QUEENSLAND DEPARTMENT OF PRIMARY INDUSTRIES
DIVISION OF PLANT INDUSTRY BULLETIN No. 342

RELATIONSHIP BETWEEN CERTAIN PHYSICAL CHANGES AND THE CLIMACTERIC PHASE IN THE BANANA

By B. C. PEACOCK, B.Sc.*

SUMMARY

It is shown that changes in external colour and firmness can be used to determine when a banana fruit begins its climacteric rise or reaches its climacteric peak.

Introduction

Experiments were commenced recently to find a maturity index for bananas. For the purpose of this work the maturity of bananas was defined as "the length of time a fruit takes to enter its climacteric phase under standard storage conditions in the absence of ethylene." However, the measurement of maturity on this basis necessitates daily measurements of respiration to determine when a fruit enters its climacteric phase. With the equipment available, the number of fruit which could be followed simultaneously was limited, and therefore it was decided that some other easily measurable method of determining when the climacteric rise had commenced should be sought. The present work was carried out to determine if a close relationship exists between respiratory changes of a fruit and the physical characteristics of pulp softening (springing) and external colour change.

Experimental Procedure

The fruit used was Cavendish variety of "commercial maturity" in that it was obtained direct from the Brisbane wholesale market. Fingers were selected according to size and ranged from very small fruit taken from the bottom hands of bunches to very large fruit taken from the top hands. This was done in an attempt to obtain fruit of a wide range of maturity, because if the relationship is to be used in a maturity index study, it must hold over a wide range. In order to allow for possible seasonal variations, fruit was selected at four different periods of the year to include the different fruit types which occur locally.

To measure respiration, fingers were kept isolated in individual containers and air passed over them at a flow rate of 80 ml/min. The air stream was humidified by passing it through water bubbles. Respiration measurements were made daily with an infrared gas analyser on the effluent air streams. Containers of fruit were kept at 64°F.

* Food Preservation Research Laboratory, Queensland Department of Primary Industries.

External colour measurements were made by comparing the fruit daily with a colour chart which consisted of colour photographs of fruit selected at different stages of external colour change, the stages being numbered from 1 to 7. The day on which the first detectable external colour change occurred was recorded.

Firmness measurements were made daily, using the "mechanical thumb" described by Schomer, Olsen, and Yeatman (1963). The day on which the first detectable change in firmness occurred was recorded.

Figures were obtained for (i) days to enter climacteric rise; (ii) days to reach climacteric peak; (iii) days to show first external colour change; and (iv) days to show first firmness change. These time intervals were measured from the date of collection at the market, which was within a few days of harvest.

Results and Discussion

There were no significant differences in days to reach climacteric peak, days to show first external colour change, and days to show first firmness change. The first detectable colour change and firmness change occurred on the day the fruit reached its climacteric peak (Figure 1).

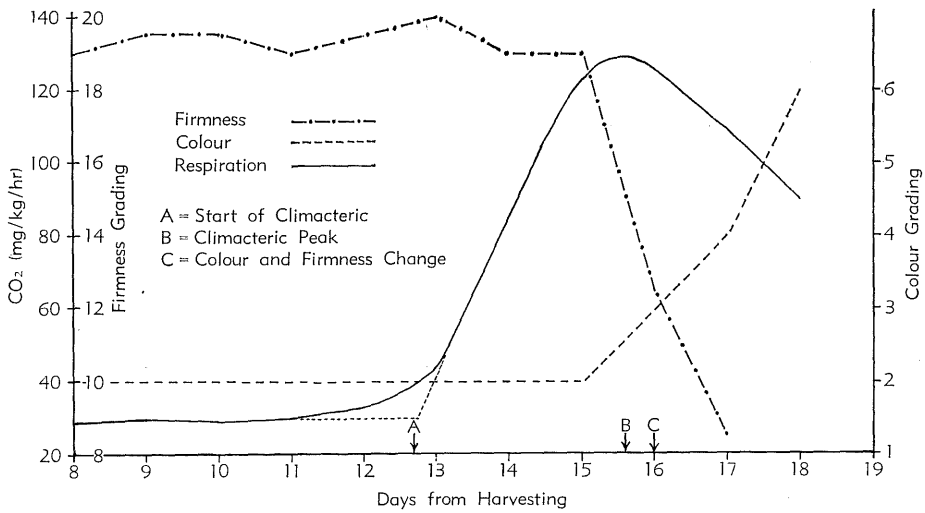

Fig. 1.—Relationship between respiratory changes and physical characteristics.

The correlation between days to enter climacteric rise and days to show first firmness change was significant at the 1% level. A typical graph obtained for this relationship is shown in Figure 2. The interval between the two points was found to be constant for a particular sampling period, and the mean values of this interval for each sampling period are shown in Table 1.

TABLE 1

MEAN VALUES OF INTERVAL BETWEEN BEGINNING OF CLIMACTERIC RISE AND FIRST FIRMNESS CHANGE

Collection Period	Interval (days)
Early January (fruit thrown in September)	3·1±0·10
Late January–early February (fruit thrown in November)	3·0±0·10
Late February–March (fruit thrown in December) ..	2·4±0·09
August–September (fruit thrown in April)	3·1±0·10

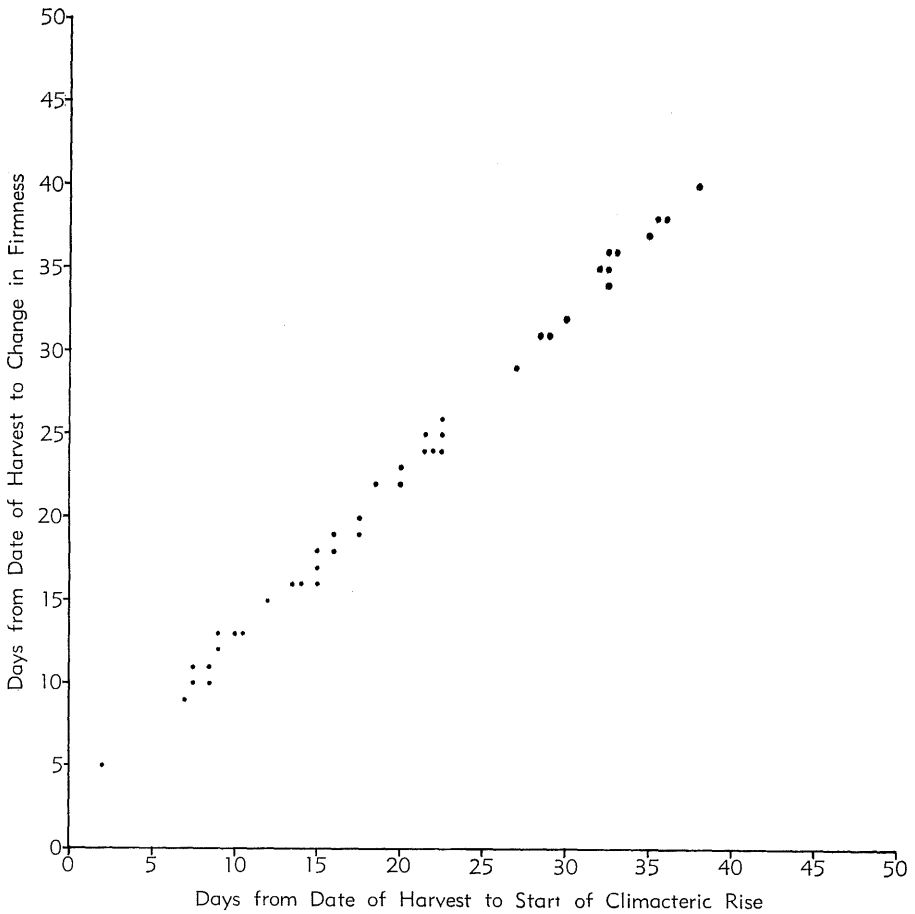

Fig. 2.—Correlation between days to enter climacteric rise and days to show first colour and firmness change.

The regression coefficients obtained when this interval is compared with days to climacteric rise for each harvesting period are shown in Table 2. None of these coefficients is significantly different from zero, indicating that the interval is not related to the maturity of the fruit when harvested.

TABLE 2

REGRESSION COEFFICIENTS OF INTERVAL BETWEEN BEGINNING OF CLIMACTERIC RISE AND FIRST FIRMNESS CHANGE ON TIME TO BEGINNING OF CLIMACTERIC RISE

Collection Period	Regression Coefficient
Early January	−0·055±0·029
Late January–early February	−0·020±0·026
Late February–March	0·001±0·009
August–September	0·001±0·010
Mean	−0·003 0·006

It is of interest to note that, though this interval is not affected by maturity, it appears that it can be affected by season, since the difference between the interval obtained in the late-February-March collection and that obtained for the other collection periods is significant at the 1% level. The fact that this interval is not related to maturity perhaps indicates that the physiological makeup of bananas when they commence their climacteric rise is fairly uniform.

These studies have shown that changes in external colour and firmness can be used to determine when a banana begins its climacteric rise or reaches its climacteric peak.

REFERENCE

SCHOMER, H. A., OLSEN, K. L., and YEATMAN, J. N. (1963).—A mechanical thumb for measuring firmness of fruits. *Mktg Bull. U.S. Dep. Agric.* No. 25.

(Received for publication September 9, 1965)