

Original Research Article

Determine of Maturity Index for Right Stage of Fruit Harvesting during Growth and Development of Aonla (*Emblica officinalis* Gaertn.) Fruit cv. Narendra Aonla-10

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ABSTRACT

Physiological maturity in aonla is mainly determined on the basis of specific gravity, ground colour, fiber content, seed colour and TSS/ acid ratio. Gradual increase was observed in average fruit weight, stone weight, pulp weight, pulp: stone ratio, total soluble solids and ascorbic acid with the advancement of maturity in aonla under northern Indian conditions. Harvesting of fruits at proper stage of maturity is desirable for maintaining the quality and consumer acceptability. Keeping in view above facts the present investigation entitled “To determine the maturity index for right stage of fruit harvesting during growth and development of Aonla (*Emblica officinalis* Gaertn.) fruit cv. Narendra Aonla-10.” is carried out with objectives to observe the physical and chemical changes during growth & development of fruits and the maturity index for right stage of fruit harvesting during 2019-2020 at Main Experimental Station of Department of Horticulture, A.N.D. University of Agriculture and Technology, Kumarganj - Ayodhya (U.P.). Results showed that all physiochemical parameter of growth and development viz- length, width, weight, pulp / fiber percentage showed significant change from 6th August to 6th December and then showed non-significant change till 6th January. Pulp / seed ratio, Vitamin C and total sugar increased up to maturity. Therefore, fruit of aonla variety NA-10 indicated maturity between 6th December to 6th January and this stage showed right stage of harvesting.

Keywords

Fruit, Maturity index, Harvesting, Growth and development, Aonla, biochemical attributes

Introduction

Indian gooseberry or aonla (*Emblica officinalis* Gaertn.) is an important indigenous fruit crop of India. Botanically, fruit is a berry and its mesocarp, an edible portion. It is acid, astringent, cooling, refrigerant, diuretic and has laxative value. The fruit is rich source of vitamin-C, pectin and tannin(Pathak *et al.*, 2003). If, the fruits

of aonla are not properly mature, tannic acid, vitamin-C and other constituents may not attain the optimum level and pose heavy post-harvest losses, including desiccation, browning of skin and prone to microbes, which resulted in poor shelf life with inferior quality.

Maturity is influenced mainly by cultivars, climate, soil, cultural practices, canopy

management and chemicals used. Scanty information are available on different aspects, i.e., shelf life (Nath *et al.*, 1992; Singh *et al.*, 2004; Singh *et al.*, 2005), plant growth regulators (Ram and Raja Rao, 1976; 1978; 1981) and vitamin C and tannin (Bajpai, 1969-71; Gupta *et al.*, 2003) and limited information on maturity indices from semi arid and arid parts of India (Singh *et al.*, 2004; Meghwal and Azam, 2004).

However, maturity indices have also not been studied well in sub-tropical region. Thus, fixation of proper stage of harvest maturity is a prerequisite to obtain optimum size, quality with prolonged shelf life. Keeping these in view, the present work has been undertaken and results are reported.

Materials and Methods

The present investigation entitled “To determine the maturity index for right stage of fruit harvesting during growth and development of Aonla (*Emblica officinalis* Gaertn.) fruit cv. Narendra Aonla-10.” was carried out at the main experimental station of Department of Horticulture, A.N.D. University of Agriculture and Technology, Kumarganj- Ayodhya (U.P.) during the year 2019-20.

The details about the materials used and experimental procedure followed in the present studies are described here under following heads and subheads.

Source of materials

Aonla fruits for analyzing physical and chemical character were taken at the 30 days intervals from pea stage to maturity from selected aonla tree planted at the Main Experimental Station of Department of Horticulture. The fruits free from any visible sign of microbiological infection, insect infestation and physical injury were selected.

Technical programme

The technical programme comprises following three experiments: -

Experiments no. 1: Determination of harvesting index for right stage of fruit harvesting.

Replications: 3

Interval: 30 days

Design: CRD

Observations recorded

Specific gravity, pulp and seed ratio, T.S.S. (%), vitamin C (mg/100g), acidity (%) and T.S.S. to acid ratio.

Methodology adopted in observations

Maturity indices

Specific gravity

The specific gravity of the fruit was calculated based on the average weight and volume of fruit. The weight was divided by the volume and represented as specific gravity of fruit. The formula of specific gravity is given below:-

$$\text{Specific gravity} = \frac{[\text{weight of fruit(g)}]/[\text{volume of fruit(ml}^3\text{)}]}{1\text{g ml}^{-3}\text{(water)}}$$

Pulp and seed ratio

Pulp to Stone Ratio was determined by dividing the weight of pulp of the fruit by the weight of the stone of the fruit. The formula of seed and pulp ratio is given below:-

$$\text{Pulp and Seed ratio} = \frac{\text{Pulp weight(g)}}{\text{Seed weight(g)}}$$

T.S.S. (%)

The total Soluble Solids (TSS) of the samples were determined with the help of hand refractometer in terms of percentage. The values of Total Soluble Solids recorded at ambient temperature were corrected at 20 °C with the help of reference table (Ranganna, 2000) and the mean value was expressed as per cent TSS content of the sample.

Acidity (%)

Titrate acidity was estimated by method suggested by Ranganna (2000). Fruit pulp 5g was taken and crushed in mortar and pestle and juice was separated through filtration with the help of muslin cloth. Aliquot of the juice sample were prepared by mixing distilled water for 100ml volume. Titrate acidity was estimated by titrating 5ml fruit extract aliquot with 0.1 N NaOH using 1 % phenolphthalein solutions as indicator. The titer values were recorded when the solution turns pink in color. The per cent titrate acidity was calculated and expressed as percent citric acid equivalent using the following formula.

$$\begin{aligned} & \text{\% titrate acidity} \\ & \frac{\text{Titre X Normality of the alkali} \\ & \quad \text{X Volume made up} \\ & \quad \text{X Equivalent weight of acid X 100}}{\text{Volume of Sample Taken for Estimation} \\ & \quad \text{X Volume of sample Taken X 1000}} \end{aligned}$$

Vitamin C (mg/100g)

To estimate vitamin C, extract of 5 ml fruit pulp of sample was taken into 50 ml volumetric flask and volume made up to 50 ml with 3% HPO₃ (Metaphosphoric acid) solution. Thereafter 5 ml aliquot were titrated against 2, 6-Dichlorophenol indophenol dye solution. The end point was marked by appearance of pink colour, which persisted

for at least 15 seconds (Ranganna, 2000). The content of Vitamin C was expressed in mg/100g sample after calculation using following formula:

$$\begin{aligned} & \text{Ascorbic Acid (mg/100ml)} \\ & \frac{\text{Titre value x Dye factor} \\ & \quad \text{x Volume made up x 100}}{\text{Aliquot taken x Volume of sample taken}} \end{aligned}$$

Standardization of dye

To 5 ml of standard ascorbic acid solution, 5 ml of 3% HPO₃ was added and Titrated with the dye solution to a pink color which persisted for 15 seconds or more to determine the dye factor, i.e. mg of ascorbic acid per ml of dye, using the following formula.

$$\text{Dye Factor} = \frac{0.5}{\text{Titre}}$$

T.S.S. to acid ratio

T.S.S. to acid ratio is calculated by following formula:-

$$\text{T.S.S. to acid ratio} = \frac{\text{Total soluble solid \%}}{\text{Acidity \%}}$$

Statistical analysis

The analysis of variance (ANOVA) of the data was carried out by the techniques as by Raghuramula *et al.*, 1983.

$$\text{Sem} \pm = \sqrt{\frac{\text{MSE}}{r}}$$

CD at 5% = S.E. x t value

Results and Discussion

Specific gravity

The data presented in table-1 reveals that specific gravity at harvest maturity is 1.01

which was observed on 6th January for aonla fruit cv. NA-10.

Pulp to seed ratio

The data on pulp to seed ratio presented in table-1 reveals that pulp to seed ratio at maturity is 20.44 which was recorded on 6th January for aonla fruit cv. NA-10.

Total Soluble Solids

The data of Table-1 reveals that the value of Total Soluble Solids at harvest maturity is 8.85% which was recorded on 6th January for NA-10.

Vitamin C

The data on vitamin C presented in table-1 reveals that vitamin C at maturity is 730.60 mg/100g which was recorded on 6th January for aonla fruit cv. NA-10.

Acidity

The data on acidity percentage presented in table-1 reveals that acidity percentage at maturity is 1.48% which was recorded on 6th January for aonla fruit cv. NA-10.

T.S.S. to Acid ratio

The data of Table-1 reveals that the content of T.S.S.: Acid ratio showed increasing trend from starting stage of observation to end of observation. The T.S.S.: Acid ratio increased from 2.57 on 6th August to 5.99 on 6th January and the changes were found to be significant. At the maturity, it was 5.99 percent. The results from present investigation entitled "To determine the maturity index for right stage of fruit

harvesting during growth and development of Aonla (*Emblica officinalis* Gaertn.) fruit cv. Narendra Aonla-10." was carried out at Main Experimental Station of the College of Horticulture & Forestry, Acharya Narendra Deva University of Agriculture and Technology, Narendra Nagar, Kumarganj, Ayodhya 224229 (U.P.) India during the years 2019-2020.

The result of the present investigation can be summarized and concluded as follows:-

Changes in specific gravity showed decreasing trend from 6th August to 6th January and specific gravity for maturity was found suitable during 6th December to 6th January.

Pulp to seed ratio observed during 6th August to 6th January during growth and development increased and found to be maximum at the maturity. This stage takes place from 6th December to 6th January.

Total soluble solid percentage recorded during 6th August to 6th January increased till 6th January. At this stage, it showed maturity in cultivar.

Acidity percentage increased during initial stage of growth and development then decreased till 6th January and at this stage it found to be 1.48%.

Vitamin C content observed during growth and development of fruit increased till maturity stage.

T.S.S. to acid ratio showed significant change during 6th August to 6th January. It decreased till 6th November and then increased till 6th January.

Table.1 Changes in fruiting attributes to determine harvesting index for fruit harvesting

Date of Sampling	Specific Gravity	Pulp to Seed Ratio	TSS (%)	Vitamin C (mg/100gram)	Acidity (%)	TSS to Acid Ratio
6/8/2019	1.23	10.44	2.35	20.67	0.97	2.57
6/9/2019	1.17	11.75	4.18	166.00	2.24	1.90
6/10/2019	1.13	13.82	7.73	275.60	2.92	2.67
6/11/2019	1.06	17.88	8.03	484.00	2.25	3.57
6/12/2019	1.02	19.95	8.79	728.70	1.91	4.64
6/01/2020.	1.01	20.44	8.85	730.60	1.48	5.99
SEm±	0.02	0.86	0.36	2.22	0.12	0.30
CD at 5%	0.05	1.92	0.80	4.94	0.27	0.67

Hence, according to result observed from present investigation, it can be concluded that all physiological parameter of growth and development showed significant change from 6th August to 6th December and then showed non-significant change till 6th January. Therefore, fruit of NA-10 indicated maturity between 6th December to 6th January and this stage showed right stage of harvesting.

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