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PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 6 (1): 70-72, 2003
ISSN 1028-8880

Studies on the Fruit Characteristics, Bio-chemical Composition and Storage Behaviour of Litchi Varieties

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Abstract: A study was carried out on six litchi varieties, for their fruit characteristics, bio-chemical composition and storage behaviour. The results showed significant difference among varieties. The fruit weight ranged from 14.36-23.97 g, percent recovery of flesh 60.58 - 71.16, TSS 16.78-19.55% and total sugar 10.0-19.2%. Rottage loss was highest in Green (81.86%) and the lowest in China-3 (37.03%). None of the varieties was found superior in all respect. However, considering the important characteristics, the fruits of BARI litchi-1 and China-3 were considered highly acceptable.

Key words: Fruit characteristics, bio-chemical composition, storage, litchi

Introduction

Litchi (*Litchi chinensis* Sonn.) is one of the popular and important fruit of Bangladesh. This fruit usually comes to the market in May and early June when very few fresh fruits are available. Though so many varieties of litchis are available in Bangladesh, only a few may be acceptable. The existing varieties are known to be different in respect of fruit characteristics (Saha and Hossain, 1992). Menzel and Simpson (1986) reported 50 to 80% flesh recoveries in 10 litchi varieties with the fruits ranging from 14 to 27 g. Sugar contents of different litchi varieties range from 6.74 to 13.86% in India (Singh and Singh, 1954) and 11.8 to 20.6% in Hawii (Miller and Bazora, 1945). The storage life of litchi fruit is extremely short, hardly 3-6 days at ambient temperature condition. In Bangladesh, no systematic research has so far been made in the past on fruit characteristics, bio-chemical composition and storage behavior of the available litchi varieties. Therefore, the present investigation was undertaken.

Materials and Methods

These studies were conducted at Fruit Research Station and Bangladesh Council of Scientific and Industrial Research, Rajshahi during May to June, 2002. Around 25 years old plants varieties of litchi viz. BARI litchi-1, Bedana, Bombai, China-3, Green and Madrajee were included in this trial. Four plants of each variety were selected at random from a large plantation to represent four replicates. Forty fruits per plant were randomly harvested, 10 of each from east, west, north and south. Length, breadth, circumference, volume and weight of fruit as well as seeds were recorded using standard methods and procedures. Percentage of skin, pulp and seed of fruits were also calculated. Total soluble solids (TSS) were recorded by hand refractometer. Vitamin-C was estimated in mg per 100 ml of juice by titration method (Mahadevan and Sridhar, 1982). Sugar content was measured by following the method of Anonymous (1980). For storage, 400 litchi fruits of each variety were taken and made into four replicates each consists of 100 litchi fruits. Identity of each variety and replicate was maintained by tagging. All the fruits were kept at well-ventilated laboratory room at normal condition. Weight loss and rottage percentage during storage were recorded at two day's interval and continued up to six days. The percent disease index (PDI) was calculated by using the following formula:

$$PDI = \frac{\text{Sum of all numerical rating X 100}}{\text{Total sum of rating X 5}}$$

The data were analyzed statistically and mean separation was done by least significant difference (LSD).

Results and Discussion

The fruits of the six litchi varieties differed in respect of their physical characteristics and chemical composition. Variety Green had longest length of fruit (3.94 cm) while it was smallest in Madrajee (3.37 cm). Maximum breadth of fruit was found in China-3 (3.63 cm) and the minimum in Madrajee (2.77 cm). Circumference of fruit ranged from 9.28 to 11.65 cm. China-3 showed highest volume of fruit (22.93 cc) and lowest volume of fruit (13.87 cc) from Madrajee. Fruit of China-3 (23.97 g), Green (23.58 g) and Bombai (23.54 g) were heavier in weight followed by

Table 1: Fruit Characteristics of litchi varieties

	Physical characteristics				Composition of fruit			
Varieties	Length of fruit (cm)	Breadth of fruit (cm)	Circumference of fruit (cm)	Volume of fruit (cc)	Weight of fruit (g)	Skin (%)	Pulp (%)	Seed (%)
BARI litchi-1	3.56	3.24	10.36	18.46	19.17	13.73	68.71	17.56
Bedana	3.79	3.26	10.56	20.83	21.25	15.96	71.16	12.88
Bombai	3.80	3.41	10.75	22.10	23.54	15.59	67.82	16.59
China-3	3.45	3.63	11.65	22.93	23.97	19.41	70.49	10.10
Green	3.94	3.42	10.80	22.15	23.58	21.64	62.60	15.76
Madrajee	3.37	2.77	9.28	13.87	14.36	22.24	60.58	17.18
LSD (0.05)	0.08	0.09	0.30	0.68	0.28	0.45	0.95	0.94
LSD (0.01)	0.11	0.13	0.42	1.19	0.39	0.62	1.32	1.29

Table 2: Seed Characteristics of litchi fruits of six varieties

Varieties	Length of seed (cm)	Breadth of seed (cm)	Circumference of seed (cm)	Volume of seed (cc)
BARI litchi-1	2.43	1.48	5.05	3.41
Bedana	2.48	1.30	4.20	2.38
Bombai	2.85	1.19	4.62	3.39
China-3	1.97	1.29	4.23	1.98
Green	2.69	1.40	4.96	3.40
Madrajee	2.51	1.34	5.05	3.29
LSD (0.05)	0.12	0.01	0.11	0.18
LSD (0.01)	0.16	0.02	0.15	0.24

Table 3: Bio-Chemical composition of litchi fruits of six varieties

Varieties	pH	TSS (%)	Acidity as citric acid (%)	Vitamin- C (mg/100g)	Total sugar (%)	Reducing sugar (%)	Non-reducing sugar (%)
BARI litchi-1	4.9	18.75	0.36	47.21	19.2	6.4	12.8
Bedana	5.1	17.75	0.28	36.50	14.4	4.8	9.6
Bombai	5.4	16.78	0.26	43.76	10.0	3.3	6.7
China-3	5.0	17.90	0.30	33.36	12.8	4.3	8.5
Green	5.1	16.93	0.34	41.21	16.8	5.6	11.2
Madrajee	4.8	19.55	0.31	33.56	14.2	5.6	8.6
LSD (0.05)	0.09	0.31	0.01	0.74	0.44	0.06	0.13
LSD (0.01)	0.13	0.43	0.02	1.02	0.61	0.09	0.19

Table 4: Post harvest behavior of litchi fruits of six varieties

	Weight loss (%)			Rottage loss (%)		
Varieties	2 days	4 days	6 days	2 days	4 days	6 days
BARI litchi-1	11.53	19.49	26.08	2.62	15.51	43.31
Bedana	18.51	25.24	30.84	5.53	30.45	72.25
Bombai	7.60	14.09	19.71	3.47	18.24	53.47
China-3	21.88	29.23	33.70	2.49	12.38	37.03
Green	15.34	27.92	37.55	6.59	32.65	81.86
Madrajee	10.09	17.53	22.86	6.41	33.79	74.69
LSD (0.05)	0.99	1.16	1.29	0.97	0.44	12.57
LSD (0.01)	1.37	1.60	1.78	1.35	0.61	17.39

Bedana (21.25 g), BARI litchi-1 (19.17 g) and Madrajee (14.36 g) (Table 1). Maiti (1985) and Saha and Hossain (1992) also recorded variations in size and weight of litchi fruits.

Skin is the non-edible waste portion of fruit. Lower the quantities of skin better will be the quality of fruit. BARI litchi-1 contained the lowest quantity of skin (13.73%). Similar quantity of skin was recorded in Bedana and Bombai. Pulp is the edible portion of fruit and the maximum pulp was recorded in Bedana (71.16%) followed by China-3 (70.49%) and BARI litchi-1 (68.71%) and Madrajee produced minimum pulp (60.58%). The highest proportion of seed was produced by BARI litchi-1 (17.56%) and it was statistically identical with Madrajee and Bombai. The other varieties showed low quantity of seed in their fruit were China-3, Bedana and Green. Menzel and Simpson (1986) obtained flesh recovery ranging from 65 to 77%. They opined that the varieties having 60% or less flesh recovery be considered as poor varieties.

The results revealed significant variation among the litchi varieties in respect of length, breadth, circumference and volume. Bombai produced the longest length of seed (2.85 cm) closely followed by green (2.69 cm) while China-3 had the shortest length of seed (1.97 cm). BARI litchi-1 had the maximum breadth of seed (1.48 cm) and Bombai (1.19 cm) obtained the minimum breadth of seed. Circumference of seed ranged from 4.20 to 5.05 cm. Volume of seed was highest in BARI litchi-1 (3.41 cc) followed by Green (3.40 cc) and Bombai (3.39 cc) (Table 2). This result is in agreement with the findings of Saha and Hossain (1992) who also reported larger seed size in BARI litchi-1 and Bombai. The morphological difference of seed from variety to variety is possibly due to the variation in genetic make up of each variety.

From the investigation, it was revealed that bio-chemical composition of litchi varieties differed significantly (Table 3). Litchi fruits pH varied from 4.8 to 5.4. The qualitative characters of a fruit are mainly judged by TSS percentage. Most of the varieties showed medium to high content of TSS. Madrajee content the highest TSS (19.55%) followed by BARI litchi-1 (18.75%), China-3 (17.90%) and Bedana (17.75%). Singh (1986) and Samson (1980) reported in close proximity the range of TSS for other varieties. Maiti (1985) also obtained relevant result with Bomabi variety (16.78%). Acidity as citric acid (%) ranged from 0.26 to 0.36%. The high percentage of juice with high vitamin-C content is always sought for selecting or recommending a litchi variety. The range of vitamin-C content was 33.36 - 47.21 mg/100 g of juice. The content of vitamin-C was higher in the variety BARI litchi-1 (47.21 mg/100g) followed by Bombai (43.76 mg/100g), Green (41.21 mg/100g) and Bedana (36.50 mg/100g). Total sugar content varied from 10.0 to 19.2% and reducing sugar content ranged from 3.3 to 6.4%. Non-reducing sugar was highest in the variety BARI litchi-1 (12.8%) and lowest in Bombai (6.7%). This result is relevant with Maiti (1985) who reported that Bombai litchi contain 11.0% sugar.

Storage behaviors of litchi fruit were significant for all the studied characters. Weight loss of litchi increased gradually with increase in storage period. After two days of storage, loss in weight of litchi was 7.60% and that of 19.71% after six days of storage in Bombai. Green lost maximum weight (37.55%) and the minimum (19.71%) was in Bombai after six days of storage. In the present study litchi fruits looses its bright red colour and turn brown with 2-3 days after harvest. The results revealed that rottage loss by diseases increased gradually with the increase in storage period. Highest loss due to rottage was recorded in Green (81.86%) and China-3 (37.03%) was the lowest. These findings are related with Maiti (1985) who mentioned that the litchi fruits did not keep for more than a few days at room temperature (Table 4).

The above mentioned findings indicated that none of the varieties was found superior in all respects. However, considering the important characteristics, the fruits of BARI litchi-1 and China-3 were considered highly acceptable.

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