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RESEARCH ARTICLE

Multiplication and evaluation of promising jackfruit genotypes

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Abstract

The results of the study conducted on Multiplication and Evaluation of Identified Elite Jackfruit *(Artocarpus heterophyllus* Lam.)" genotypes from 2020 -2022. The genotypes *viz*., KDM-Ah-8, KDM-Ah-10 and KDM-Ah- 46 were grafted through softwood and inarch grafting. The success percentage varied from softwood grafting to approach grafting. Among the grafting techniques, softwood grafting recorded the highest success of 40 percent in the genotype KDM-AhJ-08. Meanwhile, 90 percent success was recorded in the genotype KDM-AhJ-08 under approach grafting. Three identified elite jackfruit genotypes, KDM-AhJ-08, KDM-AhJ-10 and KDM-AhJ-46, were planted along with check varieties *viz*., PLR1, PLR2, red-fleshed jackfruit Siddu and Shankara. The highest tree height of 2.40 m was recorded in the genotype KDM -AhJ-8 and the lowest plant height of 1.70 m was recorded in the genotype Shankara red flesh. The highest stem girth of 32 cm was recorded in the genotype KDM-AhJ-08 and the lowest stem girth of 20.00 cm was recorded in the genotype Shankara red flesh. The highest plant circumference of 3.00 m was recorded in the genotype KDM-AhJ-08 and the least of (1.00 m) was recorded in the genotype Shankara red flesh. The highest number of primary branches of 6 was obtained in the genotype KDM -AhJ-08 and the lowest was obtained from the Siddu red flesh (3 Nos.). The highest number of secondary branches, 16, was recorded in the genotype KDM-AhJ-08 and the lowest number of 6 was obtained from the genotype Siddu red flesh. The genotype Shankara red flesh recorded the highest leaf length of 19 cm and the lowest leaf length of 14 cm was recorded in the genotype KDM-AhJ-08. The highest leaf breadth of 10.10 cm was obtained from the varieties PLR1 and Shankara red flesh and the lowest of 7.60 cm was recorded in the genotype Siddu red flesh.

Keywords

Approach grafting; *Artocarpus heterophyllus* (Ah); inarch grafting; Jackfruit, (J);KDM (Kudumiyanmali); softwood grafting

Introduction

Jack (*Artocarpus heterophyllus*, Lam) is an indigenous fruit belonging to the family Moraceae and is very popular in the rural areas of India. It is an evergreen tree growing well in areas receiving annual rainfall of more than 1,200 mm (1) and is widely cultivated in eastern and southern regions of India. In south India, the jack is a popular food, ranking next to the mango and banana in total annual production.

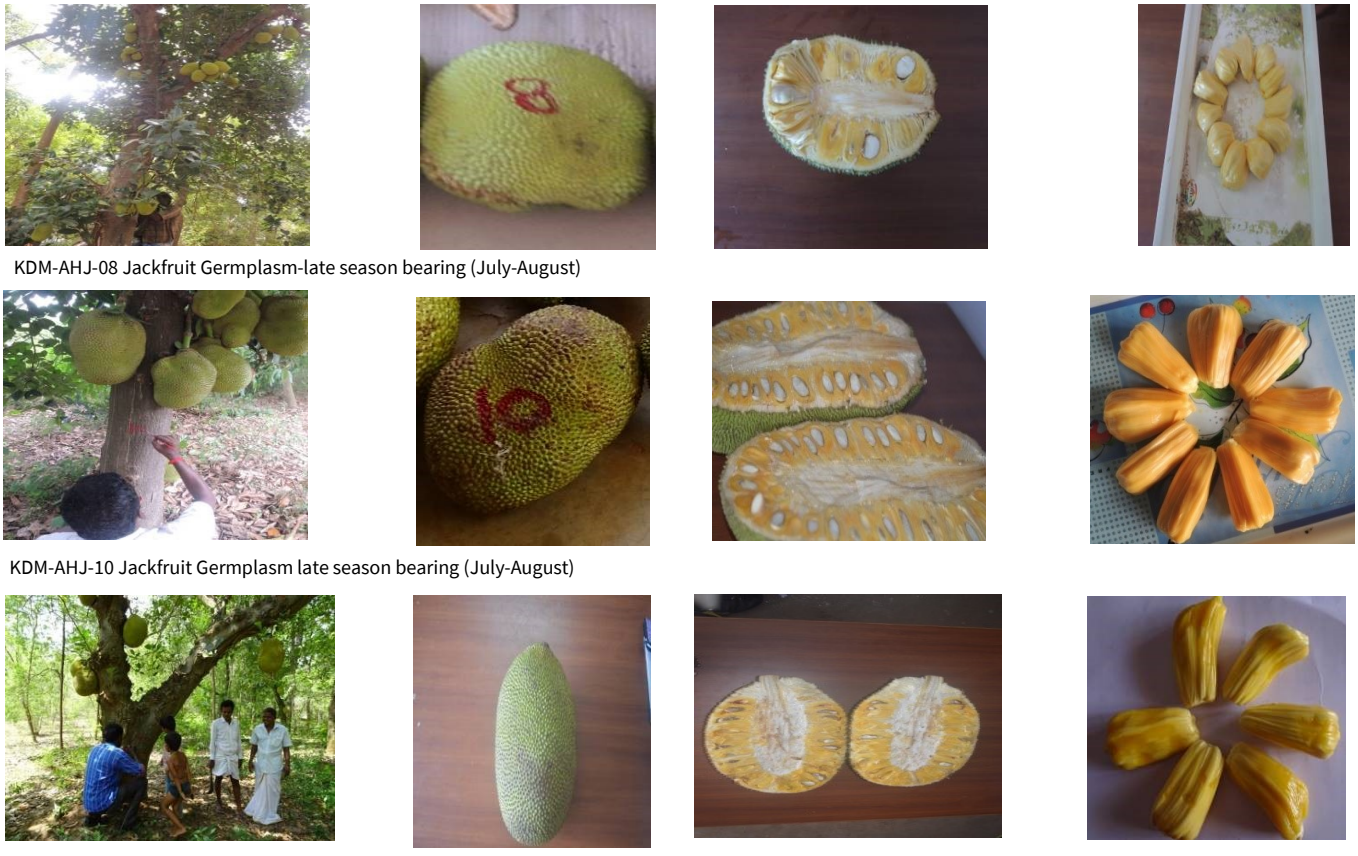
In Bangladesh, it is commonly called "poor man's food" (2) as it is cheap and plentiful during the season. Varietal improvement in jackfruit is limited to selecting high-yielding, better-quality genotypes. Several authors

(-3,4) have reported selecting desirable types through germplasm characterization and evaluation. The plants produced from seeds are quite different in size, shape, and quality and weigh up to 50 kg (5). Variation also exists in density, size and shape of spines on the rind, fruit-bearing sensory quality, flesh types, sweetness, flavour and taste (6). In India, jackfruit production is mainly found in Bihar, West Bengal, Uttar Pradesh, Assam, Orissa, Kerela and Tamil Nadu. In Tamil Nadu, jackfruit cultivation is primarily concentrated in Cuddalore, Kanyakumari, Dindigul, Ariyalur, Thanjavur and Pudukkottai districts. The farmers are growing the local varieties without knowing their cultivation practices, selection of planting materials, mostly seedling progenies, production and productivity. Sometimes, unknowingly, the farmers choose the poor-yielding seedling progenies and cannot get a good yield. The high fruit yield does not guarantee marketability if consumers do not like the produce. This will contribute to fruit dumping later. Because the characteristics of jackfruit vary according to its variety (3), the study of consumer acceptance of jackfruit's characteristics is critical to growers and marketers during their decision-making process (7).

The high fruit yield does not guarantee marketability if consumers do not like the produce. Because the characteristics of jackfruit vary according to its variety (3), to overcome this, there is an urgent need to identify the best variety suitable for this region to improve the income of the jack farmers. Hence, fifty-five jack genotypes were evaluated, viz., KDM-AhJ-01 to KDM-AhJ-55. Among the 55 genotypes, three were identified as promising based on the yield and quality characters (Fig.1.). The result obtained in this study identified the suitable variety for small families (Fig.2.). Among the various constraints for expanding the jack fruit cultivation, lack of availability of suitable clonal planting materials is one of the impediments to increasing the area of cultivation. Though seed propagation is the most common method, it will not produce true-to-type progenies besides having a more extended gestation period. Hence, the vegetative propagation technique is a prerequisite for successful cultivation. Thus, promising genotypes *viz*., KDM-AhJ-8, KDM-AhJ-10 and KDM-AhJ-46 (Table 1) were propagated through softwood grafting and approach grafting. The experiment was conducted at Agricultural College and Research station, Kudumiyanmalai, to comprised of seven treatments T1- KDM-AhJ-08, T2- KDM-AhJ-10, T3- KDM-AhJ-46, T4- PLR1, T5-PLR2, T6- red fleshed Siddu, T-7 red fleshed Shankara with four replications to assess the variation in growth characters of elite jackfruit genotypes and check varieties.

Materials and Methods

The experiment trial was conducted at AC&RI, Kudumiyanmalai, from January 2020 to December 2022. The jackfruit seeds were collected and sown immediately after separation from the pulp as they were recalcitrant. After six months of sowing, these plants were used as the rootstocks for softwood grafting. The experimental design was completely randomized (CRD) with nine replications and three treatments (KDM-AhJ-08, KDM-AhJ-10 and KDM-AhJ-46).



KDM-AHJ-08 Jackfruit Germplasm-late season bearing (July-August)

KDM-AHJ-10 Jackfruit Germplasm late season bearing (July-August)

KDM-AHJ-10 Jackfruit Germplasm late season bearing (July-August)

Fig .1. Three promising genotypes

KDM-AHJ-08 Jackfruit Germplasm

Fig. 2. Small-sized fruit suitable for small families

Material required: Jackfruit seedling (rootstock), Jackfruit scion, Polythene bag of size 25 x10 cm and 300-gauge, Polythene strip of 30 cm length, 2 cm breadth and secateurs and knife.

The six months old healthy rootstocks were selected for grafting. After the selection of rootstock, the tip was decapitated. The softwood stock was split vertically in a cleft, which appeared like a fork or the letter "V" to a length of 4-5 cm in a down word direction with a sharp knife. Scion stick girth was matched with the girth of rootstock and a gently sloping wedge cut of about 5 cm. A prepared wedge-shaped scion was slowly inserted into the "V" shaped opened slit of rootstock. The stock and scion were kept in close contact and the union was wrapped with 200-gauge transparent, stretchable polythene strips of 1.5 cm width and 40 cm length. The poly cap then covered the scions to increase the humidity and avoid desiccation. Every replication of the individual treatments had ten grafts each. Five grafts were selected randomly from each replication of the particular treatments for recording observations. The percent of graft success was recorded 90 days after grafting by formula and expressed in percentage.

$$\text{Grafting success (\%)} = \frac{\text{Number of successful grafts}}{\text{Total number of grafts}} \times 100$$

Softwood grafted plants were established (mother block) at AC&RI, Kudumiyanmalai and mass multiplication through approach grafting (Fig.4.) and (Table 2) was done from (mother block) softwood grafted plants. Progress made so far: three identified elite jackfruit genotypes, KDM-AhJ-08, KDM-AhJ-10 and KDM-AhJ-46, were multiplied and planted along with check varieties *viz*., PLR1, PLR2, red-fleshed jackfruit Siddu and Shankara. The experiment was carried out by Randomized Block Design (RBD) comprised of seven treatments: T1- KDM-AhJ-08, T2- KDM-AhJ-10, T3- KDM-AhJ-46, T4- PLR1, T5-PLR2, T6- red-fleshed Siddu, T-7 red fleshed Shankara with four replications. Assess the variation in growth characters of elite jackfruit genotypes and check varieties.

The growth parameters, *viz*., tree height (m), trunk girth (cm), plant circumference (m), number of primary branches, number of secondary branches, leaf length (cm) and leaf breadth (cm) (Table 2) were recorded. The compiled data were analyzed for measuring range, mean, standard deviation (SD), standard error of the mean (SE) and coefficient of variance (CV %) using Agres).

Tree height

The tree's height was recorded from the base to the topmost branching site and expressed in meters (m).

Trunk girth

Trunk girth was recorded 50 cm above ground level and expressed in centimetres (cm).

Tree circumference

Tree circumference was measured as the mean diameter using two directions (North-South and East-West) and expressed in meters (m).

Number of primary branches

The number of primary branches was recorded from the main stem (Nos.)

Number of secondary branches

The number of secondary branches was recorded from the primary branches (Nos.)

Leaf blade length

The length of the leaf blade was recorded from the base to the tip of the leaf and expressed in centimetres (cm).

3.3.2. Leaf blade width

The width of the leaf blade was recorded at the widest point of the leaf and expressed in centimetres (cm).

Results and Discussion

According to the International Plant Genetic Resources Institute (8), morphological variation among jackfruit trees was recorded using the jackfruit descriptor. The growth and vegetative characteristics of jackfruit were measured using the descriptors. The growth of characters was measured by observation.

Softwood grafting

The graft success significantly differed among the different genotypes (Table 1). The highest graft success was recorded in the genotype KDM-AhJ-08 (40 percent), and the lowest was found in the genotype KDM-AhJ-46 (25 percent) Fig.3. Similarly, in mango, Khader showed the highest percentage of graft success at 75.50 percent (9). Among the 23 sapota cultivars tried, cricket Ball, PKM-2, Kalipatti and Long Oval had shown less response to softwood grafting as against the highest response to the same by Kirthi barthi, Mohangootee, Murabha and Pala (10). Among the three varieties of scion in mango, *viz.*, BARI

Aam-1, BARI Aam-3 and Langra, the number of leaves ranged from 9.20 in 'BARI Aam-1' to 12.88 in 'Langra' (11). The better union of stock and scion in KDM-AhJ-08 in the present study might have quickly supplied the required nutritional quantity to the grafts for better growth. The variation also might be due to the difference in endogenous substances such as phenols and latex. The presence of more latex and the hardiness of rootstock affects the graft union process, resulting in the highest number of days to complete sprouting (12). The difference in cell division and differentiation capacity in the different jackfruit genotypes might have happened due to the varied growth in meristematic cells coupled with physiological processes like photosynthesis and respiration (13). The difference in the number of nodes and absorption of leaf primordia also might have caused the variation in the number of sprouts. Early callus formation from the rootstock component produces good union and helps deliver a more significant number of sprouts (14).

The scion's maturity is another crucial factor in deciding the success of grafting in any fruit crop. More success in a shorter period could be recorded with the softwood scion than the hardwood scion. This contradicts other fruit crops like mango (15) and Cashew (16), where relatively matured scion had more graft success. This variation may be attributed to the latex-yielding nature of jack trees, where more latex exudates in hardwood scions than softwood ones. Further, latex contains phenols, which are known to interfere with auxin synthesis (17).

Approach/Inarch grafting

Inarching is a method whereby two plants are made to unite while growing on their roots (Fig.4.). Among the genotypes, the highest success of (90 percent) was recorded in the genotype KDM-AhJ-08, and the lowest was found in KDM-AhJ-46, (75 percent) Table 1. The decreasing trends of survival percentage noticed towards the cooler month might be attributed to the reduced rate of division of cambial cells, their differentiation and consequent development in the healing of stock-scion union due to the decrease in the synthesis of endogenous auxins and mobilization of reserve food materials as a result of reduced activity of hydrolyzing enzymes. A reduction in the activity of hydrolyzing enzymes at low temperatures has been reported (18). On the other hand, the highest survival rate of inarching might be attributed to the optimum temperature and high humidity that prevailed during this period. This resulted in the successful union of cambium layers of stock and scion, early callus formation and initiation of subsequent growth (19).

In inarching, a significant difference was observed in the highest of 90 percent success due to the effect of the stock scion relationship (Table 1). A possible reason for the highest percentage of success in the present study might be due to the better production of assimilates for vegetative growth and optimum temperature, sufficient sunlight, high relative humidity and ensured water availability, which had increased the rate of photosynthesis and led to the formation of more food materials that facilitated and improved the growth and development of the shoot (20). On the other hand, the lowest percentage of success was recorded, which might be due to the high temperature and lower humidity as well as severe winter resulting in a reduced growth rate of inarched plants. The highest percentage of success may be due to favourable climatic conditions during monsoon helped in faster growths, which act positively on the rootstock and scion shoot, which might have happened due to the longer time available for development in meristematic cells coupled with a better physiological process such as photosynthesis and lower respiration (21), highest photosynthetic activity leading to the formation of more food material that facilitates the increase in girth of grafts. This might also be due to the prevailing ideal temperature and relative humidity congenial for plant activity, which had resulted in increased sprouts with more meristematic activity and early healing of graft union.

Further, it can also be due to the presence of enough carbohydrates and other food material (as a large scion is used) in the scion and rootstock and the accumulated food material is mobilized for new growth, which in turn leads high meristematic activity in the scion to a higher number of branches (21). The highest number of sprouts when grafting was performed in "Khasi" mandarin (22) and the operation time significantly affected the production of a mean number of leaves. The highest number of leaves might be due to the photosynthetic accumulation in newly grafted plants, which increased the number of nodes and absorption of nodes and nutrients by leaf primordial. Water is one of the driving forces for cell elongation and multiplication and the grafting operation done during summer and early monsoon periods got favourable soil moisture, humidity, and temperature, which showed a favourable effect on the number of leaves on scion (21) and in jamun and mango (9). This might be due to the development of more sprouts, more meristematic activity and better healing of grafts. The reason behind the poor vegetative growth in January was mainly due to the plants being less exposed to sunlight as a result of cloudy weather and severe winter observed during this month, which adversely affected the photosynthesis in plants by stomata closing in mesophyll cells, thereby resulting in less vegetative growth.

Table 1. Percentage of success of softwood grafting and approach grafting of different jackfruit genotypes

Genotypes/ Varieties	Percentage of success (%)	
	Softwood Grafting	Approach Grafting
KDM-AhJ-08	40	90
KDM-AhJ-10	30	80
KDM-AhJ-46	25	75
Grand mean	31.66	81.66
SEd =	0.47	2.37
CD(.05)=	1.31	6.59
CV% =	1.84	3.56

Rootstock

Softwood grafting of jackfruit was done in March 2019, July 2019 and November 2019

Success of grafted plants

Fig.3. Softwood grafting of jackfruit

Approach grafting of jackfruit

Success of approach grafted plants.

Fig.4. Approach grafting of jackfruit

Growth characters

The experiment was carried out by Randomized Block Design (RBD) comprised of seven treatments T1- KDM-AhJ-08, T2- KDM-AhJ-10, T3- KDM-AhJ-46, T4- PLR1, T5-PLR2, T6- red fleshed Siddu, T-7 red fleshed Shankara with four replications (Fig.5.) Assess the variation in growth characters of elite jackfruit genotypes and check varieties.

Plant height

Among the genotypes, plant height ranged from 1.70 m to 2.40 m, and the lowest plant height, 1.70 m, was recorded in Shankara red flesh, followed by Siddu red flesh and PLR2. However, the maximum tree height of 2.40 m was recorded in KDM -AhJ-8 (Table 2). The variation reported in tree height may be due to the difference in age of the tree, different genetic characteristics of the genotypes, plant physiological and soil nutrient status (23) and among the jackfruit trees who recorded that the tree height ranged from 10.94 to 23.64m and 6.5 to 16m respectively. The coefficient of variation of tree height was 23.17%. (24).

Stem girth

A maximum stem girth of 32 cm was recorded in KDM-AhJ-08 and a minimum stem girth of 20.00cm was recorded in Shankara red flesh (Table 2). The present results conform to the findings of (23) and (25)

Plant circumference

The highest plant circumference of 3.00 m was recorded in the genotype KDM-AhJ-08 and the lowest in Shankara red flesh (Table 2). Similar findings of variations in tree growth habits from erect, semi-erect and spreading were also recorded by Wangchu (26). The yield of jackfruit trees increases with the tree trunk girth of the plant. Higher stem circumference gives better support for the main branches and indirectly reflects the vigour of trees; bearing more fruits leads to higher yield. The lower the trunk height with spreading nature, the greater the number of fruits per tree due to more primary and secondary branches. Similar variability was reported by Muthulakshmi (27) in jackfruit.

Number of primary and secondary branches (Nos.)

A maximum number of primary branches of 6 was obtained in the genotype KDM-AhJ-08, and the lowest was obtained from Siddu red flesh. The highest number of secondary branches, 16, was recorded in the genotype KDM-AhJ-08 and the lowest number of 6 was obtained from the genotype Siddu red flesh (Table 2). A similar variation in branching pattern was recorded by (23) in 34 jackfruit accessions in Tamil Nadu.

Leaf length (cm)

A maximum leaf length of 19 cm was recorded in the genotype Shankara red flesh and a minimum leaf length of 14 cm was recorded in the genotype KDM-AhJ-08 (Table 2). Similar variation in leaf length was observed by (23). The variation in leaf length might be a genetic character among the jackfruit accessions and may also be attributed to varying microclimates.

Leaf breadth (cm)

The highest leaf breadth of 10.10 cm was obtained from PLR1 and Shankara red flesh and the lowest of 7.60 cm was recorded in the genotype Siddu red flesh (Table 2). The results conform to the findings of (23). The variation in leaf width might be due to the different genetic makeup of the jackfruit accessions.

Previous data of three promising jack plus tree

The lowest plant height of 7.50 m was recorded by the genotype KDM -Ah-10. However, the highest tree height of 8.10 m was recorded by the genotype KDM -Ah-8. The genotype KDM recorded the highest trunk girth of 100 cm -Ah-46 and the lowest stem girth of 75.00 cm was recorded by the genotype KDM -Ah-8. The highest canopy spread (E-W) of 3.60 m and (N-S) of 3.50 m was recorded by the genotype KDM -Ah-46 and the lowest canopy spread (E-W) 3.00 m and (N-S) 3.20 m was recorded by KDM -Ah-8. Fruit sets were found from November to December and fruit harvests were recorded from March to June for all the genotypes (Table 3). Similar variability was reported by Muthulakshmi (27-30) in jackfruit.

Table 2. Growth characters of identified elite jackfruit genotypes, along with check varieties

Genotypes /Varieties	Plant height (m)	Stem girth (cm)	Plant circumference (m)	Number of primary branches	Number of secondary branches	Leaf length (cm)	Leaf Breadth (cm)
KDM-AhJ-08	2.40	32	3.00	6	16	14	8.00
KDM-AhJ-10	1.90	24	2.50	5	10	15	8.50
KDM-AhJ-46	2.10	28	2.20	5	12	15	8.30
PLR1	1.90	24	2.00	3	10	15	10.10
PLR 2	1.80	23	1.70	4	12	16	8.10
Siddu red flesh	1.80	24	1.10	3	6	14	7.60
Shankara red flesh	1.70	20	1.00	4	10	19	10.10
Grand mean	1.94	24.99	1.92	4.28	10.85	15.42	8.67
SEd =	0.03	0.62	0.04	0.08	0.24	0.31	0.19
CD(.05) =	0.07	1.35	0.08	0.18	0.54	0.68	0.41
CV% =	2.18	3.04	2.56	2.40	2.80	2.49	2.71

Field view

KDM-AHJ-08

KDM-AHJ-10

KDM-AHJ-46

PLR 1

PLR2

SIDDU(Red flesh)

SHANKARA (Red flesh)

Fig.5. Field view

Table 3. Morphological characters of promising jackfruit genotypes (2018-2019)

S.No.	Acc.No.	Tree height (m)	Trunk girth (cm)	Canopy spread (m) (E-W) and (N-S)		Month of flowering	Month of harvest
				(E-W)	(N-S)		
1	KDM-Ah-8	8.10	75	3.00	3.20	November-December	March-June
2	KDM-Ah-10	7.50	76	3.40	3.50	November -December	March-June
3	KDM-Ah-46	7.60	100	3.60	3.50	November-December	March-June
	Grand mean	7.73	83.66	3.33	3.40	-	-
	SEd =	0.20	0.06	0.03	0.02	-	-
	CD(P=0.05)	0.56	3.47	0.18	0.06	-	-
	CV% =	3.25	1.83	2.42	0.78	-	-

Growth characters

Leaf characters

Among the genotypes, the highest leaf length of 24 c m was recorded by the genotype KDM -Ah-8, and the lowest leaf length of 20 cm was recorded by KDM -Ah 46. The genotype KDM recorded the highest leaf width of 11.50 cm -Ah-8 and the minimum leaf width of 7.00 cm was recorded by the genotype KDM -Ah-46. The genotype KDM recorded the highest petiole length of 5.50cm -Ah-8, and the lowest petiole length of 2.00 cm was recorded by the genotype KDM -Ah-46 (Table 4).

Table 4. Leaf length, leaf width and petiole length of promising jackfruit genotypes (2018-2019)

S.No.	Acc.No.	Leaf length (cm)	Leaf width (cm)	Petiole length (cm)
1	KDM-Ah-8	24.00	11.50	5.50
2	KDM-Ah-10	22.00	11.00	3.00
3	KDM-Ah-46	20.00	7.00	2.00
	Grand mean	22.00	9.83	3.50
	SEd =	0.39	0.16	0.07
	CD(P=0.05)	1.10	0.45	0.22
	CV% =	2.22	2.06	2.78

Yield characters

Among the genotypes, the highest number of fruits, 50 per tree, was recorded by KDM-Ah-8 and the lowest of 40 per tree was recorded by the genotype KDM-Ah-10. The highest fruit weight of 18 kg was recorded by the genotype KDM-Ah-46, followed by the genotype KDM-Ah-10 (16 kg) and the genotype KDM-Ah-8 recorded the lowest of 7 kg. The highest fruit yield of 810 kg/tree was recorded by the genotype KDM-Ah-46 and the lowest of 350kg /tree was recorded by the genotype KDM-Ah-8. The shape of the fruit varied from round, slender and oval. The genotype KDM-Ah-46 recorded the highest fruit length of 45 cm and the lowest of 26 cm was recorded by the genotype KDM-Ah-8. The genotype KDM-Ah-46 recorded the highest fruit diameter of 57cm and the lowest of 32 cm was recorded by the genotype KDM-Ah-8. The flake's colour varied from bright yellow to light yellow and white. The genotypes KDM-Ah-10 recorded a bright yellow colour and the genotypes KDM-Ah-Ah-8 and KDM-Ah-46 observed a light yellow (Table 5). Similar variations in yield per tree per year were reported (31-33).

Yield and quality characters

The highest fruit rind of 5.00 kg was recorded by the genotype KDM-Ah-10 and the genotype KDM-Ah-8 recorded the lowest of 3kg. The highest number of flakes per fruit was recorded by the genotype KDM-Ah-46 (210 numbers) and the genotype KDM-Ah-8 recorded the lowest of 75 numbers. The highest weight of flakes per fruit (13.60 kg) was recorded by the genotype KDM-Ah-46 and the lowest of 5.00 kg was recorded by the genotype KDM-Ah-8. The highest weight of individual flakes with seed (83g) was recorded by the genotype KDM-Ah-10 and the genotype KDM-Ah-8 recorded the lowest of 53 g. The highest weight of individual flakes without seed (70g) was recorded by the genotype KDM-Ah-10 and the genotype KDM-Ah-8 recorded the lowest of 43 g. The highest seed weight (13 g) was recorded by the genotype KDM-Ah-10 and the genotype KDM-Ah-8 recorded the lowest of 10 g. The highest Flakes: Seed ratio of 5.3 was recorded by the genotype KDM-Ah-10 and the lowest of 4.30 was recorded by the genotype KDM-Ah-8 (Table 6). Aseef (30) reported a similar result.

Table 5. Yield characters of promising jackfruit genotypes (2018-2019)

S. No.	Acc. No.	No.of fruits /tree	Individual fruit weight (kg)	Yield / tree(kg)	Fruit shape	Fruit Length (cm)	Fruit diameter (cm)	Flakes colour
1	KDM-Ah-8	50.00	7.00	350.0	Slender	26.00	32.00	Light yellow
2	KDM-Ah-10	40.00	16.00	640.0	Slender	40.00	50.00	Bright Yellow
3	KDM-Ah-46	45.00	18.00	810.0	Slender	45.00	57.00	Light Yellow
	Grand mean	45.00	13.66	600.0		37.00	46.33	-
	SEd =	0.77	0.27	12.73		0.65	0.87	-
	CD(P=0.05)	2.14	0.75	35.35		1.81	2.42	-
	CV% =	2.10	2.43	2.60		2.16	2.31	-

Table 6. Yield and quality characters of promising jackfruit genotypes (2018-2019)

S.No.	Acc.No.	Individual fruit weight (kg)	Fruit rind weight (kg)	No.of flakes per fruit	Total weight of flakes per fruit (kg)	Weight of individual flake with seed (g)	Weight of individual flake without seed (g)	Seed weight (g)	Flakes: seed ratio
1	KDM-Ah-8	7	3	75	5	53	43	10	4.30
2	KDM-Ah-10	16	5	150	11	83	70	13	5.30
3	KDM-Ah-46	18	4.40	210	13.6	80	67	13	5.20
	Grand mean	13.66	4.13	145.0	9.86	72.00	60.0	12.0	4.93
	SEd =	0.39	0.08	0.67	0.17	1.83	1.20	0.32	0.03
	CD(P=0.05)	1.08	0.24	1.87	0.48	5.10	3.33	0.91	0.09
	CV% =	3.52	2.64	0.57	2.16	3.13	2.45	3.35	0.86

Quality characters

Among the genotypes, the long shelf life of flakes was observed by the genotypes KDM-Ah-10 and KDM-Ah-46 for five days and the genotypes KDM-Ah-8 were recorded for three days without affecting the fruit quality at ambient room temperature. Among the genotypes, the highest TSS of 29 (^{0}brix) was recorded by the genotypes KDM-Ah-8. The highest organoleptic scores, 9.3 and 9.2, were recorded by the genotype KDM-Ah-8 (Table 7). Similar findings were reported by Murugan (34) (29).

Table 7. Quality characters of promising jackfruit genotypes (2018-2019)

S. No.	Acc.No.	Shelf life of flakes	TSS (^{0}brix)	Organoleptic Score
1	KDM-Ah-8	Three days	29	9.30
2	KDM-Ah-10	Five days	28	9.20
3	KDM-Ah-46	Five days	26	9.10
	Grand mean	-	27.66	9.20
	SEd =	-	0.22	0.20
	CD(P=0.05)	-	0.62	0.55
	CV% =	-	0.99	2.67

Quality characters

Among the genotypes, the highest Total sugars (24.50 percent) were recorded by the genotype KDM-Ah-8 and KDM-Ah-10 recorded the lowest of 22.50 %. The highest Reducing sugars of 6.50 % were recorded by the genotype KDM-Ah-10 and the genotype KDM-Ah-8 recorded the lowest of 6.1. The highest non-reducing sugars, 18%, were recorded by the genotype KDM-Ah-10 and the lowest, 16.40%, was recorded by the genotype KDM-Ah-8. KDM-Ah-8 recorded the lowest titrable acidity of 0.10% and KDM-Ah -10 recorded the lowest of 0.13%. The genotype KDM-Ah-8 recorded the highest Ascorbic acid content of 5.20% and the lowest of 4.20 % was recorded by the genotype KDM-Ah-10. The highest carotene content of (0.42 mg/100 g) was recorded by KDM-Ah-10 and the genotype KDM-Ah-8 recorded the lowest of (0.36 mg/100 g). As revealed visually, the flakes' colour intensity was directly related to the number of carotenoids found in each jackfruit type. So, the factors that influence carotenoid synthesis may be the factors controlling the flake flesh colour (4). Jackfruit has a high content of phytochemicals, mainly phytosterols, carotenoids, and phenolic compounds (28).

The genotype KDM-Ah-46 recorded the highest protein content of (0.76g/100 g) and the lowest of (0.70 g/100 g) was recorded by the genotype KDM-Ah-8 (Table 8). Brix is taken as a measure of the sugar or sweetness of fruits or fruit juices (34).

Conclusion

Among the various constraints for expanding jack fruit cultivation, the lack of suitable clonal planting materials impedes the cultivation area's development. Though seed propagation is the most common method, it will not produce true-to-type progenies besides having a more extended gestation period. Hence, the vegetative propagation technique is a prerequisite for successful cultivation. Thus, promising genotypes *viz*., KDM-AhJ-8, KDM-AhJ-10 and KDM-AhJ-46 (Table 1) were propagated through softwood grafting and approach grafting. Softwood grafted plants were planted for mass multiplication. Mass multiplication was done through approach grafting. The experiment was carried out by Randomized Block Design (RBD) comprised of seven treatments: T1- KDM-AhJ-08, T2- KDM-AhJ-10, T3- KDM-AhJ-46, T4- PLR1, T5-PLR2, T6- red fleshed Siddu, T-7 red fleshed Shankara with four replications. The variation in growth characters of elite jackfruit genotypes *viz*., KDM-Ah-8, KDM-Ah-10 and KDM-Ah- 46 and check varieties *viz*., PLR1, PLR2, red-fleshed jackfruit Siddu and Shankara were analyzed. Promising genotypes *viz*., KDM-Ah-8, KDM-Ah-10 and KDM-Ah-46 will be evaluated further and the promising one will be nominated for release as variety.

Table 8. Quality characters of promising jackfruit genotypes (2018-2019)

S. No.	Acc.No.	Total sugars (%)	Reducing sugars (%)	Non-reducing sugars(%)	Titrable acidity (%)	Ascorbic acid (%)	Carotene (mg/100 g)	Protein (g/100 g)
1	KDM-Ah-8	24.50	6.10	16.40	0.11	4.20	0.36	0.70
2	KDM-Ah-10	22.50	6.50	18.00	0.12	5.10	0.42	0.72
3	KDM-Ah-46	22.50	6.20	17.80	0.13	5.30	0.40	
	Grand mean	23.16	6.26	17.40	0.12	4.86	0.39	0.39
	SEd =	0.59	0.17	0.32	0.002	0.07	0.006	0.006
	CD(P=0.05)	1.65	0.47	0.90	0.007	0.20	0.01	0.01
	CV% =	3.16	3.37	2.28	2.75	1.82	1.99	1.98

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Authors' contributions

All the authors contributed equally to this research work.

Compliance with ethical standards

Conflict of interest: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper

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