The use of continuous cold chain monitoring technology that transmits real-time data during the entire cold storage and distribution process is becoming increasingly popular in the fruit industry, particularly because it enables retailers to implement ‘first expired first out’ (FEFO) management, potentially saving millions of rands annually.

Total Produce, Europe’s premier fresh produce provider based in the Netherlands, is the latest business in the industry to switch to such a system to monitor the temperature and humidity of the produce as it travels along the entire cold chain, with the data being transmitted in real time so that the appropriate corrective action can be taken in time to minimise wastage due to cold chain failures.

Henk Nelisse, quality manager of Total Produce, says that monitoring and controlling temperature during the supply chain is crucial for maintaining the freshness and quality of fresh produce. “Unlike in the past, most fresh produce is now supplied in reefer containers. Temperature data loggers are typically used to monitor the refrigeration during transportation from exporter to importer. These loggers need to be retrieved and then manually read, which, considering the large amount of containers that are delivered, is very time consuming. Furthermore, the data is only available after the containers have been unloaded and the downloaded data then has to be sent back to the exporters.”

Henk explains that Total Produce was interested in locating technology that automatically downloads the temperature-time data before the container doors are opened. In the event of a temperature breach, this enables the surveyor to be called in before the container is unloaded.

Dr Jean-Pierre Emond of the UF/IFAS Centre for Food Distribution and Retailing at the University of Florida in the USA, says the use of such systems “is probably the most significant change in the produce industry in the last 20 years”.

He says fresh perishables are a great challenge for retailers, as they must be transported as quickly as possible in order to provide consumers with the best quality goods. For some produce a delay of only a few hours in the cooling process or in the distribution chain can sufficiently reduce their marketability.

Be sure to keep your cool

by Retha Fourie
Consumer appeal
For many retailers, the best way to keep or gain market share is to present an attractive produce section. The visible attributes of the produce are the most important factor when determining the market value of fresh fruit and vegetables.

In an earlier study, consumers said the ripeness, freshness and taste of fruits and vegetables were the most important criteria (96%) for selecting an item, while appearance and condition of the product was the second in order of importance (94%).

One of the reasons is the perishable aspect of the produce. Most of the time, conditions found in the store are far from the recommended temperature and humidity needed to maintain optimal produce quality. Often, a short exposure of one or two hours to inadequate conditions (in other words, too high or too low temperatures, too dry or too moist) is enough to cause a dramatic drop in the visual quality of produce.

Temperature
Because temperature is the element of the distribution environment that has the greatest impact on the storage life and food safety of fresh perishables, effective temperature management is the most important and simplest procedure for delaying product deterioration. Optimal temperature storage retards aging, softening, textural and colour changes, as well as inhibiting undesirable metabolic changes and moisture loss, as well as pathogen invasion.

Temperature is also the factor that can be easily and promptly controlled. Preservation of the quality and safety of perishables can only be achieved when the product is brought under its optimal temperature as soon as possible after harvest or production.

Furthermore, researchers at the University of Florida have found that in many refrigerated displays, temperatures might vary between a minimum temperature of 3°C to 8,5°C and a maximum temperature of 13°C to 14,5°C, depending on the area inside of the display, even when the thermostat is set at 4°C.

“Moisture losses ranging from as little as 3% to 6% are enough to cause a noticeable loss of quality for many types of produce”

Such temperature fluctuations are adequate for most fruits or vegetables sensitive to low temperatures, such as tomatoes, cucumbers, mangoes or papayas, since they all require a storage temperature of above 10°C, but definitely not for grapes, strawberries or lettuce, which require a temperature of 0°C.

Therefore, it seems obvious that even a small adjustment in the temperature setup (cold rooms and/or merchandising displays) may help to maintain the fresh appearance and nutritional value of fresh fruits and vegetables by at least three times.

Humidity control
Most fruits and vegetables contain more than 80% water, with some, such as cucumbers, lettuce and melons, containing about 95% water, which contributes to their turgid and crispy appearance.

However, after harvesting, water loss through evaporation can occur very quickly, particularly in leafy vegetables such as spinach or lettuce. This leads to rapid shrivelling and wilting of the produce and turns the vegetable tissue into a tough, unattractive and eventually inedible product. Thus, water loss results not only in appreciable weight loss, but also in less attractive produce of poor texture and with lower quality.

Moisture losses ranging from as little as 3% to 6% are enough to cause a noticeable loss of quality for many types of produce.
Cold chain distribution

Besides temperature and water loss, the packaging, transportation, distribution centre (DC) and store operations affect the in-store quality and safety of produce. Individually, these factors are not responsible for a total loss of quality, but a combination of a few of these parameters that do not meet the requirements, can produce significant losses.

Most digital temperature loggers have to be connected to a host device in order to download data, and because of this, they have limited ‘real-time’ data interactivity, which results in after-the-fact analysis for claims, quality analysis and related issues.

RFID (radio frequency identification) temperature loggers add wireless communication to read the temperature logger in real-time. The RFID tag, with associated hardware and software, will add the benefit of having a pallet/tag scanned on receipt, so that if an alert (alert trigger programmable prior to shipping) is activated, the receiver knows immediately that there is a potential problem with the shipment and can spend the time required to remedy the problem with specific shipments, rather than conducting random inspections.

FEFO management

The potential with these new systems is endless. For example, it is now possible for a fresh produce retailer to envision managing all his/her products using a ‘first expired first out’ (FEFO) system to manage produce on the shelves, rather than the traditional ‘first in first out’ (FIFO) – although it is still a battle to convince retailers that their traditionally run operations based on ‘human intuition’ cannot measure up to these new systems.

The cost of these systems may often be minor compared to the full benefit of using them for waste reduction, quality consistency and customer satisfaction.

How it works

Disposable sensors are activated and placed in one of the middle cartons when pallets are assembled. They immediately begin monitoring temperature and relative humidity.

A communications unit (CU) installed at the facility transmits the data to the system so that reports can instantly be viewed on-screen from a secure, Web-based application. The system notifies one when pre-cooling of pallets is complete and helps to monitor produce temperature during loading.

When pre-determined temperature and humidity thresholds are breached, a notification is immediately sent via SMS or email. GPS tracking also makes it possible to view the geographic progress of the shipment.

If there is no CU onboard, sensors monitor and log data until the shipment arrives at a CU equipped facility. Upon arrival, all collected data is automatically downloaded and viewable onscreen.

If a CU is installed at a receiving facility or distribution centre, the sensors continue to monitor and transmit temperature and humidity data. Easy to read reports are available to help make informed accept/reject decisions based on actual produce quality. Compromised pallets can be diverted to cooling areas or sped on to final destination.

The sensors also relay data to a secure Internet application via standard cellular networks. Cooperating parties in the cold supply chain can view data accumulated during shipment and storage, depending on the level of agreed transparency. M&J