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Effect of severity of pruning and fruit load on graded fruit yield of custard apple

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Abstract

Custard apple (*Annona squamosa* L.) is widely valued as a fresh table fruit, and its pulp is extensively used in high-value products such as ice cream, kulfi, and milkshakes. Flowering and fruit development occur during the rainy season, while harvesting generally takes place from October to November. The plants enter dormancy thereafter, making the crop highly suitable for dryland cultivation because of its hardiness, high yield potential, and contribution to crop diversification and livelihood security. As larger fruits command greater market demand, pruning intensity and fruit load management are important for improving fruit size and quality. Considering these factors, an experiment entitled “Effect of Severity of Pruning and Fruit Load on Graded Fruit Yield of Custard Apple” was conducted during 2019, 2020, and 2021 in a farmer’s field at Dhanaj (Bu), Karanja Taluka, Washim District, Maharashtra. The study aimed to determine the most suitable pruning intensity and fruit-retention level for obtaining a better-quality yield of custard apple.

The experiment consisted of four pruning levels as the main factor: P₁, no pruning (control); P₂, light pruning of branches measuring 3–5 mm in thickness (refill thickness); P₃, medium pruning of branches measuring 6–10 mm in thickness (pencil thickness); and P₄, hard pruning of branches measuring 11–15 mm in thickness (thumb thickness). Five fruit-retention levels were evaluated as sub-factors: T₁, no fruit thinning (control); T₂, retention of up to 100 fruits plant⁻¹; T₃, retention of up to 80 fruits plant⁻¹; T₄, retention of up to 60 fruits plant⁻¹; and T₅, retention of up to 40 fruits plant⁻¹. The experiment was arranged in a split-plot design with three replications. The findings revealed that medium pruning combined with the retention of up to 40 fruits plant⁻¹ produced the highest A- and B-grade fruit yields per plant and per hectare, while recording the lowest C- and D-grade yields. This treatment was followed by the retention of up to 60 fruits plant⁻¹. The highest total soluble solids content was also observed under medium pruning with a fruit load of up to 40 fruits plant⁻¹, followed by a fruit load of up to 60 fruits plant⁻¹.

Keywords: Custard apple; *annona squamosa*; pruning severity; fruit load; fruit thinning; graded fruit yield; fruit quality; total soluble solids; dryland horticulture; fruit size.

Introduction

Custard apple (*Annona squamosa* L.), belonging to the family Annonaceae, has emerged as a high-value commercial fruit crop across arid and semi-arid regions. Celebrated for its delicate flavor, pleasant aroma, and sweet pulp, the fruit is widely consumed fresh as a table fruit and extensively utilized as processed pulp in premium preparations such as ice creams, kulfis, and milkshakes. The tree’s phenology is exceptionally well-suited for rainfed production systems: its flowering and fruit development coincide with the monsoon season, culminating in harvest between October and November. Following harvest, plants enter winter dormancy a natural drought-escape mechanism that enables survival under harsh environmental conditions. This hardy nature, coupled with minimal irrigation requirements, low pest susceptibility, and high yield potential, positions custard apple as an ideal candidate for crop diversification, land rehabilitation, and livelihood security in dryland farming systems. Despite its vast economic potential, a critical challenge facing custard apple growers is fruit size variation and a high proportion of lower-grade fruits. Modern horticultural production increasingly prioritizes consumer-driven commercial quality, where market demand strongly favors larger, premium-grade fruits (“A” and “B” grades) that command significantly higher prices than smaller ones. Optimizing fruit size, physical dimensions, and biochemical attributes such as total soluble solids (TSS) requires a precise balance between vegetative growth and reproductive sink load an equilibrium governed by

Canopy management interventions such as pruning intensity and crop load regulation (Janbandhu *et al.*, 2024)^[11]. Pruning serves as a fundamental management practice to regulate shoot vigor, enhance light interception throughout the canopy, stimulate productive flowering wood, and eliminate dead or crowded branches. However, varying pruning severities ranging from light branch tipping to hard cutting differentially influence the trees assimilate reserves and available fruiting sites. Concurrently, unmanaged heavy fruit set leads to excessive reproductive load, causing severe competition for photosynthates among developing fruits. This overbearing condition reduces individual fruit weight, compromises TSS accumulation, and increases the proportion of unmarketable "C" and "D" grade fruits. Regulating crop load through manual thinning (fruit retention) ensures that adequate metabolic reserves are allocated to individual sinks, thereby driving superior fruit development and market acceptability. While the independent advantages of pruning and fruit thinning are generally acknowledged, standardized empirical information regarding their interaction effect remains limited in custard apple. Therefore, this study was executed to determine the optimal combination of pruning severity and crop load regulation required to maximize high-grade fruit yield, optimize fruit size distribution and enhance overall quality attributes.

Materials and Methods

The experiment was conducted using a split-plot design comprising four pruning intensities and five fruit-retention levels, with each treatment replicated three times. Ten-year-old custard

apple plants were used, and five plants were selected for each treatment. Pruning was carried out during the last week of May at four levels: P₁, no pruning (control); P₂, light pruning of branches measuring 3–5 mm in thickness (refill thickness); P₃, medium pruning of branches measuring 6–10 mm in thickness (pencil thickness); and P₄, hard pruning of branches measuring 11–15 mm in thickness (thumb thickness). Fruit retention was evaluated at five levels: T₁, no fruit thinning (control); T₂, retention of up to 100 fruits plant⁻¹; T₃, retention of up to 80 fruits plant⁻¹; T₄, retention of up to 60 fruits plant⁻¹; and T₅, retention of up to 40 fruits plant⁻¹. All recommended cultural practices for custard apple cultivation were followed at the appropriate stages.

Results

1. Effect of pruning severity and fruit load on grade 'A' fruit yield per plant and per hectare

The data presented in Table 1 indicated that pruning severity significantly influenced grade 'A' fruit yield. Medium pruning produced the highest grade 'A' fruit yield (8.76 kg plant⁻¹), followed by hard pruning (6.76 kg plant⁻¹). In contrast, unpruned plants recorded the lowest yield (3.57 kg plant⁻¹).

Based on the pooled data, retaining up to 40 fruits plant⁻¹ resulted in the highest grade 'A' fruit yield (8.05 kg plant⁻¹), followed by the retention of up to 60 fruits plant⁻¹ (6.30 kg plant⁻¹). The lowest yield (4.23 kg plant⁻¹) was recorded under the no-fruit-thinning treatment. However, the interaction between pruning severity and fruit load had no significant effect on grade 'A' fruit yield.

Table 1: Effect of severity of pruning and fruit load on graded fruit yield plant⁻¹ and per hectare⁻¹

Treatments	Grade 'A' yield plant ⁻¹ (kg)				Grade 'A' yield hectare ⁻¹ (t)			
	2019	2020	2021	Pooled	2019	2020	2021	Pooled
A- Pruning (P)								
P ₁ – Control	2.98 (17.09)	3.91 (19.01)	3.82 (18.05)	3.57 (18.05)	3.31 (17.08)	4.34 (18.99)	4.25 (18.05)	3.96 (12.08)
P ₂ - Light pruning	5.25 (25.61)	6.39 (25.72)	5.44 (23.09)	5.69 (25.14)	5.83 (25.60)	7.10 (25.73)	6.04 (23.09)	6.32 (24.80)
P ₃ - Medium pruning	7.86 (33.44)	9.70 (34.08)	8.74 (35.04)	8.76 (34.18)	8.73 (34.15)	10.77 (34.71)	9.71 (35.04)	9.73 (34.63)
P ₄ - Hard pruning	6.03 (32.44)	6.84 (33.08)	7.41 (33.10)	6.76 (32.87)	6.70 (33.45)	7.60 (34.26)	8.23 (33.10)	7.51 (33.60)
F test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE (m) ±	0.40	0.50	0.30	0.40	0.45	0.40	0.41	0.42
CD at 5%	1.20	1.50	0.90	1.20	1.35	1.20	1.25	1.26
B. Fruit retention (T)								
T ₁ -No thinning (Control)	4.35 (18.71)	3.43 (13.29)	4.91 (20.01)	4.23 (17.33)	4.82 (18.66)	3.81 (13.16)	5.46 (20.01)	4.69 (17.27)
T ₂ - Fruit load up to 100	4.45 (19.87)	5.75 (23.78)	5.63 (25.19)	5.27 (22.94)	4.94 (19.86)	6.38 (22.84)	6.25 (25.19)	5.85 (22.63)
T ₃ - Fruit load up to 80	4.78 (24.28)	5.81 (24.33)	6.32 (30.23)	5.63 (26.28)	5.31 (24.28)	6.45 (24.31)	7.02 (30.23)	6.26 (26.27)
T ₄ - Fruit load up to 60	5.03 (30.05)	6.40 (30.35)	7.49 (37.24)	6.30 (32.58)	5.58 (30.02)	7.11 (30.35)	8.32 (37.24)	6.90 (32.53)
T ₅ - Fruit load up to 40	7.32 (46.62)	8.40 (44.19)	8.45 (43.21)	8.05 (44.67)	8.13 (46.62)	9.33 (44.18)	9.39 (43.21)	8.95 (44.67)
F test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE (m) ±	0.30	0.43	0.28	0.33	0.45	0.40	0.32	0.39
CD at 5%	1.20	1.29	0.89	1.12	1.35	1.20	0.95	1.16
C. (PxT)								
F test	NS	NS	NS	NS	NS	NS	NS	NS
SE (m) ±	0.60	0.86	0.57	0.67	0.89	0.81	0.65	0.78
CD at 5%	-	-	-	-	-	-	-	-

The pooled data presented in Table 1 indicated that pruning severity significantly influenced grade 'A' fruit yield per hectare. Medium pruning produced the highest grade 'A' fruit yield (9.73 t ha⁻¹), followed by hard pruning (7.51 t ha⁻¹). In contrast, unpruned plants recorded the lowest yield (3.96 t ha⁻¹). Regarding fruit load, retaining up to 40 fruits plant⁻¹ resulted in the highest grade 'A' fruit yield (8.95 t ha⁻¹), followed by the retention of up to 60 fruits plant⁻¹ (6.90 t ha⁻¹). The control treatment recorded the lowest grade 'A' fruit yield (4.69 t ha⁻¹). The higher yield obtained under medium pruning may be attributed to the favourable effect of pruning intensity, as moderately pruned plants produced fruits with a greater average weight than lightly pruned plants. These results are consistent with those reported by Bagchi *et al.* (2008)^[6] in guava, Shaban (2009)^[7] in mango,

Mohamed *et al.* (2010)^[9] and Kalpana Choudhary and Dhakare (2018)^[8] in custard apple, and Ghosh and Bera (2014)^[10] in sweet orange.

This improvement may also be associated with the enhanced absorption of water and mobilisation of minerals in the pruned portions of the plant. Similar observations were made by Bruno and Evelyn (2001)^[3] in cherimoya, Adhikari and Kandel (2015)^[4] in guava, and Singh and Bal (2008)^[5] in ber. The increased graded fruit yield of custard apple may also have resulted from the greater plant population under high-density planting. However, heavy cropping reduced the average fruit size and the proportion of extra-large fruits weighing 300–500 g. This observation closely agrees with the findings of Chander and Reju (2019)^[1] in custard apple.

2. Effect of pruning severity and fruit load on grade 'B' fruit yield per plant and per hectare

The data presented in Table 2 revealed that pruning severity significantly affected grade 'B' fruit yield per plant. Medium pruning recorded the highest grade 'B' fruit yield (8.23 kg plant⁻¹), followed by light pruning (6.84 kg plant⁻¹), whereas unpruned plants produced the lowest yield (3.69 kg plant⁻¹).

With respect to fruit retention, retaining up to 40 fruits plant⁻¹ produced the highest grade 'B' fruit yield (6.10 kg plant⁻¹), followed by retaining up to 60 fruits plant⁻¹ (5.43 kg plant⁻¹). The lowest grade 'B' fruit yield (4.09 kg plant⁻¹) was recorded under the no-fruit-thinning treatment. However, the interaction between pruning severity and fruit-retention level had no significant effect on grade 'B' fruit yield. Based on the pooled data, medium pruning resulted in the highest grade 'B' fruit yield per hectare

(9.14 t ha⁻¹), followed by light pruning (7.00 t ha⁻¹). Unpruned plants recorded the lowest grade 'B' fruit yield (4.09 t ha⁻¹). Among the fruit-retention treatments, retaining up to 40 fruits plant⁻¹ produced the highest yield (6.88 t ha⁻¹), followed by retaining up to 60 fruits plant⁻¹ (6.03 t ha⁻¹). The lowest yield (4.45 t ha⁻¹) was observed under the no-thinning treatment.

The results presented in Table 2 demonstrated that trees planted at closer spacing and maintained with fewer fruits produced larger fruits, whereas plants carrying a greater number of fruits produced comparatively smaller fruits. This may be attributed to the absence of fruit thinning in the control treatment, which increased competition among developing fruits for available resources. These findings are consistent with those reported by Meland (2009)^[1] in apple.

Table 2: Effect of severity of pruning and fruit retention on graded fruit yield per plant⁻¹ and hectare⁻¹

Treatments	Grade 'B' yield plant ⁻¹ (kg)				Grade 'B' yield hectare ⁻¹ (t)			
	2019	2020	2021	Pooled	2019	2020	2021	Pooled
A- Pruning (P)								
P ₁ – Control	2.88 (16.51)	3.94 (19.15)	4.25 (20.04)	3.69 (18.56)	3.19 (16.46)	4.37 (19.12)	4.72 (20.04)	4.09 (18.54)
P ₂ - Light pruning	6.20 (30.34)	7.22 (31.07)	7.10 (30.43)	6.84 (30.94)	5.79 (30.26)	7.35 (31.07)	7.88 (30.43)	7.00 (30.25)
P ₃ - Medium pruning	7.78 (33.81)	8.68 (34.08)	8.24 (33.21)	8.23 (32.70)	8.64 (33.80)	9.64 (31.07)	9.15 (33.21)	9.14 (32.69)
P ₄ - Hard pruning	5.21 (28.90)	6.62 (30.98)	6.29 (28.01)	6.04 (29.59)	6.89 (28.91)	6.02 (29.17)	6.99 (28.01)	6.33 (29.69)
F test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE (m) ±	0.13	0.16	0.26	0.18	0.39	0.35	0.34	0.36
CD at 5%	0.40	0.50	0.82	0.57	1.20	1.10	1.05	1.11
B. Fruit retention (T)								
T ₁ -No thinning (Control)	3.70 (15.91)	4.90 (18.99)	3.66 (15.12)	4.09 (16.67)	4.11 (15.91)	5.44 (18.78)	4.09 (15.12)	4.45 (16.60)
T ₂ - Fruit load up to 100	4.20 (18.75)	5.26 (21.75)	4.50 (20.13)	4.65 (20.21)	4.66 (18.73)	5.84 (20.91)	5.00 (20.13)	5.16 (19.92)
T ₃ - Fruit load up to 80	4.51 (22.91)	5.52 (23.12)	4.84 (23.32)	4.95 (23.11)	5.01 (22.91)	6.13 (23.11)	5.38 (23.32)	5.50 (23.11)
T ₄ - Fruit load up to 60	4.82 (28.79)	5.82 (27.60)	5.66 (28.32)	5.43 (28.23)	5.35 (28.78)	6.46 (27.57)	6.29 (28.32)	6.03 (28.22)
T ₅ - Fruit load upto 40	5.51 (35.10)	5.91 (31.10)	6.88 (35.14)	6.10 (33.78)	6.12 (35.48)	6.88 (33.64)	7.64 (35.14)	6.88 (34.75)
F test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE (m) ±	0.10	0.10	0.26	0.15	0.16	0.12	0.23	0.17
CD at 5%	0.29	0.28	0.77	0.44	0.50	0.36	0.68	0.51
C. (PxT)								
F test	NS	NS	NS	NS	NS	NS	NS	NS
SE (m) ±	0.20	0.19	0.51	0.30	0.33	0.25	0.65	0.41
CD at 5%	-	-	-	-	-	-	-	-

3. Effect of pruning severity and fruit load on grade 'C' fruit yield per plant and per hectare

The data presented in Table 3 showed that medium pruning

recorded the significantly lowest grade 'C' fruit yield (4.32 kg plant⁻¹), followed by hard pruning (4.69 kg plant⁻¹).

Table 3: Effect of severity of pruning and fruit retention on graded fruit yield plant⁻¹ and per hectare⁻¹

Treatments	Grade 'C' yield plant ⁻¹ (kg)				Grade 'C' yield ha ⁻¹ (t)			
	2019	2020	2021	Pooled	2019	2020	2021	Pooled
A- Pruning (P)								
P ₁ – Control	4.96 (28.44)	5.90 (26.74)	6.37 (30.12)	5.34 (28.43)	5.51 (28.43)	6.39 (26.74)	7.08 (30.12)	6.32 (28.43)
P ₂ - Light pruning	4.47 (22.91)	5.73 (25.02)	5.91 (25.21)	5.37 (24.38)	5.22 (22.92)	6.37 (23.09)	6.57 (25.21)	6.05 (23.74)
P ₃ - Medium pruning	3.99 (17.34)	4.48 (17.47)	4.49 (18.34)	4.32 (17.71)	4.43 (17.33)	4.97 (17.47)	4.99 (18.34)	4.79 (17.71)
P ₄ - Hard pruning	4.13 (21.93)	5.02 (22.07)	4.94 (22.10)	4.69 (22.03)	4.58 (22.87)	5.58 (24.42)	5.49 (22.10)	5.21 (23.13)
F test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE (m) ±	0.10	0.09	0.14	0.11	0.10	0.15	0.13	0.12
CD at 5%	0.45	0.26	0.43	0.38	0.30	0.45	0.39	0.38
B. Fruit retention (T)								
T ₁ -No thinning (Control)	6.48 (27.87)	7.49 (29.03)	7.86 (32.04)	8.72 (37.51)	7.20 (27.87)	8.32 (29.03)	8.73 (32.04)	8.08 (29.64)
T ₂ - Fruit load up to 100	6.12 (27.32)	6.09 (25.19)	6.08 (27.23)	7.63 (34.06)	6.80 (27.32)	6.76 (24.19)	6.75 (27.23)	6.77 (26.24)
T ₃ - Fruit load up to 80	5.22 (26.51)	6.18 (25.88)	4.63 (22.05)	5.18 (26.31)	5.80 (26.51)	6.86 (25.88)	5.15 (22.05)	5.93 (24.81)
T ₄ - Fruit load up to 60	3.44 (20.55)	4.45 (21.10)	3.24 (16.25)	3.45 (20.61)	3.82 (20.55)	4.94 (21.10)	3.60 (16.25)	4.12 (19.30)
T ₅ - Fruit load up to 40	2.44 (15.54)	3.60 (18.94)	2.36 (12.12)	2.00 (12.74)	1.67 (9.66)	2.27 (11.61)	2.62 (12.12)	2.18 (11.13)
F test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE (m) ±	0.20	0.22	0.20	0.19	0.38	0.45	0.31	0.38
CD at 5%	0.60	0.66	0.60	0.54	1.15	1.35	0.95	1.15
C. (PxT)								
F test	NS	NS	NS	NS	NS	NS	NS	NS
SE (m) ±	0.41	0.45	0.41	0.42	0.77	0.89	0.61	0.75
CD at 5%	-	-	-	-	-	-	-	-

- Unpruned plants recorded the highest grade 'C' fruit yield (5.34 kg plant⁻¹). Regarding fruit retention, retaining up to 40 fruits plant⁻¹ produced the significantly lowest grade 'C' fruit yield (2.80 kg plant⁻¹), followed by retaining up to 60 fruits plant⁻¹ (3.71 kg plant⁻¹). In contrast, the no-thinning treatment recorded the highest grade 'C' fruit yield (7.27 kg plant⁻¹). The interaction between pruning severity and fruit-retention level had no significant effect on grade 'C' fruit yield.

Based on the pooled data, medium pruning produced the lowest grade 'C' fruit yield per hectare (4.79 t ha⁻¹), followed by hard pruning (5.21 t ha⁻¹). The highest grade 'C' fruit yield per hectare

(6.32 t ha⁻¹) was recorded in unpruned plants. Among the fruit-retention treatments, retaining up to 40 fruits plant⁻¹ resulted in the significantly lowest grade 'C' fruit yield (2.18 t ha⁻¹), followed by retaining up to 60 fruits plant⁻¹ (4.12 t ha⁻¹). Conversely, the no-thinning treatment produced the highest grade 'C' fruit yield (8.08 t ha⁻¹).

The greater yield of lower-grade custard apple fruits under wider spacing may be associated with heavy cropping, which reduced the average fruit size and the proportion of larger fruits weighing 200–300 g. This result is in close agreement with the findings of Chander and Reju (2019)^[1] in custard apple.

Table 4: Effect of severity of pruning and fruit retention on graded fruit yield plant⁻¹ and hectare⁻¹

Treatments	Grade 'D' yield plant ⁻¹ (kg)				Grade 'D' yield ha ⁻¹ (t)			
	2019	2020	2021	Pooled	2019	2020	2021	Pooled
A- Pruning (P)								
P ₁ – Control	6.62 (37.96)	7.03 (34.18)	6.80 (32.10)	6.81 (34.74)	7.35 (37.93)	7.81 (34.18)	7.55 (32.10)	7.57 (34.73)
P ₂ - Light pruning	5.57 (27.17)	6.74 (27.13)	5.20 (22.13)	5.83 (25.74)	6.19 (27.18)	7.49 (27.15)	5.78 (22.13)	6.48 (25.48)
P ₃ - Medium pruning	3.88 (16.80)	4.52 (16.18)	3.49 (14.13)	3.96 (15.70)	4.31 (16.86)	5.02 (16.18)	3.88 (14.13)	4.40 (15.72)
P ₄ - Hard pruning	4.05 (22.46)	5.44 (27.11)	3.82 (17.23)	4.43 (22.26)	5.49 (22.42)	6.04 (26.43)	4.24 (17.23)	5.25 (22.02)
F test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE (m) ±	0.19	0.17	0.10	0.15	0.20	0.21	0.11	0.17
CD at 5%	0.55	0.49	0.31	0.45	0.60	0.63	0.33	0.52
B. Fruit retention (T)								
T ₁ -No thinning(Control)	9.98 (38.68)	8.10 (33.12)	8.93 (36.43)	8.72 (37.51)	9.68 (37.48)	11.00 (37.98)	9.00 (33.12)	9.89 (36.19)
T ₂ - Fruit load upto 100	8.08 (33.42)	6.30 (28.34)	7.33 (31.94)	7.63 (34.06)	8.47 (34.04)	8.97 (32.12)	7.00 (28.34)	8.23 (31.50)
T ₃ - Fruit load upto 80	6.37 (26.68)	5.26 (25.25)	5.60 (26.08)	5.18 (26.31)	5.75 (26.29)	7.07 (26.65)	5.85 (25.25)	6.22 (26.06)
T ₄ - Fruit load upto 60	4.42 (20.96)	3.84 (19.56)	3.90 (20.37)	3.45 (20.61)	3.83 (20.60)	4.91 (20.96)	4.27 (19.56)	4.33 (20.37)
T ₅ - Fruit load upto 40	3.00 (15.78)	1.97 (10.24)	2.32 (12.92)	2.00 (12.74)	1.33 (7.73)	1.06 (5.64)	2.18 (10.24)	1.52 (7.87)
F test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE (m) ±	0.16	0.29	0.21	0.19	0.24	0.33	0.35	0.33
CD at 5%	0.46	0.90	0.64	0.54	0.72	0.99	1.05	0.92
C. (PxT)								
F test	NS	NS	NS	NS	NS	NS	NS	NS
SE (m) ±	0.37	0.32	0.57	0.42	0.49	0.67	0.69	0.61
CD at 5%	-	-	-	-	-	-	-	-

4. Effect of pruning severity and fruit load on grade 'D' fruit yield per plant and per hectare

The pooled data presented in Table 4 showed that medium pruning recorded the significantly lowest grade 'D' fruit yield (3.96 kg plant⁻¹), followed by hard pruning (4.43 kg plant⁻¹). In comparison, the highest grade 'D' fruit yield (6.81 kg plant⁻¹) was obtained from unpruned plants. Regarding fruit retention, retaining up to 40 fruits plant⁻¹ resulted in the significantly lowest grade 'D' fruit yield (2.32 kg plant⁻¹), followed by retaining up to 60 fruits plant⁻¹ (3.90 kg plant⁻¹). The no-fruit-thinning treatment produced the highest grade 'D' fruit yield (8.93 kg plant⁻¹). However, the interaction between pruning severity and fruit retention had no significant influence on grade 'D' fruit yield.

The pooled data presented in Table 5 indicated that medium pruning produced the lowest grade 'D' fruit yield per hectare (4.40 t ha⁻¹), followed by hard pruning (5.25 t ha⁻¹). Unpruned plants recorded the highest grade 'D' fruit yield per hectare (7.57 t ha⁻¹). Among the fruit-retention treatments, retaining up to 40 fruits plant⁻¹ resulted in the significantly lowest grade 'D' fruit yield per hectare (1.52 t ha⁻¹), followed by retaining up to 60 fruits plant⁻¹ (4.33 t ha⁻¹). In contrast, the highest grade 'D' fruit yield (9.89 t ha⁻¹) was recorded under the no-thinning treatment. The increased yield of lower-grade custard apple fruits under wider spacing may be attributed to heavy cropping, which reduced the average fruit size and increased the proportion of fruits weighing below 200 g. This finding closely corresponds with the results reported by Chander and Reju (2019)^[1] in custard apple.

Conclusion

The present investigation clearly demonstrates that medium pruning (6–10 mm branch thickness) combined with regulated fruit retention of 40–60 fruits per plant is the most effective strategy for enhancing custard apple yield and quality. This treatment consistently produced the highest proportion of premium-grade fruits (A and B grades), with superior fruit weight and higher total soluble solids (TSS), while simultaneously minimizing the production of lower-grade fruits (C and D grades).

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