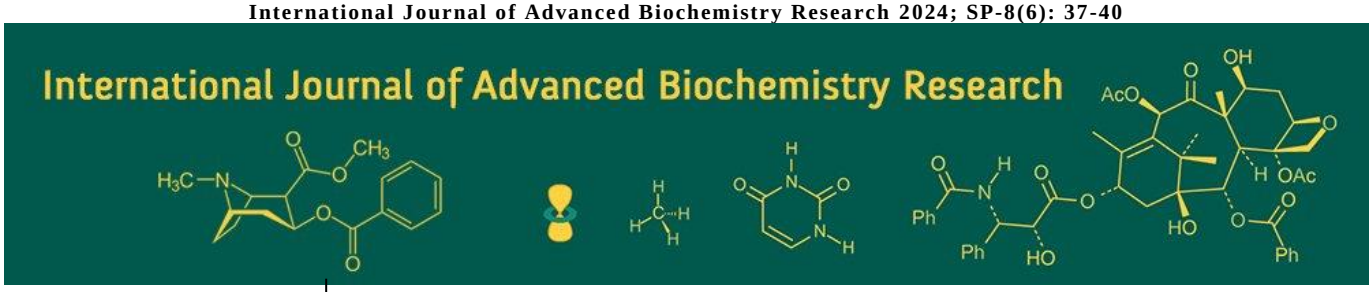

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Effect of severity of Pruning and integrated nutrient management on growth and yield custard apple

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Abstract
An experiment entitled "Effect of severity of pruning and integrated nutrient management on growth and yield of custard apple" was carried out during the year 2020-21 at Shivar Block, Central Research station, Akola. An experiment was laid out in a factorized randomized block design (FRBD) with nine treatment combinations and three replications comprising of three pruning intensities *viz*., 20 cm, 15 cm, control and three application of INM *viz*., I_1 - 75% RDF(194 g : 94 g : 94 g NPK/plant) +100g AM +100g *Azotobacter* +100 g PSB + 0.50 Kg neem cake at onset of monsoon, I_2 - Half N (97 g) +Full P&K (94 g: 94 g) + 100 g AM +100 g *Azotobacte*r + 100 g PSB + 0.50 Kg neem cake - I^{st} Application.1/4 N(48g) - II^{nd} Application and 1/4 N(48g) - III^{rd} Application respectively, at one month interval and control. Amongst the combinations of pruning and integrated nutrient management, the combined application of 20 cm pruning + Half N(97g) +Full P&K(94g:94g)+100g AM +100g *Azotobacte*r +100g PSB +0.50Kg neem cake - I^{st} Application, 1/4 N(48g) -II^{nd} Application, 1/4 N(48g) - III^{rd} Application showed the better performance in terms of plant height, Number of shoots per plant, Spread, Canopy of plant, leaf area, Yield, Stony fruit %, Average weight of fruit, Fruit Volume, Fruit to Pulp Ratio, pulp %, fruit set %, Number of different grade fruit, total soluble solids, T.S.S and acidity ratio, total sugar, reducing sugar in custard apple cv. Balanagar. In overall study of present investigation, it was observed that that for getting the quality fruit yield of custard apple pruned the custard apple plant at 20 cm from the tip in the month of April and apply Half N(97g) + Full P and K(94g:94g)+100g AM +100g *Azotobacte*r + 100g PSB +0.50Kg neem cake as I^{st} application in the month of June, 1/4 N(48g) -II^{nd} application in the month of July and 1/4 N(48g) - III^{rd} application in the Month of August.

Keywords: Custard apple, nutrition, pruning, yield, growth

Introduction
Custard apple is the most favorable fruit crop in India. It is delicious, tropical fruit crop. Among them, custard apple (*Annona squamosa* L.) is considered the best. It has got a pleasant flavour; mild aroma and sweet taste which have a universal acceptance. The custard apple is rich source of carbohydrates, protein, fibre, minerals like calcium, phosphorus, iron and vitamin C. They are considered good energy source with the value of 104 kcal. The edible portion of fruit is creamy, granular with an excellent blend of sweetness and acidity. The immature fruits, seeds, leaves and roots are known for their medicinal use in Ayurveda. It is tolerant to drought, sandy loam soil but well-structured clay loamy are also suitable with good drainage. Also, no serious pests, diseases and disorders are found on this crop. Young custard apple is vigorous and has poor precocity of bearing. The flowers are borne on current season growth (new emerging young shoots). By adopting pruning, we improve the vegetative growth and tree architecture with good aeration, light penetration, and ease in cultural practices. It requires little pruning for new growth and flowering.
The indiscriminate use of inorganic fertilizers and synthetic pesticides leads to a deteriorating chemical-based farming scenario and the increasing use of inorganic fertilizers. There is an urgent need for an alternative nutritional package to obtain long term sustainability for fruit production as well as for maintaining soil productivity under integrated nutrient management (INM) system.

Integrated nutrient management's goal is to integrate the use of all natural and manmade sources of plant nutrients, so that crop growth and productivity increases in an efficient and environmentally benign manner without sacrificing soil productivity for future generations.

Besides this for the use of mineral fertilization, organic sources, and bio-fertilizers certain factors such as timely availability of fertilizers, lack of knowledge about application of mineral fertilizers and bio-fertilizers and its adverse effect noticed if optimum dose are not used at proper time and negligence by growers regarding the use of mineral fertilizers and bio-fertilizers are the limits in integrated nutrient management in dry land fruit production.

Most of the time quality production is the constraint in custard apple and formation of stony fruits on the plants is another problem in the custard apple production which leads to poor quality and yield of custard apple fruits. This situation might be due to lack or discontinuous supply of nutrients at fruit development stage. An integrated use of organic manures, bio-fertilizers and chemical fertilizers could help in achieving the goal of obtaining safer food and environment for the people.

Therefore, the present study was carried out to know the combined effect of pruning levels and integrated nutrient management on growth, yield and quality of custard apple.

Materials and Methods

The experiment was conducted on Twenty-year-old custard apple healthy plants of uniform growth of cultivar Balanagar at Shivar Block, Central Research Station, Dr. Panjabrao Deshmukh Krishi Vidyapeeth**,** Akola. The plantation raised on light to medium black soil at 4 x 4 m spacing. Soil was medium clay, moderately deep, porous and having good drainage. The experiment was laid out in FRBD with three levels of pruning (20, 15, 0 cm from tip) and three levels of INM (I_1 - 75% RDF (194 g: 94 g: 94 g NPK/plant) +100 g AM +100 g *Azotobacter* + 100g PSB + 0.50 Kg neem cake at onset of monsoon. I_2 - Half N(97g) + Full P and K(94g:94g)+100 g AM +100 g *Azotobacte*r +100 g PSB + 0.50 Kg neem cake - Ist Application, 1/4 N(48g) - IInd Application and 1/4 N(48g) - IIIrd Application, respectively at one month interval and I_1 - Control) and replicated thrice. The pruning was done in the month of April 2021 on main shoot and subsequent secondary and tertiary shoot on whole plant, with different intensities of 15 cm and 20 cm from tip. Doses of nitrogen, potassium and phosphorous were applied in June as per treatment. Biofertilizers were applied by mixing with soil and neem cake as per treatment in first week of July.

Results and Discussion

1. Shoots per branch

After pruning significantly maximum shoots per branch (7.80) was recorded with treatment P_1I_2 which was at par with the treatment P_2I_2 (7.07). Whereas minimum shoots per branch (5.53) was recorded with treatment combination P_3I_3. The number of shoots was increased with increasing level of pruning intensity. Similar results were reported by Choudhary and Dhakare (2018) [2] in custard apple. The significant increase in fruit yield and yield attributing parameters with application of graded dose of NPK along with organic manure may be due to vigorous shoot growth, Jain *et al*. (2020) [8] in sapota.

2. Plant canopy

Effect of pruning and integrated nutrient management on canopy of plant was found to be non-significant at initiation of pruning and 30 days after pruning. Although after 60 and 90 days after pruning the canopy of plant was found to be significant.

At 90 days after pruning significantly maximum canopy of plant (26.34 m^3) was recorded with treatment P_1I_2 followed by the treatment P_2I_2 (24.69 m^3) whereas, minimum canopy of plant (14.18 m^3) was recorded with treatment combination P_3I_3.

Pruned trees were unable to make up the loss of vegetative growth caused by severe pruning treatments in this short period (Kumar and Rattanpal, 2010) [9]. Application of biofertilizers, organic manure alone or in combination with inorganic sources resulted into the increase in vegetative characteristics of plant. Similar results were obtained by Dey *et al*. (2005) [4] in guava.

Table 1: Effect of pruning and integrated nutrient management on shoots per branch, plant canopy and Leaf area

Treatments	Shoots/ branch	Plant canopy (m^3)				Leaf area (cm^2)			
		At pruning	30 DAP	60 DAP	90 DAP	90 DAP	120 DAP	150 DAP	180 DAP
	Pruning levels								
P_1	6.82	11.15	14.35	18.93	22.10	22.75	34.08	40.35	47.78
P_2	6.44	11.27	14.27	16.85	20.72	22.85	31.63	38.43	44.85
P_3	5.97	11.60	13.07	13.74	15.18	22.83	27.90	34.52	39.30
F-test	Sig	NS	Sig	Sig	Sig	NS	Sig	Sig	Sig
SE(m) +	0.19	0.22	0.33	0.37	0.58	0.44	0.45	0.47	0.73
CD at 5%	0.56	-	0.99	1.11	1.73	-	1.34	1.40	2.20
	INM								
I_1	6.47	11.38	14.01	15.94	18.91	22.65	31.07	37.08	43.08
I_2	6.86	11.31	14.62	19.18	22.23	22.91	34.15	42.17	49.20
I_3	5.91	11.33	13.07	14.40	16.85	22.86	28.40	34.04	39.65
F-test	Sig	NS	Sig	Sig	Sig	NS	Sig	Sig	Sig
SE(m) +	0.19	0.22	0.33	0.37	0.58	0.44	0.45	0.41	0.73
CD at 5%	0.56	-	0.99	1.11	1.73	-	1.34	1.23	2.20
	Interaction								
P_1 x I_1	6.37	10.94	14.57	17.74	21.27	22.66	33.72	37.72	46.40
P_1 x I_2	7.80	10.78	15.33	22.82	26.34	22.58	36.81	47.38	54.40
P_1 x I_3	6.30	11.72	13.15	16.24	18.68	23.00	31.70	35.95	42.52
P_2 x I_1	6.37	11.59	13.74	16.07	19.77	22.57	31.52	37.88	41.88
P_2 x I_2	7.07	11.18	15.48	19.72	24.69	23.05	35.14	43.35	51.16

P_2 x I_3	5.90	11.05	13.59	14.75	17.69	22.92	28.24	34.05	41.52
P_3 x I_1	6.67	11.59	13.71	14.01	15.96	22.71	27.96	35.66	40.95
P_3 x I_2	5.70	11.98	13.04	14.99	15.67	23.10	30.48	35.78	42.05
P_3 x I_3	5.53	11.22	12.47	12.22	14.18	22.67	25.26	32.13	34.90
F-test	Sig	NS	NS	Sig	Sig	NS	NS	Sig	Sig
SE(m) +	0.32	0.39	0.57	0.64	1.00	0.77	0.78	0.81	1.27
CD at 5%	0.968	-	-	1.919	2.996	-	-	2.427	3.813

3. Leaf area

Effect of pruning and integrated nutrient management on leaf area was found to be non-significant at initiation of pruning and 30 days after pruning. Although after 60 and 90 days after pruning the leaf area of plant was found to be significant.

At 90 days after pruning, significantly maximum leaf area of plant (54.40cm^2) was recorded with treatment P_1I_2 followed by the treatment P_2I_2 (51.16cm^2) whereas minimum leaf area of plant (34.90cm^2) was recorded with treatment combination P_3I_3.

Increase in leaf area was observed when the tree gives split doses of N with P and K full doses at initiation of pruning. Similar results were obtained by Pilania *et al.* (2010) [12] in guava, Pawar (2011) [11] in acid lime.

4. Days to flower

Data presented in Table 2 revealed that days to flower was influenced by severity of pruning and integrated nutrient management and the interaction effect was found to be significant.

After pruning significantly minimum days to flowering of plant (74.33) was recorded with treatment P_3I_2 followed by the treatment P_3I_1 (82.33) whereas, maximum days to flower (96.67) was recorded with treatment combination P_1I_3.

Severity of pruning increased time of flowers. Due to pruning the time required for initiation of flowering is more than the control. Similar results were found with Gupta *et al*. (1990) [7] in ber. The prolonged availability of nutrients during the growth period from vermicompost might have enhanced the flowering (Rai *et al*. 2002) [4].

5. Fruit set (%)

After pruning maximum fruit set % (75.61%) was found in treatment combination P_1I_2, which was followed by treatment combination P_2I_1 which was (66.36%). However, the minimum fruit set % was (55.29%) found in treatment combination P_3I_3.

Pruning helps in getting new fruiting units and thus increases the number of flower/shoots. Similar result found in Dalal *et al.* (2000) [3] in guava. Also the prolonged availability of nutrients during the growth period from vermicompost might have enhanced the flowering and increase the number of flowers. Present results are supported by the finding of Pinalia *et al.* (2010) [12] in guava.

6. Fruit per plant

Effect of pruning and integrated nutrient management on number of fruits per plant was found to be non-significant during course of investigation.

Table 2: Effect of pruning and integrated nutrient management on days to flower, fruit set percent, fruits per plant, yield and stony fruit percent

Treatments	Days to flowering	Fruit set (%)	Fruits per plant	Yield (kg /plant)
	Pruning levels			
P_1	93.78	65.95 (54.30)	61.06	17.86
P_2	90.67	63.88 (53.05)	72.61	19.82
P_3	80.56	55.86 (48.36)	76.61	13.70
F-test	Sig	Sig	Sig	Sig
SE(m) +	0.68	0.95	1.52	0.34
CD at 5%	2.04	2.84	4.56	1.03
	INM			
I_1	88.44	62.24 (52.08)	69.83	17.05
I_2	85.00	65.61 (54.09)	72.89	19.61
I_3	91.66	57.84 (49.51)	67.56	14.72
F-test	Sig	Sig	NS	Sig
SE(m) +	0.68	0.95	1.52	0.34
CD at 5%	2.04	2.84	-	1.03
	Interaction			
P_1 x I_1	92.67	63.44 (52.79)	58.00	18.49
P_1 x I_2	92.00	75.61 (60.40)	68.83	19.26
P_1 x I_3	96.67	58.79 (50.06)	56.33	15.83
P_2 x I_1	90.33	66.36 (54.54)	72.16	18.82
P_2 x I_2	88.67	65.82 (54.22)	75.83	23.73
P_2 x I_3	93.00	59.44 (50.44)	69.83	16.91
P_3 x I_1	82.33	56.91 (48.97)	79.33	13.84
P_3 x I_2	74.33	55.38 (48.08)	74.00	15.83
P_3 x I_3	85.00	55.29 (48.03)	76.50	11.42
F-test	Sig	Sig	NS	Sig
SE(m) +	1.18	1.64	2.63	0.59
CD at 5%	3.527	4.921	-	1.776

7. Yield (Kg/plant)

After harvesting significantly maximum yield of plant (23.73 kg/plant) was recorded with treatment P_2I_2 followed by the treatment P_1I_2 (19.26kg/plant) whereas minimum yield of plant (11.42 kg/plant) was recorded with treatment combination P_3I_3.

Due to presence of large number of mature shoots which received ample of solar radiation and accumulated more photosynthates for normal bearing. Significant interactive effect because of organic sources and fertilizers are attributed to the favourable nutritional status of the soil resulting into increased biomass production of the crop.

The results of present finding are in agreement with the finding of Pinalia *et al.* (2010) [12] in guava.

Conclusion

It is concluded that for getting the quality fruit yield of custard apple, pruned the custard apple plant at 20 cm from the tip in the month of April and apply Half N(97g) +Full P and K(94g:94g)+100g AM +100g *Azotobacte*r +100g PSB + 0.50Kg neem cake as Ist application in the month of June, 1/4 N(48g) -IInd application in the month of July and 1/4 N(48g) - IIIrd application in the Month of August.

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