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Effect of pruning severity and irrigation methods on flowering, fruit growth and yield of custard apple

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Abstract

The experiment entitled "Effect of pruning severity and irrigation methods on flowering, fruit growth and yield of custard apple" was carried out during 2018-19 at Shivar block, Central Research Station, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola with the objectives to study the effect of severity of pruning on flowering, fruit growth and yield of custard apple, to study the effect of different methods of irrigation on flowering, fruit growth and yield of custard apple and to find out the suitable severity of pruning and irrigation method for better fruit growth and yield in custard apple. The experiment was laid out in Split Plot Design with three methods of irrigation viz., I₁- no irrigation, I₂- double furrow irrigation and I₃- drip irrigation and severity of pruning are P₁- no pruning (control), P₂- light pruning, P₃- medium pruning and P₄- heavy pruning. The tree unit per treatment was two and it was replicated thrice with twelve treatment combinations. Light pruning (P₂) showed the highest number of flowers per branch and minimum days to flowering was found in control trees (P₁). Maximum number of fruits per plant, fruit yield (kg/tree), were recorded highest in treatment of light pruning (P₂) and double furrow irrigation (I₂) and maximum 'A' graded fruits/tree was produced in medium pruned (P₃) trees with drip irrigation (I₃). Irrigation does not show any significant effect except for days to harvesting in which unpruned and drip irrigated trees showed better result. The effect of interaction between severity of pruning and methods of irrigation on flowering, fruit growth and yield was found non-significant.

Keywords: Custard apple, pruning, irrigation, flowering, fruit growth, yield

Introduction

The flowers of custard apple are borne on current season growth that is young shoots, flowers are bisexual and protogynous, anthesis occurs between 6-9pm they are cross pollinated and anemophyllous, there is no different colour for sepal and petal. They shed their leaves in winter, they are deciduous evergreen tree grow upto 6-8m. The fruit is syncarp each contain a hard seed. Annona flower in which the conical mass at the base of the 2 petals left is composed of pistil fused with receptacle. The lighter band below the cone is composed of many stamens. Each of the many carpels has a single ovule. The flowers tend to be extra axillary, and it appears in clusters of 2 to 4. Apparently more nearly all flowers are borne on leafy shoots rather than old wood. The immature fruit, seeds, leaves and roots are known for their medicinal use in Ayurvedic). Besides high nutritive value, it has also high medicinal value. Root is drastic purgative; leaves are used for unhealthy ulcers and for store grain pests. The seed cake contains nitrogen, thus can be used as a manure. They are rich source of dietary fibre and help in indigestion and also used as cure for cancer. They shed their leaves in winter and flowering is observed in July and August, fruit set occurs only in rainy season, availability of custard apple starts from August and continues upto December but peak availability is observed in October to November.

Pruning is removal of any parts of tree, especially shoots, roots, buds or nipping of terminal parts. The main objective of pruning is to remove the non-productive parts and to divert the energy into those parts that are capable of bearing fruits (Singh, 2005) [12]. It ensures a proper balance of crop load and the vegetative leaf area that sustains it. Pruning allows light to enter the interior parts of the tree and also controls the size of the plant and regulates the fruit crop.

Custard apple is a small deciduous evergreen tree. Therefore, it requires little pruning. It is essential to develop a good crown to get better yield over a long period of time.

Without pruning the plant become bushy and lowers its bearing efficiency. Hence, timely removal of misplaced limbs is necessary to build a strong framework. Selective and mild pruning of dead wood, very old branches and water sprouts should be carried out to avoid congestion and encourage well-spaced branching. The increase in length and diameter of subsequent new shoots produced after pruning is directly proportional to the severity of pruning.

Regular annual pruning at bearing stage help to induce good healthy shoots which will provide maximum fruit bearing area and good quality fruits. Old bearing trees that have become low in vigour due to constant cropping should be pruned heavily, such trees respond better to heavy pruning because of their reduced vigour. Custard apple produce moderate crop in absence of irrigation, irrigation during flowering and fruit development is essential, and help in increasing the fruit size, high yield and prevent splitting of fruits. Pruning helps to control the vegetative growth to manageable size which help in easy harvesting and decrease the cost of harvesting.

Materials and Methods

The experiment entitled "Effect of pruning severity and irrigation methods on flowering, fruit growth and yield of custard apple" was conducted at Shivar block, Central Research Station, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during the year 2018-19. The experiment was conducted on 12 year old trees of custard apple cv. Balanagar spaced at 4×4m. The present research programme is laid out in Split Plot Design consisting three methods of irrigation and four different severity of pruning replicated three times. Twelve year old custard apple plants were used for research programme. Two plants were selected under each treatment. Pruning was done in 2nd June 2018 with four pruning severity i.e. No pruning (control), Light pruning: thickness of branch 3-5mm (Refill thickness), Medium pruning: thickness of branch 6-10mm (Pencil thickness) and Heavy pruning: thickness of branch 11-15mm (Thumb thickness). Irrigation methods with no irrigation (control), double furrow and drip irrigation. All cultural practices recommended for this fruit crop were timely adopted.

Results and Discussion

The result obtained from the present investigation as well as relevant discussion have been summarized under following sub heads and given in table.

Number of flowers per branch

The data from Table 1 showed that, effect of pruning severity on number of flowers per branch was found to be significant. Significantly maximum number of flowers per branch (20.79) was found in light pruning (P₂) which were found at par with control (17.80) and followed by medium pruning (16.21). However, lowest number of flowers per branch was recorded in heavy pruning treatment (14.63). Reduction in number of flowers in severely pruned branches is due to loss of potential bearing wood, this might be reason for promoted number of flowers in mild pruned branches. The result of present findings are in line with findings of Kharat (2013) ^[9], Dahapute *et al.* (2018) ^[4] and Choudhari (2012) ^[2] in custard apple. The data presented in table 1, it indicated that, the methods of irrigation showed non-significant effect on number of flowers per branch. The data presented in table 1 showed that, interaction effects due to severity of pruning and methods of irrigation was found non-significant on number of flowers per branch.

Days to flowering (from pruning)

The data from Table 1 showed that, effect of pruning severity on days to flowering was found to be significant. Significantly minimum days to flowering was recorded in control treatment (34.33) which were found at par with light pruning (35.33) and followed by medium pruning (35.89). However maximum days to flowering (36.67) was found in heavy pruning (P₄).

The most fruitful and differentiated buds are located on distal portion of the branches. Removal of such parts by pruning would also remove these buds which are quick to cane out. So the appearance of first flower on a shoot was significantly delayed with increased intensity of pruning. There is an inverse correlation between the period required for flowering and the pruning intensity was observed. A similar result has been reported by Pawar (1993) ^[11] from pruning studies in pomegranate, that appearance of first flower was delayed as intensity of pruning was increased in pomegranate. Gham (2011) ^[6] and Vinay and Chithiraichelvan (2015) ^[16] reported similar results regarding days required for flowering after pruning in custard apple. The data presented in table 1, indicated that the methods of irrigation showed non-significant effect on days to flowering. The data presented in table 1 showed that, interaction effects due to severity of pruning and methods of irrigation was found non-significant on days to flowering.

Days to harvesting (from flowering)

The data from Table 1 showed that, effect of pruning severity on days to harvesting was found to be significant. Significantly minimum days to harvesting was recorded in control treatment (106.06) which were found at par with light pruning (107.22) and medium pruning (107.94). However, maximum days to harvesting (110.11) was found in heavy pruning (P₄). 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 per cent pruning and 50 per cent pruning in custard apple (Gham, 2011) ^[6]. The data from Table 1 showed that, effect of methods of irrigation on days to harvesting was found to be significant. Significantly minimum days to harvesting (106.33) was recorded in drip irrigation (I₃) followed by double furrow irrigation (108.09). However, maximum days to harvesting (109.08) was recorded in control (I₁). Irrigation caused earlier harvesting when compared to control in custard apple (Navachinda, 1981) ^[10]. The result of present findings are in accordance with findings of Sharma and Kispotta (2016) ^[14] in banana. The data presented in table 1 showed that, interaction effects due to severity of pruning and methods of irrigation was found non-significant on days to harvesting.

Number of fruits/tree

The data from Table 1 showed that, effect of pruning severity on number of fruits per tree was found to be significant. The light pruning (P₂) produced significantly maximum number of fruits per branch (64.22) which were found at par with control treatment (62.50) followed by medium pruning (42.94). However, lowest number of fruits per tree was recorded in heavy pruning treatment (35.44). Pruning in turn, attributed to renewal of potential fruit buds and retention of more juvenile wood i.e. with increase in severity of pruning it

leads to more vegetative growth and lesser number of flowers. Minimum numbers of fruits were recorded due to 90 cm of pruning intensity in custard apple (Choudhary and Dhakare, 2018) [3]. The data presented in table 1 indicated that, the methods of irrigation showed non-significant effect on number of fruits per tree. The data presented in table 1 showed that, interaction effects due to severity of pruning and methods of irrigation was found non-significant on number of fruits per tree.

Fruit yield (kg/tree)

The data from Table 1 showed that, effect of pruning severity on fruit yield (kg/tree) was found to be significant. The light pruning (P2) produced significantly maximum fruit yield (14.29 kg/tree) which were found at par with treatment control (11.98 kg/tree) and followed by medium pruning (10.09 kg/tree). However, lowest yield (kg/tree) was recorded in heavy pruning treatment (8.47 kg/tree). More yield after light pruning might be due to availability of more metabolite and retention of sufficient size of bearing shoot after pruning. Similar results were obtained by Bruno and Evelyn (2001) [1] in custard apple, Ingle *et al.*, (2005) [8] in acid lime, Gill and Bal (2006) [7] in ber, Choudhary and Dhakare (2018) [3] in custard apple and Shinde (2018) [15] in guava. The data from Table 1 showed that, methods of irrigation on fruit yield (kg/tree) was found to be significant. Double furrow irrigation (I2) produced significantly maximum yield (12.67 kg/tree) which were found at par with drip irrigation (11.91 kg/tree). However, lowest fruit yield was recorded in control treatment (9.05 kg/tree). In non-irrigated plants, the development of water stress conditions may lead to reduce the uptake of nutrients. Water stress conditions have been found to interfere in cell division and cell enlargement thereby reduced the size of fruits and ultimately the yield. These result are in agreement with those reported by Dwyer *et al.* (1987) [5] and Sharma *et al.* (2005) [13] in strawberry. The data presented in table 1 showed that, interaction effects due to severity of pruning and methods of irrigation was found non-significant on fruit yield (kg / tree).

Graded fruit yield/ tree

Grade 'A' (300g and above)

The data from Table 1 showed that, effect of pruning severity on A grade fruits (kg/tree) was found to be significant. Medium pruning (P3) produced significantly maximum A grade fruits (3.57 kg/tree) which were found at par with heavy pruning (2.60 kg/tree) and light pruning (2.37 kg/tree). However, lowest A grade fruits was recorded in control treatment (1.67 kg/tree). The data from Table 1 showed that, methods of irrigation on A grade fruits (kg/tree) was found to

be significant. Maximum A grade fruits (3.30 kg/tree) was produced in drip irrigation (I₃) which were found at par with double furrow irrigation (3.28) and lowest A grade fruits (kg/tree) was recorded in control treatment (1.07). The data presented in table 1 showed that, interaction effects due to severity of pruning and methods of irrigation was found non-significant on A grade fruits (kg/tree).

Grade 'B' (200g-300g)

The data from Table 1 showed that, effect of pruning severity on B grade fruits (kg/tree) was found to be significant. The light pruning (P2) produced significantly maximum B grade fruits (7.06 kg/tree) followed by medium pruning (4.54 Kg/tree) and heavy pruning (4.49 Kg/tree). However, lowest B grade was recorded in control treatment (3.27 Kg/tree). The data presented in table 1 indicated that, the methods of irrigation showed non-significant effect on B grade fruits (kg/tree). The data presented in table 1 showed that, interaction effects due to severity of pruning and methods of irrigation was found non-significant on B grade fruits (kg/tree).

Grade 'C' (150g-200g)

The data from Table 1 showed that, effect of pruning severity on C grade fruits (kg/tree) was found to be significant. The heavy pruning (P1) produced significantly minimum C grade fruits (1.04 kg/tree) which were at par with medium pruning (1.56 kg/tree) and followed by light pruning (3.27 kg/tree). While, maximum C grade fruits was recorded in control (3.92 kg/tree). The data presented in table 1 indicated that, the methods of irrigation showed non-significant effect on C grade fruits (kg/tree). The data presented in table 1 showed that, interaction effects due to severity of pruning and methods of irrigation was found non-significant on C grade fruits (kg/tree).

Grade 'D' (below 150g)

The data from Table 1 showed that, effect of pruning severity on D grade fruits (kg/tree) was found to be significant. Heavy pruning produced significantly minimum D grade fruits (0.35 kg/tree) which were at par medium pruning (0.42 kg/tree) and followed by light pruning (1.59 kg/tree). However, highest D grade fruits was recorded in unpruned (P1) treatment (3.13 kg/tree). The data presented in table 1. Indicated that, the methods of irrigation showed non-significant effect on D grade fruits (kg/tree). The data presented in table 1 showed that, interaction effects due to severity of pruning and methods of irrigation was found non-significant on D grade fruits (kg/tree).

Table 1: Effect of pruning severity and irrigation methods on flowering, fruit growth and yield of custard apple.

Treatment details	No. of flowers/branch	Days to flowering from pruning	Days to harvesting	Number of fruits/tree	Fruit yield (Kg/tree)	Graded fruit yield (kg/tree)				
						A	B	C	D	
Methods of irrigation										
I ₁	18.05	36.25	109.08	45.79	9.05	1.07	4.49	2.15	1.34	
I ₂	15.05	35.67	108.09	56.00	12.67	3.28	5.21	2.88	1.30	
I ₃	18.98	34.75	106.33	52.04	11.91	3.30	4.81	2.31	1.49	
S.E±	1.91	0.52	0.37	2.13	0.53	0.20	0.15	0.16	0.10	
CD at5%	-	-	1.44	-	2.10	0.77	-	-	-	
Pruning intensity										
P ₁	17.80	34.33	106.06	62.50	11.98	1.67	3.27	3.92	3.13	
P ₂	20.79	35.33	107.22	64.22	14.29	2.37	7.06	3.27	1.59	
P ₃	16.21	35.89	107.94	42.94	10.09	3.57	4.54	1.56	0.42	

P ₄	14.63	36.67	110.11	35.44	8.47	2.60	4.49	1.04	0.35
SE _±	1.44	0.40	0.69	5.79	1.24	0.41	0.50	0.33	0.21
CD at5%	4.28	1.19	2.05	17.19	3.69	1.22	1.48	0.98	0.61
I ₁ P ₁	17.00	34.67	107.00	59.17	10.75	0.56	3.96	3.59	2.64
I ₁ P ₂	18.73	36.00	108.17	58.17	11.11	1.14	5.25	2.99	1.73
I ₁ P ₃	18.40	36.33	109.17	35.83	7.68	1.26	4.37	1.63	0.42
I ₁ P ₄	18.05	38.00	112.00	30.00	6.65	1.32	4.39	0.39	0.55
I ₂ P ₁	14.17	34.50	106.17	61.67	12.25	2.29	2.69	4.31	2.96
I ₂ P ₂	18.97	35.67	107.67	74.00	17.35	3.86	8.17	3.95	1.37
I ₂ P ₃	13.90	36.00	108.33	45.83	10.96	3.65	5.12	1.84	0.35
I ₂ P ₄	13.17	36.50	110.20	42.50	10.12	3.33	4.85	1.44	0.50
I ₃ P ₁	22.23	33.83	105.00	66.67	12.95	2.15	3.16	3.86	3.79
I ₃ P ₂	24.67	34.33	105.83	60.50	14.41	2.12	7.75	2.87	1.67
I ₃ P ₃	16.33	35.33	106.33	47.17	11.62	5.80	4.12	1.22	0.49
I ₃ P ₄	12.67	35.50	108.13	33.83	8.65	3.14	4.23	1.28	0
S.E _±	2.49	0.69	1.19	10.02	2.15	0.71	0.87	0.57	0.36
CDat5%	-	-	-	-	-	-	-	-	-

Summary and conclusion

On the basis of findings reported in present investigation, it is found that, the response of pruning severity and methods of irrigation on growth, fruit set, and yield for improvement of fruit quality of custard apple was found to be promising. In case of flowering, Light pruning (P₂) shows the highest number of flowers per branch and minimum days to flowering and harvesting was taken by control (P₁). Irrigation does not show any significant effect on these parameter except for minimum days to harvesting. Maximum number of fruit per plant, fruit yield (kg/tree), fruit yield per ha (t/ha), were recorded highest in treatment of light pruning (P₂) and double furrow irrigation (I₂) but 'A' graded fruits (kg/ tree) was found maximum for medium pruned (P₃) trees and drip irrigation (I₃). For custard apple maximum market price is fetched for the export quality fruits, more A graded fruits means maximum revenue for farmers, so they should opt medium pruning with drip irrigation.

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