Title Temporal relationship between ester biosynthesis and ripening events in bananas.

Authors Jayanty, S., Song, J., Rubinstein, N. M., Chong, A. and Beaudry, R. M.

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Abstract

The temporal relationship between changes in ethylene production, respiration, skin colour, chlorophyll fluorescence, volatile ester biosynthesis, and expression of ACC oxidase [1-aminocyclopropane-1-carboxylate oxidoreductase] (ACO) and alcohol acyl-CoA transferase (AAT) in ripening banana (Musa spp., AAA group, Cavendish subgroup cv. Valery) fruit was investigated at 22 deg C. Ethylene production rose to a peak a few hours after the onset of its logarithmic phase; the peak in production coincided with maximal ACO expression. The respiratory rise began as ethylene production increased, reaching its maximum approx equal to 30 to 40 h after ethylene production had peaked. Green skin coloration and photochemical efficiency, as measured by chlorophyll fluorescence, declined simultaneously after the peak in ethylene biosynthesis. Natural ester biosynthesis began 40 to 50 h after the peak in ethylene biosynthesis, reaching maximal levels 3 to 4 days later. While AAT expression was detected throughout, the maximum level of expression was detected at the onset of natural ester biosynthesis. The synthesis of unsaturated esters began 100 h after the peak in ethylene and increased with time, suggesting the lipoxygenase pathway be a source of ester substrates late in ripening. Incorporation of exogenously supplied ester precursors (1-butanol, butyric acid, and 3-methyl-1-butanol) in the vapour phase into esters was maturity-dependent. The pattern of induced esters and expression data for AAT suggested that banana fruit have the capacity to synthesize esters over 100 h before the onset of natural ester biosynthesis. We hypothesize the primary limiting factor in ester biosynthesis before natural production is precursor availability, but, as ester biosynthesis is engaged, the activity of alcohol acyl-CoA transferase the enzyme responsible for ester biosynthesis, exerts a major influence.