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Standardization of plant density through canopy management in custard apple (*Annona squamosa*)

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Abstract
Custard apple can be called as a delicacy of dry region due to its very sweet delicate flesh. It is being cultivated with the recommended spacing of 6 × 6 m across the country. In order to further increase the output, it needs to be evaluated with different spacing under high density planting. Therefore, a experimental trial was conducted during 2020 at Regional Research Station, Aruppukottai, Tamil Nadu, India to evaluate the possibilities of bringing custard under high density planting through canopy management. For this study, renowned custard apple variety APK 1 was taken for study and it was planted at different spacing *viz.*, 6 × 6 m, 6 × 5 m, 6 × 4 m, 6 × 3 m. The morphological and yield parameters were recorded. The results revealed that custard apple cv. APK 1 planted at 6 × 6 m registered an increase in plant height, stem girth, primary branches and plant spread than other high-density planting. Moreover, the yield and yield characters of custard apple revealed that the spacing treatment 6 × 6 m recorded higher single fruit weight (156 g), pulp weight (92.5 g/fruit), yield (24.5 kg/tree), whereas the higher yield per unit area was recorded when spaced 6 × 3 m (11.10 t/ha) compared to other treatments. Based on the results it could be concluded that, custard apple grown under 6 × 6 m plant geometry is well suited, however, still there is possibility for high density planting with compensation on quality of fruits and periodic pruning.

Keywords: Custard apple, APK 1, semi-arid conditions, high density planting, productivity

Introduction
Custard apple (*Annona squamosa* L.) is considered the best dry land fruit crop. It has got pleasant flavor; mild aroma and sweet taste have a universal acceptance. This subtropical fruit tree is distributed in Asia, Africa and the America (Kadam *et al.*, 2018) [4]. Custard apple is grown commercially in West Indies, Florida, Mexico, Brazil, Malaysia, Thailand, Philippines and Egypt. In India the area under custard apple cultivation is about 35000 ha with the production of 271000 MT out of these Maharashtra state contributes 8660 ha area with 59300 MT production (Thorat *et al.*, 2018) [11]. Custard apples are used both in Ayurvedic and Yunani system of medicines (Jamkhande *et al.*, 2017) [2]. Annona squamosa has been utilised as a natural medicine and in various other food applications, e.g., its pulp is utilised as a flavouring agent in ice cream, and 50–80% of custard apple fruit is edible and can be pulped as juice. It contains appreciable vitamin C in the range of 35–42 mg per 100 g, and dietary fibre, vitamin B1 (thiamine), and potassium contents are also notably high. Moreover, custard apple possesses a high pharmaceutical potential for treating cardiac ailments, thyroid-related disorders, diabetes, and cancer (Kumar *et al.*, 2021) [6]. There has been considerable interest in planting orchards under high density planting (HDP) to take advantage of early production and to increase economic returns (Menzel and Le Lagadec, 2017) [7]. Though this tree is suitable for cultivation in dry regions, experiments to enhance the yield have not been conducted so far. For efficient use of horizontal and vertical space, HDP technologies have been developed in Mango (*Mangifera indica* L.), Citrus sp., Papaya (*Carica papaya* L.) and Guava (*Psidium guajava* L.). Further these technologies have to be standardized for arid zone fruit crops namely Custard Apple, Ber (*Zizyphus mauritiana* Lam.), Jamun (*Syzygium cumini* L.) etc., since there is a plenty of scope for arid zone fruits to be grown in semi-arid tracts of Tamil Nadu and standardization of high-density planting techniques in custard apple would be more relevant to increase the productivity.

Materials and Methods
Research on standardization of plant density through canopy management in custard apple was carried out under All India Coordinated Research Project on Arid Zone Fruits (ICAR-AICRP

-AZF) at Regional Research Station, Tamil Nadu Agricultural University, Aruppukottai, Tamil Nadu, India during 2020. The experimental site is located at $9^0$33' N; $78^0$05' E and at an altitude of 102 m above mean sea-level.

This research station caters the needs of the people of semi-arid zones of Southern districts of Tamil Nadu, India. The centre is coming under semi-arid climatic conditions. The annual average rainfall is 770 mm. The soil type is vertisols (Black clay loam soil underlying canker nodules). Soil depth ranged between 0.6 to 1.2 m and received maximum rainfall during North-East Monsoon. The details of the weather data recorded during the course of study is given in Fig. 1.

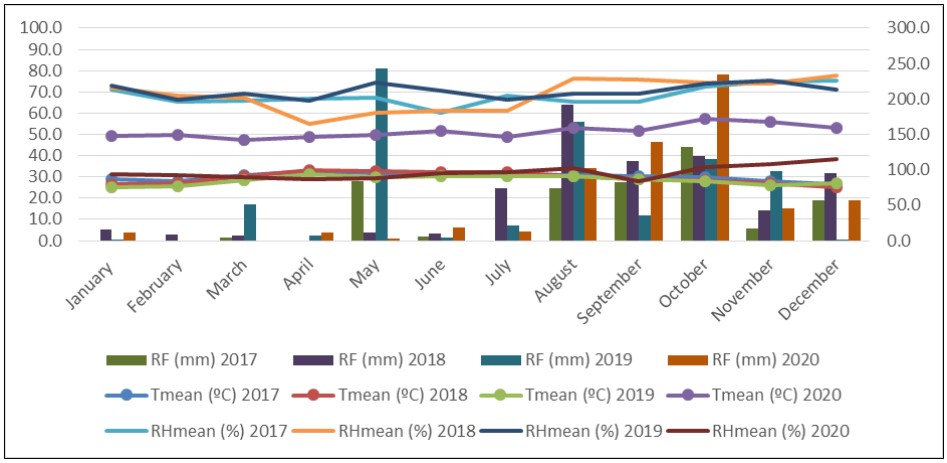

Fig 1: Weather data recorded during 2017-2020 at Regional Research Station, Aruppukottai, Tamil Nadu, India

Custard apple variety APK 1 released from this station was taken for this study. The crop was planted at different spacing *viz.*, 6 × 6 m, 6 × 5 m, 6 × 4 m, 6 × 3 m. The experiment was conducted in randomized block design (RBD) and replicated five times. The morphological parameters *viz.*, plant height (m), plant girth (cm), primary branches (Nos.), secondary branches (Nos.) and plant spread (m) were recorded; similarly biochemical parameters *viz.*, relative water content (RWC; %) as suggested by Weatherley (1950) [12], chlorophyll stability Index (CBI; %) proline content (µg/g fresh weight) and nitrate reductase enzyme activity (NREA; µmol NO_2/g Fr. wt.) were assessed during the experiment period. The yield parameters like single fruit weight (kg), pulp weight (g), total soluble solids (^{0}Brix), yield per plant (kg) and yield/ha (t) were recorded periodically.

Irrigation was provided through drip system. In this experiment uniform dose of manures and fertilizers applied to all the treatments. The recommended dose of fertilizer was FYM: 10 kg, neem cake one kg, N:250 g, P:125 g and K:250 g / tree / year. The fifty per cent of the manures and fertilizers applied during onset of South -West monsoon and remaining fifty per cent applied during North-East monsoon. Two feet away from the base of the trunk, a circular basin was formed around the tree and applied in the basin. Irrigation was given immediately after fertilizer application for effective utilization of the plants. Regular irrigation administrated once in every six days and based on the existing climatic condition. The cultivars were planted at different spacing in a randomized black design having three replications and ten plants in each replication.

Analysis of variance (ANOVA) among the years was performed using Gomez and Gomez (1984). The critical difference (CD) was tested at 5% level of probability to examine differences among the treatment means.

Results and Discussion

The results on morphological parameters of custard apple revealed that the spacing treatment T1 (6 × 6 m) registered highest plant height (1.82 m), plant girth (15.54 cm), primary branches (3.12 no/tree), secondary branches (7.82 no / tree) and plant spread (EW 0.84 m and NS 0.75 m) than other spacing treatments (Table 1). This might be due to higher nutritional availability in the soil under wider plant spacings. These findings are in line with earlier reports of Ram *et al.* (1996) [9].

The drought tolerant traits of custard apple revealed that planting at 6 × 6 m recorded more RWC (81.84%), CSI (72.04%), proline content (74.28 µg/g Fr. wt.**)** and NREA (294.12 µmol NO_2/g Fr. wt.) and was followed by spacing at 6 × 5 m recorded RWC (81.42%), CSI (71.16%), proline content (72.40 µg/g Fr. wt.**)** and NREA (282.18 µmol NO_2/g Fr. wt.) (Table 2).

Table 1: Morphological parameters and yield attributes of custard apple under HDP

Treatments	Plant height (m)	Plant Girth (cm)	Primary branches (No./tree)	Secondary branches (No./tree)	Plant spread (m)		Single Fruit Weight (g)	Pulp weight (g/fruit)	TSS (ºBrix)
					EW	NS			
T1 - 6 × 6 m	1.82	15.54	3.12	7.82	0.84	0.75	156.0	92.5	22.0
T2 - 6 × 5 m	1.61	13.08	2.46	7.08	0.80	0.86	147.0	89.0	21.0
T3 - 6 × 4 m	1.50	11.90	2.30	6.82	0.69	0.62	140.0	87.1	19.5
T4 - 6 × 3 m	1.29	10.12	2.11	7.76	0.70	0.58	139.1	85.0	19.5
S.Em±	0.15	0.43	0.28	0.20	0.13	0.11	0.06	0.04	0.06
CD (P=0.05)	0.44	1.32	0.83	0.56	0.34	0.34	0.16	0.13	0.20

Table 2: Drought tolerant traits and yield of custard apple under HDP

Treatments	RWC (%)	CSI (%)	Proline (µg/g Fr. wt)	N Rase activity (µmol NO_2/g Fr. wt.)	Yield (kg/tree)	Yield (t/ha)
T1 - 6 × 6 m	81.84	72.04	74.28	294.12	24.5	6.79
T2 - 6 × 5 m	81.42	71.16	72.40	282.18	22.0	7.33
T3 - 6 × 4 m	80.68	70.40	71.82	276.84	20.2	8.40
T4 - 6 × 3 m	80.52	70.12	70.64	271.58	20.0	11.10
S.Em±	0.56	0.44	0.45	1.56	0.02	0.74
CD (P=0.05)	1.54	1.02	1.32	4.16	0.07	2.09

The yield and yield characters of custard apple revealed that in favour of 6 × 6 m planting which recorded higher single fruit weight (156 g), pulp weight (92.5 g/fruit), total soluble solids (22.0 ^{0}brix**)** with fruit yield of 24.5 kg/tree. Whereas, lower single fruit weight (139.1g), pulp weight (85.0 g/fruit), total soluble solids (19.5.0 ^{0}brix**)** and yield (20.0 kg/tree) was recorded in the HDP at 6 × 3 m. The fruit yield per tree was recorded slightly higher under normal density, as the competition for nutrition, better light penetration (Singh *et al.*, 2009) [5] as compared to higher density planting which significantly reduced the yield and overall performance. The results are in agreement with the findings of Yogesh *et al.* (2016) [13].

Plant spacing of 6 × 3 m recorded with increase in yield per unit area (11.10 t/ha) compared to other spacing treatments (Table 3). The greater number of plants per unit area might have resulted in a greater number of fruit/plant and higher productivity (kg/ha). These results are similar to those reported earlier by Nath *et al.* (2007) [8]. In addition, annual light pruning is highly essential under HDP which takes a long time to recover the initial costs of establishing and maintaining the orchard (Kumar, 2019) [5]. Due care to be for HDP as it soon begins to crowd and shade each other and the production tends to fall.

Conclusion

Based on the results it could be concluded that, custard apple grown under 6 × 6 m plant geometry is well suited, however, still there is possibility for increasing the productivity through high density planting upto 6 × 3 m but with compensation on fruit quality and nutritional characters. Moreover, periodic pruning is inevitable to control vegetative growth on flower initiation. Further, triangular plant geometries can be evaluated for effective utilization of space and increase the overall productivity without compensating the quality and nutritional aspects.

References

1. Anonymous. Area and Production of Horticulture Crops in India. Indian Horticulture Database, National Horticulture Board. 2016.
2. Jamkhande PG, Ajgunde BR, Jadge DR. Annona cherimola Mill. (*Custard apple*): A review on its plant profile, nutritional values, traditional claims and ethnomedicinal properties. Oriental Pharmacy and Experimental Medicine. 2017;17(3):189-201.
3. Gomez KA, Gomez AA. Statistical procedures for agricultural research. John wiley & sons. 1984.
4. Kadam SR, Dheware RM, Urade PS. Effect of different levels of pruning on quality of custard apple (*Annona squmosa* L.). International Journal of Bio-resource and Stress Management. 2018;9(5):573-575.
5. Kumar N. High Density Planting in Mango-Prospects and Problems. Adv Agri Res Technol J. 2019;3:47-53.
6. Kumar M, Changan S, Tomar M, Prajapati U, Saurabh V, Hasan M, Mekhemar M. Custard apple (*Annona squamosa* L.) leaves: nutritional composition, phytochemical profile, and health-promoting biological activities. Biomolecules. 2021;11(5):614.
7. Menzel CM, Le Lagadec MD. Can the productivity of mango orchards be increased by using high-density plantings?. Scientia Horticulturae. 2017;219:222-263.
8. Nath V, Das B, Rai M. Standardization of highdensity planting in mango (*Mangifera indica*) under sub humid alfisols of eastern India. Ind. J Agril., Sci. 2007;77:3-7
9. Ram S, Singh CP, Kumar S. Success story of high density orcharding in mango. Proceeding of the 5th International Mango Symposium. Acta Hort. 1996;55:375-382.
10. Singh SK, Singh SK, Sharma RR, Srivastav M. Effect of pruning on morpho-physiological parameters and microclimate under high density planting of mango (Mangifera indica). 2009.
11. Thorat UK, Dheware RM, Jadhav AR. Influence of growth regulators on yield and economics of custard apple (*Annona squamosa* L.) Cv. balanagar. International Journal of Economic Plants. 2018;5(3):149-150.
12. Weatherley PE. Studies in water relation of cotton plants. I. Field measurement of water deficits in leaves. New Phytologists. 1950;49:81–7.
13. Yogesh prasad Rajbhar, Singh SD, Mohan Lal, Gopal Singh, Rawat PL. Performance of high density planting of mango (*Mangifera indica* L.) under mid-western plain zone of Uttar Pradesh. International Journal of Agricultural Sciences. 2016;12(2):298-301.