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Identification of Red Flesh and White Flesh Jackfruit Genotypes

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ABSTRACT: Fifty-five jackfruit germplasm *viz.*, KDM-AhJ1 to KDM-AhJ55 were selected for the study to identify superior genotype in fruit yield and quality. The selected superior genotypes differ widely among themselves. Among the fifty-five jackfruit germplasms, flakes colour varied from white, yellow, whitish yellow, light yellow, bright yellow, senthuram/deep orange. The genotypes KDM-AhJ-01, KDM-AhJ-4, KDM-AhJ-7 and KDM-AhJ-10 showed good deep orange (Senthuram colour) flakes. Genotype KDM-AhJ-45 recorded the pure white flakes and very sweet in taste (Seeni pala).

Keywords: Jackfruit (J), KDM (Kudumiyanmali), *Artocarpus heterophyllus* (Ah), senthuram/deep orange, identification, evaluation, germplasm/genotypes.

INTRODUCTION

Jackfruit is known for its exceptionally big sized fruits with high yield per tree weighing up to 50 kg each. The ripe jackfruit contains yellow pulp rich in carotene, vitamins and minerals. Other parts of the fruit contain pectin which has high value for preparation of jelly. The seeds are rich in carbohydrates and also contain minor amounts of minerals and vitamins. Jack fruit has varied diversity in every tree, differing from each other in fruit characteristics such as shape, size and quality. These types are divided based on size of fruit, taste, odour of flesh, nature of prickles on rind for the maintenance of separate variety (Singh, 1995; Jagadeesh *et al.*, 2010). Variation also exists in density, size and shape of spines on rind, fruit bearing sensory quality, flesh types, sweetness, flavour and taste (Azad, 2000). Jackfruit is a highly heterozygous, cross pollinated fruit and as such seedlings exhibit a wide range of variations which aids in the selection of the superior desirable types. Due to cross pollination and predomination of seed propagation over a long period of time, species diversity and genetic diversity within the species by their influence on the evolutionary process of extinction, selection, gene drift, gene flow and mutation increasing the diversity in the existing population (Chandrasekhar *et al.,* 2018, Mitra and Mani 2000). Wide variations were observed in sweetness, flavour, taste, size, shape and bearing habit (Goswami *et al.*, 2011). Narasimhan (1990) stated that there are different cultivated types of jackfruit which vary widely in size, shape appearance and taste. It gives more yield per tree as compared to other fruit crops, however, it is still not classified as a commercial fruit and is rarely grown on a regular plantation scale. It is one of the most drought tolerant, hardy fruit crop and traditionally it is a farmer's house hold fruit. Owing to its various culinary uses and its availability in plenty during monsoon season, jack fruit has earned the well deserved name "Poor man's food".

Jack fruit is also gaining popularity in western countries due to emerging ethnic and mainstream marketing opportunities (Campbell and El-Sawa 1998; Campbell *et al*., 1998; Schnell *et al.*, 2001). Being highly cross pollinated and mostly seed propagated, the jackfruit has innumerable types or forms with different fruit characteristics.

Jack fruit is one of the most drought tolerant, hardy fruit crop and traditionally it is a farmers house hold fruit. Sometimes unknowingly the farmers choose the poor yielding seedlings and unable to get good yield. Hence, to overcome this, there is an urgent need to identify a best variety suitable for this region to improve the income of the jack farmers.

Red jackfruit is an evergreen tree with leathery leaves that bear fruits throughout the year. The fruit features reddish-orange flesh with a pleasing aroma. Unlike certain jackfruit varieties, and has a lower latex content. Compared to other types, the red jackfruit has fewer seeds. Red Jack trees start bearing fruit within 3-4 years and high yielder. Ideal conditions for cultivating this variety include water-permeable soil and moderate sunlight. Red Jack fruit contains all the quality of common jackfruit with a high content of nutrient. Red Jackfruit is a rich source of antioxidants that are essential for a healthy immune system. Hence, Owing to its uses and ease of cultivation, identification of a variety with high yield and superior quality is the need of the hour. In Tamil Nadu, the districts like Cuddalore and Villupuram have been known as traditional districts for jackfruit cultivation. However, it has come to light

that in and around Pudukkottai district is also another potential area of jackfruit cultivation. The unique feature of jackfruit cultivation in this area is that most of the trees are grown as border trees except in few areas where it is grown on commercial scale (Single crop) under laterite soil conditions which is responsible for more colour and taste in the flakes (Mohammed Aseef *et al.,* 2017). With the foresaid background, an investigation was conducted to identify red and white fleshed jackfruit genotypes, to assess the variations in yield and fruit quality so as to identify the superior jack fruit genotype(s).

MATERIALS AND METHODS

The experiment trail was conducted with the existing bearing trees of different jackfruit genotypes at Pudukkottai District in Tamil Nadu region during the year 2016–2019. In which 55 genotypes KDM-AhJ1 to KDM-AhJ 55 were identified.

Yield and quality characters.

Yield per tree. Yield per tree was calculated by multiplying the number of fruits harvested per tree with the average fruit weight and expressed in kilogram (kg).

Total soluble solids. Total soluble solids of the fruit were recorded using a hand refractometer and the mean expressed in ° brix.

Organoleptic evaluation. An organoleptic evaluation was worked out with help of a panel consisting of 10 members. Flake colours were observed at the ripe stage and classified as coppery red, deep yellow, yellow, light yellow, creamy white and white and senthuram or deep orange colour. They were asked to evaluate the samples for its appearance, flavour, texture, taste and overall quality of jackfruit flakes using a five point Hedonic scale (Amerine *et al.,* 1965). The statistical analysis includes Mean, Range, Standard deviation, Standard error and Coefficient of variation (Burton and Devane 1953).

RESULT AND DISCUSSION

Yield characters and quality characters. Among the genotypes, the highest number of 50 fruits per tree was observed for the genotype KDM-Ah-8 and the lowest number of 40 fruits per tree was recorded for the genotype KDM-Ah-10 (Table 1). The highest fruit weight of 18 kg per tree was recorded to the genotype KDM-Ah-46 followed by the genotype KDM-Ah-10 (16 kg per tree) and the lowest of 7 kg fruit per tree was recorded to the genotype KDM-Ah-8. The highest fruit yield of 810 kg/tree was recorded for the genotype KDM-Ah-46 and the lowest of 350kg/tree was recorded to the genotype KDM-Ah-8. The shape of the fruit varied from round, slender and oval. The highest fruit length of 45 cm was recorded by the genotype KDM-Ah-46 and the lowest of 26 cm was recorded by the genotypoe KDM-Ah-8. Highest fruit diameter of 57cm was recorded by the genotype KDM-Ah-46 and the lowest of 32 cm was recorded by the genotype KDM-Ah-8. Similar variations in yield per tree per year were reported Jagadeesh *et al*. (2007); Jagtap and Bapat (2010). TSS ranged from 6.00 to 29.17 with mean value of 14.55. Among the genotypes, the highest TSS content recorded for the genotype KDM-AhJ-08 (29.17° brix) and the lowest TSS content was observed for the genotype KDM-AhJ-51 (6°brix). Similar findings were reported by Murugan (2007).

Quality characters. Colour and appearance ranged from 4.00 to 9.00 with the mean value of 6.30 (Fig.1.). Maximum colour and appearance of 9.00 was obtained from the genotype KDM-AhJ -10 and the lowest of 4.00 was found from the germplasm KDM-AhJ-43. Flavor ranged from 4.00 to 8.50 with the mean value of 6.21. Highest flavour content of 8.5 was recorded for the genotype KDM-AhJ -10 and the lowest of 4 was observed for the genotypes KDM-AhJ -36 and KDM-AhJ -39. Texture/Firmness ranged from 4.00 to 9.00 with the mean value of 6.31. Highest texture /firmness 9.00 were obtained from the genotype KDM-AhJ -08 and the lowest of 4.00 was recorded for the genotypes KDM-Ah-37 and KDM-Ah-38. Taste ranged from 3.00 to 9.00 with the mean value of 6.22. Highest taste of 9.00 was obtained from the genotype KDM-AhJ -08 followed by the genotype KDM-AhJ -10 and lowest of 3.00 was found from the germplasm KDM-AhJ-37. Overall acceptability ranged from 5.00 to 9.75 with the mean value of 6.66. Highest overall acceptability of 9.75 was observed by the genotype KDM-AhJ -08 followed by the genotype KDM-Ah J-10 (9.00) and the lowest of 5.00 was observed by the germplasms KDM-AhJ-36 and KDM-AhJ-51(Table 2). Flakes colour varied from white, yellow, whitish yellow, light yellow, bright yellow and senthuram/seep orange. The genotypes KDM-AhJ-01, KDM-AhJ-4, KDM-AhJ-7 and KDM-AhJ-10 showed good deep orange (Senthuram colour) flakes (Fig. 2) Among the 55 genotypes, the genotype KDM-AhJ -45 recorded the pure white flakes and very sweet in taste (Fig. 1). Owner of this jackfruit farmer S.Karthick, said this is for Seeni pala.

In India; a jackfruit variety is named after a farmer. 'Siddu jack' is the best among the varieties that we have studied in the Tumakuru region so far," says Dr G Karunakaran (2018), senior scientist at at Central Horticultural Experiment Station (CHES), Hirehalli, Tumakuru district (2018). Siddu jack stands out both in taste and fruit quality. This variety has entered international market with non-resident Indians from Dubai and California placing orders for saplings.

Red jackfruit is an evergreen tree with leathery leaves that bear fruits throughout the year. The fruit features reddish-orange flesh with a pleasing aroma. Unlike certain jackfruit varieties, and has a lower latex content. Compared to other types, the red jackfruit has fewer seeds. Red Jack trees start bearing fruit within 3-4 years and high yielder. Ideal conditions for cultivating this variety include water-permeable soil and moderate sunlight. Red Jack fruit contains all the quality of common jackfruit with a high content of nutrient. Red Jackfruit is a rich source of antioxidants that are essential for a healthy immune system.

The present study observed that the significant variation by the organoleptic evaluation of all the characters of flakes. Genotype namely KDM-AhJ-08 (9.75) followed by the genotype KDM-AhJ-10 (9.00) have higher score for overall quality of flakes. This may be due to genetic nature of the genotypes and growing environment. Similar findings of Murugan (2007).

Table 1: Yield characters of jackfruit genotypes KDM-Ah-1to KDM-Ah-55.

Acc. No.	No. of fruits /tree	Individual fruit weight (kg)	Yield /tree (kg)	Fruit Length (cm)	Fruit breadth (cm)	TSS (^{0}brix)
KDM-AhJ-1	10.67	9.67	108.33	37.67	40.00	9.93
KDM-AhJ-2	16.00	11.00	179.33	25.00	34.00	11.03
KDM-AhJ-3	13.67	11.33	155.33	24.67	42.67	10.07
KDM-AhJ-4	15.00	5.00	111.67	10.33	16.00	20.10
KDM-AhJ-5	12.67	11.00	141.33	21.67	45.00	9.10
KDM-AhJ-6	13.33	6.67	93.33	14.00	16.33	7.10
KDM-AhJ-7	11.33	8.33	95.00	15.33	28.00	24.10
KDM-AhJ-8	43.33	4.67	211.67	24.00	30.00	29.17
KDM-AhJ-9	15.00	13.00	209.33	28.00	21.00	12.10
KDM-AhJ-10	30.00	14.33	458.33	38.00	48.00	27.43
KDM-AhJ-11	25.67	13.67	355.00	14.00	22.00	10.20
KDM-AhJ-12	24.67	10.33	271.33	19.33	32.00	10.17
KDM-AhJ-13	22.67	10.67	254.67	20.00	29.33	22.10
KDM-AhJ-14	30.00	10.67	320.00	20.33	32.00	12.23
KDM-AhJ-15	19.33	8.33	170.33	24.67	29.00	13.23
KDM-AhJ-16	8.00	7.33	62.67	24.33	30.00	8.23
KDM-AhJ-17	9.33	7.67	75.33	30.00	22.00	10.23
KDM-AhJ-18	9.00	8.00	73.67	26.67	29.00	7.43
KDM-AhJ-19	12.33	8.00	102.67	23.67	26.00	9.23
KDM-AhJ-20	14.00	9.00	130.67	24.00	29.00	7.43
KDM-AhJ-21	10.33	8.00	86.67	20.00	42.00	7.23
KDM-AhJ-22	8.33	9.67	85.33	21.33	28.00	7.27
KDM-AhJ-23	9.00	10.00	95.33	26.33	38.33	8.47
KDM-AhJ-24	10.33	8.67	95.33	19.33	27.00	7.17
KDM-AhJ-25	15.00	8.00	124.67	11.00	23.00	7.10
KDM-AhJ-26	23.33	7.67	192.00	22.00	30.00	7.10
KDM-AhJ-27	24.33	11.67	299.67	24.00	32.00	18.17
KDM-AhJ-28	24.67	10.67	280.67	24.00	31.00	12.13
KDM-AhJ-29	21.67	11.33	265.67	30.33	38.00	24.27
KDM-AhJ-30	22.33	9.67	230.67	26.00	48.67	18.37
KDM-AhJ-31	33.33	7.00	243.33	10.67	42.00	27.13
KDM-AhJ-32	19.00	10.67	214.67	20.00	25.00	23.03
KDM-AhJ-33	23.00	8.00	195.00	10.33	25.67	12.27
KDM-AhJ-34	27.00	9.00	255.33	31.00	40.00	21.17
KDM-AhJ-35	24.67	11.00	281.33	28.33	45.00	9.17
KDM-AhJ-36	14.00	10.33	152.00	29.33	45.67	10.17
KDM-AhJ-37	12.00	7.67	99.33	24.67	34.33	7.17
KDM-AhJ-38	10.00	10.00	104.67	16.00	25.00	20.17
KDM-AhJ-39	10.33	10.67	112.00	18.67	28.33	10.17
KDM-AhJ-40	12.67	8.00	107.00	20.33	24.67	20.23
KDM-AhJ-41	15.00	9.00	140.33	28.00	40.00	26.27
KDM-AhJ-42	28.33	10.00	296.33	16.67	28.33	24.10
KDM-AhJ-43	16.67	9.00	158.00	28.00	43.00	9.13
KDM-AhJ-44	29.00	12.00	347.33	30.00	32.00	28.27
KDM-AhJ-45	22.67	11.00	260.00	25.67	35.33	20.23
KDM-AhJ-46	29.00	16.33	480.67	43.00	54.67	28.23
KDM-AhJ-47	14.00	13.33	188.00	23.00	30.00	17.23
KDM-AhJ-48	17.67	10.00	183.67	30.33	34.00	10.17
KDM-AhJ-49	18.00	13.33	242.00	25.00	32.00	10.23
KDM-AhJ-50	16.33	11.33	187.00	15.33	21.33	7.10
KDM-AhJ-51	15.33	9.00	144.00	18.00	21.67	6.10
KDM-AhJ-52	27.00	11.33	309.67	16.00	23.33	7.17
KDM-AhJ-53	23.00	9.00	218.00	14.00	18.00	8.17
KDM-AhJ-54	30.67	12.00	382.33	20.00	24.67	25.17
KDM-AhJ- 55	29.67	11.00	340.67	26.33	31.00	24.17
Grand mean	199.6121	9.8909	189.758	22.8848	31.7152	14.55
SEd =	5.4285	0.7427	5.4285	1.0620	1.3842	0.11
CD(.05)=	10.7602	1.4722	10.7602	2.1051	2.7437	0.21
CV% =	35.04	9.20	35.04	5.68	5.35	0.92

Table 2: Quality characters of jackfruit genotypes KDM-Ah-1to KDM-Ah-55.

Acc. No.	Colour and appearance	Flavor	Texture/Firmness	Taste	Overall acceptability
KDM-AhJ-1	7.6	6.8	7.2	7.1	7.8
KDM-AhJ-2	7.2	6.2	6.2	5.0	5.20
KDM-AhJ-3	6.4	5.9	6.6	6.5	5.70
KDM-AhJ-4	6.7	5.7	5.9	5.8	7.80
KDM-AhJ-5	6.7	7.0	6.1	6.4	6.30
KDM-AhJ-6	6.3	6.0	6.0	4.9	5.30
KDM-AhJ-7	7.9	7.5	7.7	8.1	7.50
KDM-AhJ-8	7.0	8.0	9.0	9.5	9.75
KDM-AhJ-9	8.0	8.0	8.0	8.0	7.5
KDM-AhJ-10	9.0	8.5	8.5	8.5	9.0
KDM-AhJ-11	7.3	6.6	6.8	8.3	8.10
KDM-AhJ-12	6.6	7.1	7.7	7.1	6.90
KDM-AhJ-13	7.6	7.4	7.1	8.0	8.10
KDM-AhJ-14	6.8	6.7	7.0	6.3	5.90
KDM-AhJ-15	7.0	7.3	6.9	7.2	7.40
KDM-AhJ-16	5.3	6.4	6.1	5.9	5.70
KDM-AhJ-17	7.1	6.8	6.6	6.4	5.90
KDM-AhJ-18	5.2	5.7	6.1	6.5	5.80
KDM-AhJ-19	6.0	5.4	5.7	6.2	5.60
KDM-AhJ-20	7.0	7.2	7.5	7.1	6.90
KDM-AhJ-21	7.1	7.3	7.0	6.9	6.70
KDM-AhJ-22	5.9	5.7	6.1	6.1	5.60
KDM-AhJ-23	6.1	6.5	6.2	5.7	6.80
KDM-AhJ-24	6.2	5.4	6.1	5.3	5.80
KDM-AhJ-25	5.8	6.1	6.2	5.7	5.80
KDM-AhJ-26	6.1	5.7	5.5	5.8	6.20
KDM-AhJ-27	7.2	6.9	5.9	6.3	6.40
KDM-AhJ-28	6.4	6.8	7.1	7.3	6.70
KDM-AhJ-29	7.3	7.8	7.1	6.9	6.00
KDM-AhJ-30	5.3	5.7	6.2	5.4	5.50
KDM-AhJ-31	6.3	6.5	6.1	6.8	8.50
KDM-AhJ-32	6.2	6.4	5.3	6.1	9.00
KDM-AhJ-33	7.4	7.6	7.1	7.5	6.20
KDM-AhJ-34	6.9	5.9	6.1	7.1	8.10
KDM-AhJ-35	7.8	7.1	7.9	7.7	8.50
KDM-AhJ-36	6.0	4.0	6.0	4.0	5.0
KDM-AhJ-37	5.0	5.0	4.0	3.0	6.00
KDM-AhJ-38	6.0	5.0	4.0	4.0	7.00
KDM-AhJ-39	5.0	4.0	5.0	6.0	5.20
KDM-AhJ-40	6.0	5.0	4.0	6.0	7.00
KDM-AhJ-41	6.0	6.0	7.0	6.0	8.00
KDM-AhJ-42	5.0	5.0	6.0	5.0	8.00
KDM-AhJ-43	4.0	5.0	5.0	5.0	6.00
KDM-AhJ-44	5.0	5.0	6.0	6.0	6.00
KDM-AhJ-45	6.0	5.0	7.0	6.0	7.00
KDM-AhJ-46	9.0	8.5	8.5	8.5	9.00
KDM-AhJ-47	5.0	6.0	5.0	5.0	6.00
KDM-AhJ-48	4.0	5.0	4.0	5.0	5.30
KDM-AhJ-49	5.0	6.0	5.0	4.0	5.70
KDM-AhJ-50	5.0	6.0	7.0	5.0	5.30
KDM-AhJ-51	5.0	7.0	5.0	6.0	5.00
KDM-AhJ-52	6.0	5.0	4.0	5.0	6.00
KDM-AhJ-53	6.0	5.0	6.0	5.0	6.00
KDM-AhJ-54	5.0	5.0	6.0	7.0	6.00
KDM-AhJ- 55	6.0	6.0	7.0	5.0	7.00
Grand mean	6.3006	6.2170	6.2945	6.2218	6.6661
SEd =	0.3876	0.3532	0.4106	0.3916	0.3927
CD(.05) =	0.7682	0.7001	0.8138	0.7762	0.7784
CV% =	7.53	6.96	7.99	7.71	7.22

KDM-AhJ-08

KDM-AhJ-45 Seeni pala (White flesh)

KDM-AhJ-07

KDM-AhJ-13

KDM-AhJ-10

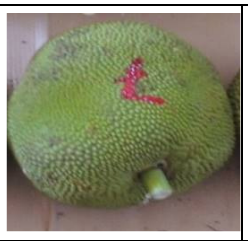
KDM-AhJ-55

Fig. 1. Colour variation of jackfruit genotypes.

KDM-AhJ-01

KDM-AhJ-04

KDM-AhJ-07



KDM-AhJ-10

Fig. 2. Identified Red fleshed Jackfruit genotypes.

CONCLUSIONS

In this experiment trail the highest number of fruits per tree (43.33.) was recorded for the genotype KDM-AhJ-8. Among the genotypes, the genotypes KDM-AhJ-01, KDM-AhJ-4, KDM-AhJ-7 and KDM-AhJ-10 showed good deep orange (Senthuram colour) flakes. The genotype KDM-AhJ-45 recorded the pure white flakes and very sweet in taste (Seeni pala). Based on the yield and quality characters the above mentioned genotypes are having excellent characters. In general, the research was able to show differences among the jackfruit genotypes used in India, which could help identify superior ones.

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