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PARTITIONING AND METABOLISM OF ASSIMILATES IN DEVELOPING FRUITS

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Fruits import a wide range of assimilates, such as carbohydrates and nitrogenous compounds, that are then partitioned between the fruit structures and the developing seeds. At certain stages of development many fruits accumulate organic acids, such as citric, malic, quinic, and ascorbic acids, together with their anions. These acids are a metabolically diverse group. Citric, and to a lesser extent malic acid, together with their anions, accounts for the bulk of the organic acid content of many soft fruits and there is a decrease in their content of citric and/or malic acid during ripening. In some fruits, such as Hamlin orange, this decrease can be accounted for by dilution arising from expansion of the fruit. In others, catabolism is also involved. In soft fruit, little is known about the metabolic pathways involved in this catabolism, however, this has been studied in the flesh of grapes and tomatoes, and in these a number of fates for malate/citrate have been suggested. These are oxidation by the Krebs cycle, gluconeogenesis, fermentation reactions that produce ethanol, anthocyanin synthesis, and amino acid interconversions. However, uncertainty exists as to what proportion of malate/citrate is used by each of these processes. In plant cells, PEP carboxykinase (PEPCK) is only present in the cytosol. As in other organisms, PEPCK is only present in certain tissues of plants, and in many of these only under certain conditions. Although, the occurrence of PEPCK in most fruits is uncertain, studies have been done in grapes and tomatoes. In these PEPCK appears, or increases in abundance, in the flesh at the onset of ripening, and this led to the suggestion that PEPCK might function in the catabolism of malate and/or citrate. By contrast, there are a number of forms of malic enzyme in plants, there are cytosolic and plastidic forms of NADP-malic enzyme (NADP-ME) and a mitochondrial NAD-malic enzyme. The malic enzymes have been studied in several fruits, and it has been proposed that NADP-ME may function in the catabolism of malic and citric acids in the flesh during ripening.