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## Morphological fruit characters and nutritional food value of different jackfruit (*Artocarpus heterophyllus* Lam.) cultivars in Rajshahi region of Bangladesh

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### Abstract

Morphological fruit characters and nutritional food value of different jackfruit cultivars were studied during May to July 2012 to find out the superior ones in terms of the standard variables. The different cultivars of jackfruit were collected from Rajshahi, Natore, Noagoan and Chapai Nawabgonj. These cultivars showed variability in morphological fruit characters and nutritional food values. Among them the percentage of pulp (38.60-47.37%), percentage of rind (15.67-20.00%), percentage of skin (14.86-23.68%), percentage of seed (09.46-19.33%), moisture content (63.39-76.62%), TSS (18.80-27.37%), total sugar (11.84-17.01%), vitamin C content (17.82-31.55 mg/100gm) and acidity (0.037-0.075% as citric acid) were estimated. The findings show that, evaluation of these promising cultivars have identified them as superior ones. The data provide important information in improving the quality characteristics of jackfruit for plantation and processing industry.

**Keywords:** Morphological fruit characters; Nutritional value; Jackfruit cultivar and Recognition

### Introduction

Jackfruit is well known and the most important fruit of Bangladesh and also it is the "national fruit of Bangladesh". Jackfruit is certainly one of the delicious and esteemed fruits of the world. It is a nutritious fruit and an excellent source of essential minerals, beta carotene (Provitamin A), vitamin C, carbohydrate and energy in human nutrition, therefore, is useful to prevent many deficiency diseases (Salunkhe and Kadam, 1995).

It is widely cultivated in most tropical countries like Bangladesh, India, Burma, Brazil, Philippines, Pakistan, Thailand, Malaysia, Sri Lanka, Africa and some other parts of Australia and America. With increasing recognition of their nutritional value in human diet, these fruits are gaining commercial importance (Salunkhe and Desai, 1984). The jackfruit is hardly regarded as commercial fruit crop although extensively cultivated (Bose and Mitra, 1990).

Jackfruit is a seasonal fruit and a tropical evergreen tree having the botanical name *Artocarpus heterophyllas* Lam. under genus *Artocarpus* and family Moraceae (Alam *et al.*, 2011). It is cross pollinated and largely propagated by seeds. Jackfruits are oval or oblong, pale green to yellow-brown in

color, rind formed by a number of conical homy protuberances. Raw (tender) jackfruit can be separated into edible (47%) and non edible portions (53%) whereas ripe fruit can be separated in five parts, viz.(i) pulp (bulbs), (ii) seeds, (iii) rind, (iv) central core and (v) sheath around the pericarp. Of these parts of jackfruit, pulp is the part most utilized for human consumption. The pulp whether ripe or immature can be used for making jams, jellies, beverages, candies and dehydrated products (Sonwalkar, 1951; Bhatia *et al.*, 1995; Chadha and Pareek, 1993 ). Virtually all parts of the fruit are usable either as food for human consumption or as cattle feed.

Awareness in respect of improved jackfruit production is lacking. In view of the above aspect, the present study has been undertaken to throw light on some of the constituents of jackfruit with a view to apprehending the fruit as a supplementary food having a good nutrient value as well as to select the varieties for plantation with a hope to be a member of jackfruit exporting countries.

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## Materials and methods

The present experiment was carried out at BCSIR Laboratories, Rajshahi during the period from May to July 2012. The freshly harvested jackfruits (10 cultivars) used in this experiment were procured randomly from three Jackfruit garden of Rajshahi, Natore, Noagoan and Chapai Nawabgonj. The jackfruits under experiment were designated as AH001, AH002, AH003, AH004, AH005, AH006, AH007, AH008, AH009 and AH010. The morphological fruit characteristics of the jackfruits viz. the colour, shape, surface and the pulp (bulb) colour, flavour and taste were estimated and presented in Table I. & Fig. 1.

**Table I: Morphological fruit characters of ten jackfruit cultivars in Rajshahi region**

Sl.No.	Accessions	Fruit colour	Fruit shape	Fruit surface	Pulp colour	Pulp taste	Pulp flavour
01.	AH001	yellowish	Ellipsoid	Spiny	Yellow	Sweet	Weak
02.	AH002	Light yellow	Ellipsoid	Spiny	Yellow	Light Sweet	Stroge
03.	AH003	Yellowish	Oblong	Spiny	Light yellow	Sweet	Stroge
04.	AH004	Redish yellow	Oblong	Spiny	Deep yellow	Deep weet	Stroge
05.	AH005	Light yellow	Oblong	Spiny	Yellowish	Sweet	Weak
06.	AH006	Yellowish	Spherid	Spiny	Light yellow	Light Sweet	Stroge
07.	AH007	Yellowish	Oblong	Spiny	Yellow	Sweet	Medium
08.	AH008	Light yellow	Ellipsoid	Spiny	Yellowish	Sweet	Stroge
09.	AH009	Green yellow	Ellipsoid	Spiny	Yellow	Light Sweet	Stroge
10.	AH010	Yellowish	Oblong	Spiny	Yellow	Sweet	Medium

The ripen jackfruits were cleaned, weighed, peeled and the stone (seed) were separated. The weight of whole jackfruit, weight of stone (seed), weight of skin (peel), weight of pulp, were determined using standard methods and the data were presented in Table II.

The total soluble solids (TSS) was determined with a hand refractometer (Alam *et al.*, 2011), sugar was determined by colorimetric method i.e. Anthrone method (Dubois *et al.*, 1956), vitamin C was determined titrimetrically using 2,6-dichlorophenolindophenol (Gryorgy and Pearson, 1967), acidity was determined titrimetrically with the visual acid-base titration method (Ranganna, 1986). The pH was determined with a digital pH meter (Jayaraman, 1981), moisture was determined by oven drying method (Karmas, 1990) and ash was determined by muffle furnace by ashing method (Modevan and Sridhar, 1982). All experiments were conducted at ambient temperature and carried out in three replications and also the mean values are recorded in Table III. The above data were statistically analyzed and the mean of

different parameters was compared by least significant difference (LSD) test.

The organoleptic tests and the morphological characters (e.g. colour, flavour and taste) of these ripe jackfruits were carried out and evaluated by a panel of seven judges. The jackfruits were classified as follows on the basis of their grading as excellent 80% or above, good 70-79% and fair bellow 70%. The results are presented in Table IV.

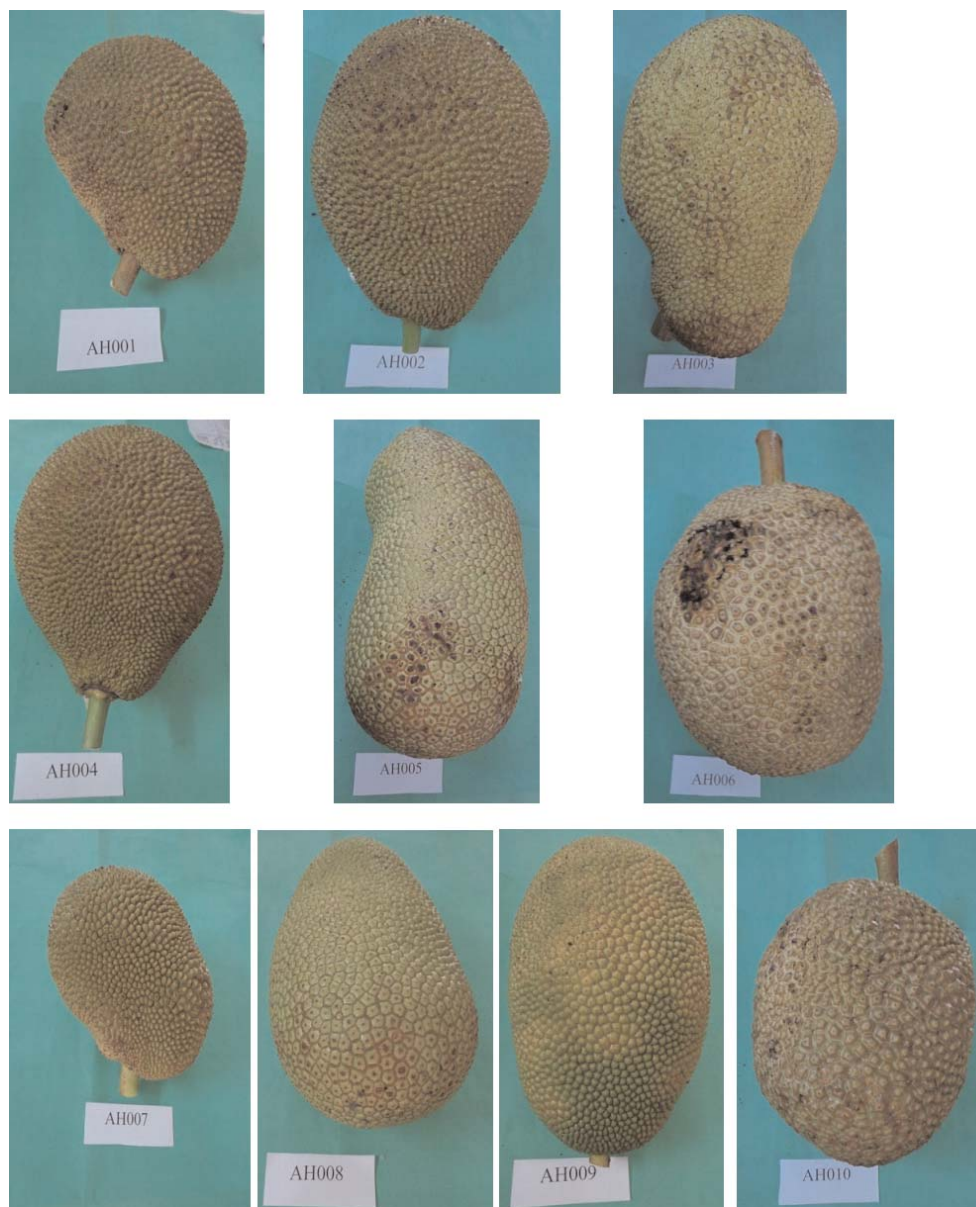
## Results and Discussion

The findings of fruit morphological study (Table I, Fig.1.) show that, the fruit colour was found yellowish in the culti

var of AH001, AH003, AH006, AH007 and AH010 while AH005 and AH008 showed light yellow colour. The cultivars AH001, AH002, AH008 and AH009 produced fruits of ellipsoid shape whereas the cultivars AH003, AH004, AH005, AH007 and AH010 produced oblong shapes of fruits. The surface of the fruits of all the cultivars are spiny. Only the cultivar AH004 obtained deep yellow pulp colour whereas AH001, AH002, AH007, AH009 and AH010 produced yellow pulp colour and pulp of major cultivars were tasted sweet except AH002, AH006 and AH009 which had light sweet taste and AH004 had deep sweet taste.

The strong pulp flavor was observed in most of the cultivars but AH001 and AH005 possessed weak pulp flavor while AH007 and AH010 were of medium type. The findings are in conformity with those of Alam *et al.*, (2011) (Jagadeesh *et al.*, (2007) and Biswas *et al.*, (2001).

Significant variation was observed among the different cultivars in respect of whole fruit weight. The maximum fruit



**Fig. 1. Ten cultivars of jackfruit in Rajshahi region of Bangladesh**

weight was recorded in AH003 (5.70 kg) which was 1.5 times heavier than the next heaviest AH006 (3.80 kg). The smallest fruit (1.39 kg) was recorded in AH007 (Table II.). The information were similar with the findings of Alam *et.al.*, (2011) who reported jackfruits to be in the range of 2.2 to 5.9 kg in fruit weight. Fruit is composed percentage of peel (skin), pulp, rind and the composition of fruits are varied among the cultivars (Table II.). Pulp percentages (edible portion) were above 44.44 % of AH002, AH004 and AH006.

The rind percentage ranged from 15.67 to 22.73%, the peel percentage varied from 14.86 to 23.68%. The wastage per-

centage varied from 38.33 to 46.04%. The highest wastage cultivars were AH002, AH003 and AH007. The least seeded cultivars were AH004, AH005 and AH006 and maximum were AH009 and AH010, variation in percentage of edible portion (pulp), peel (skin), rind, wastage and seed was also recorded by Alam *et al.*, (2011).

The moisture content, dry mater, TSS , pH, total sugar content, reducing sugar, non reducing sugar, vitamin C content, acidity and ash content of jackfruit cultivars varied among the cultivars and presented in Table III. and wide variation

**Table II. Morphological fruit characters of ten jackfruit cultivars in Rajshahi region**

SL No	Accessions	Whole weight of fruit( kg)	Weight of Pulp. (%)	Weight of Rind (%)	Weight of Seed (%)	Weight of skin (%)	Weight of wastage (%)
1	2	3	4	5	6	7	8
01	AH001	3.50	43.45	20.00	15.71	22.86	42.85
02	AH002	3.70	45.95	22.73	16.46	14.86	44.59
03	AH003	5.70	38.60	21.05	16.67	23.68	44.73
04	AH004	3.60	44.44	19.44	13.89	22.22	41.67
05	AH005	4.25	43.36	21.00	12.12	23.53	39.41
06	AH006	3.80	45.37	17.11	13.16	22.36	43.53
07	AH007	1.39	43.17	15.67	17.98	23.18	46.40
08	AH008	2.95	38.90	19.95	18.61	22.54	42.71
09	AH009	3.6	38.90	21.06	19.22	18.06	38.33
10	AH010	3.75	39.33	19.14	19.33	22.20	40.50
	LSD 5%	0.0506	0.0095	0.0094	0.7280	0.0338	0.0338
	LSD 1%	0.0693	0.0129	0.0129	0.0995	0.0463	0.0463

was observed in all the parameters. Maximum moisture content (76.62%) was found in cultivar AH006 while minimum dry matter (23.38%) was found in AH006. The total soluble solids (TSS) and pH were ranged from 18.80 to 27.30% and 4.53 to 4.75% respectively. Total sugar content was found the highest (17.01%) in AH001 whereas the lowest (11.84%) found in AH003. Maximum reducing sugar content (4.59%) and maximum non reducing sugar content (12.42%) were found in AH001. The maximum vitamin C content was found (31.55 mg/100g) in cultivar AH010 while that of min-

imum (17.82 mg/100g) was found in AH008. Highest acidity (0.075% as citric acid) was observed in AH009 followed by AH008 (0.068% as citric acid) where as AH005 had the lowest acidity (0.037% as citric acid). Ash content of different jackfruit cultivars were ranged from 0.403 to 1.276 %. These results were found similar to earlier findings of Bhatia *et.al.* (1995) in jackfruits (Reddy *et.al.*, 2004; Silvaraj and Pal, 1989; Chadha and Pareek, 1993 and Jagadish *et.al.*, 1989).

Consumer's acceptability of jackfruit depends mainly on appearance (colour), flavor and taste. Hence, organoleptic

**Table III. Nutritional food value of ten jackfruit cultivars in Rajshahi region**

SL. No.	Accessions	Moisture %	Dry matter %	Total Soluble Solids (%)	pH	Total Sugar %	Reducing Sugar %	None Reducing Sugar %	Vitamin C mg/ 100gn	Acidity % As Citric Acid	Ash %
1	2	3	4	5	6	7	8	9	10	11	12
01	AH001	63.39	36.61	24.5	4.55	17.01	4.59	12.42	20.35	0.055	1.119
02	AH002	74.40	25.39	21.1	4.65	13.29	3.58	09.71	28.00	0.056	0.928
03	AH003	73.63	26.37	18.8	4.55	11.84	3.43	08.41	28.30	0.053	0.859
04	AH004	70.74	29.26	22.0	4.45	13.64	3.81	09.83	23.54	0.058	1.203
05	AH005	76.14	23.86	22.1	4.53	13.70	3.56	10.14	19.92	0.037	0.806
06	AH006	76.62	23.38	19.6	4.70	12.35	3.45	08.90	22.23	0.046	0.103
07	AH007	67.82	32.18	25.3	4.47	16.74	4.35	12.39	22.70	0.063	1.076
08	AH008	68.67	31.33	24.2	4.45	16.12	4.19	11.93	17.82	0.068	1.932
09	AH009	62.39	38.60	22.1	4.75	13.70	3.67	10.03	28.95	0.075	1.516
10	AH010	67.98	32.02	20.5	4.63	12.92	3.74	09.18	31.55	0.045	1.976
	LSD 5%	0.0210	0.0133	0.0797	0.0132	0.0162	0.0126	0.0129	0.0030	0.00054	0.00079
	LSD 1%	0.0288	0.0181	0.1090	0.0182	0.0222	0.0173	0.0178	0.0041	0.00074	0.00109



**Table IV. The grading of ripen jackfruit as judged by the panel of seven judges based of general qualities of jackfruits.**

SL No	Accessions	Physical characters	Marking by individual judges (%)							Total	Mean (%)	Order of rating
			1	2	3	4	5	6	7			
01	AH001	Colour	70	65	68	75	72	71	69	490	70.0	Good
		Flavour	63	58	57	67	53	59	64	521	60.1	Fair
		Taste	81	83	85	84	82	80	82	577	82.4	Excellent
02	AH002	Colour	60	52	57	49	50	52	48	368	52.6	Fair
		Flavour	45	43	41	50	53	51	49	332	47.4	Fair
		Taste	63	61	58	45	61	56	45	389	55.6	Fair
03	AH003	Colour	73	78	69	73	75	71	76	515	73.6	Good
		Flavour	93	74	88	71	74	98	96	614	87.7	Excellent
		Taste	90	93	89	94	96	84	87	633	90.4	Excellent
04	AH004	Colour	92	90	88	87	93	94	87	631	90.1	Excellent
		Flavour	75	82	80	85	78	76	84	560	80.0	Excellent
		Taste	78	88	78	86	88	86	83	587	83.9	Excellent
05	AH005	Colour	75	72	78	63	86	69	77	520	74.3	Good
		Flavour	72	83	70	75	78	80	81	539	77.0	Good
		Taste	90	86	95	79	88	87	82	607	86.7	Excellent
06	AH006	Colour	67	77	65	72	78	71	62	492	70.3	Good
		Flavour	60	57	54	63	65	60	59	418	59.7	Fair
		Taste	73	68	74	77	69	65	72	498	71.1	Good
07	AH007	Colour	65	71	60	74	66	75	68	479	68.4	Fair
		Flavour	63	60	68	72	65	76	70	474	67.7	Fair
		Taste	70	73	61	66	74	70	62	476	68.0	Fair
08	AH008	Colour	72	78	73	80	84	70	74	531	75.9	Good
		Flavour	66	72	65	63	68	81	62	477	68.1	Fair
		Taste	74	73	79	82	85	80	76	549	78.4	Good
09	AH009	Colour	71	76	72	85	80	75	71	530	75.7	Good
		Flavour	68	62	60	65	59	63	54	436	61.6	Fair
		Taste	75	72	76	82	86	75	84	550	78.6	Good
10	AH010	Colour	82	76	72	80	84	82	79	555	74.3	Good
		Flavour	78	72	68	73	78	82	81	532	76.0	Good
		Taste	80	85	81	78	85	82	80	571	81.6	Excellent

testes were done on pulp (bulb) colour, flavour and taste of these fruits by a panel of seven judges. The results of the preferential comments from the panel members were summarized and converted into acceptability scores and also order of rating (Table IV). In this study, the cultivar AH004 made the highest score in the total acceptability and ranked as excellent followed by the cultivar of AH001, AH003, AH005 and AH010. (Shamsudin *et al.*, 2009; Reddy *et al.*, 2004; Rahman *et al.*, 1994).

### Conclusion

The results show that there are significant variations in the morphological fruit characters and nutritional food values of

jackfruit such as total soluble solid, pH, titrable acidity, vitamin C, sugar content, moisture content, pulp colour, flavour and taste. The study provides important information to the processing industry to produce better quality of commercial and thus can open product a potential market for commercial cultivation of jackfruit.

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