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OPTIMIZATION OF THE MATURITY INDICES OF 12 MANGO VARIETIES GROWN AT CHAPAINAWABGANJ

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Abstract: Mango is an important tropical fruit that has great potential in international markets. The acceptance of exported mango in destination countries depends largely on eating quality, which is affected by maturity at harvest. The subjectivity of the external criteria used for the determination of mangoes maturity at its harvest led to the search for additional reliable parameters to determine the optimal harvesting maturity. Mango maturity can be judged visually, based on skin color, or determined chemically based on soluble solids content, acid content, and solids: acid ratio. Maturity determination based on visual observation is unreliable and prone to errors. For that, an experiment was conducted at the Regional Horticulture Research Station, Bangladesh Agricultural Research Institute (BARI), Chapainawabganj to optimize maturity indices of 12 popular mango varieties during January 2014 to August 2016. A non-destructive method, days to maturity after fruit set, was used and found that the maturity and harvesting time differed for all the varieties included in this study. The highest total soluble solids (23% Brix) was recorded from BARI Aam-3 followed by BARI Aam-4, Gopalbhog, Khirsapat and Langra (22%) since the lowest TSS recorded in BARI Aam-7. The days required for maturity of BARI Aam-1, BARI Aam-2, BARI Aam-3, BARI Aam-4, BARI Aam-6, BARI Aam-7, BARI Aam-8, Gopalbhog, Khirsapat, Langra, Fazli, and Ashwina were 91, 103, 99, 114, 111, 115, 128, 87, 90, 97, 104 and 136days, respectively. Among the varieties, commercial variety Ashwina took the longest time (136 days) while the shortest (87 days) was recorded from commercial Gopalbhog variety for maturity. Therefore, mango producers can follow these findings for harvesting their mangoes to ensure good taste and quality of their mangoes.

Key words: Mango, maturity, harvesting time, varieties, Chapainawabganj

Introduction

Mango (*Mangifera indica* L.) is one of the most popular and important fruit crop cultivated in Bangladesh. It is considered as the ‘’king of fruits’’. It has a unique position in respect of nutritional quality, taste, consumer’s preference (Mukherjee, 1997). Currently, the area under

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mango cultivation is 95300 ha and production 12.19Lakh MT (BBS, 2020). Bangladesh is one of the major mango producing countries along with India, China, Pakistan, Mexico, Brazil, the Philippines, etc. Mango as a climacteric fruit is frequently harvested when less than fully ripe. This is often necessary to obtain optimal eating quality at the time of consumption where markets are a considerable distance or export from the place of harvest. Maturity indices of BARI released and commercial mango varieties were determined to reduce post-harvest losses or getting optimal eating quality. In addition, accurate harvesting time is important for the extension of shelf life. Mango harvesting season mainly divided into three seasons such as early, mid and late variety. Farmers harvested their mangoes whenever they like and they use some ripening hormones for faster ripening of those immature mangoes. As a result, consumers didn't get their desire taste for each variety. The ripening time greatly depends on the maturity stage of fruits at the harvest (Dick *et al.,* 2009). Recently mangoes are exported to European countries and shelf life is also an important parameter for consideration. However, optimum quality, taste, and flavour of mangoes can only be assured when fruit are harvested after attaining physiological maturity (Reid, 2002; Slaughter, 2009). The physiological and biochemical activities of over mature fruits differ from that of mature ones in terms of respiration rate, transpiration, conversion of starch to sugar and storage life (Hulme, 1971; Kader *et al.,* 2002). Specific gravity has certain advantage over other criteria in determination of maturity, since it is nondestructive and easy to apply. Skin color was used as amaturity index in harvesting mangoes (Anjum, 2006; Jha *et al*., 2006; Abbasi *et al.,* 2011). Malevski *et al*., (1977) reported that both, maximum red and maximum yellow color intensities at harvest, could serve as a good index of maturity in mango and concluded that maximum red coloration was found to be a more sensitive maturity index that yellow coloration. It was reported, in the year 2013 and 2014, mango farmers harvested their mango not maintaining the proper harvesting stage and they used ripening hormone to ripe the immature mangoes. The number of days from flowering and fruit set to harvest was found to be a good nondestructive maturity index for many fruits such as banana, guava and mangoes (Slaughter, 2009; Dick *et al*., 2009). Still, there is no guide line or maturity indices for harvesting BARI released and commercial mango variety. Therefore, this study has been under taken to optimization of maturity indices for BARI released and commercial mangoes grown at Chapainawabganj.

Materials and methods

Location and Variety

The experiment was conducted at Regional Horticulture Research Station, BARI, Chapainawabganj during 2014-16. Twelve varieties including seven BARI released varieties viz., BARI Aam-1, 2, 3, 4, 6, 7, 8 and five commercial varieties viz., Gopalbhog, Khirsapat, Langra Fazli and Ashwina. Just completion of natural dropping, 30 mangoes were tagged randomly of each variety.

Mango harvesting

The mango harvesting was started 10 days before the conventional harvesting time and continues 4 times with an interval of 5 days of each variety and data were taken accordingly. Mangoes were harvested considering external morphological criteria such as fruit size, peel colour, fruit shape. Then mangoes were taken into the laboratory and ripening took place at ambient temperature of 29-35 degree centigrade. After ripening (as confirmed by pressed manually for flesh firmness) eating quality. TSS (%) and shelf life were recorded.

Total soluble solids (TSS)

Total soluble solids (TSS %) was measured by using Erma Hand Refractometer (0 to 32 °Brix).

Shelf life of fruits (days)

The shelf life (days) was accounted from the date of harvesting. When 50% fruits were spoiled and losses consumer's preferences then it was recorded.

Statistical analysis

Statistical analyses were performed using R-statistics software Version 4.0.2 for Windows (R Core Team, 2020). The bar graph was performed using the Statistical Tool for Agricultural Research (STAR), Version: 2.0.1 (STAR, 2014).

Results and Discussion

Data on panicle initiation, 50 percent flowering, 100 percent flowering, date of fruit set, date of harvest, fruit skin colour and fruit attractiveness were recorded (Table 1 and 2).Panicle initiation was started at last week of January for early variety (BARI Aam-1 and Gopalbhog) and continues upto 21 February to other varieties (Table-1).100 percent flowering was completed within the March month (Table 1). Harvesting was started from the last week of May from BARI Aam-1 and Gopalbhog variety and continues up to last week of July at Ashwina variety (Table-2). At the mature stage BARI Aam-3, BARI Aam-4, BARI Aam-6, BARI Aam-8, Gopalbhog, Khirsapat, Langra, Fazli and Ashwina varieties produced light green colour when the other varieties BARI Aam-1 produced yellowish green colour, BARI Aam-2 produced yellow colour and BARI Aam-7 produced reddish green colour (Table-2). Majority of the varieties were looking good and two varieties (BARI Aam-2 and BARI Aam-7) were looking excellent at ripening stage (Table-2).

Table 1. Flowering and fruit characteristics of 12 mangoes at RHRS, Chapainawabganj during January 2014-July 2016

Variety	Panicle initiation			50% flowering			100% flowering		
	2014	2015	2016	2014	2015	2016	2014	2015	2016
BARI Aam-1	28.1.14	27.1.15	26.1.16	13.2.14	11.2.15	14.2.16	23.2.14	21.2.15	24.2.16
BARI Aam-2	20.2.14	18.2.15	18.2.16	04.3.14	05.3.15	02.3.16	14.3.14	14.3.15	14.3.16
BARI Aam-3	21.2.14	20.2.15	18.2.16	05.3.14	8.3.15	6.3.16	15.3.14	18.3.15	16.3.16
BARI Aam-4	17.2.14	18.2.15	14.2.16	02.3.14	6.3.15	28.2.16	12.3.14	16.3.15	11.3.16
BARI Aam-6	12.2.14	13.2.15	10.2.16	27.2.14	28.2.15	25.2.16	09.3.14	10.3.15	8.3.16
BARI Aam-7	12.2.14	13.2.15	10.2.16	26.2.14	01.3.15	25.2.16	08.3.14	11.3.15	9.3.16
BARI Aam-8	13.2.14	14.2.15	10.2.16	28.2.14	02.3.15	26.2.16	10.3.14	12.3.15	8.3.16
Gopalbhog	30.1.14	29.1.15	28.1.16	15.2.14	14.2.15	11.2.16	24.3.14	23.2.15	22.2.16
Khirsapat	12.2.14	13.2.15	10.2.16	27.2.14	28.2.15	25.2.16	9.3.14	10.3.15	08.3.16
Langra	13.2.14	14.2.15	10.2.16	28.2.14	2.3.15	27.2.16	10.3.14	12.3.15	9.3.16
Fazli	13.2.14	15.2.15	10.2.16	28.2.14	2.3.15	25.2.16	11.3.14	13.3.15	07.3.16
Ashwina	14.2.14	15.2.15	11.2.16	28.2.14	3.3.15	25.2.16	10.3.14	13.3.15	10.3.16

Table 2. Fruit characteristics of 12 mangoes at RHRS, Chapainawabganj during January 2014-July 2016

Variety	Date of fruit set			Date of Harvest			Fruits Skin color	Fruit attractiveness
	2014	2015	2016	2014	2015	2016		
BARI Aam-1	28.2.14	27.2.15	02.3.16	29.5.14	28.5.15	30.5.16	YG	Good
BARI Aam-2	19.3.14	19.3.15	18.3.16	30.6.14	29.6.15	28.6.16	Yellow	Excellent
BARI Aam-3	20.3.14	23.3.15	20.3.16	28.6.14	27.6.15	26.6.16	LG	Good
BARI Aam-4	17.3.14	21.3.15	16.3.16	12.7.14	11.7.15	10.7.16	LG	Good
BARI Aam-6	15.3.14	15.3.15	12.3.16	3.7.14	5.7.15	30.6.16	LG	Good
BARI Aam-7	14.3.14	16.3.15	15.3.16	7.7.14	8.7.15	05.7.16	RG	Excellent
BARI Aam-8	15.3.14	18.3.15	14.3.16	22.7.14	23.7.15	20.7.16	LG	Good
Gopalbhog	2.3.14	1.3.15	28.2.16	27.5.14	26.5.15	25.5.16	LG	Good
Khirsapat	14.3.14	15.3.15	13.3.16	13.6.14	14.6.15	11.6.16	LG	Good
Langra	16.3.14	18.3.15	14.3.16	21.6.14	22.6.15	20.6.16	LG	Good
Fazli	15.3.14	18.3.15	12.3.16	28.6.14	27.6.15	25.6.16	LG	Good
Ashwina	17.3.14	19.3.15	18.3.16	2.8.14	3.8.15	31.7.16	LG	Good

*LG= Light green, RG= Reddish green, YG=Yellowish green

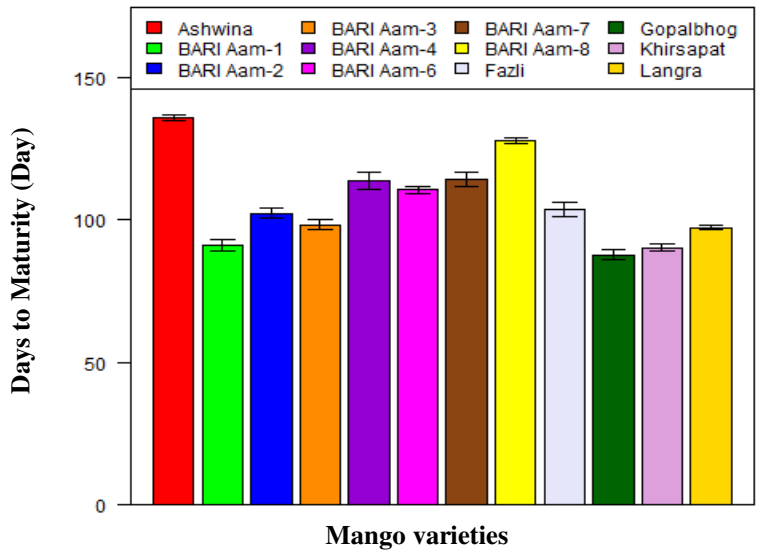

Fig.1. Days to maturity of different varieties of mango. Vertical bars indicate ± SE value.

Days to maturity of different varieties of mango

The Figure.1 represents the days to maturity of different mango varieties. The analysis showed that the highest days (136 days) was recorded from commercial Ashwina variety followed by BARI Aam-8 (128 days), BARI Aam-7 (115 days) since the lowest time (87 days) recorded at Gopalbhog variety for maturity.The maturity stage of mango was assessed by identifying the panicle initiation date up to harvesting.The variation of days to maturity of different mango varieties, may be due to genetic makeup of the varieties. Dick *et al.,*(2009) reported that Kent variety took 94 days for physiological maturity.

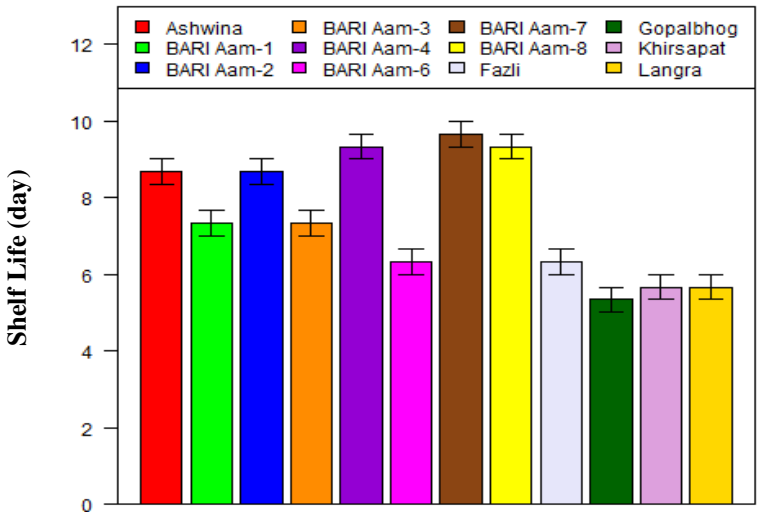

Fig. 2. Shelf life (SL) of different varieties of mango. Vertical bars indicate ± SE value.

The Figure.2 represents the shelf life of different mango varieties. The analysis showed that the highest shelf life (10 days) was recorded at BARI Aam-7variety followed by BARI Aam-2, BARI Aam-4, BARI Aam-8 and Ashwina (9 days) since the lowest shelf life (5 days) recorded atGopalbhog variety.

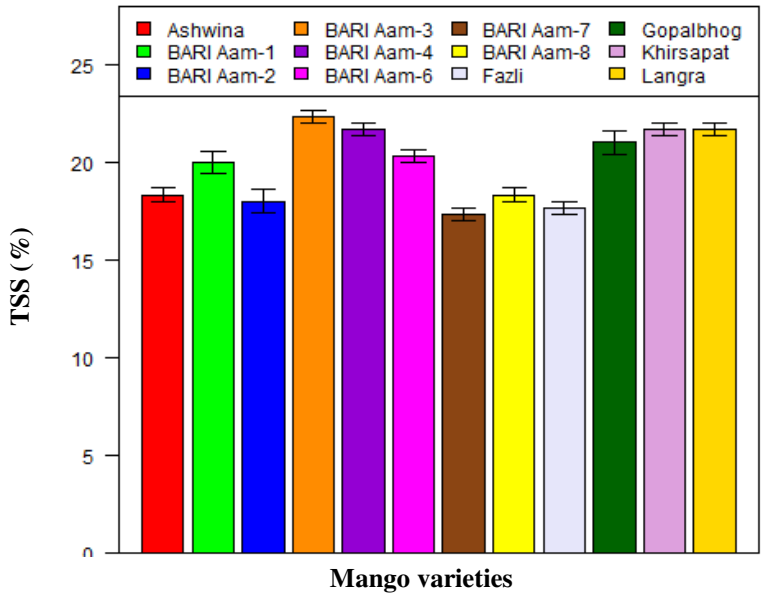

Fig. 3. TSS of different varieties of mango. Vertical bars indicate ± SE value.

The Figure.3 represents the Total Soluble Solids(TSS%) of different mango varieties. The analysis showed that the highest TSS (23%) was recorded from BARI Aam-3 followed by BARI Aam-4, Gopalbhog, Khirsapat,Langra (22%) when the lowest (17%) TSS from BARI Aam-7. This results confirmed with Azad *at el.* (2020), they reported that BARI released mango varieties TSS (%) ranged from 17.5% to 24.5%.

Conclusion

From the experimental results, it is revealed that days required for mango maturity is not similar and different to each variety. BARI Aam-1, BARI Aam-2, BARI Aam-3, BARI Aam-4, BARI Aam-6, BARI Aam-7, BARI Aam-8, Gopalbhog, Khirsapat, Langra, Fazli, Ashwina were required 91, 103, 99, 114, 111, 115, 128, 87, 90, 97, 104 and 136days respectively after fruit set.to harvest.Many maturity indices for mangoes have already been studied by many other scientists. Among these, we emphasize a nondestructive and easy method such as numbers of days taken after fruit set to maturity.Thus, these days taken for maturity of each variety was found as the most suitable for mango harvesting ensuring desired taste and quality of each mango variety.Therefore, this maturity index could be followed for mango harvesting to ensure desired taste and quality of each mango variety.

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