

Variability of fruit characters of Jackfruit in Rongram Block of West Garo Hills, Meghalaya

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ABSTRACT

Jackfruit (*Artocarpus heterophyllus* Lam.) is a popular fruit among the Garo tribe, and is grown as a homestead crop. Most of the cultivated trees are of seedling progeny. Wide variations are found among the trees concerning fruit-bearing, fruit morphology, and fruit quality. A survey was conducted in Rongram block of West Garo Hills district of Meghalaya to study the fruit and seed characters of different jackfruit trees. Out of the 20 trees observed, Type 4, Type 6, Type 15, Type 19 and Type 20 produced very juicy pulp which are suitable for juice processing. Type 1, Type 11 and Type 17 produced fruits with firm textured, thick flakes which are suitable for chips making. Type 4, Type 9, and Type 12 produced fruits with soft and sweet flakes which can be used for processing into products like jam, jelly, halwa, etc. Fruits of Type 11 and Type 18 exhibited a total soluble solids (TSS) content of 25°Brix which may be used for table purpose.

Key words: Jackfruit, West Garo Hills, Fruit Characters, Seed characters

INTRODUCTION

The jackfruit tree (*Artocarpus heterophyllus* Lamk.) is a tropical evergreen tree belonging to family Moraceae bearing a dicotyledonous compound fruit. Jackfruit is a very popular fruit among the Garo tribe, commonly known as 'Tebrong' and is grown as a homestead crop. The fruits are good source of vitamin A, B, C, potassium, calcium, iron, proteins, minerals and carbohydrate (Chadha, 2009). Jackfruits are highly nutritive and a rich source of pectin, carotene, ascorbic acid and contain the substantial amount of fiber (Sharma *et al.*, 2009). The seeds are very rich in protein and contain a high amount of starch. Most of the jackfruit trees grown in Garo Hills are of seedling origin and do not bear true-to-type. Considerable variations in morphological characters of jackfruit trees were observed for various traits like tree growth habit, canopy structure, leaf size, leaf shape, leaf petiole, fruit maturity, fruiting season, fruit shape, fruit size, number of fruits per tree, fruit weight, fruit rind thickness, pulp texture, seed shape, and seed weight (Haq (2006). This has drawn the attention of researchers to find out desirable characters in jackfruit for eventual release as novel variety in future. Although jackfruit is grown extensively in West Garo Hills, it is still a neglected fruit crop

and very less research work has been done in this region. Therefore, an investigation was conducted to study the fruit characters, flake characters and seed characters of jackfruit trees grown in different locations of Rongram block of West Garo Hills district of Meghalaya.

MATERIALS AND METHODS

The present study was carried out in the Rongram Development block of West Garo Hills district of Meghalaya during 2014-2015. The West Garo Hills district lies approximately between 90° 30' and 89° 40' E longitudes and 26° and 25° 20' N latitudes. Twenty trees were selected randomly from different locations within the district, and 10 fruits from each tree were selected to record the fruiting behavior, fruit characters (quantitative and qualitative), flake characters (quantitative and qualitative) and seed characters (quantitative and qualitative). The data were collected as per the jackfruit descriptors prescribed by IPGRI (International Plant Genetic Resources Institute, 2000), Rome, Italy. Statistical tools such as standard deviation, the coefficient of variation, etc. were used to assess variations among the different types of jackfruit trees.

RESULTS AND DISCUSSION

Among the 20 jackfruit trees studied under Rongram block, wide variations were observed

among the fruit and seed characters. The fruiting season of the selected trees started from March to May and ended during June-September. All trees showed a regular bearing habit. It was observed that fruits of Type 4, Type 6, Type 7, Type 8, Type 9, Type 15, Type 17 and Type 20 were borne on primary branches. Type 5 and Type 16 produced fruits on secondary branches, while Type 13 and Type 14 bore fruits on the main trunk. The remaining types produced fruits on primary, secondary and tertiary branches. Type 1, Type 2, Type 3, Type 4, Type 6, Type 7, Type 10, Type 12, Type 13, Type 14 and Type 18 bore fruits in clusters while Type 5, Type 9, Type 15, Type 16, Type 17, Type 19, and Type 20 showed solitary bearing. Type 11 and Type 8 showed cluster as well as a solitary bearing habit (Table 1).

Varied fruit shapes were observed among the 20 trees like the ellipsoid, oblong, spheroid, clavate, obloid and irregular (Table 2). Similarly, varied flake shapes were also observed like spheroid, obovate, rectangular, cordate, twisted and irregular (Table 3). Type 1, Type 6, Type 11, Type 14 and Type 17 had thick flake. The flake texture was observed to be firm, soft, coarse and fibrous among the 20 trees. Type 1, Type 3, Type 8, Type 11, Type 13, Type 17 and Type 20 exhibited firm flake texture. Pulp taste was sweet in Type 1, Type 2, Type 3, Type 4, Type 7, Type 8, Type 9, Type 11, Type 12, Type 16 and Type 18; insipid in Type 5, Type 6, Type 10, Type 14, Type 15, Type 17 and Type 20; acidic in Type 13 and Type 19. Pulp consistency was found to be soft, firm, medium and slimy. Some types exhibited a very strong pulp flavour, while some had weak and intermediate flavour. Fruits of Type 4, Type 6, Type 15, Type 19 and Type 20 were very juicy. Pulp colour varied from light to deep yellow and white to creamy white (Table 3).

Type 16 exhibited the highest average fruit weight of 12.1 kg followed by 11.9 kg in Type 1 and 10.1 kg in Type 17. The highest number of flakes per kg fruit (35.21) was recorded in Type 7. Highest flake weight per kg fruit (225 g) was recorded in Type 19. The weight of fresh flake with seed was recorded highest (46.7 g) in Type 1, which also recorded the highest weight of fresh flake without seed (39.42 g). Highest flake: fruit ratio of 0.61

was noted in Type 12 followed by 0.59 in Type 16. Flake length was highest (6.5 cm) in Type 4 and 14. Flake width was highest (4.3cm) in Type 4. The longest rachis of 38.7 cm was noticed in Type 4 while the diameter of the rachis was highest in Type 14 (11.3 cm). Type 11 and Type 18 recorded the highest TSS of 25 °Brix (Table 4).

Highest seed length (3.6 cm) was recorded in Type 15 while highest seed width was recorded in Type 13. The highest number of seeds per kg fruit (35.21) was noted in Type 7. Highest 100-seed weight (1084.33 g) was recorded in Type 6. Flake: seed ratio was highest in Type 1 (6.44) while lowest ratio (1.07) was observed in Type 5 (Table 5). Varied seed shapes were observed among the 20 types like reniform, spheroid, elongate and irregular. Seed coat colour varied from brown to dull brown and creamish to off-white (Table 6).

Reddy *et al.* (2004) conducted characterization studies on jackfruit in South Karnataka and observed enormous variability in the qualitative and quantitative traits of fruits. Mannan *et al.* (2005 and 2006) studied 28 off-season jackfruit germplasm of South Western regions of Bangladesh and observed significant variations among the germplasm in relation to fruit characteristics. Mitra and Mani (2000) observed nearly 1800 trees in Eastern India over a period of 7 years and identified 2 types with very juicy content as suitable for processing. Jagadeesh *et al.* (2007) observed 34 jackfruit types in a hilly region of Karnataka and identified 4 types suitable for chips making based on study of 9 flake characters. Mitra and Mani (2000) identified some types which were exhibiting TSS more than 25 °Brix and considered suitable for table purpose.

The sensory attributes of jackfruit flakes like appearance, colour, flavour, texture, and sweetness showed wide variation among the 20 types studied in Rongram block. Type 1, Type 11, and Type 17 produced fruits with firm textured, thick flakes suitable for chips making. Type 4, Type 9 and Type 12 produced fruits with soft and sweet flakes suitable for processed products like jam, jelly, halwa, candy, etc. Fruits of Type 4, Type 6, Type 15, Type 19 and Type 20 produced very juicy pulp which may be suitable for juice processing. Type 11 and Type 18 produced fruits with total soluble solids (TSS) content of 25° Brix suitable for table purpose.

Table 1: Fruiting behaviour of different types of jackfruit of Rongram block of West Garo Hills

Tree type	Start of fruiting season	End of fruiting season	Fruit bearing habit	Fruit bearing position	Fruit clustering habit	Fruit bearing intensity
Type 1	March	June-July	Regular	Other	Clusters	Heavy
Type 2	March	June-July	Regular	Other	Clusters	Heavy
Type 3	March	June	Regular	Other	Clusters	Medium
Type 4	March	June	Regular	Primary branch	Clusters	Poor
Type 5	April	August-September	Regular	Secondary branch	Solitary	Medium
Type 6	April	August-September	Regular	Primary branch	Clusters	Medium
Type 7	April	August-September	Regular	Primary branch	Clusters	Medium
Type 8	April	July-September	Regular	Primary branch	Other	Medium
Type 9	April	July-September	Regular	Primary branch	Solitary	Poor
Type 10	May	September	Regular	Other	Clusters	Medium
Type 11	March	June-July	Regular	Other	Other	Medium
Type 12	March	June	Regular	Other	Cluster	Poor
Type 13	March	June	Regular	Main trunk	Cluster	Poor
Type 14	March	June	Regular	Main trunk	Cluster	Poor
Type 15	March	July	Regular	Primary branch	Solitary	Poor
Type 16	March	July	Regular	Secondary branch	Solitary	Poor
Type 17	April	September	Regular	Primary branch	Solitary	Poor
Type 18	April	September	Regular	Other	Cluster	Medium
Type 19	April	September	Regular	Other	Solitary	Poor
Type 20	April	September	Regular	Primary branch	Solitary	Poor

Table 2: Fruit morphological characters of different types of jackfruit

Tree type	Fruit shape	Fruit surface	Shape of spine	Spine density	Latex exudation
Type 1	Ellipsoid	Spiny	Sharp pointed	Sparse	Low
Type 2	Irregular	Spiny	Sharp pointed	Sparse	Low
Type 3	Ellipsoid	Spiny	Sharp pointed	Dense	Low
Type 4	Oblong	Spiny	Sharp pointed	Dense	Medium
Type 5	Spheroid	Spiny	Intermediate	Sparse	High
Type 6	Ellipsoid	Spiny	Intermediate	Dense	High
Type 7	Spheroid	Spiny	Intermediate	Sparse	High
Type 8	Spheroid	Spiny	Intermediate	Sparse	Medium
Type 9	Oblong	Spiny	Sharp pointed	Dense	High
Type 10	Oblong	Spiny	Sharp pointed	Sparse	High
Type 11	Spheroid	Spiny	Intermediate	Sparse	Low
Type 12	Oblong	Spiny	intermediate	Sparse	Medium
Type 13	Spheroid	Spiny	Intermediate	Sparse	Low
Type 14	Ellipsoid	Spiny	Intermediate	Sparse	Medium
Type 15	Obloid	Spiny	Intermediate	Sparse	Low
Type 16	Clavate	Spiny	Sharp pointed	Sparse	High
Type 17	Oblong	Spiny	Intermediate	Sparse	Low
Type 18	Clavate	Spiny	Intermediate	Sparse	High
Type 19	Clavate	Spiny	Intermediate	Dense	Low
Type 20	Spheroid	Spiny	Sharp pointed	Dense	Medium

Table 3: Flake qualitative characters of different types of jackfruit

Tree type	Flake shape	Flake thickness	Flake Texture	Pulp Taste	Pulp Consistency	Pulp Flavour	Pulp Juiciness	Pulp Colour
Type 1	Irregular	Thick	Firm	Sweet	Medium	Intermediate	Not juicy	Yellow
Type 2	Irregular	Medium	Coarse	Sweet	Medium	Weak	Not juicy	Creamy white
Type 3	Twisted	Medium	Firm	Sweet	Slimy	Intermediate	Juicy	Deep yellow
Type 4	Irregular	Thin	Soft	Sweet	Soft	Strong	Very juicy	Yellow
Type 5	Cordate	Medium	Soft	Insipid	Slimy	Intermediate	Not juicy	Creamy white
Type 6	Rectangular	Thick	Soft	Insipid	Slimy	Intermediate	Very juicy	Light yellow
Type 7	Twisted	Medium	Soft	Sweet	Medium	Strong	Not juicy	Light yellow
Type 8	Irregular	Medium	Firm	Sweet	Firm	Weak	Not juicy	Deep yellow
Type 9	Cordate	Medium	Soft	Sweet	Slimy	Strong	Not juicy	Yellow
Type 10	Spheroid	Medium	Soft	Insipid	Soft	Intermediate	Juicy	Light yellow
Type 11	Spheroid	Thick	Firm	Sweet	Firm	Intermediate	Juicy	Yellow
Type 12	Cordate	Medium	Soft	Sweet	Slimy	Intermediate	Juicy	Yellow
Type 13	Twisted	Medium	Firm	Acid	Firm	Weak	Juicy	White
Type 14	Twisted	Thick	Soft	Insipid	Soft	Intermediate	Juicy	Light yellow
Type 15	Rectangular	Thin	Fibrous	Insipid	Slimy	Weak	Very juicy	Creamy white
Type 16	Obovate	Medium	Fibrous	sweet	Slimy	Strong	Juicy	Yellow
Type 17	Rectangular	Thick	Firm	insipid	Firm	Weak	Juicy	Light yellow
Type 18	Rectangular	Thin	Fibrous	Sweet	Slimy	Intermediate	Juicy	Yellow
Type 19	Rectangular	Thin	Soft	Acid	Slimy	Strong	Very juicy	Creamy white
Type 20	Rectangular	Medium	Firm	Insipid	Firm	Weak	Very juicy	Creamy white

Table 4: Fruit characters (quantitative) of different types of jackfruit

Tree Type	Stalk length (mm)	Stalk diameter (mm)	Average fruit weight (kg)	Number of flakes per kg fruit	Weight of flakes per kg fruit (g)	Avg. weight of fresh flake with seed (g)	Avg. weight of fresh flake without seed (g)	Flake/fruit ratio	Flake length (cm)	Flake width (cm)	Rachis length (cm)	Rachis diameter (cm)	TSS (°Brix)
Type 1	43.21	37.12	11.9	7.31	341.42	46.7	39.42	0.34	6	4.1	33	5.6	20
Type 2	68	18.5	3.25	32.61	369.23	11.3	6.6	0.36	3.6	2.5	18.2	4.4	20
Type 3	49.23	17.36	3	29.33	483.33	16.48	11.9	0.48	5.3	3.4	16.9	5.3	22
Type 4	55	36.35	6.55	14.19	389.31	27.42	21.18	0.38	6.5	4.3	38.7	4.4	19
Type 5	51.35	14.86	3.5	18.85	428.57	22.73	16.67	0.42	4	3.6	12.08	4.6	15
Type 6	75.85	30.08	8.55	10.29	380.11	36.93	26.7	0.38	6.4	3.9	32.5	8.3	19
Type 7	75.85	30.08	2.3	35.21	478.26	13.58	9.88	0.47	3.4	2.3	12.9	4.3	24
Type 8	79.44	17.74	2.5	9.6	340	35.42	27.08	0.34	4.9	3.8	13.9	3.4	21
Type 9	39.34	21.98	3.9	14.87	358.97	24.14	18.1	0.35	4.2	3.5	18	5.5	20
Type 10	66.17	16.87	3.8	11.31	315.78	27.91	20.93	0.31	4.8	3.8	17.6	3.9	19
Type 11	80.28	20.08	5.7	11.4	429.82	37.69	30	0.43	4.6	3.9	21	5.8	25
Type 12	78.25	21.23	4.2	19.52	607.14	31.09	23.78	0.61	4.9	3.6	17.8	4.6	22
Type 13	67.26	19.17	2.95	21.02	372.88	17.74	11.29	0.37	4.6	3.2	11.6	3.7	15
Type 14	33.8	23.11	9.85	10.65	639.59	43.52	36.57	0.46	6.5	3.9	23.6	11.3	17
Type 15	28.32	20.39	6.1	34.43	450.81	13.09	7.86	0.45	4.8	2.4	22.5	7.9	14
Type 16	50.23	16.19	12.1	16.3	586.95	36	27.33	0.59	5.6	3.6	34.5	4.9	20
Type 17	118.18	21.92	10.1	15.15	495.04	32.68	22.87	0.49	5.9	3.2	5.8	3.9	17
Type 18	47.51	18.1	3.4	22.5	376.81	16.88	12.99	0.38	5.2	2.6	15.5	3.5	25
Type 19	32.03	23.47	2	32.5	225	6.92	3.08	0.22	2.1	2.8	15	4.7	10
Type 20	49.23	24.18	4.5	28.89	377.77	13.08	9.23	0.38	5.7	2.4	4.9	2.4	18
Mean	59.43	22.44	5.51	19.80	422.34	25.57	19.17	0.41	4.95	3.34	19.30	5.12	19.1
SD	21.67	6.33	3.25	9.25	102.94	11.65	10.13	0.09	1.13	0.63	9.23	2.02	3.77
SEM±	4.85	1.42	0.73	2.07	23.02	2.60	2.26	0.02	0.25	0.14	2.06	0.45	0.84
CV (%)	36.47	28.23	59.03	46.74	24.37	45.55	52.82	22.29	22.79	18.85	47.83	39.41	19.73

Table 5: Seed quantitative characters of different types of Jackfruit

Tree type	Seed length (cm)	Seed width (cm)	Number of seeds per kg fruit	100-seed weight (g)	Flake/seed ratio
Type 1	3.5	2	6.89	771.95	6.44
Type 2	2.6	1.8	32.61	471.69	2.5
Type 3	2.3	1.6	28.66	465.11	3.62
Type 4	2.9	2	13.28	666.66	4.3
Type 5	2.8	1.7	18.85	606.06	1.07
Type 6	3.2	2.2	9.71	1084.33	3.61
Type 7	2.4	1.5	35.21	370.37	3.66
Type 8	2.9	2.4	9.2	869.56	4.25
Type 9	2.7	1.9	14.87	603.44	4
Type 10	3.2	2.4	11.31	697.67	4
Type 11	2.7	2.5	11.23	781.25	4.9
Type 12	3.1	2.3	19.05	750	4.25
Type 13	2.8	2.7	21.02	645.16	2.75
Type 14	3.2	2.1	10.65	697.14	6.24
Type 15	3.6	1.6	33.61	600	2.39
Type 16	3.3	1.9	16.19	800	4.15
Type 17	3.5	2	13.96	1063.82	3.33
Type 18	2.8	1.7	20.87	416.66	4.33
Type 19	2.1	1.6	32.5	384.61	1.8
Type 20	3.2	1.6	28.89	384.61	3.4
Mean	2.94	1.98	19.43	656.50	3.75
SD	0.41	0.35	9.29	208.09	1.30
SEM±	0.09	0.08	2.08	46.53	0.29
CV (%)	13.93	17.68	47.82	31.70	34.57

Table 6: Seed qualitative characters of different types of jackfruit

Tree type	Seed shape	Seed surface sliminess	Seed surface pattern	Seed coat colour	Adherence of seed coat to kernel	Vivipary
Type 1	Irregular	Highly slim	Uniform	Creamish	Easily separable	Present
Type 2	Irregular	Intermediate	Uniform	Creamish	Intermediate	Absent
Type 3	Irregular	Intermediate	Uniform	Creamish	Difficult to separate	Present
Type 4	Irregular	Highly slim	Patches	Dull brown	Difficult to separate	Absent
Type 5	Irregular	Highly slim	Regular striations	Dull brown	Easily separable	Present
Type 6	Reniform	Intermediate	Uniform	Dull brown	Easily separable	Present
Type 7	Reniform	Slightly slimy	Uniform	Creamish	Difficult to separate	Absent
Type 8	Irregular	Intermediate	Uniform	Off-white	Difficult to separate	Present
Type 9	Spheroid	Highly slim	Uniform	Dull brown	Difficult to separate	Absent
Type 10	Reniform	Intermediate	Uniform	Creamish	Easily separable	Present
Type 11	Spheroid	Intermediate	Uniform	Brown	Difficult to separate	Absent
Type 12	Irregular	Intermediate	Uniform	Dull brown	Difficult to separate	Absent
Type 13	Irregular	Intermediate	Other (crack)	Brown	Easily separable	Present
Type 14	Irregular	Slightly slim	Uniform	Brown	Easily separable	Present
Type 15	Elongate	Intermediate	Uniform	Dull brown	Intermediate	Absent
Type 16	Irregular	Intermediate	Uniform	Brown	Intermediate	Present
Type 17	Irregular	Slightly slim	Uniform	Dull brown	Difficult to separate	Present
Type 18	Irregular	Highly slim	Uniform	Brown	Difficult to separate	Absent
Type 19	Spheroid	Highly slim	Uniform	Dull brown	Difficult to separate	Absent
Type 20	Elongate	Intermediate	Uniform	Creamish	Difficult to separate	Absent

REFERENCES :

- Chadha, K.L. 2009. *Handbook of Horticulture*. Indian Council of Agricultural Research. Pp. 195-196.
- Haq, N. 2006. *Jackfruit (Artocarpus heterophyllus)* Southampton for underutilized crops, University of Southampton, Southampton, SO17 1BJ, UK. Pp. 77-99.
- Jagadeesh, S.L., Gorbali, K., Hedge, L., Swami, G.S.K.R., Reddy, B.S., Basavaraj, N. and Raghavan, G.S.V. 2007. Variability studies in physicochemical parameters in chips purpose jackfruit selections of the hilly zone in Karnataka. *Karnataka J. Agric. Sci.*, **20**(2): 346-349.
- Mannan, M.A., Sultana, S and Gain, P. 2005. Fruit characteristics of some off-season jackfruit germplasms. *J. Bangladesh Soc. Agric. Sci. Technol.*, **2**(3&4): 69-72.
- Mannan, M.A., Sultana, S. and Khan, S.A.K.U. 2006. Evaluation of physical characteristics of some off-season jackfruit germplasms from south-western region of Bangladesh. *Khulna University Studies*, **7**(2): 71-76.
- Mitra, S.K. and Mani, D. 2000. Conservation and utilization of genetic resources in jackfruit (*Artocarpus heterophyllus Lamk.*)-A potential underutilized fruit. *Acta Hort.*, **523**:229-232.
- Reddy, B.M.C., Patil, P., Kumar, S.S. and Govindaraju, L.R. 2004. Studies on physicochemical characteristics of jackfruit clones of south Karnataka. *Karnataka J. Agri. Sci.*, **17**(2): 279-282.
- Sharma, G., Sharma, O.C. and Thakur, B.S. 2009. *Systematics of the fruit crop*. New Delhi Publishing Agency. Pitam Pura, New Delhi. Pp. 217-220.