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Effect of pruning and ga_3 on morpho-physiological traits and yield in 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 morpho-physiological and yield in custard apple cv. Arka Sahan. The maximum plant spread (E-W and N-S) was observed with (T_1) control treatment and followed by 25% canopy removal, the minimum was obtained in 75% canopy removal treatment and followed by 50% canopy removal. The highest leaf area and leaf area index was recorded in 75% canopy removal treatment and followed by 50% canopy removal. The highest number of fruits (108.35) in control treatment and followed by (T_5) 25% of canopy removal + 1500 ppm GA_3 (70.27) and (T_2) 25% canopy removal treatment (69.44). The fruit yield was observed in (T_1) control treatment (25.51 kg/plant or 10.20 t/ha) and it was followed by the (T_5) 25% of canopy removal + 1500 ppm GA_3 (18.66 kg/plant or 7.46 t/ha) and (T_6) 25% of canopy removal + 2000 ppm GA_3 treatment (18.36 kg/plant or 7.34 t/ha).

Keywords: custard apple, arka sahan, pruning, ga_3, morpho-physiological, yield

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 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. Pruning and GA_3 treatment helps 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, a study was taken up to standardize the pruning level and GA_3 spray on growth and yield attributes of custard apple cv. Arka Sahan.

2. Material and Methods
The field experiment was conducted at Akkimaradi, located in the Mudhol taluk of Bagalkot district in Karnataka, by adopting RCBD design with 8 treatment and 3 replications at a plant spacing of 5 m × 5 m. Pruning of the plants in different levels during the initial month of march (25%, 50%, 75% canopy removal), after the pruning application of Bordeaux paste (1%) in pruned tree. Application of fertilizer like FYM, neem cake and vermicompost during the land preparation. Spraying of chemicals, irrigation and weed management in different

growth intervals. After flowering, pollination was done using the cultivar Balanagar as a pollinizer. Hand pollination was common in all the treatments except T_1 (control). After fruit set, spraying of GA_3 in different concentrations (500, 1000, 1500, 2000 ppm) at 15 days intervals. The treatments like T_1 - Control (No pruning and No Hand pollination), T_2 - 25% of canopy removal, T_3 - 50%of canopy removal, T_4 - 75% of canopy removal, T_5 - 25% of canopy removal + 1500 ppm GA_3 (1^{st},3^{rd},5^{th} WAF), T_6 - 25% of canopy removal + 2000 ppm GA_3 (1^{st},3^{rd},5^{th} WAF), T_7 - 50%of canopy removal + 1000 ppm GA_3 (1^{st},3^{rd},5^{th} WAF), T_8 - 75% of canopy removal + 500 ppm GA_3 (1^{st},3^{rd},5^{th} WAF). Harvesting of fruits was done at full maturity stage. During the experimental period, harvestings were done periodically in several pickings and separating of fruits in treatment wise.

2.1 Growth parameters

2.1.1 Plant spread (North-South) (m) and Plant spread (East- West) (m)

The tree spread measured in North-South and East and west. Canopy spread was recorded in meter before initiation of experiment, 60 days after pruning and at the harvesting stage.

2.1.2 Number of primary branches and number of secondary branches

Number of primary and secondary branches emerged from main stem of the plant was counted from each plant in the treatment.

2.1.3 Leaf area (cm^2)

The leaf area was calculated by using leaf area meter and was expressed in cm^2.

2.1.4 Leaf area index

Leaf area is generally expressed in terms of leaf area index (LAI), which is calculated using the following formula:

$$LAI = \frac{\text{Total leaf area of the plant } (cm^2)}{\text{Ground area occupied by the plant } (cm^2)}$$

2.2 Yield parameters

2.2.1 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 was referred as total number of fruits per plant.

2.2.2 Fruit yield /plant (kg)

The total weight of fruits harvested during the entire harvesting period was considered as total weight of fruits per plant.

2.2.3 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.

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) [2]. Whenever 'F' test was found significant for comparing the means of two treatments, critical difference (C. D. at 5%) was worked.

3. Result and Discussions

The tree spread of N-S and E-W at initial stage (before pruning) showed the non significant, but in case of 60 DAT and harvesting time showed the significant. The different pruning intensities influence on the canopy spread. The maximum N-S and E-W canopy spread (4.73 m and 4.25 m) (Table.1) was recorded in (T_1) control followed by 25% canopy removal in 60 DAT. The maximum N-S and E-W canopy spread (4.94 m and 4.44 m) was recorded in (T_1) control followed by 25% canopy removal in harvesting time (Babu and Lavania (1985) [1], Kassem *et al*. (2010) [4], Wahdan *et al*. (2011) [9], Goswami *et al*. (2013) [3]). The maximum leaf area (88.71 cm2 and 95.24 cm2) was recorded in (T_4) 75% of canopy removal followed by 50% canopy removal in 60 DAT and harvesting time respectively. The maximum leaf area index (2.95) was recorded in (T_8) 75% of canopy removal + 500 ppm GA_3 followed by 50% canopy removal in harvesting time. This may be due to the increased pruning intensity the canopy size was decreased but in leaf area and leaf area index (LAI) (Table.1) was increased as compared with different pruning intensity. The effect of pruning levels did not exert significant effect on number of primary branches and secondary branches.

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.2). This might be due to pruning, significantly decreased the number of fruits per plant. When plants were unpruned, the number of fruits was maximum in (T_1) control treatment, this resulted increased yield but fruits were smaller in size. In severely pruned plants (75%) the number of fruits was minimum but size of the fruit was be maximum. The effect of pruning and gibberellic acid in cell enlargement, cell division and increased the number and size of fruits which ultimately resulted in higher fruit yield in T_5 and T_6 (Singh *et al*. (2007) [7] and Srivastava *et al*. (2009) [8] and Nkansah *et al*. (2012) [6]. 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) [5].

Table 1: Effect of pruning on morpho-physiological traits at different growth stages of custard apple cv. Arka Sahan

Sl. No	Treatment	Tree spread (m) at (N-S) direction			Tree spread (m) at (E-W) direction			Leaf area (cm^2)			Leaf area index		
		Initial (before pruning)	60 DAT	Initial (before pruning)	60 DAT	Initial (before pruning)	60 DAT	Initial (before pruning)	60 DAT	Harvesting time	Initial (before pruning)	60 DAT	Harvesting time
1	T_1 - Control	4.45	4.73	4.94	4.02	4.25	4.44	72.44	75.58	76.53	2.23	2.25	2.37
2	T_2 - 25% of canopy removal	4.31	3.91	4.23	3.95	3.69	3.85	73.34	80.56	82.44	2.24	2.46	2.54
3	T_3 - 50% of canopy removal	4.42	3.21	3.75	4.12	2.89	3.32	73.39	81.86	85.62	2.25	2.55	2.70

4	T_4 - 75% of canopy removal	4.38	2.44	3.05	4.02	2.09	2.52	72.61	88.71	95.24	2.19	2.66	2.88
5	T_5 - 25% of canopy removal + 1500 ppm GA_3	4.30	3.83	4.14	4.12	3.70	3.94	72.73	80.22	80.03	2.27	2.50	2.49
6	T_6 - 25% of canopy removal + 2000 ppm GA_3	4.33	4.04	4.33	4.06	3.61	3.88	73.09	80.28	84.77	2.25	2.46	2.55
7	T_7 - 50% of canopy removal + 1000 ppm GA_3	4.33	3.05	3.45	3.95	2.80	3.21	72.55	81.62	85.43	2.21	2.54	2.64
8	T_8 - 75% of canopy removal + 500 ppm GA_3	4.28	2.44	2.95	3.98	2.14	2.56	72.33	88.63	90.66	2.25	2.73	2.96
	S.Em±	0.13	0.11	0.24	0.31	0.22	0.27	2.91	2.11	2.27	0.06	0.22	0.08
	CD at 5%	NS	0.32	0.74	NS	0.67	0.83	NS	6.46	6.96	NS	NS	0.26

4. Conclusion

Severe pruning attributed to the maximum leaf area and leaf area index in growth parameters. In case of yield attributes were concerned, control (T_1) showed the maximum number of fruits per plant and yield but smaller fruits in size and followed by the 25 % of canopy removal + 1500 ppm GA_3 (T_5) (7.46 t/ha).

Table 2: Effect of pruning and GA_3 on yield components 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

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