**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.

Fresh-cut produce deteriorates faster than the correspondent intact produce.

Preparation of fresh-cut produce does not include a killing step, or a treatment which determines a negligible final microbial count.

Is your salad safe to eat?

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.
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

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

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

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

www.quafety.eu
**WP1** DIAGNOSTIC KIT

- Fast and reliable tools for early detection of L. monocytogenes and E. coli O157:H7
- Identification of molecular markers to monitor quality

**WP2** PROCESS CONTROL

- Evaluation of SPME VOC collection for non-destructive analysis of post-harvest quality
- Prediction models to manage quality and safety of fresh-cut fruits

**WP3** DECISION SUPPORT

- Development of decision support models to predict the barrier properties of packaging materials

**WP4** INNOVATIVE PROCESSES

- Preventing nutrient and functional loss through the use of MAP and other preservation techniques
- Identification of molecular markers for nutritional and functional quality

**MONITORING AND PREDICTION**

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

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

**Through transcriptome data a number of genes were selected possibly associated with stress or quality losses and potentially used as molecular markers.**

**Identifying molecular markers**

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

**Nutritional and functional loss through the use of MAP and other preservation techniques**

- **Pre-harvest**
  - Dark
  - N deficiency
  - Heat stress
  - Water loss

- **Post-harvest**
  - Dark
  - N deficiency
  - Heat stress
  - Water loss

**Courtesy:** Dr. A. Ferrante
Correlation analysis between putative quality marker and chlorophyll a fluorescence derived index:

- \( r = 0.788 \)
- \( r = 0.877 \)
- \( r = -0.815 \)

Courtesy: Dr. A. Ferrante

**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.

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 #2: is it possible to non-destructively tell the history of these melon chunks?**
Question(s) #3: do these rocket leaves taste as good as they look? do they contain as many nutrients as claimed?

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?

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

Ascorbic Acid (C(0)/C(i))

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<th>Rate constant, b (days⁻¹)</th>
<th>Confidence interval</th>
<th>n</th>
<th>Confidence interval</th>
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<td>-2.20</td>
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Amodio et al., J. Food Eng. 2015
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

Use of this relation to describe the quality changes for any temperature profile and to estimate shelf-life

ANSWER

Samples retained about 60% of the initial Vitamin C content and the actual content was very close to predicted value
Grazie per l'attenzione!

Thanks for your attention!

Obrigado por sua atenção!

Bedankt voor uw aandacht!

Ευχαριστώ για την προσοχή σας!

Dziękujemy za uwagę!

תודה על תשומת ליבך שלנו

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