



Perceptual characterisation for quality assessment of jackfruit (*Artocarpus heterophyllus*) in Terai districts of West Bengal

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ABSTRACT

India is the second largest producer in the world and considered as the native of seasonal and tropical evergreen jackfruit (*Artocarpus heterophyllus* L.) tree. Each and every village of North Bengal, have various types of jackfruit plants which needs to be known for their characteristics. Data were gathered from 60 jackfruit farmers of five villages of Cooch Behar and Alipurduar district through a structured interview schedule. The characteristics of jackfruit plant were assessed through IPGRI descriptor. The results showed that the jackfruit trees of North Bengal were dominated by irregular crown (40.32) and branch shape (39.24) with narrowly elliptical leaf blade shape (51.08), but broadly pyramidal crown shape and ellipsoid flake shape produced best quality vegetable as well as ripe fruit; whereas clavate fruit shape for vegetable and ellipsoid fruit shape for fruit was perceived best. The quality was assessed through matrix ranking of different parameters by group of farmers. On the basis of crown shape, most respondents preferred broadly pyramidal shape tree, acuminate leaf apex, ellipsoid fruit shape, cordate flake shape, yellow flake colour, ellipsoid seed shape and fruit position on the stem. Farmers opined middle time as best production time of jackfruit and pyramidal shape tree as best shape. Broadly elliptical leaf shape, acuminate leaf apex, obtuse apex shape and clavate fruit shape were the most preferred morphological characteristics. Although the farmers are the best evaluator but a scientific level evaluation is recommended for validation of the parameters for universal use.

Key word: Jackfruit, Morphological character, Quality, Rank base quotient

Jackfruit (*Artocarpus heterophyllus* L.) belonging to Moraceae family is one of the most important underutilized fruit crops (Alam *et al.* 2011), suitable for growing in arid and semi-arid regions having versatile adaptability, hardy in nature, having low maintenance cost and high yield. It is a multipurpose tree and all parts of the plant are equally important (Corner 1938 and Purseglove 1968). Being freely available in Indian and adjoining continents, is an integral part of common Indian diet. Its medicinal properties find mention in Ayurveda (Prakash *et al.* 2009). Jackfruit regarded as the largest edible fruit in the world (Sturrock 1959) is found as a major tropical fruit grown in rain forests of India, Bangladesh, Sri Lanka, Southern China, and Southeast Asian countries (Samaddar 1985). As per various reports, in West Bengal alone there are 28 genotypes of jackfruit clones

which showed wide variability in yields, fruit weight, fruit shape, skin colour, number of spines, pulp colour, number of segments, pulp weight, texture of pulp, TSS (total soluble sugar), total sugar and acidity contents of fruit (Mittra 1998, Ibrahim *et al.* 2012). The ripe fruit contains yellow pulp rich in carotene, vitamins and minerals. The seeds are rich in carbohydrates and also contain minerals and vitamins. Jackfruit is commonly used as a cuisine all over the world. It can be consumed in various form, as like; in Bangladesh, unripe fruit is used in curry and often seed is dried and preserved for later use; in Thailand and Vietnam it is used as canned sugary syrup; in Indonesia, the ripe fruit is consumed as a sweet dessert; in Philippines, the unripe fruit is usually cooked in coconut milk and is eaten as a viand together with rice. In Vietnam, it is used to make a sweet dessert soup called as jackfruit 'chè'; In Nepal, unripe fruit is used to prepare savory curry. In Sri Lanka, Jackfruit is used to make wine and pickles. In Africa, seeds of jackfruit are grounded into a flour type meal and used mainly for bread and other baking purposes. In Australia, it is used to make patties, casserole and salad. In Malaysia, it is often added to rice dishes and salads, mixed with shrimp, or used in drinks like *lassi* (savoury drink). In Florida, jackfruit is used in ice creams, jams, jelly, and to make sweet curry and fruit salad. In West Bengal, The fruits are either eaten

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alone or as a supplement to rice, *roti* (Indian bread), *chira* (flattened rice), or *muri* (puffed rice). Sometimes, the juice is extracted and either taken directly or as a supplement with *muri*. The extract is sometimes condensed and eaten as candies. Seeds are used to make spicy side-dishes with rice or *roti* (Arora and Parle, 2016). As most consumers eat with their eyes, the four attributes typically affect in the order specified preference, for example evaluating the visual appearance and color first, followed by the taste, aroma, and texture. In this relation, it is very relevant to investigate the characteristic features of jackfruit available in the Terai (the low-lying land at the foot of the Himālayas) districts of West Bengal as it is the most common homestead fruit crop (JIT report, 2016-17).

MATERIALS AND METHODS

The study was conducted in Cooch Behar and Alipurduar districts of West Bengal. From selected districts, three blocks namely *Tufanganj*, *Falakata*, *Alipurduar-I* were purposively selected. In *Tufanganj* block, village namely, *Bhelakopa Pratham Khanda* and *Chilakhana*; in *Alipurduar-I* block, village *Banchukumri*; and under *Falakata* block, village *Mairadanga* and *Kunjanagar* were purposively selected considering the tradition and concentration of jackfruit growers in consultation with the scientists from KVK Cooch Behar and Department of Pomology and Post Harvest Technology, UBKV. From exhaustive list of jackfruit growers of sampled villages, 60 respondents were selected randomly and information was recorded with the help of interview schedule.

For identification of jackfruit characteristics or physical parameter; Jackfruit Descriptors of IPGRI (International Plant Genetic Resources Institute, Rome, Italy, 2000) was used. The respondents were asked to identify his/her plant according to this descriptor. Different parts of the plant are classified in the descriptor according to morphological characters of the plant part. Crown shape follows, (1) Pyramidal (2) Broadly pyramidal (3) Spherical (4) Oblong (5) Semicircular (6) Elliptical and (7) Irregular in pattern; Branching follows, (1) Erect (2) Opposite (3) Verticillate (4) Horizontal (5) Irregular pattern; Leaf blade follows, (1) Obovate (2) Elliptic, (3) Broadly elliptic, (4) Narrowly elliptic, (5) Oblong, (6) Lyrate (wavy) type of shape; Leaf apex follows, (1) Acute (2) Acuminate (3) Retuse (4) Obtuse shape; Leaf base follows, (1) Oblique, (2) Rounded, (3) Cuneate, (4) Shortly attenuate shape; Fruit follows, (1) Oblong, (2) Spheroid, (3) Ellipsoid, (4) Clavate, (5) Oblong (6) Irregular in shape; Stalk attachment to fruit can be, (1) Depressed, (2) Flattened, (3) Inflated; Flakes are (1) Spheroid, (2) Cordate, (3) Twisted, (4) Obovate, (5) Rectangular, (6) Oblong with curved tip, (7) Irregular; Seeds can be, (1) Spheroid, (2) Ellipsoid, (3) Elongate, (4) Oblong, (5) Reniform, (6) Irregular in shape.

For jackfruit quality assessment also, the IPGRI Jackfruit Descriptors was used. Quality was judged in respect of all the morphological characters. Data were collected in groups through matrix ranking procedure. For identifying

best parameter, Rank Base Quotient (RBQ) was calculated as suggested by Sabarathnam (1988):

$$RBQ = \frac{\sum fi(n+1-i)}{n \times N}$$

where, f_i = Frequency of farmer groups select a particular character under ' i^{th} ' rank, n = Number of rank or character, N = Total group of information.

RESULTS AND DISCUSSION

Morphological characterization of the jackfruit

There were mainly seven types of crown shaped trees. As shown in Table 1, there was highest percentage of trees with irregular shape (40.32%), followed by elliptical shape trees (31.18%), spherical shape (11.83%), semicircular shape (8.60%), broadly pyramidal (6.45%) and pyramidal shape (1.61%) respectively. However, there were no oblong shape trees in the study area. As far as branching pattern is concerned, there were mainly five types of branching pattern in study area. It was found that 39.24% of the trees were having irregular branching pattern, 38.70% were having erect pattern, 16.66% opposite pattern, 3.76% were having verticillate pattern and 1.61% were having horizontal branching pattern.

There were mainly five types of leaf blade shape, i.e. trees with narrowly elliptic (51.08%), elliptic (14.52%), broadly elliptic (13.98%), obovate (13.44%), and oblong (6.99%). Table 1 further show that there were five types leaf apex of jackfruit trees. Most of the trees having acuminate leaf apex (54.84%), followed by acute leaf apex (23.66%), obtuse (14.52%), retuse (6.45%), and other leaf apex (0.54%) found in study area. Leaf base shape being another important character was found of five types. Most of plants were rounded leaf base (54.30%), followed by cuneate leaf base (23.66%), shortly attenuate leaf base (11.29%), oblique leaf base (10.22%), and other leaf base (0.54%). Table also shows that among observed seven types of fruit shape in study area most of the fruit shape were ellipsoid (41.40%), followed by clavate (33.87%), oblong (18.28%), spheroid (3.76%), and irregular (2.69%).

There were three types of stalk attachment. More than half of jackfruit stalk attachment were flattened (64.52%) in pattern, followed by 20.97% depressed, 13.98% as inflated and 0.54% others types. Seven types of flake shapes namely; rectangular (38.71%), oblong with curved tip shape flake (38.71%), irregular shape (16.13%), followed by obovate (15.05%), twisted shape (10.75%), spheroid shape (9.68%), and cordate shape flake (6.99%) were observed. Most of the seeds were oblong (69.89%) shaped, followed by ellipsoid (18.82%), spheroid (6.45%), elongate (3.76%), and reniform (1.08%). However, there was no irregular shape seed in study area.

Assessment of jackfruit fruit quality

Table 2 presents ranking of different crown shapes of the jackfruit trees towards contribution to fruit quality

Table 1 Classification of available trees in sampled area on the basis of various morphological characteristics

Terai districts		Crown shape					
	<i>Pyramidal</i>	<i>Broadly pyramidal</i>	<i>Spherical</i>	<i>Oblong</i>	<i>Semicircular</i>	<i>Elliptical</i>	<i>Irregular</i>
Alipurduar	2(2.38)	5(5.95)	10(11.90)	0(0.00)	9(10.71)	24(28.57)	34(40.48)
Cooch Behar	1(0.98)	7(6.86)	12(11.76)	0(0.00)	7(6.86)	34(33.33)	41(40.20)
Total (%)	3(1.61)	12(6.45)	22(11.83)	0(0.00)	16(8.60)	58(31.18)	75(40.32)
<i>Branching pattern</i>							
	<i>Erect</i>	<i>Opposite</i>	<i>Verticillate</i>	<i>Horizontal</i>	<i>Irregular</i>		
Alipurduar	34(40.48)	9(10.71)	5(5.95)	2(2.38)	34(40.48)		
Cooch Behar	38(37.25)	22(21.57)	2(1.96)	1(0.98)	39(38.24)		
Total (%)	72(38.70)	31(16.66)	7(3.76)	3(1.61)	73(39.24)		
<i>Leaf blade shape</i>							
	<i>Obovate</i>	<i>Elliptic</i>	<i>Broadly elliptic</i>	<i>Narrowly elliptic</i>	<i>Oblong</i>		
Alipurduar	9(10.71)	14(16.67)	11(13.10)	42(50.00)	8(9.52)		
Cooch Behar	16(15.69)	13(12.75)	15(14.71)	53(51.96)	5(4.90)		
Total (%)	25(13.44)	27(14.52)	26(13.98)	95(51.08)	13(6.99)		
<i>Leaf apex</i>							
	<i>Acute</i>	<i>Acuminate</i>	<i>Retuse</i>	<i>Obtuse</i>	<i>Other</i>		
Alipurduar	24(28.57)	39(46.43)	5(5.95)	15(17.86)	1(1.19)		
Cooch Behar	20(19.61)	63(61.76)	7(6.86)	12(11.76)	0(0.00)		
Total (%)	44(23.66)	102(54.84)	12(6.45)	27(14.52)	1(0.54)		
<i>Leaf base shape</i>							
	<i>Oblique</i>	<i>Rounded</i>	<i>Cuneate</i>	<i>Shortly attenuate</i>	<i>Other</i>		
Alipurduar	11(13.10)	33(39.29)	26(30.95)	14(16.67)	0(0.00)		
Cooch Behar	8(7.84)	68(66.67)	18(17.65)	7(6.86)	1(0.98)		
Total (%)	19(10.22)	101(54.30)	44(23.66)	21(11.29)	1(0.54)		
<i>Fruit shape</i>							
	<i>Obloid</i>	<i>Spheroid</i>	<i>Ellipsoid</i>	<i>Clavate</i>	<i>Oblong</i>	<i>Irregular</i>	
Alipurduar	0(0.00)	4(42.86)	36(44.05)	37(7.14)	6(1.19)	1(4.76)	
Cooch Behar	0(0.00)	3(2.94)	41(40.20)	26(25.49)	28(27.45)	4(3.92)	
Total(%)	0(0 .00)	7(3.76)	77(41.40)	63(33.87)	34(18.28)	5(2.69)	
<i>Stalk attachment</i>							
	<i>Depressed</i>	<i>Flattened</i>	<i>Inflated</i>	<i>Other</i>			
Alipurduar	17(20.24)	51(60.71)	16(19.05)	0(0.00)			
Cooch Behar	22(21.57)	69(67.65)	10(9.80)	1(0.98)			
Total (%)	39(20.97)	120(64.52)	26(13.98)	1(0.54)			
<i>Flake shape</i>							
	<i>Spheroid</i>	<i>Cordate</i>	<i>Twisted</i>	<i>Obovate</i>	<i>Rectangular</i>	<i>Oblong with curved tip</i>	<i>Irregular</i>
Alipurduar	4(4.76)	4(4.76)	13(15.48)	8(9.52)	33(39.29)	0(0.00)	22(26.19)
Cooch Behar	14(13.73)	9(8.82)	7(6.86)	20(19.61)	39(38.24)	5(4.90)	8(7.84)
Total (%)	18(9.68)	13(6.99)	20(10.75)	28(15.05)	72(38.71)	5(2.69)	30(16.13)
<i>Seed shape</i>							
	<i>Spheroid</i>	<i>Ellipsoid</i>	<i>Elongate</i>	<i>Oblong</i>	<i>Reniform</i>	<i>Irregular</i>	
Alipurduar	3(3.57)	13(15.48)	5(5.95)	61(72.62)	2(2.38)	0(0.00)	
Cooch Behar	9(8.82)	22(21.57)	2(1.96)	69(67.65)	0(0.00)	0(0.00)	
Total (%)	12(6.45)	35(18.82)	7(3.76)	130(69.89)	2(1.08)	0(0.00)	

Table 2 Perceptual relation between different types of crown shapes and their quality of ripe and green fruit

Crown shape	Frequency of ranks for ripe fruit							RBQ	Rank	Frequency of ranks for green fruit							RBQ	Rank	
	RANK									RANK									
	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th			1 st	2 nd	3 rd	4 th	5 th	6 th	7 th			
Pyramidal	0	0	0	0	3	4	1	0.32	VI	1	0	0	0	4	3	0 Crown shape	0.45	VI	
Broadly pyramidal	5	1	2	0	0	0	0	0.91	I	5	0	2	1	0	0		0	0.88	I
Spherical	0	5	0	1	1	0	0	0.66	IV	0	4	1	1	1	1		0	0.68	III
Oblong	0	0	0	0	0	4	4	0.21	VII	1	1	0	2	0	4		0	0.52	V
Semicircular	0	1	5	0	2	0	0	0.66	III	1	3	4	0	0	0		0	0.80	II
Elliptical	3	0	0	5	0	0	0	0.73	II	0	0	1	4	3	0	0	0.54	IV	
Irregular	0	1	1	1	2	0	3	0.43	V	0	0	0	0	0	0	8	0.14	VII	

of jackfruit according to the farmers' perception. In study area eight farmer groups were selected, they gave 1st rank to broadly pyramidal shape tree (RBQ-0.91), that is good crown shape for jackfruit tree. Chronologically others rank were 2nd to elliptical (RBQ-0.73), 3rd to semicircular (RBQ-0.66), 4th to spherical (RBQ-0.66), 5th to irregular (RBQ-0.43), 6th to pyramidal (RBQ-0.32) and 7th to oblong (RBQ-0.21). Table 2 presents crown shape rank of jackfruit tree as good quality green jackfruit. Farmer groups gave 1st rank to broadly pyramidal shape tree (RBQ-0.88), that is good crown shape jackfruit tree for green fruit of jackfruit. It followed semicircular (RBQ-0.80), spherical (RBQ-0.68), elliptical (RBQ-0.54), oblong (RBQ-0.52), pyramidal (RBQ-0.45) and irregular (RBQ-0.14).

Table 3 shows the leaf apex rank according to farmer groups' perception. Most of the farmer selected acuminate leaf apex (RBQ-0.88) and gave 1st rank, followed by acute

leaf apex (RBQ-0.75), obtuse leaf apex (RBQ-0.50), and retuse apex shape (RBQ-0.38). Also, the leaf apex rank in relation to fruit according to farmer group's perception selected acuminate leaf apex (RBQ-0.94) and gave 1st rank, followed by acute leaf apex (RBQ-0.90), retuse leaf apex (RBQ-0.63) and obtuse apex shape (RBQ-0.63) respectively.

Table 4 gives a view of quality rank of fruit shape according to farmers' group opinion in study area. All the farmers' groups preferred ellipsoid fruit shape (RBQ-1.00) and ranked on 1st position followed by clavate fruit shape (RBQ-0.77), oblong fruit shape (RBQ-0.73), obloid fruit shape (RBQ-0.46), spheroid fruit shape (RBQ-0.38), and irregular fruit shape (RBQ-0.17) respectively. Table 4 also depicts quality rank of fruit shape according to farmers' group opinion in study area. All the farmers' groups gave 1st position to clavate fruit shape (RBQ-0.92), followed

Table 3 Perceptual relation between different types of leaf apex with quality of ripe and green fruit

Leaf apex	Frequency of ranks for ripe fruit				RBQ	Rank	Frequency of ranks for green fruit				RBQ	Rank
	RANK						RANK					
	1 st	2 nd	3 rd	4 th			1 st	2 nd	3 rd	4 th		
Acute	2	5	0	1	0.75	II	3	5	0	0	0.90	II
Acuminate	5	2	1	0	0.88	I	5	3	0	0	0.94	I
Retuse	1	0	1	6	0.38	IV	0	0	3	6	0.63	III
Obtuse	0	1	6	1	0.50	III	0	0	6	2	0.63	IV

Table 4 Perceptual relation between different types of fruit shapes with their quality of ripe and green fruit

Fruit shape	Frequency of ranks for ripe fruit						RBQ	Rank	Frequency of ranks for green fruit						RBQ	Rank
	RANK								RANK							
	1 st	2 nd	3 rd	4 th	5 th	6 th			1 st	2 nd	3 rd	4 th	5 th	6 th		
Obloid	0	0	0	6	2	0	0.46	IV	0	0	0	0	8	0	0.33	V
Spheroid	0	0	0	2	6	0	0.38	V	0	0	0	8	0	0	0.50	IV
Ellipsoid	8	0	0	0	0	0	1.00	I	1	4	3	0	0	0	0.79	II
Clavate	0	5	3	0	0	0	0.77	II	4	4	0	0	0	0	0.92	I
Oblong	0	3	5	0	0	0	0.73	III	3	0	5	0	0	0	0.79	III
Irregular	0	0	0	0	0	8	0.17	VI	0	0	0	0	0	8	0.17	VI

by ellipsoid fruit shape (RBQ-0.79), oblong fruit shape (RBQ-0.79), spheroid fruit shape (RBQ-0.50), obloid fruit shape (RBQ-0.33), and irregular fruit shape (RBQ-0.17) respectively.

Table 5 presents the distribution of flake shape rank according to farmers' perception. Among the various flake shapes, farmers' groups selected cordate flake shape at 1st position (RBQ-0.95). Twisted flake shape (RBQ-0.84) received 2nd position followed by rectangular flake shape (RBQ-0.61), obovate flake shape (RBQ-0.46), oblong and curved tip flake shape (RBQ-0.39), spheroid flake shape (RBQ-0.36) and irregular flake shape respectively for ripe fruit. Table further presents the distribution of flake shape rank of green fruit according to farmers' perception. The obovate flake shape (RBQ-0.96) was ranked at the top followed by rectangular flake shape (RBQ-0.79), cordate flake shape (RBQ-0.61), twisted flake shape (RBQ-0.61), oblong with curved tip flake shape (RBQ-0.57), spheroid flake shape (RBQ-0.32) and irregular flake shape (RBQ-0.14) respectively.

Table 6 shows that all the farmers' groups gave 1st position to ellipsoid seed shape (RBQ-0.94) for the quality of the ripe fruit followed by oblong seed shape (RBQ-0.81), elongate seed shape (RBQ-0.75), spheroid seed shape (RBQ-0.48), irregular seed shape (RBQ-0.29), and reniform seed shape (RBQ-0.23). However for green fruit (vegetable purpose) all the farmers' groups preferred in similar fashion and gave 1st position to ellipsoid seed shape (RBQ-0.92) followed by oblong seed shape (RBQ-0.83), elongate seed

shape (RBQ-0.75), spheroid seed shape (RBQ-0.50), irregular seed shape (RBQ-0.25), and reniform seed shape (RBQ-0.25) respectively.

Perusal to Table 7 regarding distribution of flake colour according to the opinion of farmers' group, whereas, it is clear that yellow colour (RBQ-1.00) was ranked 1st for jackfruit flake, followed by other colours (yellow and red colours mixed), white colour flake and red colour respectively. Further table 8 depicts the distribution of fruit position rank in the jackfruit tree. Farmers' groups opined that if the fruit hold in the stem it is best position for jackfruit production. They gave 1st rank to stem position, 2nd rank to branch position, and 3rd rank to root position respectively. On the basis of production time of jackfruit in the study area farmers selected middle time (RBQ-1.00) as the best production time of jackfruit for taste purpose followed by early time (RBQ- 0.67) and late time (RBQ-0.33) respectively.

The characters of Jackfruit can be considered important for finding out the quality superiority of this nutritive fruit. Trees were observed mostly irregular in shape but no oblong shape trees; branching followed mostly erect in pattern. More than half sampling cultivars were found narrowly elliptic leaf blade shape, acuminate leaf apex and rounded leaf base; ellipsoid fruit shape and flattened stalk attachment. Flakes were mostly rectangular and oblong with curved tip shape and oblong seed shape. On the basis of crown shape, most respondents preferred broadly pyramidal shape tree, acuminate leaf apex, ellipsoid fruit shape, cordate

Table 5 Perceptual relation between types of flake shapes and quality of ripe and green fruit

Flake shape	Frequency of ranks for ripe fruit							RBQ	Rank	Frequency of ranks for green fruit							RBQ	Rank
	RANK									RANK								
	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th			1 st	2 nd	3 rd	4 th	5 th	6 th	7 th		
Spheroid	0	1	0	0	0	7	0	0.36	VI	0	0	0	0	2	6	0	0.32	VI
Cordate	6	1	1	0	0	0	0	0.95	I	0	0	4	2	2	0	0	0.61	III
Twisted	1	6	0	1	0	0	0	0.84	II	1	0	0	6	1	0	0	0.61	IV
Obovate	0	0	0	4	3	0	1	0.46	IV	6	2	0	0	0	0	0	0.96	I
Rectangular	0	0	3	4	1	0	0	0.61	III	0	4	4	0	0	0	0	0.79	II
Oblong with curved tip	0	0	0	0	7	0	1	0.39	V	1	2	0	0	3	2	0	0.57	V
Irregular	1	0	0	0	0	0	7	0.25	VII	0	0	0	0	0	0	8	0.14	VII

Table 6 Perceptual relation between different types of seed shape and quality of ripe and green fruit

Seed shape	Frequency of ranks for ripe fruit						RBQ	Rank	Frequency of ranks for green fruit						RBQ	Rank
	RANK								RANK							
	1 st	2 nd	3 rd	4 th	5 th	6 th			1 st	2 nd	3 rd	4 th	5 th	6 th		
Spheroid	0	0	0	7	1	0	0.48	IV	0	0	0	8	0	0	0.50	IV
Ellipsoid	6	1	1	0	0	0	0.94	I	6	0	2	0	0	0	0.92	I
Elongate	0	4	4	0	0	0	0.75	III	1	2	5	0	0	0	0.75	III
Oblong	2	3	3	0	0	0	0.81	II	1	6	1	0	0	0	0.83	II
Reniform	0	0	0	0	3	5	0.23	VI	0	0	0	0	4	4	0.25	VI
Irregular	0	0	0	1	4	3	0.29	V	0	0	0	0	4	4	0.25	V

Table 7 Perceptual relation between different types of flake colours with quality of ripe fruit

Flake colour	Frequency of ranks for ripe fruit				RBQ	Rank
	RANK					
	1 st	2 nd	3 rd	4 th		
Yellow	8	0	0	0	1.00	I
Red	0	0	2	6	0.31	IV
White	0	2	6	0	0.56	III
Others	0	6	0	2	0.63	II

Table 8 Perceptual relation among different types of fruit position and fruit production time with quality of ripe fruit

Fruit position	Frequency of ranks for ripe fruit			RBQ	Rank
	Rank				
	1 st	2 nd	3 rd		
Root	0	0	8	0.33	III
Stem	8	0	0	1.00	I
Branch	0	8	0	0.67	II
Production time					
Early	0	8	0	0.67	II
Mid	8	0	0	1.00	I
Late	0	0	8	0.33	III

flake shape, yellow flake colour, ellipsoid seed shape and fruit position on the stem. Farmers selected middle time as best production time of jackfruit and pyramidal shape tree as best shape. Broadly elliptical leaf shape, acuminate leaf apex, obtuse apex shape and clavate fruit shape were the most preferred morphological characteristics. This study attempted to document the morphological variations found in the crop pool along with farmers' preference as the determinant for quality of ripe as well as green fruit which can serve as useful information for plant breeders

working on quality aspects of jackfruit and for the value chain managers in the farmer-consumer chain for branding of jackfruit.

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