was recorded by considering the selling price of custard apple fruits @ Rs 120/kg, 100/kg, 60/kg and 40/kg of fruits based on the grades, like A - Extra large (Rs 120/kg), B - Large (Rs 100/kg), C - Medium (Rs 60/kg), D - Small (Rs 40/kg). These prevailing prices was soled in the HOPCOMS, Bengaluru

2.2.3 Net monetary returns (Rs/ha)
The net monetary returns of each treatment was worked out by subtracting the cost of cultivation of each treatment from the gross monetary returns gained from the respective treatment.

2.2.4 Benefit to cost ratio
The benefit to cost ratio of each treatment was calculated by dividing the gross monetary returns by the cost of cultivation of the respective treatment.
The Cost Benefit Ratio (CBR) was calculated on the basis of the formula given below:

$$CBR = \frac{\text{Gross realization (Rs/ha)}}{\text{Total cost of cultivation (Rs/ha)}}$$

2.3 Statistical analysis
The design adopted was randomized block design. The data on all the growth parameters and yield was tabulated and subjected to statistical analysis using method of analysis of variance (ANOVA) for randomized complete block design (RCBD) by Fisher and Yates (1963) [1]. Whenever 'F' test was found significant for comparing the means of two treatments, critical difference (C. D. at 5%) was worked.

3. Result and discussion
The maximum number of fruits per tree (108.35) in (T_1) control and fruit yield (25.51 kg/plant) or (10.20 t/ha) was noted under the treatment (T_1) control as compared to other treatments (Table. 1). This might be due to pruning, significantly decreased the number of fruits per plant. When plants were unpruned, the maximum number of fruits and yield was maximum in T_1 but fruits were smaller in size. In severely pruned plants (75%) fruit number was minimum but size of the fruit was maximum. The effect of pruning and gibberellic acid in cell enlargement, cell division and increasing the number and size of fruits which ultimately has resulted in higher fruit yield in T_5 and T_6 (Singh *et al*. (2007) [5] and Srivastava *et al*. (2009) [6] and Nkansah *et al*. (2012) [3]. Pruning in turn, attributed to renewal of potential fruit buds and retention of more juvenile wood as explained earlier. Although, pruning encourages substantial new growth, the total growth of unpruned trees was greater than that observed in pruned trees, suggesting that pruning is a dwarfing process (Nijjar, 1972) [2]. Therefore, one has to strike a proper balance between vegetative growth and productivity, if pruning is to be practiced. The surplus availability of other factors such as irrigation, fertilizer nutrients etc., concomitant with pruning might help in maintaining the proper C:N in the left over parts of the pruned trees.
The data reveals that, the highest cost of cultivation (Rs 22,900/ha) was incurred in the treatment (T_6) 25% of canopy removal + 2000 ppm GA_3 followed by the treatment T_5 (Rs 21,850/ha), T_7 (Rs 20,800/ha) and treatment T_8 (Rs 19,750/ha). While, the lowest cost of cultivation (Rs 17,500/ha) was incurred in control (T_1). The minimum cost of cultivation in control (T_1) could be due to maximum expenditure towards the cost of either inputs or its of application. However, the highest cost in treatment (T_6) 25% of canopy removal + 2000 ppm GA_3 could be attributed due to cost incurred on tillage operation, chemicals, pruning, GA_3 spray, weeding, fertilizer and the labour charges were required. The highest gross monetary returns per hectare (Rs 7,72,800) was incurred in the treatment (T_8) 75% of canopy removal + 500 ppm GA_3 followed by treatment T_4 (Rs 6,82,800). While, the lowest gross returns per hectare (Rs 4,08,000) was recorded in (T_1) control. This could be attributed to production of the highest yield of fruits with pruning and GA_3 spray. The highest net monetary returns per hectare (Rs 7,53,050) was obtained in the treatment (T_8) 75% of canopy removal + 500 ppm GA_3 followed by the treatment T_4 (Rs 6,64,100). While, the lowest net returns per tree (Rs 3,90,500) was recorded in (T_1) control. This could be attributed to production of higher yield of fruits with comparatively low cost of cultivation. While, low yield in control treatment leads to minimum values of gross and net monetary returns. The results revealed that, the highest benefit to cost ratio (39.13:1) was obtained in the treatment (T_8) 75% of canopy removal + 500 ppm GA_3 which was closely followed by treatment T_4 (36.51:1) (Table.2). While, the lowest benefit to cost ratio (19.23:1) was recorded in (T_6) 25% of canopy removal + 2000 ppm GA_3. could be attributed to better gross monetary returns and comparatively moderate cost of cultivation that resulted in higher benefit to cost ratio. The custard apple was sold at different prices based on the grade like A - Extra large (Rs 120/kg), B - Large (Rs 100/kg), C - Medium (Rs 60/kg), D - Small (Rs 40/kg). The variation in benefit to cost ratio due to foliar application of different concentration of growth regulators (GA_3) in custard apple was also reported by Prajapati *et al*. (2016) [4].

Table 1: Influence of different levels of pruning and GA_3 on number of fruits per plant, fruit yield /plant (kg) and fruit yield (tonnes/ha) of custard apple cv. arka sahan

Sl. No	Treatment	Number of fruits/ plant	Yield	
			(kg/plant)	(t/ha)
1	T_1 - Control	108.35	25.51	10.20
2	T_2 - 25% of canopy removal	69.44	17.35	6.94
3	T_3 - 50% of canopy removal	58.10	15.08	6.03
4	T_4 - 75% of canopy removal	51.11	14.23	5.69
5	T_5 - 25% of canopy removal + 1500 ppm GA_3	70.27	18.66	7.46
6	T_6 - 25% of canopy removal + 2000 ppm GA_3	68.34	18.36	7.34
7	T_7 – 50% of canopy removal + 1000 ppm GA_3	57.53	16.00	6.40
8	T_8 - 75% of canopy removal + 500 ppm GA_3	53.44	16.10	6.44
	S.Em±	4.82	1.32	0.54
	CD at 5%	14.77	4.05	1.65

4. Conclusion

The 25% canopy removal + 1500 ppm GA_3 obtained the maximum number of fruits per plant, yield (kg/plant) and yield (t/ha) except control (T_1) treatment. As per as economics concerned 75% of canopy removal + 500 ppm GA_3 treatment showed the maximum GMR, NMR and benefit to cost ratio.

Table 2: Influence of different levels of pruning and GA_3 on economics of custard apple cv. Arka Sahan

Sl. No.	Treatment	Cost of cultivation (Rs/ha)	Gross monetary returns/ha	Net monetary returns/ha	Benefit to cost ratio
1.	T_1 - Control	17,500	4,08,000	3,90,500	23.31:1
2.	T_2 - 25% of canopy removal	18,700	4,16,400	3,97,700	22.27:1
3.	T_3 - 50% of canopy removal	18,700	6,03,000	4,84,300	32.24:1
4.	T_4 - 75% of canopy removal	18,700	6,82,800	6,64,100	36.51:1
5.	T_5 - 25% of canopy removal + 1500 ppm GA_3	21,850	4,47,600	4,25,750	20.49:1
6.	T_6 - 25% of canopy removal + 2000 ppm GA_3	22,900	4,40,400	4,17,500	19.23:1
7.	T_7 - 50% of canopy removal + 1000 ppm GA_3	20,800	6,40,000	6,19,200	30.76:1
8.	T_8 - 75% of canopy removal + 500 ppm GA_3	19,750	7,72,800	7,53,050	39.13:1

Grades: A - Extra large (Rs 120/kg) (Prevailing prices in the HOPCOMS, Bangaluru)
B – Large (Rs 100/kg)
C - Medium (Rs 60/kg)
D - Small (Rs 40/kg)

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