

Positive Correlation Between Yield and Quality Parameters in Jackfruit (*Artocarpus heterophyllus* Lam.)

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Abstract

Evaluation of 20 genotypes of jackfruit was conducted to evaluate yield and quality parameters and correlation on different parameters. Jackfruit fruit length had positively correlation with number of flakes and seeds per fruit and fruit diameter had positively correlation with number of seeds per fruit and fruit weight had positively correlation with seed diameter, flakes length, skin thickness, pectin and acidity. Flake length had positive correlations with fruit weight, fruit length, skin thickness and pectin whereas; flake width had positive correlation with fruit weight, acidity, seed diameter, and flake length and skin thickness. Seed diameter had also significant positive correlation with fruit weight, flake width, skin thickness, pectin and acidity while skin thickness had positive correlation with fruit weight seed diameter, flake width and pectin.

Key words : Jackfruit, Yield characters, Quality characters, Positive correlation.

Jackfruit (*Artocarpus heterophyllus* Lam.) is one of the most important minor edible fruit, though it is a quite palatable and rich in carbohydrates. It is slowly gaining commercial importance in dry lands of arid regions also, as a rainfed sustainable dry land Horticulture crop. It useful tree in the important genus *Artocarpus* under the family Moraceae. No one knows the place of origin of jackfruit but it is believed indigenous to the rain forests of Western Ghats (1) and now has spread throughout the tropics. It is a medium to big sized evergreen tree typically reaching 8 to 25 m in height that is recognized by its fruit, the largest among cultivated plants. The fruit is borne primarily on the trunk and interior part of main branches; usually weight 4.5 to 30 kg, although a weight of 50 kg has been reported. The jackfruit has innumerable types considering the fruit characteristics. The types differ widely among themselves in bearing, size, shape, quality and period of maturity. In India, mainly two types viz., soft flesh and firm flesh are available. Some types with local names like Gulabi (rose-scented), Champa (flavor like that of *Michelia* sp.), Hazari (bearing large number of fruits), Rudrakshki (roundish fruit) are also available. In South India, Jackfruits are classified as of two general types : *Koocha chakka*, the fruit of which have small, fi-

brous, soft, mushy, but very sweet carpels; *Koozha pazham*, more important commercially, with crisp carpel's of high quality known as *Varika*. These types are apparently known in different areas by other names such as *Barka* or *Berka* (soft, sweet and broken with the hands) and the *Kapa* or *Kapiya* (crisp and cut open with a knife) as reported by Simon et al. (2). The ripe fruit has high nutritive value and contains minerals and, vitamins A and C. However, this gaining popularity of the fruit crop is reported to be suffered from the fruit cracking a physiological disorder. There is not much systematic research work done on fruit yield and quality parameters correlation in jackfruit in India or elsewhere (3—5). So, to evaluate a good cultivar or genotype a positive correlation will provide reliable information on the nature and extent of relationship for bringing about improvement in the yield and other traits. So, for further crop improvement in jackfruit in the future this investigation is being carried out.

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Methods

The study involved survey and identification of

Table 1. List of jackfruit cultivars collected from different places in Karnataka.

Accession name	Place of collection	Fruit character
FSO-01	Farm Superintendent Office, GKVK	Non-cracking
FSO-02	Farm Superintendent Office, GKVK	Non-cracking
FSO-03	Farm Superintendent Office, GKVK	Non-cracking
FSO-04	Farm Superintendent Office, GKVK	Non-cracking
FSO-05	Farm Superintendent Office, GKVK	Non-cracking
TCJ-01	HRS, GKVK	Cracking
TCJ-02	HRS, GKVK	Cracking
TCJ-03	HRS, GKVK	Cracking
TCJ-04	HRS, GKVK	Cracking
T-01	Horticulture Farm, Tamaka, Kolar	Non-cracking
T-02	Horticulture Farm, Tamaka, Kolar	Non-cracking
T-03	Horticulture Farm, Tamaka, Kolar	Non-cracking
T-04	Horticulture Farm, Tamaka, Kolar	Non-cracking
T-05	Horticulture Farm, Tamaka, Kolar	Non-cracking
T-06	Horticulture Farm, Tamaka, Kolar	Cracking
T-07	Horticulture Farm, Tamaka, Kolar	Cracking
T-08	Horticulture Farm, Tamaka, Kolar	Cracking
T-09	Horticulture Farm, Tamaka, Kolar	Cracking
T-10	Horticulture Farm, Tamaka, Kolar	Cracking
T-11	Horticulture Farm, Tamaka, Kolar	Cracking

cracking and non cracking jackfruit genotypes from the field, and evaluation and correlation of morphological, yield and quality parameters of cracking and non-cracking genotypes done at Plant Molecular Biology Laboratory, Division of Horticulture, University of Agricultural Sciences, GKVK, Bangalore during the period of 2005-2008. To achieve the above mentioned objectives orchards growing jackfruit were randomly selected around Bangalore and Kolar districts, Karnataka. The lists of various cracking and non-cracking (control) genotypes that are surveyed for identification and evaluation and correlation of yield and quality parameters presented in Table 1 among the cracking and non-cracking cultivars of jack-

fruit to assess the correlation of different parameters. The quality parameters was estimated using the protocol describe by Shyamalauma et al. (6).

Results and Discussion

Correlation studies provide reliable information on the nature and extent of relationship for bringing about improvement in the yield and other traits. The data collected on various plant characteristics among the cracking and non-cracking cultivars of jackfruit were analyzed to assess the correlation among various yield and quality parameters. Results of the yield and quality parameters and the correlation analysis of 12 variables are given in Tables 2 to 4. It was observed that the values showed significant and positive correlations only between some characters and remaining were non-significant and negatively correlated.

Fruit Weight

Differences with respect to fruit weight were also observed among cracking and non-cracking (control) cultivars of Jackfruit. The maximum average fruit weight of 10.06 kg was recorded in T-02, which was followed by T-09. The least average fruit weight of 4.4 kg was observed in TCJ-03.

Fruit Length

Significant differences with regard to fruit length were recorded among the cracking and non-cracking (control) cultivars of jackfruit. The maximum fruit length of 51.33 cm was recorded by T-02, which was followed by T-09. The least average fruit length of 32.33 cm was observed in FSO-02.

Fruit Diameter

Significant difference with regard to fruit diameter was noticed among the cracking and non-cracking (control) cultivar of jackfruit. The maximum average fruit diameter of 78.33 was recorded for T-02, which was followed by T-09 (77.6 cm). The least average fruit diameter of 57.6 cm was observed in TCJ-01.

Number of Flakes/Fruit

The data with respect to number of flakes per

Table 2. Yield parameters of cracking and non-cracking genotypes of Jackfruit.

Tree name	Frt wt (kg)	Frt length	Frt diam (cm)	No. of flakes/fruit	Flake length (cm)	Flake width (cm)	Rind thickness (cm)	No. of seed/frt	Seed diam (cm)
1 FSO-01	5.0	34.6	59.6	165.2	5.02	2.23	1.34	165.2	2.17
2 FSO-02	6.7	36.6	67.6	241.2	5.07	2.42	1.31	241.2	2.00
3 FSO-03	8.6	45.8	73.0	249.0	5.22	3.05	1.12	249.0	1.88
4 FSO-04	5.8	40.6	61.0	192.5	5.16	2.74	1.23	192.5	1.96
5 FSO-05	5.7	38.6	65.6	178.7	5.54	3.09	1.28	178.7	1.91
6 TJC-01	4.7	35.3	60.0	170.4	4.54	1.91	1.03	170.4	1.71
7 TJC-02	4.7	32.3	57.6	175.1	4.75	2.04	1.13	175.1	1.73
8 TJC-03	4.4	36.3	59.0	162.8	3.34	1.84	0.97	162.8	1.81
9 TJC-04	6.1	43.6	67.6	231.8	4.45	2.15	1.03	231.8	1.76
10 T-01	5.1	37.3	58.6	168.3	4.03	2.42	2.08	168.3	1.61
11 T-02	10.06	51.3	78.3	342.2	5.41	2.74	2.14	342.2	1.67
12 T-03	6.7	43.6	72.0	214.4	3.77	2.96	1.28	214.4	1.74
13 T-04	0.06	43.3	64.3	188.06	3.95	2.35	1.98	188.0	1.63
14 T-05	4.9	41.3	60.0	146.6	3.04	2.66	2.03	146.6	1.73
15 T-06	5.9	43.0	68.3	201.7	4.35	2.04	1.66	201.7	1.74
16 T-07	5.2	38.6	64.0	171.6	3.16	2.78	1.79	171.6	1.71
17 T-08	5.2	41.6	62.3	179.6	3.71	1.95	2.05	179.6	1.61
18 T-09	9.1	48.0	77.6	293.3	4.64	3.25	0.76	293.3	1.80
19 T-10	5.2	41.0	62.6	189.6	4.82	2.54	1.43	189.6	1.69
20 T-11	6.1	37.3	65.0	195.2	4.93	2.85	1.54	195.2	1.87
F-test	NS			NS				NS	
CV	24.11	7.90	11.26	23.78	0.46	0.92	1.89	23.78	5.92
SE ±	0.84	1.85	4.24	27.92	0.01	0.01	0.01	27.92	0.17
CD 5%	2.42	5.28	12.12	79.80	0.03	0.03	0.04	79.80	0.49

fruit among the cracking and non-cracking (control) cultivars of jackfruit were recorded. The maximum average number of flakes per fruit of 342.2 was recorded for the T-02, which was followed by T-09 (293.30). The least average number of flakes per fruit of 162.8 was observed in TCJ-03. Haq (2006) also reported that normally 100 to 500 seeds per fruit were reported in each fruit.

Size (Length and Width) of Flakes

With regard to size of flakes differences were observed among cracking and non-cracking (control) cultivars of jackfruit. The maximum average length of flakes of 5.54 cm was recorded with FSO-5, which was followed by T-02 (5.41 cm). The least average length of flakes of 3.04 cm was recorded in T-05. Similarly, the maximum average width of flakes of 3.25 cm was recorded by T-09, which was followed by FSO-05 (3.09 cm). The least average width of flakes of 1.84 cm was observed in TCJ-03. Rai et al. (7) also reported that

evaluation of jackfruit under Eastern Indian condition of different genotypes has also content flakes per fruit of 90 to 333 and average flake size of 10.3—33.5 cm length and 2.7—5.0 cm flake width.

Rind/Skin Thickness

Differences with respect to rind/skin thickness were also observed among cracking and non-cracking (control) cultivar of jackfruit. The maximum average rind/skin thickness 2.14 cm was recorded for the T-02, which was followed by, T-01. The least average rind/skin thickness 0.76 cm was observed in T-09.

Number of Seeds/Fruit

The results with respect to number of seeds per fruit among the cracking and non-cracking (control) cultivar of jackfruit were recorded. The maximum average number of seeds per fruit of 342.2 was recorded by T-02, which was followed by T-09. The least average number of seeds per fruit of 146.6 was observed

Table 3. Quality parameters of different jackfruit genotypes.

Tree name	TSS (°Brix)	Pectin (%)	Acidity (%)
FSO-1	17.13	4.01	0.04
FSO-2	20.10	4.41	0.14
FSO-3	15.43	5.18	0.16
FSO-4	16.20	3.21	0.14
FSO-5	20.56	3.28	0.03
TJC-1	26.44	3.48	0.05
TJC-2	27.60	3.61	0.04
TJC-3	24.53	2.81	0.05
TJC-4	32.20	2.89	0.04
T-1	23.26	3.12	0.03
T-2	14.60	2.99	0.22
T-3	18.73	3.16	0.08
T-4	25.20	2.41	0.04
T-5	22.30	2.61	0.03
T-6	26.30	2.23	0.05
T-7	23.23	1.99	0.05
T-8	31.20	1.82	0.03
T-9	17.60	1.92	0.13
T-10	29.30	2.67	0.02
T-11	20.20	3.53	0.15
F-test	*	*	*
CV	0.70	13.15	0.44
SE ±	0.09	0.005	0.008
CD 5%	0.26	0.01	0.02

in T-05.

li-
ps*Diameter of Seed*

Significant differences with regard to diameter of seed were recorded among the cracking and non-cracking (control) cultivars of jackfruit. The maximum average seed diameter of 2.17 cm was recorded for FSO-

Pectin (%)

Slight differences with regard to pectin were noticed among the cracking and non-cracking (control) cultivar of jackfruit. The maximum average pectin of 5.18% was recorded for the FSO-03, which was followed by, FSO-02 (4.41 per cent). The least average

Table 4. Correlation matrix for twelve variable fruit characters. 1. Fruit length, 2. Fruit diameter, 3. Fruit weight, 4. Number of flakes per fruit, 5. Seed diameter, 6. Flake length, 7. Flake breadth, 8. Number of seeds/fruit, 9. Skin thickness, 10. TSS, 11. Pectin, 12. Acidity.

	1	2	3	4	5	6	7	8	9	10	11	12
1	1.000											
2	0.373	1.000										
3	0.078	-0.854**	1.000									
4	0.578*	0.894**	-0.384*	1.000								
5	-0.029	-0.909**	0.992**	-0.676*	1.000							
6	0.076	-0.276	0.507*	0.020	0.466	1.000						
7	0.260	-0.589*	0.852**	-0.363	0.815**	0.513*	1.000					
8	0.575*	0.897**	-0.590*	1.000	-0.682*	0.015	-0.369	1.000				
9	-0.021	-0.910**	0.992**	-0.677*	0.999**	0.456	-0.814**	-0.683*	1.000			
10	-0.256	0.386	-0.607	0.199	-0.366	-0.379	-0.379	0.203	-0.565*	1.000		
11	-0.097	-0.873**	0.958**	-0.631*	0.964**	0.582*	0.582*	-0.637*	0.960**	-0.586*	1.000	
12	0.017	-0.881**	0.997**	-0.625*	0.996**	0.493	0.493	-0.631*	0.996**	-0.591*	0.966**	1.000

acidity of 1.82% was observed in the T-08.

Acidity (%)

Significant differences with regard to acidity percentage were observed among the cracking and non-cracking (control) cultivars of jackfruit. The maximum average acidity of 0.22% was recorded by the cultivar T-02, which was followed by, FSO-03. The least average acidity of 0.02% was observed in T-10.

Positive Correlations Between Characters of Yield and Quality Parameters

The fruit length had significant positive correlation with number of flakes per fruit (0.57) and number of seeds per fruit whereas the fruit diameter had significant positively correlated with number of seeds per fruit. Fruit weight had significant positive correlation with the seed diameter (0.99), flake length (0.56), flake width (0.85), skin thickness (0.99), pectin (0.95) and acidity (0.99). Number of flakes per fruit and seeds per fruit had significant positive correlation with fruit diameter (0.89). Flake length had positive correlations with fruit weight (0.56), fruit length (0.51), skin thickness (0.55) and pectin (0.58) whereas; flake width had positive correlation with fruit weight (0.85), acidity (0.88), seed diameter (0.81), flake length (0.51) and skin thickness (0.81), pectin (0.80) and acidity (0.83). Seed diameter had also significant positive correlation with fruit weight (0.99), flake width (0.81), skin thickness (0.99), pectin (0.96) and acidity (0.99) while skin thickness had positive correlation with fruit weight (0.99), seed diameter (0.99), flake width (0.81) and pectin (0.96). Further, pectin had also significant positive correlation with fruit weight (0.95), seed diameter (0.96), flake width (0.80), skin thickness (0.96) and acidity (0.96) and quality parameter acidity had positive correlation with fruit weight (0.99), seed diameter (0.99), flake width (0.83) and skin thickness (0.99).

Singh et al. (8) also reported that the RAPD analysis identified OPC-07 as the polymorphic primer showing band size of 810 bp as the polymorphic marker for the differentiation of cracking and non-cracking geno-

types of jackfruit. The sequence data of fruit cracking character was analyzed for its identity using BLASTX search for its homology with the sequence of a gene already recorded in the database of NCBI, Bethesda, USA and nucleotide sequence data reported in Gene Bank (NCBI). Thus, from the above investigation it can be concluded that positive correlation will provide reliable information on the nature and extent of relationship for bringing about improvement in the yield and other traits and the screening of the cracking cultivars can be done in the seedling stage through molecular marker application which is reported to be contained less pectin in the peel of it causing cracking in the jackfruit.

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