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The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(12): 108-110
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www.thepharmajournal.com
Received: 13-09-2021
Accepted: 23-11-2021

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Effect of pruning and integrated nutrient management on growth and flowering of custard apple (*Annona squamosa* L.) cv. Sindhan

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Abstract
The present experiment entitled "Effect of pruning and integrated nutrient management on growth and flowering of custard apple (*Annona squamosa* L.) cv. Sindhan" was carried out at Fruit Research Station, Madhadi Baugh Farm, Department of Fruit science, College of Horticulture, Junagadh Agricultural University, Junagadh during April 2019 to November 2020. The experiment was laid out in Randomized Block Design with Factorial concept (FRBD) consisting three factors with three replications. The result revealed that application of different level of pruning had produced non-significant effect on growth and flowering parameters *viz*., plant height and plant spread (N-S and E-W) except length of shoot (13.40 cm) and number of flowers per shoot (14.94) which were higher in medium pruning at 20 cm (P_3), while minimum days to flower initiation (73.41) was recorded with unpruned tree (P_1). In case of integrated nutrient management, the variation was also found non-significant for growth parameters *viz*., plant height and plant spread (N-S and E-W) except length of shoot (14.95 cm) with the application of 100% RDN + 10 kg FYM + *Azotobacter* 15 ml + PSB 15 ml + Micronutrient grade-IV (0.5%) + GA_3 25 ppm (F_2). Similarly, the minimum days to flower initiation (70.72) was recorded with application of 60% RDN + 10 kg FYM (F_5). Whereas, maximum number of flower per shoot (16.27) was recorded in 80% RDN + 10 kg FYM + *Azotobacter* 30 ml + PSB 30 ml + Micronutrient grade-IV (1.0%) + GA_3 50 ppm (F_4). For interaction effect, the result was found non-significant for all parameters.

Keywords: Pruning, integrated nutrient management, growth and flowering

1. Introduction
Custard apple (*Annona squamosa* L.) is known as Sitaphal or sugar apple of sweet shop, can be called as a delicacy of dry region due to its very sweet delicate flesh belongs to family annonaceae. The total area of custard apple in India 42.00 thousand ha. and production 3.49 lakh MT, (Anon., 2019) [3]. In Gujarat, custard apple area 6457 ha., production 66613 MT and productivity 10.32 MT/ha (Anon., 2018a) [1]. Moreover, the area under custard apple cultivation is increasing day by day in the state whereas, in Junagadh district production 3588 MT as well as productivity 9.20 MT/ha under 390 ha area of cultivation (Anon., 2018b) [2].
The integrated nutrient management infuses long term sustainability in the productivity level because of availability of nutrients in soil for next season crop. Incorporation of organic fertilizers is a common practice to improve the yield of many fruit crops. It also limits chemical intervention and finally minimizes the negative impact on the wider environment. Due to the high cost of chemical fertilizers and poor purchasing capacity, organic manures have been used for their eco-friendly and beneficial effect on environment and fruit crops.
The increase in length and diameter of subsequent new shoots produced after pruning is directly proportional to the severity of pruning. Average fruit size and weight are also increased in pruned trees as compared to those in un-pruned ones (Gham, 2011) [8]. The quality of good size harvested fruit is increased with pruning. Hence, for obtaining improved growth and better quality fruit, a light pruning to break apical dominance (i.e. removal of unwanted growth) and a general thinning of diseased and broken branches, are reported to be essential. As a result, horticulture has received due emphasis during the last few decades. The successful commercial cultivation of custard apple depends on many factors among them, judicious removal of plant part to obtain better and qualitative yield is termed as pruning. Pruning is started in later part of plant life, when it becomes capable to produce flowers and fruits. Pruning to regulate flowering and fruiting, augment production of plants which bears on new

shoots, obtain regular bearing, remove diseased, damaged insect infested and week shoos.

2. Materials and Methods

The present experiment entitled "effect of pruning and integrated nutrient management on growth and flowering of custard apple (*Annona squamosa* L.) cv. Sindhan" was carried out at Fruit Research Station, Madhadi Baugh Farm, Department of Fruit science, College of Horticulture, Junagadh Agricultural University, Junagadh during two years April 2019 to November 2019 and April 2020 to November 2020. The experiment was laid out in Randomized Block Design with Factorial concept (FRBD) consisting three factors with three replications. The treatment comprised with three levels of pruning *viz*., Unpruned (P_1), light pruning at 10 cm (P_2) and medium pruning at 20 cm (P_3) and eight treatments of integrated nutrient management *i.e*. 100% RDN + 10 kg FYM (F_1), 100% RDN + 10 kg FYM + *Azotobacter* 15 ml + PSB 15 ml + Micronutrient grade-IV (0.5%) + GA_3 25 ppm (F_2), 80% RDN + 10 kg FYM (F_3), 80% RDN + 10 kg FYM + *Azotobacter* 30 ml + PSB 30 ml + Micronutrient grade-IV (1.0%) + GA_3 50 ppm (F_4), 60% RDN + 10 kg FYM (F_5), 60% RDN + 10 kg FYM + *Azotobacter* 45 ml + PSB 45 ml + Micronutrient grade-IV (1.5%) + GA_3 75 ppm (F_6), 10 kg FYM + 4 kg Castor cake + 2.5 kg Vermicompost + Micronutrient grade-IV (1%) + GA_3 50 ppm (F_7) and 10 kg FYM + Panchgavya @ 3% + Jivamrut 500 l/ha + Amritpani @ 600 l/ha + Banana pseudostem sap @ 1% 100% RDN + 10 kg FYM (F_8). The orchard was 16 years old and spacing of the plant was 6 x 6 m^2. Observations on growth and flowering parameters *viz*., plant height, plant spread (N-S and E-W), length of shoot, minimum days to flower initiation and maximum number of flower per shoot. Collected data was statistically analyzed as per the method given by Panse and Sukhatme (1985) [10]. The appropriate standard error of mean SE (m±) and the critical difference (CD) were calculated at 5% level of probability.

3. Result and Discussion

The pooled data presented in Table-1 observed that, pruning and integrated nutrient management were produce significant effect on growth and flowering parameters in custard apple studied in this experiment.

3.1 Effect of pruning

The variation in different level of pruning was observed non-significant result on plant height, plant spread (N-S and E-W). However, significantly maximum length of shoot (13.40 cm) and maximum number of flowers per shoot (14.94) were noted in medium pruning at 20 cm (P_3) which was at par with light pruning at 10 cm (P_2). This might be due to pruning remove carbon-starved, fruiting exhausted shoots and promotes new leaf growth to build up carbohydrate reserves for the next flowering and allows the sprouting of lateral buds which, ultimately influenced the length of shoot. The findings are also in accordance with Choudhary and Dhakare (2018) [5] in custard apple.

While the minimum days to flower initiation (73.41 days) was noted in unpruned plant (P_1) in but was found at par with light pruning at 10 cm (P_2). This might be due to the most fruitful and differentiated buds are located on distal portion of the branches. A removal of such parts by pruning would also remove these buds which are quick to cane out. It is also thought that, there exists juvenility gradient in tree. The juvenility is more at the base of a tree or branch and gradually reduced in acropetal manner towards the distal end. Due to pruning, promoted new growth to build up carbohydrates reserves for flowering and allows the sprouting of lateral buds which produced flowers in early stage due to reduced juvenility of shoot. Similar findings were reported by Dahapute *et al*. (2018) [6] in custard apple; Ghatul *et al*. (2019) [11] in pomegranate and Pilania *et al*. (2010) [11] in sapota

3.2 Effect of Integrated Nutrient Management

The variation in different integrated nutrient management was observed non-significant result on plant height, plant spread (N-S and E-W). While, significantly maximum length of shoot (14.95 cm) was noted effective in 100% RDN + 10 kg FYM + Azotobacter 15 ml + PSB 15 ml + Micronutrient grade-IV (0.5%) + GA_3 25 ppm (F_2) which was at par with treatments F_1 and F_4. The result may be due to integration of inorganic and organic manure and bio fertilizer that favoured good soil physical, biological properties tends to increased fertility status which improved the availability of nutrient and ultimately improved shoot length. The better nourishment through FYM caused beneficial effects such as accelerated rate of photosynthesis, assimilation and cell division resulted to vegetative growth. Similarly, GA_3 application also increased cell division and cell elongation, thereby increasing the shoot length. This finding confirmed by Bhatnagar and Singh (2015) [4] in custard apple.

Number of flowers per shoot (16.27) was noted significantly maximum with the application of 80% RDN + 10 kg FYM + *Azotobacter* 30 ml + PSB 30 ml + Micronutrient grade-IV (1.0%) + GA_3 50 ppm (F4). However, minimum days to flower initiation (70.72 days) was noted in 60% RDN + 10 kg FYM (F_5) but which was at par with 60% RDN + 10 kg FYM + *Azotobacter* 45 ml + PSB 45 ml + Micronutrient grade-IV (1.5%) + GA_3 75 ppm (F_6). The reduced days to flower initiation might be due to less availability of nitrogen, enhanced the C: N ratio which increased various endogenous hormonal levels in the plant. Besides, *Azotobacter* is also associated with the production of growth promoting substances, antifungal compounds which in turn might have leads to better root development, better transport and uptake of nutrients which resulted in increasing growth of plant and improved flowering. Similar findings were reported by Waghmare *et al*. (2018) [13] in custard apple; Gajbhiye *et al*. (2020) [7] in pomegranate and Singh and Varu (2013) [12] in papaya.

3.3 Interaction effect

The interaction between different level of pruning and integrated nutrient management on plant height, plant spread (N-S and E-W), length of shoot, minimum days to flower initiation and maximum number of flower per shoot.

Table 1: Effect of pruning and integrated nutrient management on growth and flowering of custard apple (*Annona squamosa* L.) cv. Sindhan

Treatments	Plant height (m)	Plant spread (N-S)	Plant spread (E-W)	Length of shoot (cm)	Days to flower initiation	Number of flower per shoot
Level of pruning (P)						
P_1	3.95	4.13	4.17	12.27	73.41	10.78
P_2	3.99	4.10	4.12	12.77	74.33	12.51
P_3	4.03	4.06	4.07	13.40	76.82	14.94
S.Em.±	0.044	0.051	0.047	0.152	0.815	0.143
C.D. at 5%	NS	NS	NS	0.43	2.29	0.40
Integrated nutrient management (F)						
F_1	4.00	4.07	4.10	14.82	75.79	14.51
F_2	3.95	4.14	4.16	14.95	77.47	15.26
F_3	3.99	4.08	4.11	14.12	75.66	13.77
F_4	3.99	4.03	4.07	14.54	76.07	16.27
F_5	4.04	4.08	4.10	9.52	70.72	8.69
F_6	3.99	4.20	4.21	10.19	71.11	9.77
F_7	3.99	4.10	4.12	12.37	76.02	12.52
F_8	3.98	4.06	4.10	11.97	75.97	11.13
S.Em.±	0.071	0.083	0.077	0.248	1.331	0.233
C.D. at 5%	NS	NS	NS	0.70	3.74	0.65
Interaction (P X F)						
S.Em.±	0.23	0.144	0.134	0.429	2.306	0.404
C.D. at 5%	NS	NS	NS	NS	NS	NS
CV%	7.56	8.63	7.97	8.20	7.54	7.76

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