

III International Conference  
on Fresh-cut Produce

UCDAVIS POSTHARVEST TECHNOLOGY September 13-18, 2015 ISHS

**A *QUAFETY* APPROACH TO QUALITY MONITORING & PREDICTION FOR FRESH-CUT PRODUCE**

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Antonio Parroni  
Hillary Rogers

QUAFETY - COMPREHENSIVE APPROACH TO ENHANCE QUALITY & SAFETY OF READY-TO-EAT FRESH PRODUCTS

**Quafety** is a neologism which entails to a *global approach in considering quality and safety of a food product* as a composite strategy leading to a sole, **all-inclusive objective**, consisting of full satisfaction of consumer in terms of *sensorial and nutritional expectations*, with no harmful effect associated with the consumption.

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**FRESH-CUT PRODUCE DETERIORATES FASTER THAN THE CORRESPONDENT INTACT PRODUCE**



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**PREPARATION OF FRESH-CUT PRODUCE DOES NOT INCLUDE A KILLING STEP, OR A TREATMENT WHICH DETERMINES A NEGLIGIBLE FINAL MICROBIAL COUNT**



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**IS YOUR SALAD SAFE TO EAT?**

It always looks so healthy. But pre-packed salad is tainted by pesticides, 'cleaned' by workers who live in disease-ridden squalor, and washed in water containing 20 times more chlorine than a swimming pool

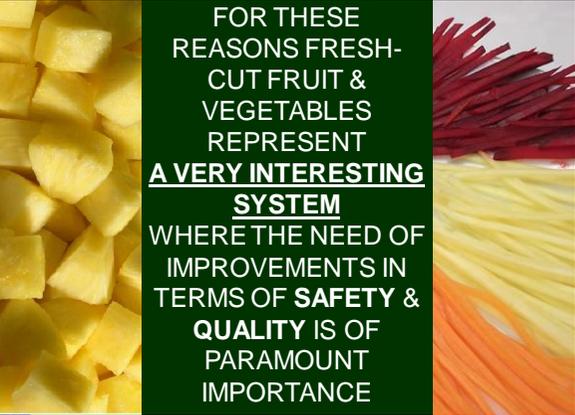
From peaches to potatoes, a toxic timebomb

WHAT ARE WE EATING? DAY THREE

TOMORROW: THE DANGERS IN FISH

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**FOR THESE REASONS FRESH-CUT FRUIT & VEGETABLES REPRESENT A VERY INTERESTING SYSTEM WHERE THE NEED OF IMPROVEMENTS IN TERMS OF SAFETY & QUALITY IS OF PARAMOUNT IMPORTANCE**



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SEVENTH FRAMEWORK PROGRAMME  
THEME 2: Food, Agriculture and Fisheries, and Biotechnology  
Collaborative Projects KBBE.2011.2.4-01

**COMPREHENSIVE APPROACH TO ENHANCE QUALITY & SAFETY OF READY-TO-EAT FRESH PRODUCTS**

www.quafety.eu

Total Budget: 3.9 MEuro  
EC contribution: 2.8 MEuro (35% to SMEs)

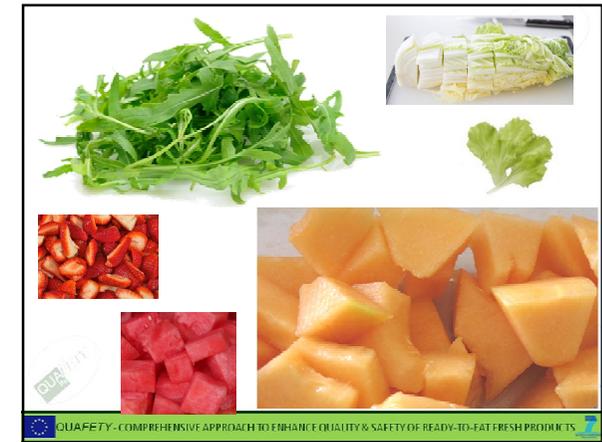




**QUAFETY AIMS TO IMPROVE SAFETY & QUALITY OF FRESH-CUT PRODUCE THROUGHOUT THE WHOLE CHAIN**

- by developing new predictive and probabilistic models and decision-making tools
- by exploring rapid and non-destructive methods for quality evaluation and prediction
- by applying novel technologies to quantify and manage spoilage and pathogenic microorganisms, minimizing risks to consumers and preserving quality



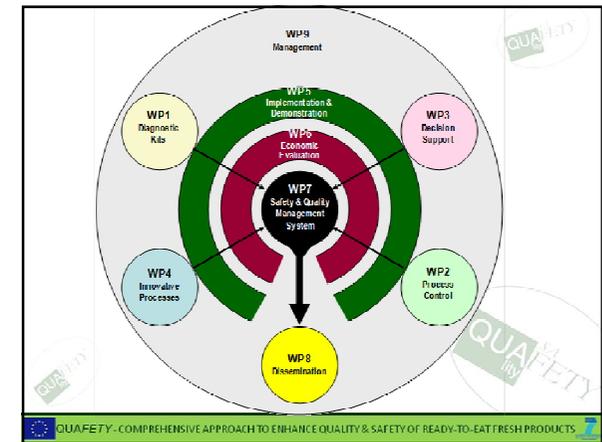



As the Project aimed to improve safety and sensorial quality of fresh-cut produce, it required:

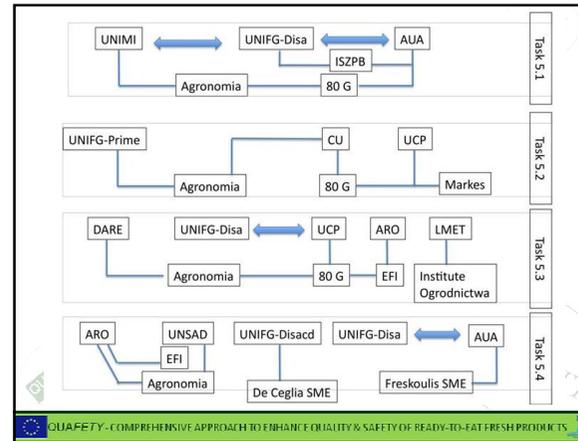
- a broad range of scientific expertises
- representatives from different european regions
- specialists in different phases of the process
- local enterprises
- intermediates with local enterprises & consumers







WP1	WP2	WP3	WP4
DIAGNOSTIC KITS	PROCESS CONTROL	DECISION SUPPORT	INNOVATIVE PROCESSES
Fast and reliable tools in order to trace <i>L. monocytogenes</i> and <i>E. coli</i> O157:H7	Predicting nutritional and organoleptic quality based on external attributes degradation kinetics	Ideal melon for preparing RTE products: model and application	Effect of hot water treatments on nutritive and sensory quality and on safety of fresh-cut vegetables
Identification of molecular markers to evaluate quality	Evaluation of SPME VOC collection for non-destructive analysis of post-harvest quality	Development of models to predict the barrier properties of polymeric films intended for packaging application	Automatic line for hands-off fresh-cut melon processing based on machine vision
Identification of molecular markers to identify microbial contaminant	Nutritional and functional audit to the process of fresh-cut fruits and vegetables and other lightly processed convenience food	Determination of single cell lag phase duration of pathogens in various environmental conditions	UV treatments for improving quality and safety of fresh-cut produce
Prevalence of <i>L. monocytogenes</i> and <i>E. coli</i> O157:H7	Identification of markers for nutritional and functional quality	Model-driven control of spoilage and off-flavour in RTE fresh-cut fruit	Passive refrigeration system (PRS) to ensure farm-to-fork cold chain
		Providing an ad-hoc model for an ex-ante appraisal of investments in technology & packaging of RTE fresh products	Inhibition of biofilm formation by <i>L. monocytogenes</i>
		Developing physiology-based models to assess the benefits of MAP on fresh-cut fruit and vegetables	Active intelligent packaging
			Improving produce quality and safety through soilless cultivation systems
			Innovative chlorine-alternative method for water and product disinfection
			Novel sustainable physical method for melon surface decontamination



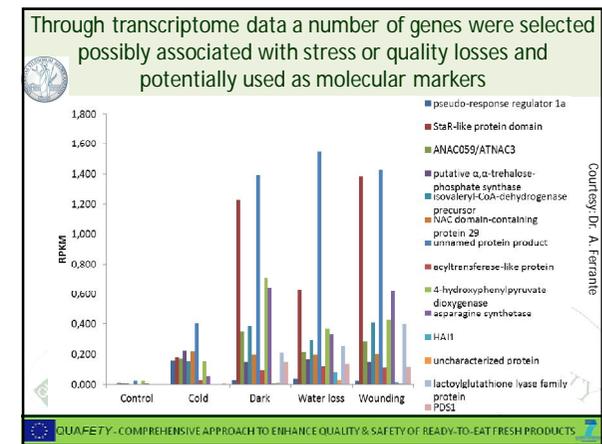
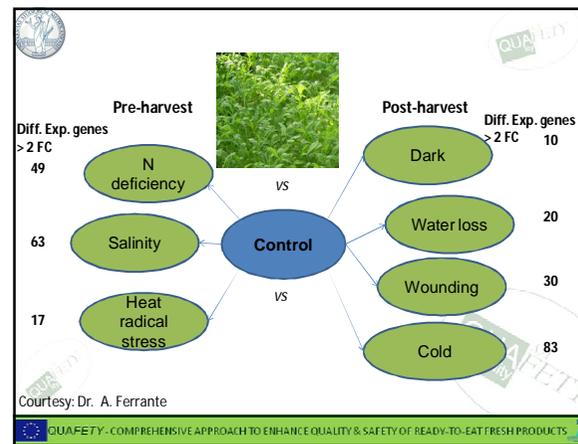
Monitoring and prediction is part of the "QUAFETY approach" both in terms of early detection and of estimation of fate for main quality attributes.

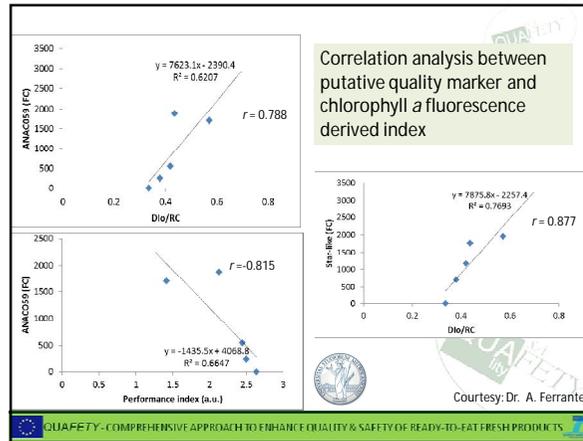
Identification of molecular markers to evaluate quality

Evaluation of SPME VOC collection for non-destructive analysis of post-harvest quality

Predicting nutritional and organoleptic quality based on external attributes degradation kinetics

Question #1: is it possible to tell potential shelf-life of these rocket leaves through a simple analytical kit?





### THESE POTENTIAL GENES AND RELATIVE PROTEINS CAN BE USED AS MOLECULAR MARKERS

Possible development is to scale down all the complex assay procedures in order to use directly crude protein extracts of fresh cut vegetables against their antibody arrays for quality evaluation.

Courtesy: Dr. A. Ferrante

Question #2: is it possible to non-destructively tell the history of these melon chunks?

MARKES International

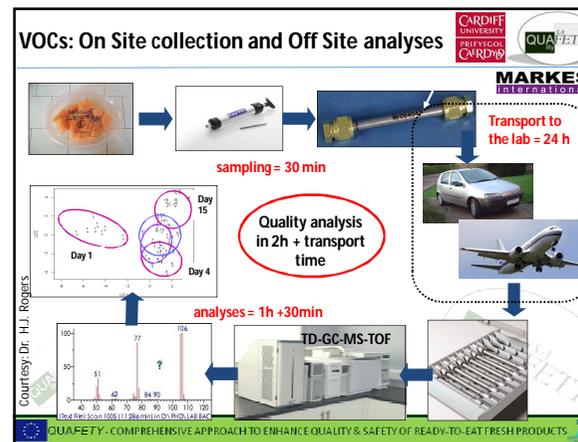
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CARDIFF UNIVERSITY PRIFYSGOL CAERDYDD

Use of thermal desorption gas chromatography coupled with time of flight mass spectrometry (TD-GC-MS-TOF) offers a sensitive and robust method for the analysis of changes in profiles of volatile organic compounds (VOCs) during post-harvest storage.

The large sorbent bed (~ 150 mg) of the collection tubes eliminates the characteristics of equilibrium sampling and over-loading often associated with other collection methods which are widely used such as solid phase micro extraction (SPME).

Furthermore VOCs are adsorbed onto collection tubes which are then capped such that the VOCs are trapped within the tube enabling remote sampling followed by transport to the laboratory.



A total of 104 VOC compounds were detected from a range of melon cultivars.

The library was used for diverse experiments including comparison of VOC profiles between cultivars, and differences due to season or location of cultivation; changes in profiles dependent on cut size of melon flesh cubes (Spadafora et al., 2015) and temperature and time of storage.

Following inoculation with a human pathogen (*Listeria monocytogenes*) it was possible to detect markers for contamination with the *Listeria* that might be of potential use in safety audits.

Question(s) #3:  
do these rocket leaves taste as good as they look?  
do they contain as many nutrients as claimed?



Università di Foggia

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This rocket bag was stored for 5 days before to arrive to our lab.

Can we predict how much **Vitamin C** retained without a laboratory test?



Courtesy: Dr. M.L. Amodio

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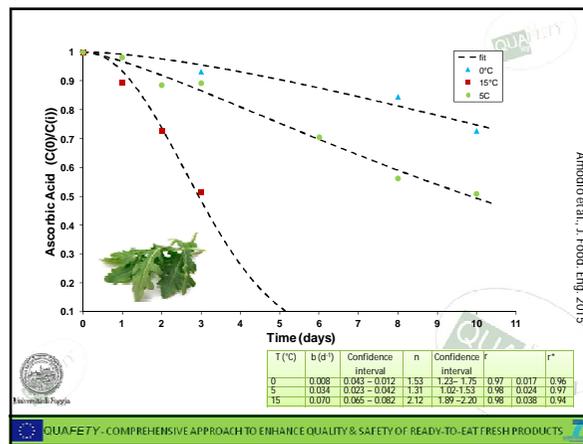
EXPERIMENTAL APPROACH

Acquisition of quality changes over time of the most important sensorial, physical and nutritional attributes for at least 3 temperatures

Model degradation kinetics of quality attributes which change over time

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EXPERIMENTAL APPROACH

Acquisition of quality changes over time of the most important sensorial, physical and nutritional attributes for at least 3 temperatures

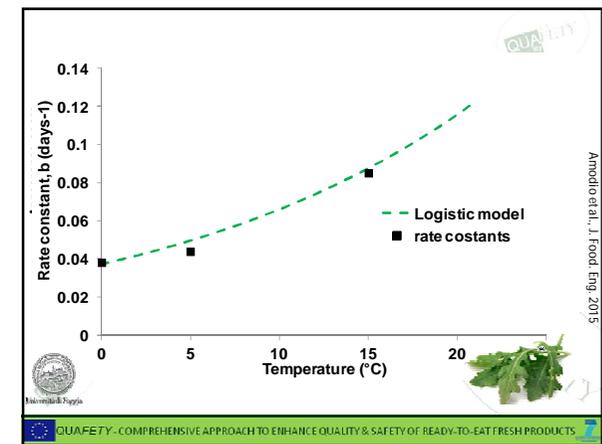
Model degradation kinetics of quality attributes which change over time

Selection of important external and internal quality attributes to be related

Description of the temperature dependence of the model equation parameters

QUAFETY

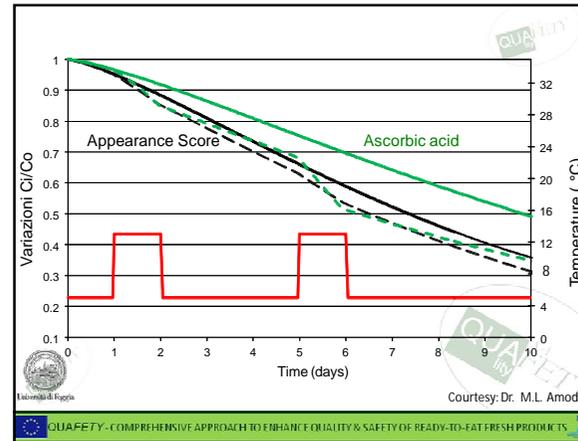
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- Description of the temperature dependence of the model equation parameters
- Use of this relation to describe the quality changes for any temperature profile and to estimate shelf-life

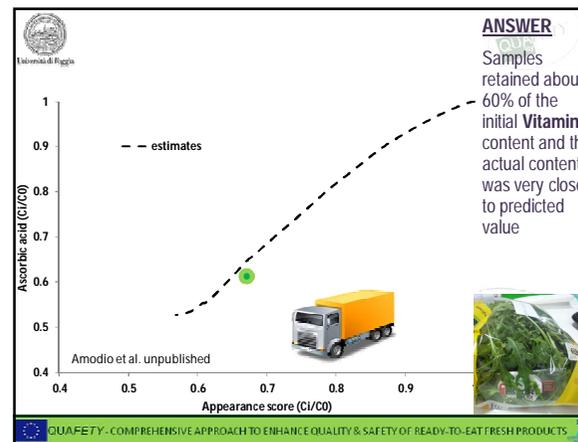
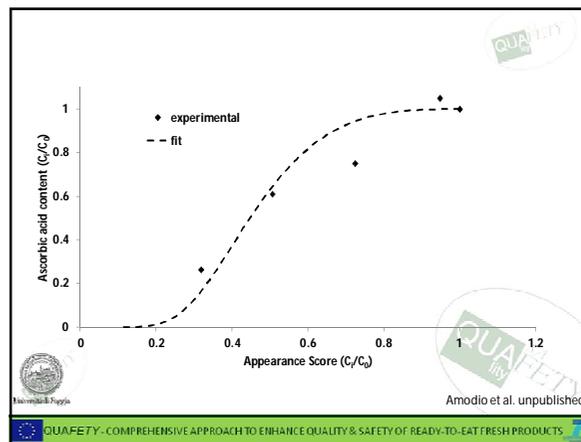
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- Calculation of the residual nutritional quality in term of vitamin C for rocket leaves knowing temperature profile and the external score at any given time

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