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### QUALITY ASSESSMENT OF STRAWBERRY (*Fragaria × ananassa* Duch.) CULTIVATED IN RAJSHAHI REGION OF BANGLADESH

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## QUALITY ASSESSMENT OF STRAWBERRY (*Fragaria × ananassa* Duch.) CULTIVATED IN RAJSHAHI REGION OF BANGLADESH

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### ABSTRACT

Chowdhury AN, Nargis A, Ibrahim M, Alam AKMS, Rahman MZ (2014) Quality assessment of strawberry (*Fragaria × ananassa* Duch.) cultivated in rajshahi region of Bangladesh. *Int. J. Sustain. Crop Prod.* 9(1), 35-38.

Fruit quality of two strawberry variety viz., RABI-3 and American Festival cultivated in the Rajshahi region of Bangladesh were investigated. Strawberry fruits of RABI-3 cultivar have moisture content 91.7%, dry matter 8.2%, pH 2.9, total soluble solids 9.1%, vitamin C 68.6 mg/100g, total sugar 5.6% reducing sugar 1.7%, non-reducing sugar 3.7%, acidity 1.1%, and sugar acid ratio 5.1%. Whereas American variety has moisture content 92.7%, dry matter 7.3%, pH 2.7, total soluble solids 7.1%, vitamin C 65.9 mg/100g, total sugar 5.1%, reducing sugar 1.5%, non-reducing sugar 3.4%, acidity 1.6% and sugar acid ratio 3.4%. Therefore, the fruit quality of strawberry var. RABI-3 is better than that of var. American festival.

**Key words:** strawberry fruit quality, RABI-3, american festival, fruit quality assessment, total soluble solids, total sugar, acidity, vitamin C

### INTRODUCTION

The strawberry, (*Fragaria × ananassa* Duch.) is the most popular fruits in the world and a new source of nutrition in Bangladesh. Although strawberry is a fruit of temperate climatic country, it can also be produced in Bangladesh (Karim 2008). The production and consumption of strawberry is increasing day by day because of its higher food values and other health promoting importance (Ayub *et al.* 2010). However, it has high post harvest losses due to its high perishability and climatic pattern of respiration. Therefore, its marketability is closely related with the development of suitable technology which reduces the loss of storage life.

Strawberries are growing in many areas of Bangladesh from last few years. It has become very popular fruit to the people of the country. Strawberries were well grown in large quantities few years back but with gradual increase in demand for table varieties as well as from processing unit. As a result, a number of farmers have now taken up their activity. Some fruits and vegetables are available in some season and not throughout the year. Strawberries are such type of fruit that can be grown only in winter season. People adopted modern technologies to preserve such seasonal foods as intact for later use. Some progressive farmers should undertaken strawberry processing as a measure of forward integration with assured supply of good quality fruits. Strawberries, quality of products would be very good and the competitive edge would also go up (Imran 2010).

Many workers (Yagmur *et al.* 2011; Patres *et al.* 2010; Hartmann *et al.* 2008; Klopotek *et al.* 2005 and Ayub *et al.* 2010) studied the post harvest losses and physiochemical changes during ripening and storage life of strawberry. But those studies may not be appropriate to explain the situation in our country, environment and upon the adapted new cultivars of strawberry.

Most of its production is destined for the fresh market, but because of the short shelf life and seasonal nature of this fruit, a part of its production is being processed. Modern food processing makes the strawberries available year round, either as frozen or as canned. Therefore, an attempt was made to measure the fruit qualities of two strawberry cultivars grown in Rajshahi region of Bangladesh.

### MATERIALS AND METHODS

Two strawberry varieties viz., RABI-3 and American Festival were used as plant material in this experiment. The variety RABI-3 was developed by the Plant Breeding and Genetic Engineering Lab, Department of Botany, University of Rajshahi, Bangladesh (Biswas *et al.* 2010). It is popular and widely cultivated strawberry variety in Bangladesh. American festival, also known as 'Strawberry Festival' originated from a 1995 through crossing between 'Rosa Linda' and 'Oso Grande'. This cultivar has vigorous growth, short-day nature and it tends to produce numerous runners. Fruits of American Festival have a very firm texture and excellent flavor (Chandler *et al.* 1997).

Freshly harvested strawberries at ripening stage were collected from the experimental field of Bangladesh Council of Scientific and Industrial Research Laboratories (BCSIR) Rajshahi. Fruit samples were collected at every alternate day and physiological weight loss was recorded. Strawberry fruits were selected by uniform size and healthy appearance. Only fresh, spotless and disease free fruits were used throughout the investigation. The procedure of storage in poly pack and tissue paper were observed at ambient, freezing and 40% sugar solution. The procedures of storing in 40% sugar solution at ambient temperature were as follows.

Fresh strawberry  $\Rightarrow$  Washing  $\Rightarrow$  Picking  $\Rightarrow$  Calyx removing  $\Rightarrow$  Weight measuring  $\Rightarrow$  Wrapping with tissue paper  $\Rightarrow$  Keeping at refrigerator  $\Rightarrow$  Next day observation  $\Rightarrow$  Weight measuring of the wrapped strawberry.

In case of control, after weight measurement the strawberry fruits were kept in normal air, light and temperature and at refrigerator without keeping in any other media. Data were collected on weight loss of fruits in order to compare the effectiveness of different storage conditions. Weight loss was calculated according to weight of each package before and after storage and expressed as a percentage of initial weight of strawberry fruit (Zhang *et al.* 2001, 2002, 2005).

The pH was determined using a digital pH meter (Jayaraman 1981), and moisture by oven drying method (Karmas 1980). The total soluble solids (TSS) was determined with a hand held refractometer (Alam *et al.* 2011), whereas sugar by colorimetric method/anthrone method (Dubois *et al.* 1956), reducing sugar by spectrophotometric method (Miller 1959), Vitamin C by titrimetrically using 2, 6-Dichlorophenolindophenol (Gyorgy and Pearson, 1967; Anon 1984) and acidity by the visual acid–base titration method (Ranganna 1986). All experiments were conducted at ambient temperatures and carried out in three replications.

## RESULTS AND DISCUSSION

The physiological weight loss of strawberry fruit in different storage conditions was compared in Table 1. The result showed that the strawberry fruits dipped in 40% sugar solution media losses the lowest percentage of weight at both ambient and freezing conditions. The moisture content were 91.7% and 92.7%, dry matter 8.2% and 7.3, pH 2.9 and 2.7, TSS 9.1% and 7.1%, Vitamin C 68.6 mg/100g and 65.9%, and total sugar 5.6% and 5.1% in RABI-3 and American Festival, respectively. Physiological weight loss of strawberry fruit in different conditions showed that, in case of ambient temperature (AT), dipping in 40 percent sugar solution media leaves the highest shelf life which is 8 days. The post harvest life of strawberry fruits can be as short as 5 to 7 days (Hardenburg *et al.* 1986) which is in contrast with our results.

Table 1. Physiological weight loss of strawberry varieties in different storage methods

Storage methods	Average weight (g)		Average weight loss (%)		
	1 <sup>st</sup> day	2 <sup>nd</sup> day	3 <sup>rd</sup> day	4 <sup>th</sup> day	5 <sup>th</sup> day
Poly Pack (AT)	108	13.9	23.1	37.0	58.3
Poly Pack (FC)	128	8.3	14.1	21.9	32.6
Tissue Paper (AT)	127	15.6	42.5	68.5	92.1
Tissue Paper (FC)	110	10.0	25.1	33.6	42.0
Dipping in 40% sugar solution (AT)	120	7.5	12.2	27.7	40.5
Dipping in 40% sugar solution (FC)	125	6.4	10.5	20.0	26.4
Control (AT)	112	16.7	33.3	53.6	73.2
Control (FC)	130	11.5	26.9	37.0	58.3

AT = Ambient Temperature, FC = Freezing Condition

Table 2. Biochemical characteristics of strawberry varieties as affected by the different storage media

Features	Name of the variety	
	RABI-3	American variety
Moisture (%)	91.0±0.02	92.7±0.01
Dry matter (%)	8.2±0.04	7.3±0.01
pH	2.9±0.02	2.7±0.01
TSS (%)	9.1±0.20	7.1±0.1
Vitamin C (mg/100g)	68.6±0.07	65.9±0.01
Total sugar (%)	5.6±0.10	5.1±0.1
Reducing sugar (%)	1.7±0.10	1.5±0.1

Both varieties are with good qualities with some differences but RABI-3 is better than American festival. We can recommend these two varieties for cultivation under Bangladesh soil condition. Negrul (1968) worked on the moisture content of strawberry and found the moisture content as 89.9% while Watt and Merrill (1959) also found the same result and they also recorded Vitamin C as 59.0 mg/100g raw strawberry fruit. The mature soft strawberry fruit contains about 5.0% total sugar and 0.90% to 1.85% acidity (Mitra *et al.* 1991). In our investigation, the amount of Vitamin C was 68.6 mg/100g and 65.9 mg/100mg in RABI-3 and American festival, respectively. The level of acidity in a fruit has a strong connection with its pH, sugar and TSS (Fig. 1-3). It was observed that fruits with lower acidity have higher pH, sugar and TSS. While working on *Mangifera indica* L. and *Artocarpus heterophyllus* Lam., Ibrahim *et al.* (2011, 2012) also found the same relationship. The results of coefficient of correlation analysis between acidity and pH ( $Y = 0.0554X + 1.193$ ;  $r = 0.93$ ), acidity and total sugar ( $Y = -0.1214X + 1.193$ ;  $r = 0.99$ ), acidity and TSS were ( $y = -0.4714X + 10.13$ ;  $r = 0.93$ ), which were highly positive and significant at 0.05% level.

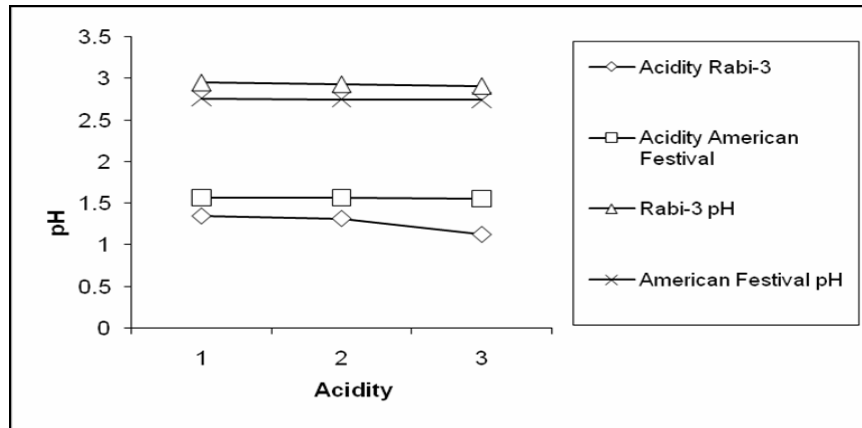


Fig. 1. Relation between acidity and pH of RABI-3 and American festival

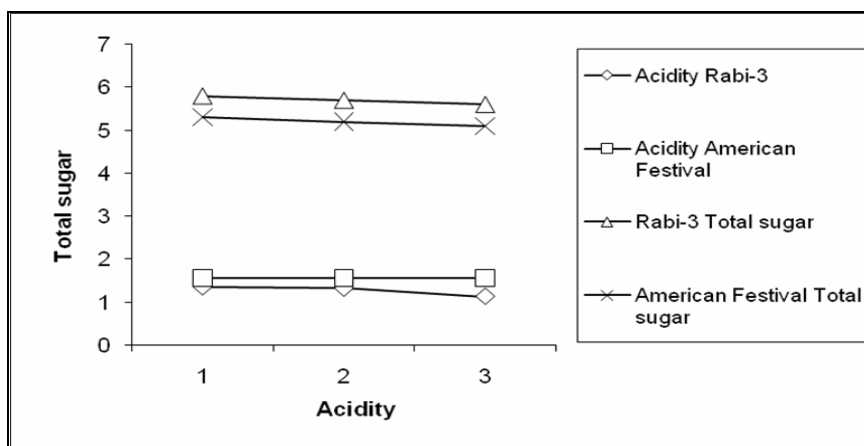


Fig. 2. Relation between acidity and Total Sugar of RABI-3 and American festival

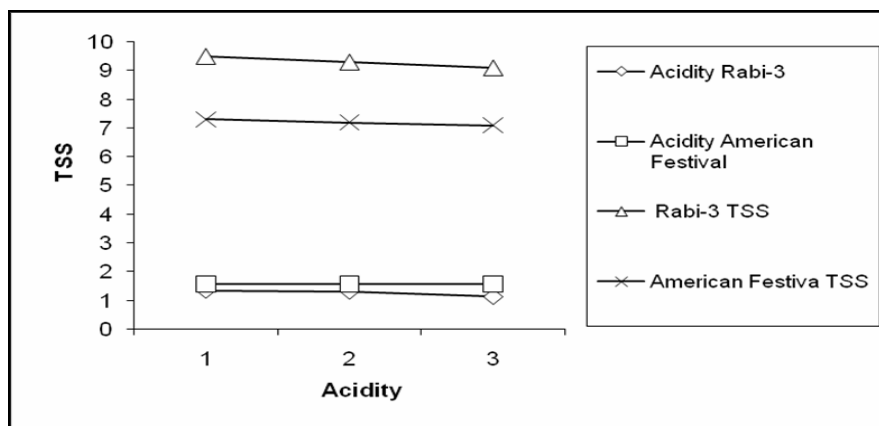


Fig. 3. Relationship between acidity and Total soluble solids of RABI-3 and American festival

**CONCLUSION**

The result of present study indicates that RABI-3 has better fruit qualities than that of American Festival. Therefore, RABI-3 can be recommended for commercial production in the Rajshahi region of Bangladesh.

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**REFERENCES**

Alam MA, Islam MS, Uddin MZ, Hossain MM, Bashir MM (2011) Fruit characteristics of ten jackfruit genotypes grown in Chapai Nawabgonj condition. *J. Bangladesh Soc. Agric. Sci. Technol.* 8(1&2), 189-192.

- Anonymous (1984) Official Methods of Analysis of the Association of Official Analytical Chemists (AOAC), 15<sup>th</sup> ed. p.1058-1059.
- Ayub M, Ullah J, Ali M, Alam Z (2010) Evaluation of strawberry juice preserved with chemical preservatives at refrigeration temperature. *Int. J. Metabol.* 2(2), 27-32.
- Biswas MK, Roy UK, Islam R, Hossain M (2010) Callus culture from leaf blade, nodal, and runner segments of three strawberry (*Fragaria* sp.) clones. *Turk. J. Biol.* 34, 75-80.
- Chandler CK, Albrechts EE, Howard CM, JK Brecht (1997) 'Sweet Charlie' strawberry. *Hort. Sci.* 32, 1132–1133.
- Dubois M, Giles KA, Hamittion JK, Rebers PA, Smith F (1956) A colorimetric method for determination of sugar, *Anal. Chem.* 28 (3), 360-366.
- Gyorgy P, Pearson WN (1967) The Vitamins, 2<sup>nd</sup> edn, Academic Press, New York. p. 32.
- Hardenburg RE, Watada AE, Wang CY (1986) The commercial storage of fruits, vegetables and nursery stocks. Agriculture handbook, USDA, Washington DC. p. 66.
- Hartmann A, Patz CD, Andlauer W, Ditrich H, Ludwig M (2008) Influence of processing on quality parameter of strawberries. *J. Agric. Food Chem.* 56(20), 9484-9489.
- Ibrahim M, Helali MOH, Shafique MZ, Samad, Alam AKMS (2011) Studies on the shelf life and physiological weight loss of Langra mango cultivar (*Mangifera indica* L.) and also its quality characteristics as affected by plant hormones. *J. Subtrop. Agric. Res. Dev.* 9(4), 907-912.
- Ibrahim M, Islam MS, Helali MOH, Alam AKMS, Shafique MZ (2012) Physiological and biochemical characteristics of different Jackfruit (*Artocarpus heterophyllus* Lam.) cultivars in Rajshahi region of Bangladesh. *J. Subtrop. Agric. Res. Dev.* 10(6), 1033-1037.
- Imran H (2010) Strawberry project, Faculty of business administration. M.Sc thesis, University of Rajshahi. Bangladesh. p. 1.
- Jayarman J (1981) Laboratory Manual in Biochemistry. *New Age Int. Lit.* India. p.180.
- Karim R (2008) varietal improvement of strawberry (*Fragaria X ananassa* Duch) adaptive to agro climatic condition of Bangladesh. MSc thesis, Department of Botany, University of Rajshahi, Bangladesh.
- Karmas E (1980) Techniques for measurement of moisture content of foods. *Food Technol.* 34, 52.
- Klopotek Y, Otto K, Böhm V (2005) Processing Strawberries to different products Alter Contents of Vitamin C, Total Phenolics, Total Anthocyanins and Antioxidant capacity. *J. Agric. Food. Chem.* 53, 5640-5646.
- Miller GL (1959) Use of dinitrosalicylic acid reagent for determination of reducing sugar. *Anal. Chem.* 31(3), 426-428.
- Mitra SK, Rathore DS, Bose TK (1991) Temperature fruits. Horticulture and Allied Publishers, India. p. 549.
- Negrul AN (1968) Question of the origin and breeding of the grapevine on a genetical basis. *Genetika* 4(3), 84.
- Patras A, Brunton NP, Pieve SD, Butler F (2010) Impact of high pressure processing on total antioxidant activity, phenolic, ascorbic acid, anthocyanin content and colour of strawberry and blackberry purées, *Innovative Food Sci. Emerging Technol.* 10, 308-313.
- Ranganna S (1986) Handbook of Analysis and quality control for Fruit and Vegetable products, Tata McGraw-Hill Pub Company Ltd, New Delhi.
- Watt BK, Merrill A (1959) A table of food values, *In: USDA yearbook of Agriculture.* Supt. of Documents, Washington DC.
- Yagmur C, Taskin M (2011) Study on changes in mineral content of plum (*Prunus domestica*) and strawberry (*Fragaria X ananassa*) during canning. *Indian J. Agric. Sci.* 81(8), 723-728.
- Zhang M, Li CL, Huan YJ, Tao Q, Wang HO (2001) Preservation of fresh grapes at ice-temperature-high - humidity, *Int. Agrophysics*, 159(2), 139-143.
- Zhang M, Tao Q, Huan YJ, Wang HO, Li CL (2002) Effect of temperature control and high-humidity on the preservation of JUFENG grapes, *Int. Agrophysics*, 16(4), 277-282.
- Zhang M, Xiao G, Peng J, Salokhe VM (2005) Effects of single and combined atmosphere packages on preservation of strawberries. *Int. J. Food Eng.* 1(4), 141-148.