

FaVOR-DeNonDe

*Drying, juices and purees of organic fruit and
vegetables: what happens to “desired” and
“non desired” compounds?*

Mid-Term Results

Partners: Ass. Prof. Ulvi Moor (Estonia) NR 2

Dr. Eivind Vangdal (Norway) NR 3

Prof. Ulla Kidmose (Denmark) NR 4

Prof. Wilfried Schwab (Germany) NR 5

Dr. Gabriele Campanelli (Italy) NR 6

Prof. Giovanna Speranza (Italy) NR 7

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**CREA-IAA (Research Unit of Food
Technology) NR 1**

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WP1 *Relationship between sensory quality, secondary metabolite profile and antioxidant capacity in raw and processed products from organic agriculture (tomato, sweet pepper, strawberry, plums, apple).*

WP leader: Prof. Ulla Kidmose, Partner 4 (Denmark)

Responsible partners: Partner 1, 6 and 7 (Italy), Partner 3 (Norway) and Partner 2 (Estonia).

WP2 *Allergenicity of fruit and processed products (strawberry) and of different organic and conventional fruits (strawberry, apple, plum and tomato).*

WP leader: Prof. Dr. Wilfried Schwab, Partner 5 (Germany)

Responsible partners: Partner 3 (Norway), Partner 2 (Estonia) and Partner 1 (Italy)

WP3 *Presence of health-beneficial and health-threatening compounds in organic apple juice.*

WP leader: Ass. Prof. Ulvi Moor, Partner 2 (Estonia)

Responsible partners: Partner 3 (Norway), Partner 4 (Denmark), and Partner 1 (Italy)

WP4 *Proposed dissemination activities.*

Partner 1 (Italy, WP Leader) and all other Partners.

WP leader: Roberto Lo Scalzo (Partner 1, Italy)

Responsible partners: Partner 2 (Estonia), Partner 3 (Norway), Partner 4 (Denmark), Partner 5 (Germany), Partner 6 (Italy) and Partner 7 (Italy)

List of analyzed samples

Species	Variety	Country	Sampling	Processing	Year	Analyses
Apple	Sügisjooknik	Estonia	ORG	juice	2015	1, 3, 4, 5
	Krameri tuviõun	Estonia	ORG + CONV	juice	2015	
	Krista	Estonia	ORG + CONV	juice	2015	
	Talvenauding	Estonia	ORG + CONV	juice	2015	
	Cortland	Estonia	ORG	juice	2015	
	Aroma	Denmark	ORG	juice	2015	
	Ahrista	Denmark	ORG	juice	2015	
	Rubinstep	Denmark	ORG	juice	2015	
	Discovery	Norway	ORG	juice	2015	
	Karen Schneider	Norway	ORG	juice	2015	
	Aroma	Norway	ORG + CONV	juice	2015	
Plum	Jubileum	Norway	ORG + CONV	drying	2015 + 2016	1
	Reeves	Norway	ORG + CONV	drying	2015 + 2016	
	Victoria	Norway	ORG + CONV	drying	2015 + 2016	
Strawberry	Asia	Italy	ORG + CONV	puree + drying	2015 + 2016	1, 3
Tomato	Perbruzzo F1	Italy	ORG + CONV	drying	2015 + 2016	1, 2, 3
	SAAB	Italy	ORG + CONV	drying	2015 + 2016	
Sweet pepper	Alceste F1	Italy	ORG + CONV	drying	2015 + 2016	1, 2, 3
	RTV	Italy	ORG + CONV	drying	2015 + 2016	

1: phytochemicals. 2: taste active compounds. 3: sensory analyses. 4: patulin. 5: allergens.

WP1 Objectives

Main question:

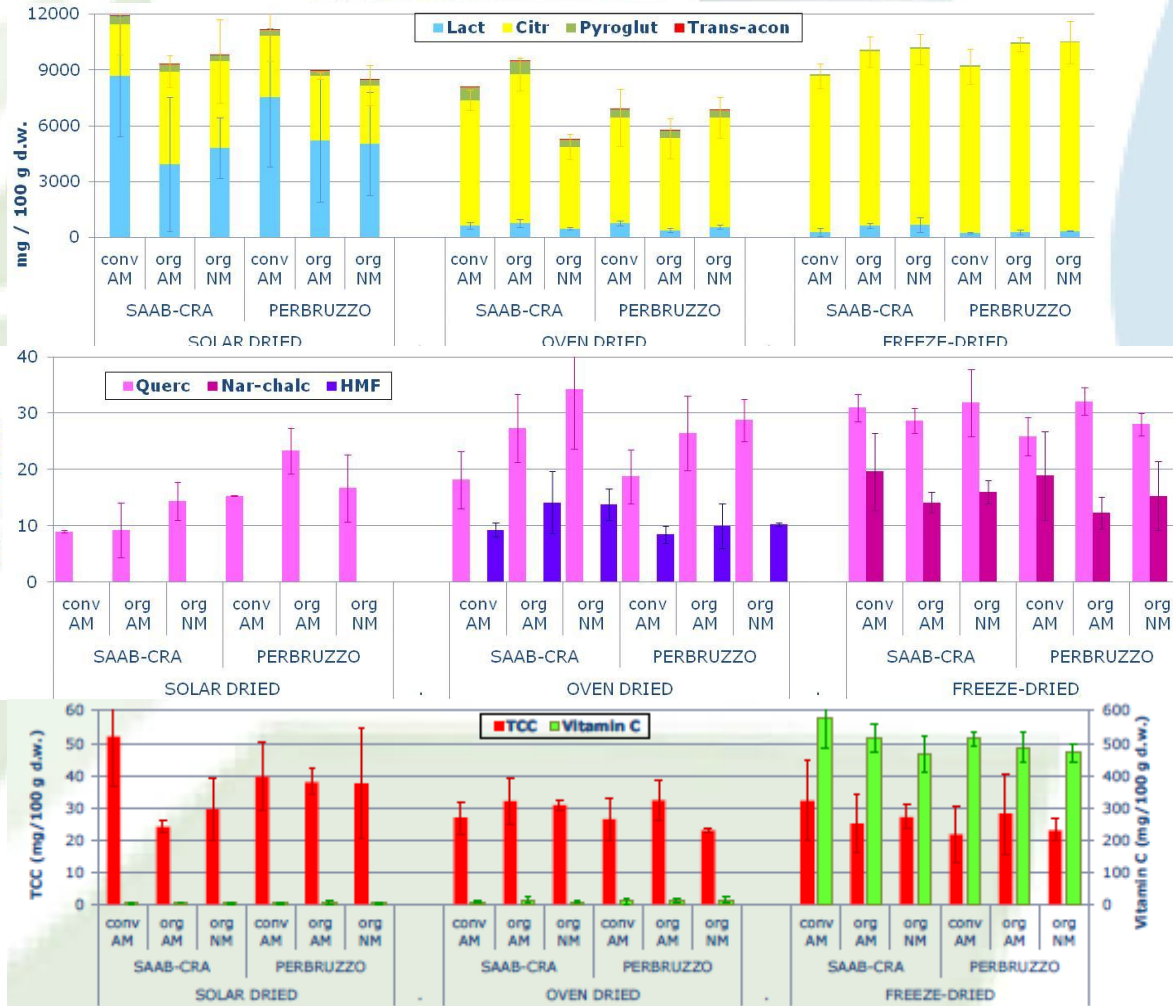
“Is an organic product, also after sustainable processing, sufficiently tasty and nutritious?”

The preliminary results suggest that, with a proper varietal choice, and a sustainable processing, the organic products can meet these characteristics.

Project Partner : Italy

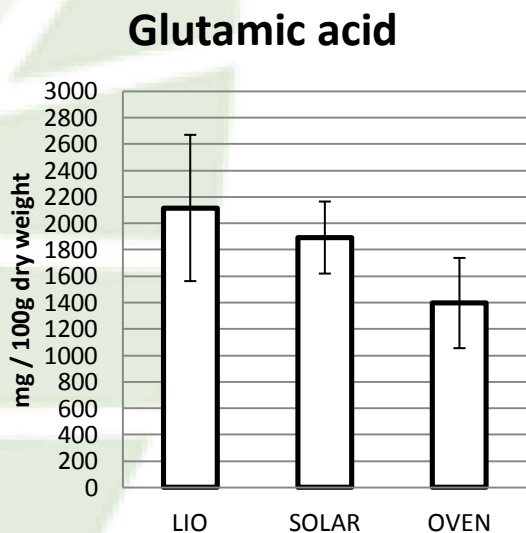
Dr. Roberto Lo Scalzo, Dr. Giulia Bianchi, Dr. Marta Fibiani, Dr. Valentina Picchi,
P.A. Fabio Lovati, Dr. Dario Paolo (CREA-IAA)
roberto.loscalzo@crea.gov.it

Drying of tomatoes

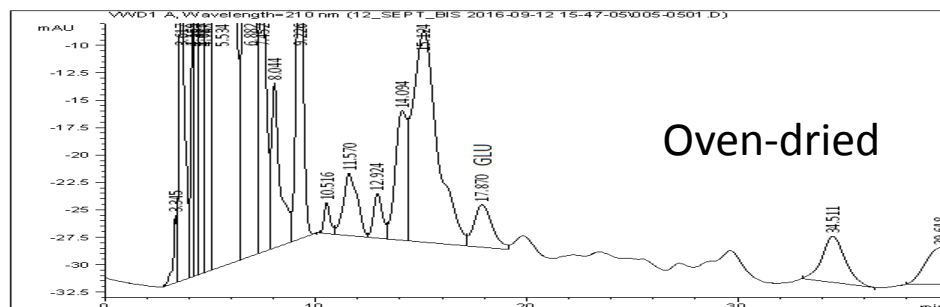
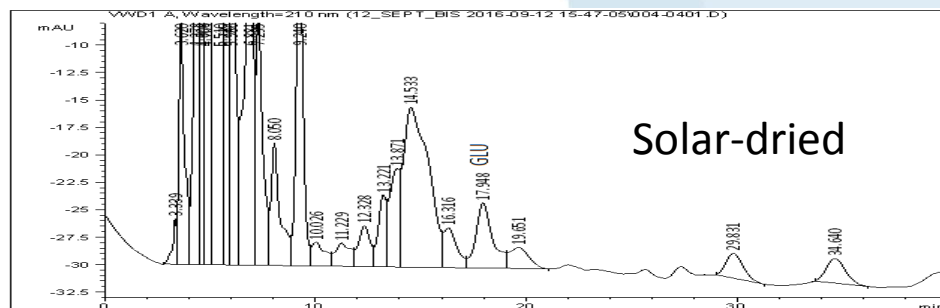
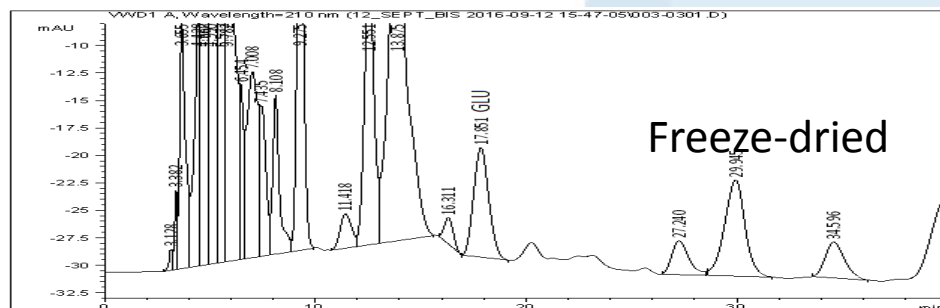


Project Partner: Italy

Taste-active compounds in tomatoes (UMAMI)



No clear difference evaluated among the three types of cultivation

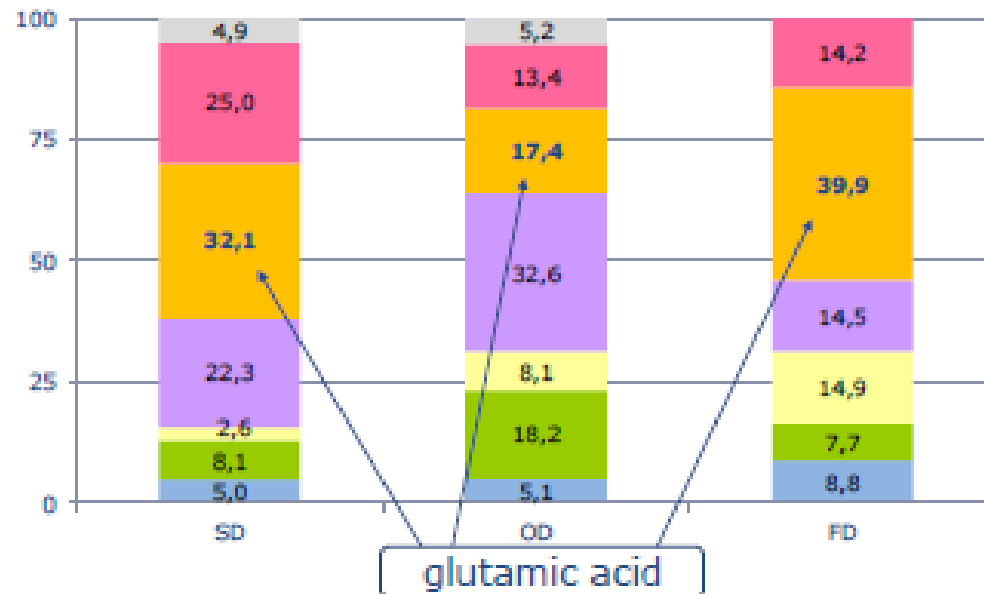


Project Partner: Italy

Prof. Giovanna Speranza, Università degli Studi di Milano; giovanna.speranza@unimi.it

Taste active compounds in Tomato samples

Relative percentage of constituents in MEOH extracts - HPLC analysis



Sweet bell pepper

RAW

Variety	Growing	AsA average	mg/100g dw dev std
RTV	PA conv	899,1	96,7
RTV	PA org	1031,9	16,0
RTV	PN org	952,5	44,2
Alceste HF1	PA conv	718,8	75,7
Alceste HF1	PA org	526,1	26,9
Alceste HF1	PN org	456,4	49,8

Higher AsA level in ORG for RTV variety, lower AsA level in ORG Alceste HF1

DRIED

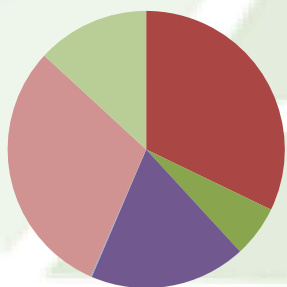
			% loss vs freeze
solar-	RTV	PA conv	84,9
solar-	RTV	PA org	91,5
solar-	RTV	PN org	87,3
solar-	Alceste HF1	PA conv	86,1
solar-	Alceste HF1	PA org	89,0
solar-	Alceste HF1	PN org	78,9
			average 86,3 %
forced-air	RTV	Paconv	76,9
forced-air	RTV	PA org	87,8
forced-air	RTV	PN org	81,8
forced-air	Alceste HF1	PA conv	78,3
forced-air	Alceste HF1	PA org	82,7
forced-air	Alceste HF1	PN org	68,1
			average 79,3 %

Higher AsA loss in Solar-dried than Forced-air dried samples

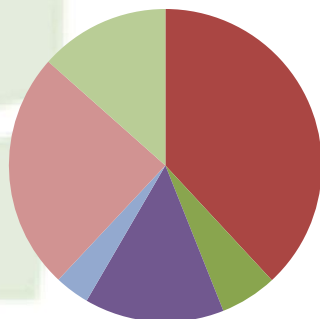
Project Partner: Italy

Odour-active compounds in strawberries purees

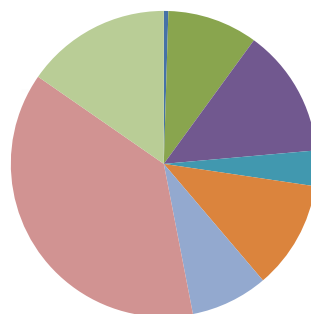
CONV



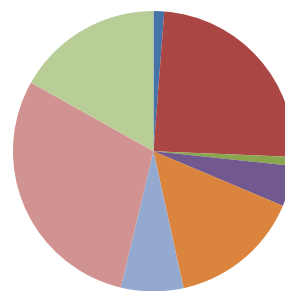
OR



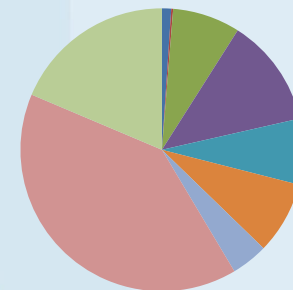
OR-M



OR-H



CONV-M



sulphur compounds esters ketones aldehydes alcohols acids
 furanones terpenoids lactones

- Significant differences in raw products (CONV and OR), higher amounts of esters and furanones-strawberry like aromas in ORG;
- Esters disappear in mild technologies purees (M) and are present in home-made (H);
- Furanones remain higher in ORG purees (OR-M and OR-H)

Project Partner : Italy

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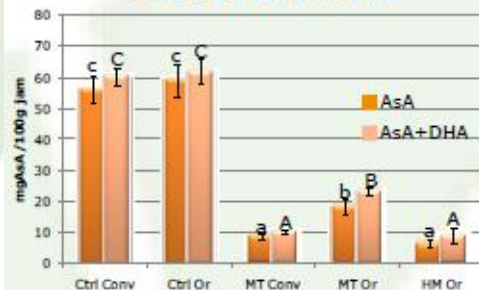
Dr. Emidio Sabatini, emidio.sabatini@crea.gov.it



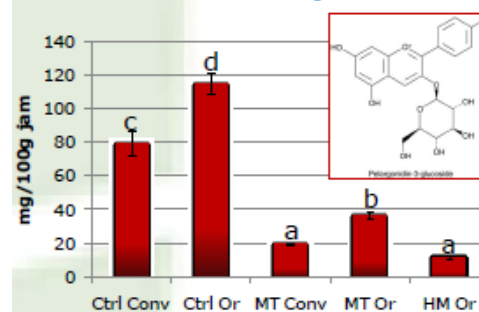
- ✓ Tomato and Bell Pepper cultivation by innovative agronomic techniques (some detail ????)
- ✓ Processing of ORG and CONV strawberry purees with a miniaturized plant
- ✓ Solar drying of tomato and bell pepper
- ✓ Significant difference in phytochemical content in ORG and CONV strawberries products



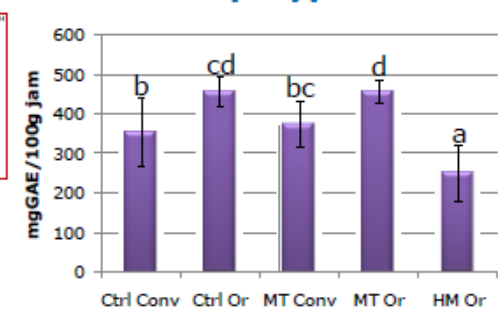
Ascorbic acid



Anthocyanins



Total polyphenols



Project Partner: Estonia

Ass. Prof. Ulvi Moor, Estonian University of Life Sciences;
Ulvi.Moor@emu.ee

Different organic apple varieties



Apple juice processing



RFP

BP

WP

3 methods of juice extraction

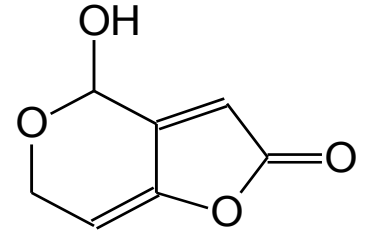
- ✓ Traditional home-made (RFP)
- ✓ Industrial (BP)
- ✓ Innovative for small-scale production (WP)

- Some differences found between CONV and ORG products
- Very relevant differences with different juice processing methods.
- BP samples stood out for the low PPO activity.
- BP and WP samples better retained phenol content and antioxidant capacity

Project Partner: Estonia

Ass. Prof. Ulvi Moor, Estonian University of Life Sciences;
Ulvi.Moor@emu.ee

Patulin levels in 2015 apple juices ($\mu\text{g/L}$)



Varieties	Countries	juice after harvest	
Sügisjoonik	Estonia ORG	below detection limit *	
Krameri tuviõun	Estonia ORG	below detection limit	
Krista	Estonia ORG	below detection limit	
Talvenauding	Estonia ORG	below detection limit	
Cortland	Estonia ORG	below detection limit	
Aroma	Denmark ORG	33	27
Ahrista	Denmark ORG	191	203
Rubinstep	Denmark ORG	below detection limit	
Discovery	Norway ORG	64	57
Karen Schneider	Norway ORG	below detection limit	
Aroma	Norway ORG + CONV	below detection limit	
* detection limit 4 $\mu\text{g/L}$			

JUICES FROM STORED APPLES						
Varieties	Country	type	stored + 2°C		stored + 8°C	
Krameri tuviõun	Estonia	ORG			8	4
Krameri tuviõun	Estonia	CONV	25	8		
Krista	Estonia	ORG		6		
Krista	Estonia	CONV				
Talvenauding	Estonia	ORG			28	
Talvenauding	Estonia	CONV			5	10

Project Partner : Norway

Dr. Eivind Vangdal, Norwegian Institute of Bioeconomy Research

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- ✓ 3 plums varieties
- ✓ 2 cultivation methods
- ✓ 2 drying methods



Forced-air dryer



Solar dryer

- Some ORG varieties better retain neo-cga content in both drying methods;
- Less anthocyanin loss in solar-dried products

		LOSS of NEO-CGA (%)	
		forced-air drying	solar drying
Jubileum	CONV	23,4	72,3
Jubileum	ORG	21,3	65,1
Reeves	CONV	39,9	51,8
Reeves	ORG	1,9	36,1
Victoria	CONV	44,0	51,1
Victoria	ORG	7,1	31,2
		LOSS of ATH as cyan-3-glu (%)	
		forced-air drying	solar drying
Jubileum	CONV	91,6	58,8
Jubileum	ORG	96,4	73,5
Reeves	CONV	88,7	19,6
Reeves	ORG	70,6	60,5
Victoria	CONV	53,8	42,6
Victoria	ORG	64,0	59,2



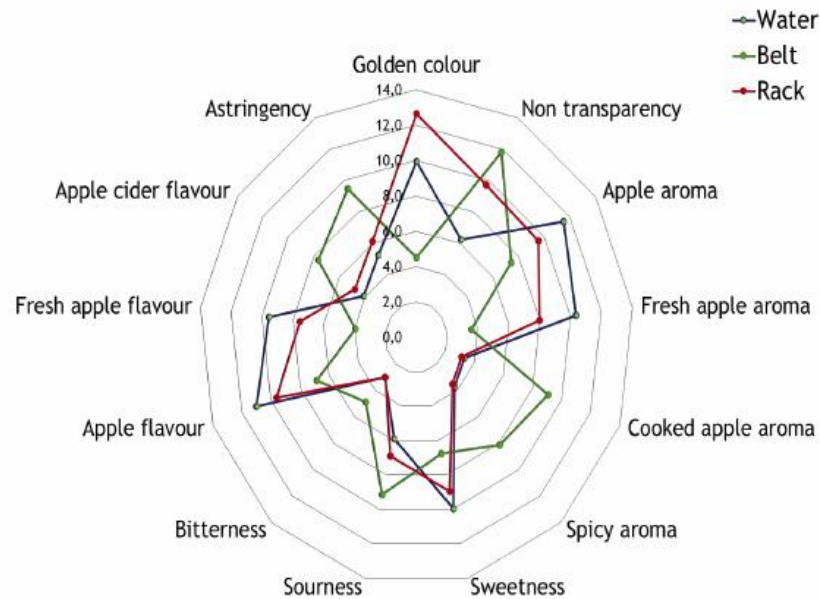
Project Partner: Denmark

Prof. Ulla Kidmose, AU-FOOD Aarhus University ulla.kidmose@food.au.dk

Sensory quality after processing:
differences between CONV and ORG?

Differences due to processing methods
in apple juice

✓ Apple juices (different pressing methods)





Project Partner: Denmark

Prof. Ulla Kidmose, AU-FOOD Aarhus University ulla.kidmose@food.au.dk

✓ Dried sweet bell pepper (solar and oven)



Code	Drying	Variety	Soil m.	Cultivation
SRPaC	Solar	RTV	PA	Convent
SRPaO	Solar	RTV	PA	Organic
SRPnO	Solar	RTV	PN	Organic
SFPaC	Solar	F1	PA	Convent
SFPaO	Solar	F1	PA	Organic
SFPnO	Solar	F1	PN	Organic
CRPaC	Convent	RTV	PA	Convent
CRPaO	Convent	RTV	PA	Organic
CRPnO	Convent	RTV	PN	Organic
CFPaC	Convent	F1	PA	Convent
CFPaO	Convent	F1	PA	Organic
CFPnO	Convent	F1	PN	Organic

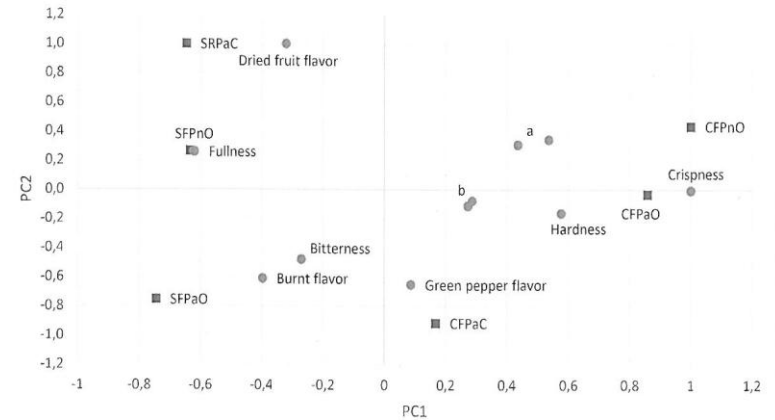
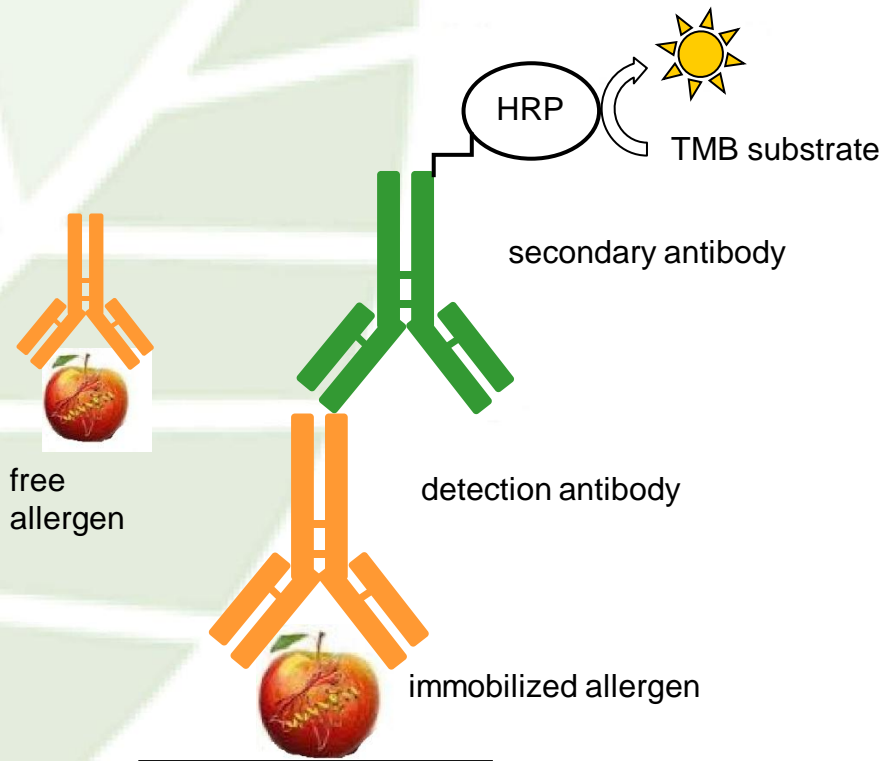


Figure 4: PCA bi-plot on the score of samples and attribute loadings in study 3. Explained variance: PC1 – 86,8 %; PC2 – 9,6 %. Blue squares are samples (see table 1 details). Orange dots are attributes (see table 2 for details). Cluster a: sweetness and sweet red pepper flavor. Cluster b: pickled baked pepper aroma and dried pepper aroma.

Project Partner : Germany

Prof. Wilfried Schwab, Technische Universität München wilfried.schwab@tum.de



principle of the indirect competitive ELISA
to measure allergen content

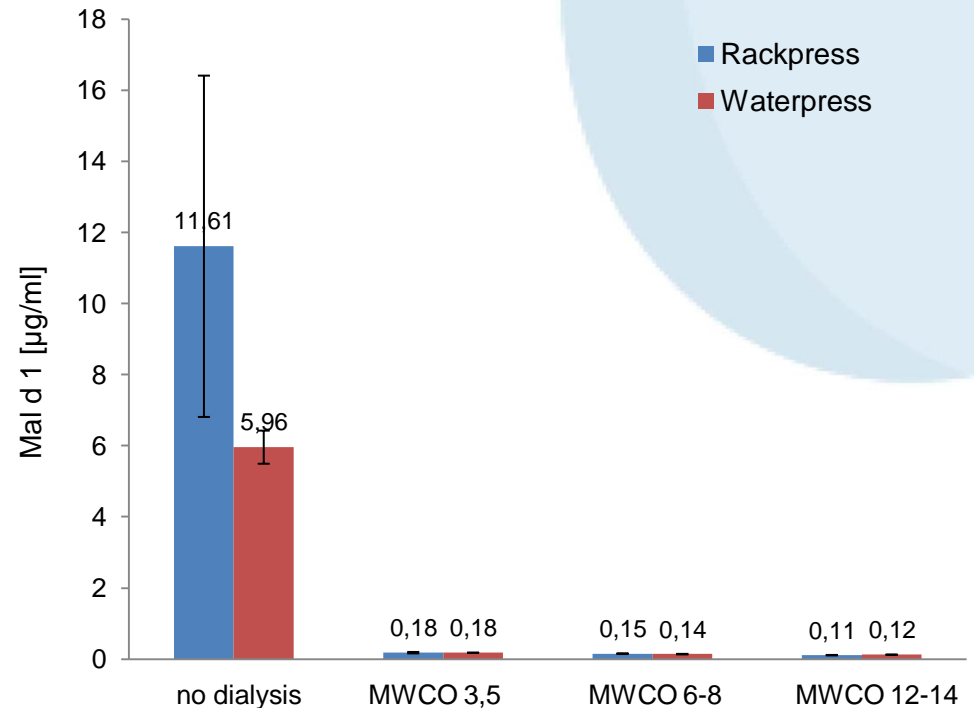
- Mal d 1 in apple or apple juice
- Pru d 1 in plum
- Sola l 4 in tomato
- Fra a 1 in strawberry

Project Partner : Germany

Prof. Wilfried Schwab, Technische Universität München wilfried.schwab@tum.de

Optimization of the workup of the samples:
 apple cultivar Krista (ecological cultivation,
 Rackpress vs. Waterpress) were analyzed;
 dialysis of apple juice with different
 molecular weight cut-offs (3,5 kDa; 6-8 kDa,
 12-14 kDa) was performed:

- apple juice cannot directly analyzed by ELISA due to interfering compounds
- further treatment (dialysis) is needed before ELISA analysis
- apple juice produced by rackpress and waterpress show identical low allergen levels and standard deviation



Mid-Term Conclusions

- ✓ The type of processing strongly impact the quality indexes of all analyzed F&V products;
- ✓ In Strawberry and Sweet bell pepper some quality indexes reported significant changes also in raw CONV and ORG products;
- ✓ No significant changes between CONV and ORG types were found in the parameters measured from apple juices, tomatoes and plums.
- ✓ An higher number of ORG cultivated genotypes should be explored to establish their suitability for processing.



Thank you!