

# farmsoft

RFID pallet management for fresh produce



Auto pallet/bin/bag  
location tracking

Pallets put onto truck are  
auto added to order and  
checked for accuracy

Pick up a pallet and its  
instantly selected

Add/tip pallet/bin into  
production line and auto  
added to batch





# Zero waste

Stock rotation and expiry can be eliminated through automatic alerts, automatic FIFO enforcement, staff are guided to the exact location of fresh produce that must be processed or sold first.

# Zero effort

Simply pick up a pallet/bin/bag and move it. RFID by farmsoft automatically tracks fresh produce inventory movement, updates its location, and flashes an alert on your tablet. Select an order, load pallets onto truck..... RFID by farmsoft automatically adds the pallets to the order / invoice. Tip a bin into a batch or add pallet to a batch, its auto added to the batch. If you have your own trucks, you can RFID tag them; when you load an order farmsoft RFID will know which truck you have loaded.

# Zero errors

Ever put the wrong pallet onto a truck, only to discover the error and must unload? Ever sent the wrong pallet across the country only to have to pay for it to be returned? Never again! RFID by farmsoft will alert you the second you pick up a pallet that doesn't match current order. Make fresh produce load outs faster, and 100% accurate.

**Simply move inventory around, farmsoft does the rest.**





- 1 Pallet position reader**  
Reads the exact location of the pallet when you put the pallet down.
- 2 Pallet tag reader**  
Reads each pallet you pick up.
- 3 10" Android tablet**  
View & select orders, view pallet maps, and more...

Example configuration: other configurations available including pallets with built in RFID, please see FAQ.

**Hardware costs as low as \$450 per forklift.**

**No other infrastructure costs necessary.**

**Reliable RFID pallet control for around 10% of the traditional cost.**

**Worlds first truly affordable RFID pallet control solution.**



# For each forklift you will need...

## Android tablet \$100

10" recommended, minimum resolution 800 x 600, requires a USB port.



Use farmsoft on to view pallet maps (map shows where required pallet is), view / select / fill orders, send invoices, choose a batch and more. iOS not supported.

[Sample](#)

## RFID reader \$200 for two

You need two of these. 865-915Mhz recommended. [Testing tags](#).



Use any RFID reader with emulated keyboard mode, match reader with your tags and test scan distances.

[Sample](#)

## USB data hub \$35

Data hub allows multiple RFID readers to be connected to the tablet and will also power readers and keep tablet charged.



Should be high wattage (36+) with its own power supply to ensure enough power.

[Sample](#).

## Other bits \$100

Tablet clamp, USB extension cables as required, [USB adapter](#), cable ties, brackets for readers.




Mount readers (see FAQ), tablet, and conceal/secure cables.





Pallet 5487 is at 01 02 04  
Cooler 1, Isle 2, Space 4

Space	Isle 1	Isle 2	Isle 3	Isle 5	Isle 5
5	5489	5499	5460	5462	5461
4	5463	5487	5465	5466	5468
3	5472	5475		5467	5469
2		5476		5470	5471
1					



3-D pallet tracking.  
Find pallets rapidly by viewing  
**pallet maps**, easy to select  
another pallet that isn't obstructed



Pallet 5487 is at 01 02 04  
Cooler 1, Isle 2, Space 4

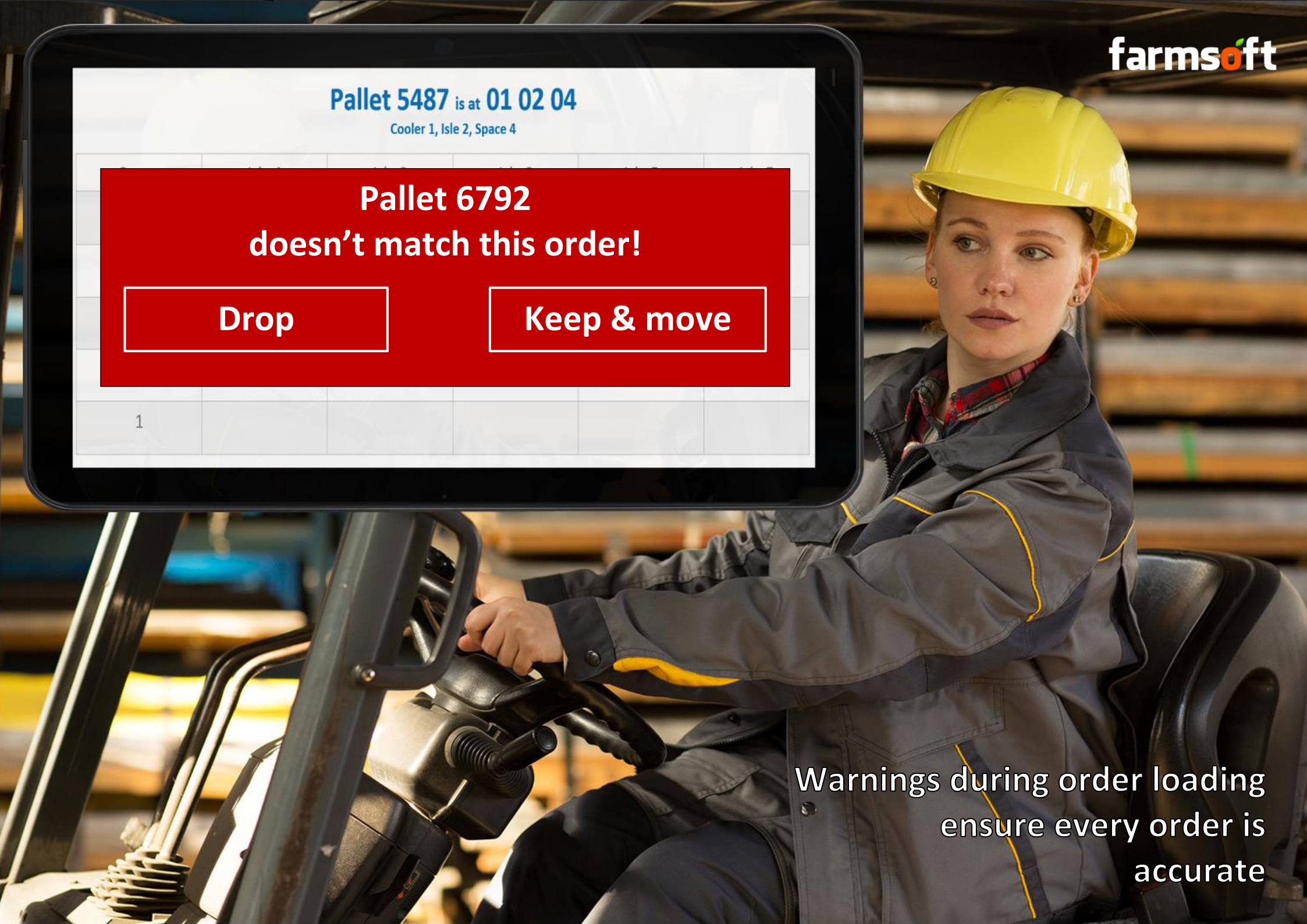
**Pallet 6792  
doesn't match this order!**

**Drop**

**Keep & move**

1

Warnings during order loading  
ensure every order is  
accurate







aler RFID perishable affordable RFID

### Apply the RFID!

When you print pallet labels from farmsoft, you can scan the RFID (or two, one for each forklift pickup side) so farmsoft knows which pallet to assign the RFID. This process takes 2 seconds and can be done using a tablet or PC and an RFID reader or an Android RFID unit.

Choose RFID tags that with a unique serial number encoded into them; there is no need for you to write to the RFID. RFID stickers start from 20 cents per sticker or use re-usable tags (remove during load out process).

Purchase your hardware from your chosen vendor (eg: Amazon.com) and install yourself. Purchase some plastic encased RFID to embed into the floor to identify each pallet position.

We have a simple step by step testing document so you can trial your RFID hardware on one forklift before you purchase equipment for your entire fleet.

*RFID for fresh produce pallet control by farmsoft is available June 2020.*

# RFID for fresh produce inventory: FAQ

## Can I test before committing to farmsoft RFID for fresh produce pallet control?

Yes! The test below should cost no more than \$130. Before you purchase bulk RFID hardware; you should buy a few testing items such as one RFID reader/scanner and three or four different types of RFID tags (make sure the tag matches the scanner, and has pre-programmed serial number) and the USB hub.

1. Plug the scanner into the hub, and the hub into any Android tablet. Open up a text document or blank email on the tablet (we just need a space where text can be dumped by the RFID reader).
2. Simulation test: On a forklift position the reader where you intend on installing it, and move the RFID tag into the position it will be on the pallet or floor and note the distances at which the reading occurs (in the blank document on the Android tablet, you will see a string of text added every time the RFID scanner reads the tag). If the RFID tags scan at reasonable distances based on where you intend to fix the reader, then this part of the test has succeeded. Otherwise reposition RFID scanner or tags until you get good results. See "How should I label my pallet positions?" for additional testing. You should test with your four different RFID tags to see if selected tags scan at different distances (this is common).
3. The Pallet Position Reader (1) should preferably not read when the fork is lifted for pallet transportation.
4. Test that your Wifi works in all coolers and warehouses (farmsoft fresh produce RFID requires an always on data connection). If you have dead spots, install boosters or Wifi access points with better antennae (note that 5Gen Wifi is pretty much useless in commercial environments because of its very short range and weak signal).

If you can pass the tests above you are ready to buy your RFID hardware for your entire fleet of forklifts. Didn't pass the test? Try some different hardware / tags.

## What RFID tags should I use?

We recommend 856-915Mhz RFID tags because their range is practical for most fresh produce RFID applications ([our lab testing used this RFID tag](#)). You can use RFID stickers that are applied to any carton on the pallet (obviously in the correct position for scanning) and will be disposable (from 20 cents a label). Alternatively you can apply re-useable plastic reinforced RFID tags that have a greater read distance, however cost a lot more so need to be removed from the pallet when its loaded for shipping.

## Can you purchase the hardware and install it for us?

Yes. Please ask us consultant for a quote. The labor and consulting will usually double the cost of your project (that's before hardware costs are added), its much more economical to install your RFID equipment yourself.

## How do I mount Pallet Position reader (1)?

If possible, we suggest you mount the reader on the fork that lifts when a pallet is raised (you may need a longer USB cable depending on your forklift design). This should result in no RFID reads when you pass over a position tag and the pallet is raised for movement; when you lower the pallet a position tag will be read and the pallet will be automatically deselected (if no Order is currently selected). If you can't mount this reader on the bottom of the fork then tags will be read every time you pass over one, in this case you can enable a setting that stops farmsoft from automatically deselecting the pallet (note you will have to tap the screen to tell farmsoft when you are deselecting a pallet in this case. Mount the reader in position indicated about 4" from the ground for optimal RFID reads.



## How do I mount Pallet RFID tag reader (2)?



This reader doesn't need to move with the fork (it can however if you want), and should be mounted at the height you will apply the RFID tag on the pallet (as close to as possible, and not obstructed by metal. Staff that build pallets should be instructed to apply the tag at a consistent height and position to ensure every pallet RFID tag will be read easily. If your RFID tag is not integrated into your pallet label then you can continue to apply your pallet label in your chosen position for easy readability. There is no height at which the RFID tag must be placed; choose a height that is practical for your combination of forklift and reader to maximize pallet tag accuracy and RFID scan distance.

## Can I use pallets with built in RFID tags?

Yes. In this case you will mount the pallet RFID reader on the fork near the position RFID reader. The process for assigning the pallet to the RFID is the same, obviously they need to scan the pallet to get the RFID serial.

## How do I associate RFID tags with a pallet?

Simply scan the RFID after you add a new pallet in farmsoft (you will need to plug a reader into your PC [if using Android you will need a powered data hub and an [external keyboard](#) because plugging in an RFID reader will disable the software keyboard in Android OS), for this purpose the reader can simply be on a bench next to or near the PC (since users are likely printing labels during this same process), or use an Android device that has a built in RFID reader.



# RFID for fresh produce inventory: FAQ

## How should I label my pallet positions?

Name each warehouse/cooler with a number, eg: 01, 02 etc. Isles with a number 01, 02 etc. Pallet positions with an number 01, 02 etc. If you stack pallets two high, swap the 0 for a 2, eg: 21 (level 2, position 1), 22 etc. You can tell the exact position of a pallet within your business: 01 02 04 (Cooler 1, Isle 2, Position 4). Apply RFID tags in front of each pallet position. Make sure the tag is in a position where it will be read when putting a pallet down. This is usually a few inches before the pallets physical floor space. Test before you permanently apply pallet position RFID tags by simply placing the tag on the floor and using the simulation test to check its read distance and position. To apply RFID tags for fresh produce pallet positions, chip a very shallow hole into the cement, insert RFID tag, cover over with superglue to make the surface flat and protect & preserve the RFID tag. Larger tags have better scan rates so you may choose a larger tag for your pallet positions, again, testing is essential. Paint pallet spaces on the floor to ensure pallets dropped in correct space for maximum RFID rea accuracy.

Space	Isle 1	Isle 2	Isle 3	Isle 5	Isle 5
5	5489	5499	5460	5462	5461
4	5463	5487	5465	5466	5468
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2		5476		5470	5471
1					

*Illustration: Live fresh produce pallet position in a cooler. RFID tags are installed in front of each pallet space. Pallet spaces should be painted on the floor to ensure correct positioning and reliability of RFID tag reading.*

## How can I make my RFID tags read at greater distance?

If you need your pallet position RFID tags to read at greater distance ask your RFID tag provider which tags can have their read range boosted by placing a metal plate under them prior to installation (or experiment yourself with your test tags). You can also plug the USB hub (which powers the RFID reader) into a higher powered USB charger (eg: higher wattage and voltage, or use a smart adaptable maximum wattage charger). Using a hub that isn't powered (by a higher wattage USB charger) shortens read distances by 50% in our tests. In our testing with RFID tags; we achieved maximum read distance of 9.5" / 24cm using the cheapest readers we could find (ie: if this distance doesn't work for you [it should if you position everything correctly] then buy more expensive RFID readers and use higher power UBB hub & charger, place metal plates behind RFID pallet position tags, or use non disposable tags that are larger and have greater read distance (remove from pallets during shipping process).

## Can I skip RFID tagging pallet positions?

Yes, however users will need to select a new storage location every time they move a pallet; essentially the only benefit of using RFID for fresh produce like this would be to have the pallet automatically selected when it is picked up (for movement, and for adding to orders).

## Can I tag every case?

Yes, however this will significantly increase the cost of your RFID software module (please enquire) and the required hardware by about 400-800%. Individual case tagging requires a project to determine your exact requirements and modify farmsoft RFID to match.

## Can I substitute any brand of RFID hardware?

Yes. Just make sure it passes the tests. You can use any RFID equipment from any vendor or simply order from Amazon.com.

## How do I tag positions inside our trucks?

If you tag pallet positions inside your own delivery trucks, farmsoft RFID can detect the truck that you loaded the order onto. Simply tag the pallet spaces the same way you would for a warehouse or cooler.

## Can we integrate other systems with farmsoft fresh produce RFID?

Yes. Ask your solution consultant for a quote to have our team perform any integration you require. Or, if you have your own I.T. department or vendor; you can integrate using the farmsoft API which is open to all companies and vendors.



# RFID for fresh produce inventory: FAQ

## **What happens if an RFID doesn't scan?**

This can happen because the RFID has been removed/fell off, or placed well outside the scan zone. In this case the forklift driver can simply type the pallet number into farmsoft to select that pallet.

## **Is the RFID solution available without farmsoft Post Harvest Business Management?**

The RFID pallet control module is an optional addon to the farmsoft inventory solution, you need to buy both modules.

## **Can I perform Quality Control on the RFID tracked pallets?**

Yes, use farmsoft's Quality Control, Supplier Quality Management, Customer Feedback for fresh produce modules.



# RFID for fresh produce inventory: A History

*An innovative gapless traceability system able to improve the main business processes of the fresh vegetables supply chain. The performed analysis highlighted some critical aspects in the management of the whole supply chain, from the land to the table of the end consumer, and allowed us to reengineer the most important processes. In particular, the first steps of the supply chain, which include cultivation in greenhouses and manufacturing of packaged vegetables, were analyzed. The re-engineered model was designed by exploiting the potentialities derived from the combined use of innovative Radio Frequency technologies, such as RFID and NFC, and important international standards, such as EPCglobal. The proposed tracing and tracking system allows the end consumer to know the complete history of the purchased product. Furthermore, in order to evaluate the potential benefits of the reengineered processes in a real supply chain, a pilot project was implemented in an Italian food company, which produces ready-to-eat vegetables, known as IV gamma products. Finally, some important metrics have been chosen to carry out the analysis of the potential benefits derived from the use of the re-engineered model.*

*The ability to track and trace complete information at item level in an efficient and trustworthy manner is becoming more and more important for companies, mainly due to the increased consumer concern over the safety and the quality of the purchased products. This is even more true for companies involved in the fresh vegetables supply chain, because the delicacy of fresh-cut products requires all stakeholders to organize their business processes as efficiently as possible to guarantee the end customers the highest quality products. The shift from quantity-oriented agriculture to new emphasis on products quality and people's safety has placed new demands for the development and adoption of traceable supply chains.*

*Traceability represents the ability to capture, collect, and store information related to all processes in the supply chain in a manner that provides guarantee to the consumer and other stakeholders on the origin, location and life history of a product. In particular, the adoption of an effective gapless traceability system, in the fresh vegetables supply chain, could enable companies to (i) detect warnings associated with product contaminations quickly and accurately, and (ii) optimize their main production processes in order to reduce cultivation costs and to ensure, at the same time, production optimization. Furthermore, an efficient traceability system represents a fundamental tool for people with special needs, such as patients affected by multiple intolerances [1], who struggle every day to perform elementary actions, such as the choice of food, because of the adverse reactions that particular components could cause if taken.*

*The development of an efficient traceability system requires the introduction in the supply chain of the technological innovations needed for product identification, process characterization, information capture, analysis, storage, and transmission, as well as the overall systems integration. These technologies include hardware (such as identification tags*

They promise to replace the traditional optical auto-identification solutions in near future. Among the different types (i.e., passive, semi-passive, and active) of RFID transponders, often called "tags", the passive ones are used in most tracing systems, because they are characterized by a very low cost and small dimensions, since they do not require battery to operate. Passive RFID tags can also be classified according to the frequency band used (e.g., LF, HF, UHF, etc.) and the type of coupling (i.e., magnetic or electromagnetic) between tag antenna and reader antenna. The UHF tags could occasionally encounter problems, causing performance degradation, in the presence of materials, such as liquids and metals, which absorb Radio Frequency (RF) energy.

However, some recent works [4–7] have demonstrated that the design of particular UHF tags is able to resolve such issues, thus demonstrating that they represent the best solution for item-level tracing systems in the whole supply chain. NFC is a short-range wireless (HF 13.56 MHz) technology derived from the RFID family. NFC entities can share power and data over a distance of a few centimeters (less than 5 cm). They inherit the basic features of RFID technology (i.e., working in reader/writer mode with passive tags) but they are also characterized by the possibility to share data across active (powered) devices [8]. The diffusion of these RF technologies has been significantly increased by the asserting of international standards such as EPCglobal [9–12] and Global Standard 1 (GS1). In particular, the EPCglobal standard provides a promising open architecture for tracking and tracing objects over the Internet. It defines a full protocol stack able to guarantee item-level data sharing related to products that move in the whole supply chain.

The combined use of different RF technologies and standards in order to improve the supply chain management has been strongly investigated in literature [13, 14]. They were also successfully applied to the agro-food sector [15, 16]. However, the development of a complete gapless traceability system, from the land to the table of the end consumer, is still at the early stages and many issues are still open. Most works propose solutions too invasive and, therefore, not accepted by the operators. A typical example concerns the use of Wireless Sensor Networks (WSN) in greenhouses in order to achieve a precision agriculture [17–19]. Although the use of this technology promises many benefits, its adoption is very limited, since expert agronomists, that argue no sensor node can ever replace their skills, do not accept its use. Therefore, a very critical aspect in a reengineering procedure is that the proposed solution must be thoroughly understood by the operators, before to be accepted, and applied. Furthermore, costs related to the introduction of new technologies are relevant and block their wide adoption. Indeed, although most of the solutions presented in literature are exclusively based on the use of RFID tags, the cost of a tag is still too high to justify its adoption in the packaging of low cost products, such as fresh-cut products, whose price in Italy is about 1-2 euro per pack. Particular attention must be also paid to the choice of the type of tag to be