CHAPTER 14

Ripening and biochemistry of the fruit

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14.1 INTRODUCTION

During their growth bananas steadily accumulate starch. First they elongate, then they increase in width. The increase in width continues as long as the fruits are not harvested, so that in section they become rounded. Under these conditions the fruits can even split, without ripening having been triggered. When this is observed in the field it is generally linked to stress or injury.

After harvest, the life of the banana passes through three successive stages:

1. The preclimacteric phase, of relatively low metabolic activity, the so-called ‘green life’.
2. The ripening phase itself, the main reactions of which are set off following a period of intense respiratory activity: the climacteric.
3. The senescent phase, during which metabolism slows, fruit quality deteriorates and pathogens are liable to develop.

14.2 THE PRECLIMACTERIC PHASE

The duration of the preclimacteric depends on the variety, and on the physiological state of the fruit at harvest (Nolin, 1989; Marchal and Nolin, 1990. It can be prolonged by the use of appropriate storage techniques that allow the fruits to be brought to the right stage for marketing. Cooking bananas, including plantains, unlike dessert bananas, are mainly eaten in the green state and are sold without ripening being triggered, but they can equally be used at more advanced stages of ripeness, although with a reduced market value. In both dessert and cooking types the need is for the

Figure 14.1 Changes in CO$_2$ evolution (■) and in the conductance (+) of intact fruit during the preclimacteric and climacteric in Giant Cavendish bananas. (From Nolin, 1985.)

longest possible ‘green life’ by harvesting the fruits at a suitable stage, and by adopting appropriate storage conditions.

14.2.1 Factors affecting the duration of the preclimacteric

The end of the preclimacteric phase can be determined by measuring of the increased softness of the pulp (Deullin and Monnet, 1956; New and Marriott, 1974; Marriott and New, 1975; Marriott et al., 1979), from the conductance of the peel and pulp (Deullin, 1980; Marchal et al., 1988) and by correlating this conductance with the rate of respiration (Fig. 14.1) (Nolin, 1985). The duration of the preclimacteric can be estimated by measuring the grade of the fruit, but greater precision can be obtained by measuring the minimum concentration of ethylene that can trigger the climacteric (Nolin, 1985). Further factors, besides the physiological state, influence the duration of the preclimacteric, including the temperature, relative humidity and atmospheric composition.

Temperature

In general temperatures lower than 11.5°C lead to symptoms of cold damage, but the critical temperature can vary with the cultivar, relative humidity, and the length of exposure to cold (cf. Section 14.2.3). Between 12.5 and 21.5°C the duration of the preclimacteric is an inverse linear