

STUDY ON THE PHYSICO-CHEMICAL CHARACTERISTICS OF LONGAN (*Euphoria longana*) GERMPLASM

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Abstract

A study on the physico-chemical characteristics of 15 promising longan germplasm was carried out at the fruit Research Farm of Horticulture Research Centre (HRC) as well as laboratory of Post harvest Technology Section of HRC and the Central Laboratory of Bangladesh Agricultural Research Institute, Joydebpur, Gazipur. The experiment was conducted during the fruiting season of 2010. Fifteen promising lines of longan germplasm including BARI Anshphal-1, BARI Anshphal-2, EL-Joy 003 to EL-Joy 015 of 12 years old were included in this experiment. A wide range of variations were observed among the germplasm in respect of different characteristics under the present study. Per cent edible portion was the highest in EL-Joy 010 (76.57 %), EL-Joy 006 (74.55%), EL-Joy 003 (74.20 %) and the lowest in EL-Joy 012 (65.10 %). Total reducing and non-reducing sugar was the maximum in EL-Joy 009 (6.94 %) and BARI Anshphal-2 (16.50 %), respectively. BARI Anshphal-1 contained the highest amount of ascorbic acid (13.00 mg/100 g) and EL-Joy 009 possessed the maximum total soluble solids (22.30 %). The study revealed that BARI Anshphal-1, BARI Anshphal-2, EL-Joy 003, EL-Joy 006, EL-Joy 009, EL-Joy 010 were the best in respect of physical and chemical characteristics of fruits.

Keywords: Longan, physico-chemical characteristics, Vitamin-C.

Introduction

The longan (*Euphoria longana*) is a highly esteemed arilloid fruit species in Asia and belongs to the family of Sapindaceae. The word 'longan' or 'long yan' or 'lungngan' comes from the Chinese and literally means 'dragon-eye' which is an apt description of the fruit after the skin has been removed. It grows satisfactorily in a wide range of tropical and subtropical countries but is exploited commercially only in Thailand, China, Taiwan and recently in Vietnam (Wong, 2000). Like the lychee, longan is adapted to a subtropical environment with warm, humid summer and cool, dry winter. Nevertheless, it doesn't tolerate temperatures below 32⁰F (0⁰C), and temperatures of 26 to 28⁰F (-2 to -3⁰C) can cause severe damage or death to young trees (Anon, 2007). In the tropics, longan can be grown from sea level to 1,800 feet (549 m) altitude. The longan is adaptable to different soils, but doesn't tolerate water logging or saline conditions (Anon., 2007). Growth is the best in fertile, deep soils with a pH of 5.5 to 6. The

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climatic condition of Bangladesh may be suitable for longan cultivation. The longan resembles the lychee (*Litchi chinensis*). Fruit can be eaten fresh, frozen, canned or dried. It contains 109.0 calorie, 1.0 g protein, 0.5 g fat, 25.2 g carbohydrate, 2.0 mg calcium, 0.3 mg iron, 6.0 mg phosphorus, 28.0 I.U. vitamin A, 8.0 mg vitamin C per 100 g of edible fruit (Wong and Saichol, 1991). Longan was introduced in Bangladesh in early sixties. As it is an introduced fruit, the information of fruiting behaviour of this fruit is scanty. Only one experiment on performance of longan at joydebpur condition was carried out (Saifullah, 1996). The detailed study on longan fruits has not been carried out in this country. So the present study was undertaken to select superior genotypes in respect of fruit quality.

Materials and Method

A study on the physico-chemical characteristics of 15 promising longan germplasm was carried out at the fruit Research Farm of Horticulture Research Centre (HRC) as well as laboratory of Post Harvest Technology Section of HRC, Central Laboratory of Bangladesh Agricultural Research Institute, Joydebpur, Gazipur. The experiment was conducted during the fruiting season of 2010. Fifteen promising lines of longan germplasm including BARI Anshphal-1, BARI Anshphal-2, EL-Joy 003 to EL-Joy 015 of 12 years old were included in this experiment. The seedling plants were planted in 1997 at 4 m × 4 m spacing. Single plant of each germplasm was considered as one replication.

For this study, 30 mature fruits were collected randomly from each plant. After collection, the fruits were kept on the laboratory desk at ambient condition for recording physical and chemical characteristics. Twenty full ripe fruits per plant were used for physical characteristics and rest ten fruits were taken to the Bio-chemistry Laboratory for chemical analysis. Data on different parameters of fruits were recorded according to book of “Longan Production in Asia” edited by Wong Kai Choo (2000) with the help of digital balance, vision refractometer. Organoleptic tests were done by a pannel of three members. Data on different parameters were recorded and analyzed statistically.

Results and Discussion

Quantitative characteristics of longan fruits

The qualitative and quantitative characteristics of fruits of some longan genotypes are presented in Table 1 and 2. Wide range of variability was observed among the genotypes under study in respect of different physical and chemical characteristics of fruits. Fruit weight of different genotype varied from 3.65g to 8.80g. The highest fruit weight was recorded in the genotypes EL-Joy 013 (8.80g) and EL-Joy 015 (8.80g) followed by EL-Joy 010 (7.94g), EL-Joy 014

(7.65g) and EL-Joy 012 (7.45g). The lowest fruit weight was obtained from the variety BARI Anshphal-1 (3.65g). The length and diameter of fruits varied from 1.67 to 2.38 cm and 1.86 to 2.63 cm, respectively. The maximum fruit length was found in EL-JOY 012 (2.38 cm) and EL-Joy 013 (2.38 cm), whereas the minimum in BARI Anshphal-1 (1.67 cm). The maximum fruit diameter was obtained from EL-Joy 010 (2.63 cm), while the minimum from BARI Anshphal-1 (1.86 cm). Morton (1987) reported that fruits are 1.25-2.50 cm in diameter. The highest rind weight was recorded in EL-Joy 015 (1.40g) followed by EL-Joy 012 (1.25 g) and EL-Joy 013 (1.33 g) whereas, the lowest in EL-Joy 008 (0.44 g). The weight of aril was the highest in EL-Joy 010 (6.08g) closely followed by EL-Joy 015 (6.00g) and EL-Joy 013 (5.87 g), while the lowest in BARI Anshphal-1 (2.62 g). The heaviest seed (1.60 g) was obtained from EL-Joy 013 (1.60 g), whereas the lightest from the variety BARI Anshphal-1 (0.45 g) (Fig. 1). Percent edible portion of fruits ranged from 65.10 to 76.57 %. The highest percentage of edible portion was recorded in the germplasm EL-Joy 010 (76.57 %) followed by EL-Joy 006 (74.55 %), EL-Joy 003 (74.02 %), and EL-Joy 005 (72.68 %) while the lowest in EL-Joy 012 (65.10 %). Wong (2000) stated that the aril constitute from 60 to 75 percent of the total fruit weight.

Table 1. Quantitative characteristics of fruits of some longan genotypes

Treatment	Fruit wt. (g)	Fruit length (cm)	Fruit diameter (cm)	Aril wt (g)	Rind wt (g)	Seed wt (g)	Edible portion (%)
BARI Anshphal-1	3.65	1.67	1.86	2.62	0.58	0.45	71.78
BARI Anshphal-2	5.25	2.03	2.11	3.51	0.72	1.02	66.86
EL-Joy 003	5.85	2.20	2.31	4.33	0.65	0.87	74.02
EL- Joy 004	6.60	2.32	2.49	4.35	1.02	1.23	65.91
EL- Joy 005	5.49	2.02	2.19	3.99	0.61	0.89	72.68
EL- Joy 006	6.17	2.18	2.28	4.60	0.55	1.02	74.55
EL- Joy 007	6.45	2.08	2.22	4.47	0.93	1.05	69.30
EL- Joy 008	4.77	2.06	2.03	3.26	0.44	1.07	68.34
EL- Joy 009	5.57	2.04	2.18	3.92	0.50	1.15	70.38
EL- Joy 010	7.94	2.30	2.63	6.08	0.63	1.23	76.57
EL- Joy 011	6.34	2.12	2.38	4.44	0.69	1.21	70.03
EL- Joy 012	7.45	2.38	2.55	4.85	1.25	1.35	65.10
EL- Joy 013	8.80	2.38	2.48	5.87	1.33	1.60	66.70
EL- Joy 014	7.65	2.36	2.46	5.20	0.95	1.50	67.97
EL- Joy 015	8.80	2.31	2.43	6.00	1.40	1.40	68.18
Mean	6.45	2.16	2.31	4.50	0.82	1.14	69.89
SD	1.46	0.19	0.21	1.00	0.31	0.28	3.41
CV (%)	22.68	8.87	9.15	22.19	38.21	24.98	4.87

Qualitative characteristics of longan fruits

Fruit shape of the germplasm was observed as roundish flat, round, irregularly round, heart shape. Among the germplasm, fruits of BARI Anshphal-1 were roundish flat, EL- Joy 004 irregularly round, EL- Joy 010 heart shape and rest of the fruit of the germplasm were round. Rind colour at ripen stage were brown, blackish brown, deep brown, reddish brown, and whitish brown. Most of the fruit colour was brown. Rind texture of the genotypes varied from smooth to slightly rough/warty. Seed colour of the genotypes were glossy black to glossy reddish black and seed shape varied from roundish flat to round. The seed shape of the variety BARI Anshphal-1 was roundish flat, whereas rest of the genotypes was roundish in shape. Only one seed was present in each fruit in all the germplasm. This findings supported with the findings of Wong (2000). Texture of the aril of all the genotypes was less juicy to very crispy, while aril colour of all the genotypes was translucent white and possessed sweet to bland flavour. The fruits of EL- Joy 010 germplasm were excellent in taste but the others were good to poor. Fruit attractiveness of all the genotypes was good to poor.

Chemical characteristics of fruits in longan germplasm

Chemical characteristics of different longan germplasm were presented in the Table 3. Total soluble solids (TSS) in the fruit ranged from 16.00 to 22.3%. TSS was maximum in the genotype EL- Joy 009 (22.3%) closely followed by EL- Joy 012 (21.7%), EL- Joy 007 (21.5%), EL- Joy 003 (21.20%) and EL- Joy 008; EL- Joy 014 (20.0%) whereas, minimum in EL- Joy 013 (16.0%). Wong (2000) reported that the aril has TSS values ranged from 15 to 25 %.

The highest moisture (80.0%) was recorded in the variety BARI Anshphal-1, EL-Joy 004, EL-Joy 011, and EL- Joy 013, while the lowest percentage was recorded in BARI Anshphal 2 (74%). The highest dry matter was recorded in BARI Anshphal-2 (26%), whereas the lowest (20%) in the genotypes BARI Anshphal 1, EL- Joy 004, EL- Joy 011, and EL- Joy 013. This result was similar to the findings of Wong and Saichol (1991).

The maximum total sugar (19.91%) was recorded in the genotypes EL- Joy 009 followed by BARI Anshphal-2 (19.39%), BARI Anshphal-1 (18.14%) and EL- Joy 005 (17.86%), while the minimum was recorded in EL- Joy 006 (9.18%). The maximum reducing sugar was obtained from EL- Joy 009 (6.94%), which was followed by the germplasm EL- Joy 012 (6.58%), EL- Joy 011 (5.88%) and EL- Joy 014 (5.21%), whereas the minimum from EL- Joy 013 (2.59). The highest non-reducing sugar was recorded in the variety BARI Anshphal-1 (14.60%), while the lowest in EL- Joy 007 (6.01%).

Table 2. Qualitative characteristics of fruits of some longan germplasm.

Treatment	Fruit shape	Fruit colour	Rind texture	Seed colour	Seed shape	Aril texture	Flavor	Eating quality
BARI Anshphal-1	Roundish flat	Brown	Smooth	Glossy black	Roundish flat	Less juicy	Sweet	Good
BARI Anshphal-2	Round	Blackish Brown	Slightly rough	Glossy reddish black	Round	Very juicy	Sweet	Good
EL-Joy 003	Round	Brown	Smooth	Glossy reddish black	Round	Juicy	Sweet	Good
EL- Joy 004	Irregular round	Deep brown	Smooth	Glossy light reddish black	Round	Very crispy	Bland	Poor
EL- Joy 005	Round	Whitish brown	Smooth	Glossy reddish black	Round	Juicy	Sweet	Good
EL- Joy 006	Round	Brown	Smooth	Glossy reddish black	Round	Juicy	Sweet	Good
EL- Joy 007	Round	Reddish brown	Smooth	Glossy reddish black	Round	Juicy	Sweet	Intermediate
EL- Joy 008	Round	Brown	Slightly rough	Glossy black	Round	Juicy	Sweet	Good
EL- Joy 009	Round	Brown	Smooth	Glossy black	Round	Juicy	Sweet	Good
EL- Joy 010	Heart shaped	Brown	Slightly rough	Glossy light reddish black	Round	Crispy	Sweet	Excellent
EL- Joy 011	Round	Brown	Smooth	Glossy reddish black	Round	Juicy	Sweet	Good
EL- Joy 012	Round	Brown	Slightly rough	Glossy reddish black	Round	Juicy	Slight pungent	Good
EL- Joy 013	Round	Brown	Smooth	Glossy reddish black	Round	Juicy	Slight pungent	Good
EL- Joy 014	Round	Brown	Smooth	Glossy reddish black	Round	Juicy	Slight pungent	Good
EL- Joy 015	Round	Brown	Smooth	Glossy black	Round	Juicy	Slight pungent	Good

Table 3. Chemical characteristics of fruits of 15 longan genotypes.

Treatments	Percent moisture	Percent dry matter	TSS (%)	Percent reducing sugar	Percent non-reducing sugar	Percent total sugar	Ascorbic acid (mg/100g)	β -carotene (mg/100 g)
BARI Anshphal-1	80.0	20.0	19.1	3.52	14.60	18.14	13.77	0.40
BARI Anshphal-2	74.0	26.0	19.6	2.86	16.50	19.39	10.71	0.25
EL-Joy 003	78.0	22.0	21.2	4.63	7.66	12.29	7.80	0.35
EL- Joy 004	80.0	20.0	16.4	4.46	7.26	11.72	3.30	0.21
EL- Joy 005	78.0	22.0	19.5	3.01	14.85	17.86	5.90	1.29
EL- Joy 006	77.0	23.0	19.5	2.91	6.27	9.18	7.60	1.32
EL- Joy 007	79.0	21.0	21.5	3.68	6.01	9.69	4.40	1.31
EL- Joy 008	78.0	22.0	20.0	3.55	10.34	13.89	2.90	1.33
EL- Joy 009	76.0	24.0	22.3	6.94	12.97	19.91	5.00	1.02
EL- Joy 010	76.0	24.0	19.3	3.79	12.51	16.30	5.60	1.60
EL- Joy 011	80.0	20.0	19.3	5.88	11.04	16.92	6.20	0.32
EL- Joy 012	76.0	24.0	21.7	6.58	10.09	16.67	0.70	2.26
EL- Joy 013	80.0	20.0	16.0	2.59	6.98	9.57	0.50	2.23
EL- Joy 014	76.0	24.0	20.0	5.21	9.12	14.33	2.10	2.39
EL- Joy 015	78.0	22.0	19.4	4.55	8.84	13.39	0.50	2.50
Mean	77.7	22.27	19.6	4.28	10.34	14.62	5.13	1.25
SD	1.87	1.87	1.73	1.37	3.33	3.60	3.79	0.82
CV (%)	2.41	8.40	8.80	31.92	32.26	24.62	73.93	65.84

The maximum amount of vitamin C was obtained from the variety BARI Anshphal-1 (13.77 mg/100 g) followed by the variety BARI Anshphal-2 (10.71 mg/100 g), whereas the minimum (0.50 mg/100 g) in the genotypes EL- Joy 013 and EL- Joy 015.

The highest amount of β -carotene was recorded in EL- Joy 015 (2.50 mg/100g) followed by EL- Joy 014 (2.39 mg/100 g), EL- Joy 012 (2.26) and EL- Joy 013 (2.23 mg/100 g), while the lowest was obtained from EL- Joy 004 (0.21 mg/100 g).

Conclusions

The findings of the present study will help selecting longan varieties/lines for fresh consumption, processing and variety development programmes. Considering the overall physical and chemical characteristics of fruits of all the studied germplasm, BARI Anshphal-1, BARI Anshphal-2, EL- Joy 003, EL- Joy 006, EL- Joy 009, EL- Joy 010 were found superior to other germplasm in respect of fruit weight, edible portion, TSS, total reducing, non-reducing sugar, and ascorbic acid.

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