



CARBOHYDRATE CHANGES DURING FRUIT RIPENING STAGES IN MANGO.

KEYWORDS

Mango, fruits, carbohydrate.

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ABSTRACT

In the present investigation study the various changes of carbohydrate on fruit ripening stages. Fruit ripening is a highly diverse series of processes, with marked variations in metabolism occurring between different fruit types. Despite this all fruit can be classified as either climacteric or non climacteric, with the two groups differing in their pattern of respiration and ethylene synthesis during ripening. Climacteric fruits are characterised by an increased rate of respiration that occurs at an early stages in the ripening process eg. Mango. The non climacteric fruit do not show any increase in respiration during ripening.

INTRODUCTION

Fruit has been grown in India for thousands of years and occupies today a position of considerable importance on human diet. Soil and climate condition in India are very favourable to large number of fruits.

Mango is subtropical fruit crop grown on plains of India. As the fruit reaches the end of its growth period, it may undergo some characteristic qualitative and quantitative changes, this collectively referred to as ripening. The ripening process is frequently coincident with termination of fruit growth. Maturation refers to the associated with fruit reaches full size and ripening refers to the processes which qualitatively transform the mature fruit. At maturity fruits undergo many changes which include the development of colour, aroma and improvements in flavour and texture that make them attractive to potential consumer (Phan 1970). The quality of fruit is influenced by variety, nutritional status, and environmental conditions during growth of the parent plant, since these factors can influence the import of material during fruit development (Sen, P.K. (1943), the ripening process itself, however is concerned mainly with alterations in components already existing in the organs and many fruits are capable of ripening to a very acceptable standard after being detached from the plant, providing they have reached maturity prior to picking.

Ripening changes involve a multiplicity of biochemical pathways that affect all the cell compartments. Colour changes are due to alteration in chlorophyll and carotenoids contents of plastids or the accumulation of anthocyanins in vacuoles. Softening is brought about by alterations in cell wall metabolism and is due to partial solubilisation of pectin or cellulose. In some cases degradation of starch stored in the plastids may also contribute to changes in texture. Alteration in metabolism of organic acids and the generation of volatile compounds that produce a characteristic aroma are common. Various changes associated. Ripening of fruits is an important physiological event in the life cycle of plant in which several morphological and biochemical change occurs. During development and maturity, fruits undergo many changes which include of colour, aroma, improvement in flavour and texture, hydrolytic conversions of storage material and multiplicity of biochemical pathways that affect all the cell compartments in fruit

(Singh, Ranjit 1969).

MATERIAL AND METHODS

Mango fruits of Alphonso and Lalbag were obtained at mature green (unripe) stage from the orchard of Mahatma Phule Krishi Vidhyapeeth Rahuri and brought to laboratory, mature green fruits were kept for ripening in straw. At each stage of ripening i.e. mature green (unripe) stage partial ripe stage carbohydrate from fruits are estimated by Somogyi-Nelson method (1944).

RESULTS AND DISCUSSION

In present investigation attempts have been made to study the changes in carbohydrate content in Mango fruit at three different stages of ripening. Many fruits are capable of photosynthesis. The bulk of their carbohydrate is provided by translocation of sucrose from the rest of the plant (Phan 1970). This carbohydrate accumulates during fruit development as starch, sucrose, glucose and fructose. The relative proportion of each varying enormously between different fruit (Whiting 1970). The total levels of sucrose, glucose and fructose increase during ripening either from further accumulation from plant or from the breakdown of stored carbohydrate. The absolute level of reducing sugar and non-reducing sugars was attained during ripening varies from fruit to fruit.

The changes in reducing sugars, total sugars, starch and total carbohydrates were studied at mature green (unripe) stage, partial ripe stage and ripe stage in Mango varieties-Alphonso and Lalbag and the results obtained are presented in Table-1. Carbohydrate contents of mango fruit showed an increase during ripening in Alphonso as well as in Lalbag with an exception of starch, where it was decreased during ripening. Harkness and Cobin (1951) found that in mango the reducing sugar remained constant at about -4 % from a very immature stage until ripeness. The composition of different varieties of Mango varies considerably, particularly in the percentage of sugar which may be as low as 11 % or higher than 20 %, A typical Badami variety contains 7.13 % reducing sugar and 11.42 % non-reducing sugar (Lal et.al. 1952) (Lele et.al. 1943). Studied the ripening of mango fruits and found that the fully ripe contained 2.19 % glucose. 0.41 % fructose and 1.98 % non-reducing sugars which during ripening Cheema et.al (1950) reported more than 16.0 % total sugar in variety Langra.

Reducing sugars varied from 1.4 to 4.83 % and non-reducing 8.19 % to 13.81 % our result of present investigation (table 1) also show increase in the level of carbohydrates during ripening in Alphanso the level of carbohydrate is more than Lalbag.

Reducing sugar in Alphanso at unripened stage is 2.34 % and it is increased 6.42 % to 9.58 % in ripen stage. The content of reducing sugar is comparatively more in Alphanso variety than Lalbag variety. At ripened stage Alphanso contains 9.58 % reducing sugar 10.99 % total sugars, 4.23 %starch and 24.8 % total carbohydrate. However lalbag variety at ripened stage contains 6.57% reducing sugar, 8.24 % total sugar, 4.17% stage and18.98% total carbohydrates. This Indicates that Alphanso variety contains more carbohydrate than Lalbag variety (table-1) This includes that mature green fruit (unripened stage) of both the variety contain large Amount of starch and during ripening there may be breakdown of starch to give rise sucrose, Glucose and fructose which is evidenced by decrease in starch content and increase in Sugar in ripening stage of both the varieties. Thus during ripening there is both breakdown of Starch accompanied with increase in reducing and non reducing sugar. The breaking of Starch may be due to increase in the activity of enzyme amylase and phosphorylase during ripening.

It is observed that in both varieties the colour of fruits varieties the colour of fruit at unripened stage is green and it changes to yellow and orange. The colour changes may be due to alterations in chlorophyll and carotenoid content, or due to accumulation of anthocyanins. The changes in texture of the fruit is also noticed where tissue softening is brought about during ripening. This may be due to alterations in cell wall metabolism and partial solubilisation of pectin or cellulose. The characteristic aroma is also noticed in both Alphanso and Lalbag variety which may be due to alterations in metabolism of organic acids and the generations of volatile compounds that produce a characteristic aroma.

Table. 1. Carbohydrate contents at different stages of ripening in mango fruits.

Variety	Stage	Reducing sugar %	Total sugar %	Starch %	Total carbohydrate
Alphanso	Un-ripened	2.34	5.84	9.98	18.16
	Partial ripened	6.42	9.63	5.57	21.62
	Ripened	9.58	10.99	4.23	24.8
Lalbag	Un-ripened	1.84	3.89	8.92	14.65
	Partial ripened	4.13	6.84	5.34	16.31
	Ripened	6.57	8.24	4.17	18.98

Acknowledgement

The authors are grateful to Dr. K.J.Salunke, Head, Department of Botany and Dr. S.R. Walunj, Principal, P.V.P. College, Loni, for providing necessary laboratory facilities.

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