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Effect of severity of pruning and fruit retention on growth and harvesting of custard apple

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Abstract
The present investigation entitled "Effect of severity of pruning and fruit retention on vegetative parameters of custard apple" was carried out during 2019-20 and 2020-21 Farmers field at Dhanaj (Bu), Tq-Karanja, Dist-Washim (MS) to study the effect of severity of pruning on flowering, fruit setting and fruit development of custard apple. The experiment was laid out in Split Plot Design designed with four severity of pruning *viz*., P_1- No pruning (control), P_2- Light pruning: thickness of branch 3-5 mm (Refill thickness), P_3- Medium pruning: thickness of branch 6-10 mm (Pencil thickness) and P_4-Hard pruning: thickness of branch 11-15 mm (Thumb thickness) and fruit thinning are T_1- no thinning (control), T_2- Fruit retention up to 100 fruits per plant, T_3-Ffruit retention up to 80 fruits per plant, T_4- Fruit retention up to 60 fruits per plant and T_5-fruit retention up to 40 fruits per plant. Light pruning shows the highest number of flowers per branch. However, maximum fruit set percentage and less stony fruit percentage was obtained in medium pruning. Early sprouting, maximum number of shoots emerged per branch, minimum days to flowering and minimum days to harvesting was found in unpruned plant. The early harvesting and less stone fruit were noticed in fruit retention up to 40 fruit per plant followed by fruit retention up to 60 fruit per plant. The fruit retention does not show any significant effect on growth parameters except days to harvesting and stony fruit percentage.

Keywords: Fruit retention, severity of pruning, custard apple

Introduction
Among annonaceous fruits, Custard apple (*Annona squamosa* L.) a tropical fruit crop is popular by virtue of its spontaneous spread in forest, waste lands, rocky slope and other uncultivated places, its nutritional value and wide uses in processing industries as well as in manufacturing bio-pesticides. It is proving boon to the arid zones of Maharashtra because of their wider adaptability, comparatively freeness from pests and diseases, hardy nature, known to thrive under diverse soil and climatic conditions and also escape from stray and grazing animals. The custard apple has widened the food basket by providing variety in diet as it is a rich source of carbohydrates, protein, fibre, and minerals like calcium, phosphorus, iron and vitamin C. They are considered good energy source with the value of 104 Kcal. The fruit contains carbohydrates 23.5 g, moisture 70.5%, protein 1.6 g, mineral 0.9 g, fibre 3.1 g, calcium 17 mg, phosphorus 47 mg, iron 1.5 mg and vitamin (37 mg). These values are based on 100 fruit pulp. Its immature fruits, seeds, leaves, bark and roots are used for making medicines. In Custard apple the flowering occurs singly or rarely in smsall clusters and observed mostly on both old and current season's growth and very rarely on older wood. The flowering period of custard apple is very long commencing from March-April, continuing upto July-August. The peak flowering is observed in April and May. (Rajput and Pattanayak, 1985) [17]. 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) [12], guava (Lakpathi and Rajkumar, 2018) [13], pomegranate (Asha Hiremath *et al*., 2018) [2], 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. The flowers are borne on current season growth (new emerging young shoots). Therefore, it requires 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.

The crop loads are one of the most important factors influencing the relationship of source and sinks. The high crop load of fruit trees led to the weakness of tree vigor and affects the development of leaves which resulted in the fruit trees senescence at later growth stage. Additionally, high crop load reduced trees storage nutrition, which significantly affected the vegetative growth and flower bud differentiation in the second year. Fruit thinning is most effective method to maintain the vegetative and reproductive growth of the plant, which ensures high yield quality in fruit trees by adjusting the relationship between source and sink which influence the transportation and distribution of photosynthates. Another reason for the poor quality of rainy season crop is that the fruit trees tend to set excessive numbers of fruits irrespective to its capacity and leaf area, which results in small size and poor-quality fruits development, this it also reduces the shelf life of produce and their market price. Thinning of fruits and flowers as to prevent excessive fruiting which leads to production of bigger size fruits with better quality. Thinning process serves to increase the plant's ability to form flower buds for the next year (Mishra *et al.*, 2020) [14].

Materials and Methods

The present research programmed is laid out in Split Plot Design consisting four severity of pruning and five fruit retention on tree replicated three times. Ten years old custard apple plant used for research programmed. Five plant was selected under each treatment. Pruning was done in in last week of May with four severity of pruning *viz*., P_{1}- No pruning (control), P_{2}- Light pruning: thickness of branch 3-5mm (Refill thickness), P_{3}- Medium pruning: thickness of branch 6-10 mm (Pencil thickness) and P_{4}- Hard pruning: thickness of branch 11-15 mm (Thumb thickness) and fruit thinning done when fruit was aonla size with fruit thinning are T_{1}- no thinning (control), T_{2}- Fruit retention up to 100 fruits per plant, T_{3-F}fruit retention up to 80 fruits per plant, T_{4}- Fruit retention up to 60 fruits per plant and T_{5}- fruit retention up to 40 fruits per plant. All cultural practices recommended for this fruit crop were timely adopted.

Result and Discussion

1) Days to sprouting (Days)

The data from Table 1. Showed that, effect of severity of pruning was found to be significant. Significantly minimum number days to sprouting (16.71 and 16.79 Days) was found in medium pruning and followed by hard pruning (17.45 and 17.14 Days) during first and second year, respectively. However, maximum days to sprouting (18.68 and 18.47 Days) was recorded in unpruned tree during first and second year, respectively. On pooled basis, significantly minimum number days to sprouting (16.75 Days) was found in medium pruning and it was followed by hard pruning (17.29 Days). The maximum days to sprouting was found in unpruned tree (18.75 Days). This might due to pruning accumulates more carbohydrates as availability of nutrients are in sufficient quantities of plant to come out their metabolic and physiological process. These findings are in accordance with result reported by Pawar *et al.* (1994) [20] in pomegranate, Suleman *et al.* (2006) [19] in guava, Ghum, (2011) [9] in custard apple and Patil *et al.* (2018) [16] in acid lime. The fruit retention per plant showed non-significant effect on days to sprouting. The interaction effects of due to severity of pruning and fruit retention was found non-significant on days to sprouting.

2) Number of shoots emerged per branch

The data from Table 1. showed significantly maximum number of shoots emerged per branch (18.65 and 18.93) was found in control treatment and followed by medium pruning (15.57 and 14.87) during first and second year, respectively. However, significantly minimum number of shoots emerged per branch was recorded in hard pruning (14.46 and 13.13) during first and second year, respectively. On pooled basis, significantly maximum number of shoots emerged per branch (18.79) was found in control, which were found at par with treatment light pruning (17.62) and followed by medium pruning (15.22). The lowest number of shoots emerged per branch was found in hard pruning (13.79). These may be due to the fact that due to heavy pruning number of nodes will be decreased and so number of sprouts emerged will be less, hence number of shoots emerged decreases with increase in pruning intensity. These results are in accordance with those reported by Dalkiliç *et al.* (2014) [21] in peach and Dalal *et al.* (2004) [5] in guava. The fruit retention per plant showed non-significant effect on number of shoots emerged per branch. The interaction effects of due to severity of pruning and fruit retention was found non-significant on number of shoots emerged per branch.

3) Days to flowering (Days)

The data from Table 1. showed that, significantly minimum number days to flowering (35.00 and 34.66 Days) was recorded in unpruned tree and it was followed by light pruning (37.42 and 36.11 Days) during first and second year, respectively. However, maximum days to flowering was recorded in hard pruning (38.52 and 37.74 Days) during first and second year, respectively. On pooled basis, significantly minimum days to flowering (34.83 Days) was found in unpruned tree and it was followed by light pruning (36.86 Days). The maximum days to flowering (38.13 Days) was found in hard pruning. Delayed pruned trees initiate flowering later as comparison to unpruned trees and the new vegetative growth was delay. 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 delay flowering in pruned trees (Dhaliwal and Singh 2004) [8] in guava. The fruit retention per plant showed non-significant effect on days to flowering. The interaction effects of due to severity of pruning and fruit retention was found non-significant on days to flowering.

4) Number of flowers per shoot

The data from Table 2. Showed significantly maximum number of flowers per shoot (19.02 and 18.26) was found in light pruning and followed by medium pruning (16.82 and 16.99) during first and second year, respectively. The lowest number of flowers per shoot (15.04 and 13.87) was recorded in hard pruning during first and second year, respectively. On pooled basis, significantly maximum number of flowers per shoot (18.64) was found in light pruning and followed by medium pruning (16.90). The lowest number of flowers per shoot (14.15) was found in hard pruning. Severe pruning had much adverse effect on flowering than mild pruning. Reduction in number of flowers in severely pruned branches due to loss of potential bearing wood of tree. This might be reason for promoted number of flowers in mild pruned branches. The result of present finding are in agreement with the finding of Sheikh and Hulmani (1997) [22] and Jadhao *et*

al. (2002) [23] in guava, Mohamed (2010) [15] in custard apple. The fruit retention per plant showed non-significant effect on number of flowers per shoot. The interaction effects of due to severity of pruning and fruit retention was found non-significant on number of flowers per shoot.

5) Fruit set (%)

The data from Table 2. showed significantly maximum fruit set percentage (76.21 and 76.16%) was recorded in medium pruning and it was followed by light pruning (74.97 and 74.75%) during first and second year, respectively. However, minimum fruit set percentage (70.14 and 70.84%) was recorded in unpruned tree during first and second year, respectively. On pooled basis, significantly highest fruit set percentage (76.18%) was found medium pruning and followed by light pruning (74.41%). The lowest fruit set percentage (70.49%) was found in unpruned tree. It was found that, the treatment of heading back by pruning 10 cm of shoot gave the highest values of fruit set percentage (14.6% and 14.8%) in custard apple (Mohamed *et al*., 2010) [15]. The fruit retention per plant showed non-significant effect on fruit set. The interaction effects of due to severity of pruning and fruit retention was found non-significant on fruit set.

6) Days to harvesting (From Pruning)

The data from Table 2. Showed significantly minimum number days to harvesting (107.17 and 107.00 Days) was recorded in unpruned tree and it was followed by light pruning (108.51 and 108.40 Days) during first and second year, respectively. However, maximum days to harvesting was recorded in hard pruning (110.72 and 110.38 Days) during first and second year, respectively. On pooled basis, the minimum number days to harvesting (107.08 Days) was found in unpruned tree and followed by light pruning (108.45 Days). The maximum days to harvesting (110.55 Days) was found in hard pruning. Pruning induces strong vigorous and juvenile growth evident in vegetative parts. This indicates that in pruned trees longer period is required for physiological maturity of the organs. Different intensities of pruning of previous season shoots shows significant results i.e. the minimum number of days were observed in control pruning of previous year shoots, followed by 25% pruning and 50% pruning reported by Gham (2011) [24] in custard apple. The data regarding to fruit retention, minimum days to harvesting (107.23 and 107.24 Days) was found in fruit retention up to 40 fruits per plant and it was followed by fruit retention up to 60 fruits per plant (108.27 and 108.24 Days) during first and second year, respectively. However, maximum days to harvesting (109.25 and 109.85 Days) was recorded in no thinning plant during first and second year, respectively. on pooled basis, significantly minimum number days to harvesting (107.24 Days) was found in fruit retention up to 40 fruits per plant and it was followed by fruit retention up to 60 fruits per plant (108.25 Days). However, maximum days to harvesting was recorded in no thinning plant (108.25 Days). The advancement in fruit maturity in different thinning treatments might be due to the faster accumulation of minerals and metabolites that helped in early fruit development than control trees. The present findings are in closely conformity with the findings of Chander and Khajuria (1983) [4] and Kaur Balwinderjit (1997) [11] in peach. Compared with high crop load trees, fruit from low crop load trees showed advanced maturity at harvest was reported by Jens *et al*. (2005) [25] in apple and Abeer and Mohsen (2010) [1] in peach.

Table 1: Effect of severity of pruning and fruit retention on days to sprouting, number of shoots emerged per branch and days to flowering

Treatments	Days to sprouting (Days)			Number of shoots emerged per branch			Days to flowering (Days)		
	2019-20	2020-21	Pooled mean	2019-20	2020-21	Pooled mean	2019-20	2020-21	Pooled mean
A-Pruning (P)									
P_1–Control	18.68	19.47	19.07	18.65	19.93	19.29	35.00	34.66	34.83
P_2 -Light pruning	17.17	18.12	17.64	17.86	18.88	18.74	37.62	36.62	37.12
P_3-Medium pruning	16.71	17.79	16.89	15.57	14.87	15.22	37.32	36.31	36.76
P_4-Hard pruning	18.45	19.10	18.27	14.35	14.13	14.39	38.52	37.74	38.13
F test	Sig.	Sig	Sig	Sig.	Sig	Sig	Sig.	Sig	Sig
SE (m)	0.27	0.22	0.24	0.74	0.42	0.58	0.47	0.46	0.46
CD at 5%	0.71	0.62	0.66	2.14	1.20	1.67	1.34	1.32	1.33
B. Fruit retention (T)									
T_1-No thinning	16.26	17.62	16.94	16.83	16.54	16.68	37.25	35.46	36.35
T_2-100 fruit retention	16.67	17.70	17.18	15.97	16.48	16.22	37.00	36.39	36.69
T_3-80 fruit retention	17.88	18.95	18.41	17.41	16.04	16.72	37.50	36.78	37.14
T_4-60 fruit retention	18.05	19.85	18.45	16.38	15.56	15.97	37.06	36.11	36.58
T_5-40 fruit retention	19.05	20.02	19.53	16.59	15.77	16.18	36.90	36.92	36.91
F test	NS	NS	NS	NS	NS	NS	NS	NS	NS
SE (m)	0.70	0.62	0.66	0.37	0.43	0.40	0.47	0.78	0.62
CD at 5%	-	-	-	-	-	-	-	-	-
C. Interaction									
F test	NS	NS	NS	NS	NS	NS	NS	NS	NS
SE (m)	1.40	1.24	1.32	0.75	0.85	0.70	0.94	1.57	1.25
CD at 5%	-	-	-	-	-	-	-	-	-

Table 2: Effect of severity of pruning and fruit retention on number of flowers per shoot, fruit set percentage and days to harvesting

Treatments	Number of flowers per shoot			Fruit set (%)			Days to harvesting (Days)		
	2019-20	2020-21	Pooled mean	2019-20	2020-21	Pooled mean	2019-20	2020-21	Pooled mean
A-Pruning (P)									
P_1 – Control	16.20	17.22	16.66	70.04	70.59	70.72	107.17	108.00	107.58
P_2 -Light pruning	19.02	20.26	19.14	74.07	74.75	74.41	108.51	109.40	108.55
P_3-Medium pruning	16.82	17.99	17.40	76.21	75.78	76.00	108.54	109.65	109.09
P_4-Hard pruning	15.04	14.87	14.65	71.36	75.78	71.56	110.72	111.38	111.05
F test	Sig.	Sig	Sig	Sig.	Sig	Sig	Sig.	Sig	Sig
SE (m)	0.55	0.46	0.50	0.52	0.40	0.46	0.43	0.71	0.57
CD at 5%	1.60	1.32	1.46	1.49	1.16	1.32	1.23	2.15	1.69
B. Fruit retention (T)									
T_1-No thinning	17.26	18.02	17.14	72.26	69.32	72.35	111.95	112.85	111.7
T_2-100 fruit retention	16.41	17.09	16.75	73.08	70.91	73.27	110.42	111.44	110.43
T_3-80 fruit retention	16.84	17.78	17.31	73.64	70.78	73.73	109.79	110.82	109.80
T_4-60 fruit retention	16.79	17.56	17.17	72.83	70.66	72.97	108.27	109.24	108.25
T_5-40 fruit retention	16.55	17.35	16.95	72.81	71.30	73.04	107.23	108.25	107.24
F test	NS	NS	NS	NS	NS	NS	Sig.	Sig	Sig
SE (m)	0.33	0.47	0.50	0.31	0.38	0.34	0.36	0.35	0.35
CD at 5%	-	-	-	-	-	-	1.03	1.00	1.01
C. Interaction									
F test	NS	NS	NS	NS	NS	NS	NS	NS	NS
SE (m)	0.65	0.93	0.79	0.61	0.75	0.68	0.71	0.70	0.70
CD at 5%	-	-	-	-	-	-	-	-	-

Conclusion

It concluded that early sprouting, maximum number of shoots emerged per branch, minimum days to flowering and minimum days to harvesting was found in unpruned plant. The early harvesting and less stone fruit were noticed in fruit retention up to 40 fruit per plant followed by fruit retention up to 60 fruit per plant. The fruit retention does not show any significant effect on growth parameters except days to harvesting and stony fruit percentage. Light pruning shows the highest number of flowers per branch. However, maximum fruit set percentage and less stony fruit percentage was obtained in medium pruning.

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