

# VI International Conference on Managing Quality in Chains (MQUIC 2013)

Cranfield University (United Kingdom), 2.-5. September 2013

## The intelligent container for banana transport supervision and ripening

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**Keywords:** Green life, temperature mapping, respiration heat

### Abstract

Bananas differ from other fruits by the fact that a special ethylene treatment is applied in the destination country to turn 'green' into ripe bananas. Moderate differences in bunch age at harvest, transport duration and temperature have no measurable effect on the fruit quality after ripening as long as the bananas are maintained in a mature green state with no signs of unwanted self-induced ripening (turners) before ethylene treatment. Therefore, systems for automated transport supervision should focus on the detection of turners by higher respiration activity and gas production as well as by the detection of potential hot spots caused by high respiration heat in combination with insufficient air flow through the affected pallet. Under optimal cooling conditions, the subsequent ripening process can be carried out directly in the container. This paper will focus on three topics related to meeting this challenge. Firstly, the technical system of the intelligent container for remote on-line supervision of transports, which has been tested during three transports of bananas from Costa Rica to Europe, but can also be used for different types of perishable products. Second, a simple heat transfer model is introduced which allows estimating index values for local cooling effects and respiration activity per pallet from the measured temperature curves. The model can thereby predict the risk of hot spots. Finally, we present the first test results for container ripening of bananas. The major obstacle therein is the large amount of heat generated during the process, which is about 5 times higher than during the transportation of green bananas. We applied different modifications in the packing scheme to improve the air flow, which showed clear benefits with regard to the amount of heat removed by cooling.