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Temperature Tracking Using RFID in the Pineapple Supply Chain

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The global pineapple market requires highly effective temperature-controlled supply chains that will prolong the product's shelf life while avoiding its chilling injury. Current temperature tracking systems lack the accuracy and simplicity demanded by the real conditions of a fast-paced produce supply chain. In recent years, radio-frequency identification (RFID) technology has been suggested to be an enhanced method for temperature tracking because of its many benefits, such as using very little instrumentation, offering the quick readings necessary for real-time decision making, and allowing the capture of long-duration temperature profiles. Still, its limitation lies in its failure to provide accurate temperature readings on the critical points of the pallet.

Our research presents a solution to this problem by developing and applying heat transfer software able to predict temperatures at different locations in the pallet, based on RFID temperature readings obtained on the exterior of it. In order to do so, the creation of a customized temperature tracking system is proposed. This involves three steps: a cold chain analysis, the creation of the software, and the model validation.

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As part of the cold chain analysis, a sea shipment of crownless pineapples packed in corrugated boxes and reusable plastic containers (RPC) was studied in order to find the critical points of the pallets and the container. ThermAssure RF (Evidencia, Memphis, TN) RFID sensors and HOBO (Onset, New Brunswick, NJ) sensors were placed in four different positions inside the pallets; later on, these were situated in three different locations along a refrigerated container. The relationships between the temperature profiles obtained with the HOBO sensors and the ThermAssure RF RFID sensors placed on the pallet located in the critical position in the container were also examined. And finally, the temperature profile correspondent to the HOBO sensor that correlated the best with the external RFID sensor's temperature profile was selected to validate the model.

It is expected that once applied, this RFID temperature tracking system will be a powerful decision-making tool for both suppliers and retailers, and that their economic returns and the satisfaction of their costumers will increase. In addition, it is also anticipated that, when joining forces with shelf-life prediction models, this technology will be able to offer in situ real-time shelf-life estimates for produce loads during each step of the supply chain.