

# Methodology to forecast the harvest date of banana bunches

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## Methodology to forecast the harvest date of banana bunches.

**Abstract — Introduction.** This method is used to forecast the harvest date of banana bunches from as early as the plant shooting stage. It facilitates the harvest of bunches with the same physiological age. The principle, key advantages, time required and expected results are presented. **Materials and methods.** Details of the four steps of the method (installation of the temperature sensor, tagging bunches at the flowering stage, temperature sum calculation and estimation of bunch harvest date) are described. Possible problems are discussed. **Results.** The application of the method allows drawing a curve of the temperature sum accumulated by the bunches which have to be harvested at exactly 900 degree-days physiological age.

France (Guadeloupe) / *Musa sp.* / forecasting / harvest / temperature / methods

## Méthodologie de prévision de la date de récolte des régimes de bananes.

**Résumé — Introduction.** Cette méthode est utilisée pour prévoir la date de récolte des régimes de banane dès le stade floraison. Elle facilite la récolte de régimes ayant un même âge physiologique. Le principe, les principaux avantages, le temps nécessaire et les résultats attendus de l'application de la méthode sont présentés. **Matériel et méthodes.** Le détail des quatre étapes de la méthode (installation de la sonde de température, marquage des régimes au stade de floraison, calcul de la somme des températures, évaluation de la date de récolte des régimes) est décrit. D'éventuels problèmes sont discutés. **Résultats.** L'application de la méthode permet de tracer une courbe de la somme des températures accumulées par les régimes qui doivent être récoltés à l'âge physiologique de 900 degré-jours.

France (Guadeloupe) / *Musa sp.* / technique de prévision / récolte / température / méthode

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## 1. Introduction

### Application

This method is used to forecast the harvest date of banana bunches from as early as the plant shooting stage. It facilitates the harvest of bunches with the same physiological age.

### Principle

With no limiting factors, banana grade growth is highly dependent on temperature

[1]. Moreover, regardless of the fruit growth rate, the physiological age of banana fruits is closely correlated with the mean daily temperature sum accumulated by the fruit during its development [2]. It was demonstrated that bunches of Cavendish that have accumulated a temperature sum of 900 degree-days reach the commercial grade, with green life duration sufficient to support exportation [3, 4]. This method includes daily temperature records from the shooting stage and calculation of the mean daily temperature sums at the 14 °C threshold (14 °C

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is only valid for Cavendish). Very early harvest forecasts can be made based on normal seasonal temperatures. The harvest date forecast can then be gradually readjusted according to actual temperatures.

### Key advantages

This method enables planning of harvesting operations. Moreover, physiological age of harvested regimes can be determined.

### Time required

Around 1 h a week is required to collect the weather data and to calculate the mean temperatures and temperature sums at the 14 °C threshold.

### Expected results

The application of the method allows drawing a curve of the temperature sum accumulated by the bunch.

## 2. Materials and methods

### 2.1. Materials

The method requires coloured plastic tags to mark the bunch at flowering (one colour per week of flowering); an electronic temperature sensor (or thermometer), a weather instrument shelter, a computer or calculator.

### 2.2. Protocol to forecast banana harvest dates

- Step 1  
Install the temperature sensor:  
Set up the weather instrument shelter on flat ground in a grassy area (about 1500 m<sup>2</sup>) close to the banana plot (the weather instrument shelter should be painted white).

*Caution:* the temperature sensor should be attached with a non-metallic link under the shelter.

- Step 2  
Tag bunches at the flowering stage:

When banana plants are at the shooting stage, attach a coloured tag to the end of the floral stalk with the shooting date of the plant noted on the tag. Wrap bunches in a blue plastic cover. *Note:* the shooting stage is defined as follows: all female hands should be as bare as possible, with one or two bare male hands. Fingers are horizontal and begin to straighten.

- Step 3  
Calculate the temperature sum:

- When an automatic temperature sensor is used, collect the data on a weekly basis. The automatic sensor should be adjusted to log temperatures every 10 min. Then, actual mean temperatures can be calculated using a computer and spreadsheet calculator.

- Subtract 14 °C from the mean calculated temperature, *i.e.*, calculate:  $(T_{\text{mean}} - 14)$ , then sum up the daily  $(T_{\text{mean}} - 14)$  values from the flowering stage. This gives the physiological age of the bunch in degree-days.

*Note:* it is important to note that 14 is only used for the Cavendish variety. For other varieties, the temperature thresholds must be determined.

- Step 4  
Estimate the bunch harvest date:
  - As the bunches grow, adjust the theoretical harvest date (based on temperature records of previous years) with the actual temperatures so that they can be harvested at exactly 900 degree-days physiological age.
  - To obtain a long-term forecast of the harvest date of banana bunches, calculate the theoretical shooting to harvesting interval, *i.e.*, the number of days required to reach 900 degree-days (based on temperature records of previous years).

- As the bunches grow, refine the determination of the bunch harvest date using the actual recorded temperatures.

### 2.3. Troubleshooting

Imprecise estimation of physiological fruit age (harvest date) can occur. This problem can be due to two reasons:

- Temperature sensor was inaccurately positioned with respect to the banana plot.

*Solution:* the sensor should be moved to a site that is representative of the mean temperature on the plot, or several sensors will be required if the plot is highly heterogeneous (e.g., top and bottom of the plot, for example).

– Temperature sensor is poorly adjusted.

*Solution:* it is recommended to set up a second sensor to validate the temperature measurement.

### 3. Typical results obtained

The application of the method allows drawing a curve of the temperature sum accumulated by the bunches which have to be harvested at exactly 900 degree-days physiological age.

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