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## Organic plant products: from perceptions to scientific realities

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*Nutrition and Health  
From science to practice*



EGEA<sup>edition 8</sup>  
International conference

**Food Contaminants: when we mix science and politics**

# Organic plant products: from perceptions to scientific realities

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*EGEA VIII , Nov 7-9 2018*

# Organic products the market





# Organic production and market

- organic production has markedly increased during the last decade, representing up to 3–20% (mean 5.1%)
- in 2010, a worldwide organic production of 700 million tons of food per year

Organic Trade Organization

Website Internet: <http://www.ota.com>. 2012

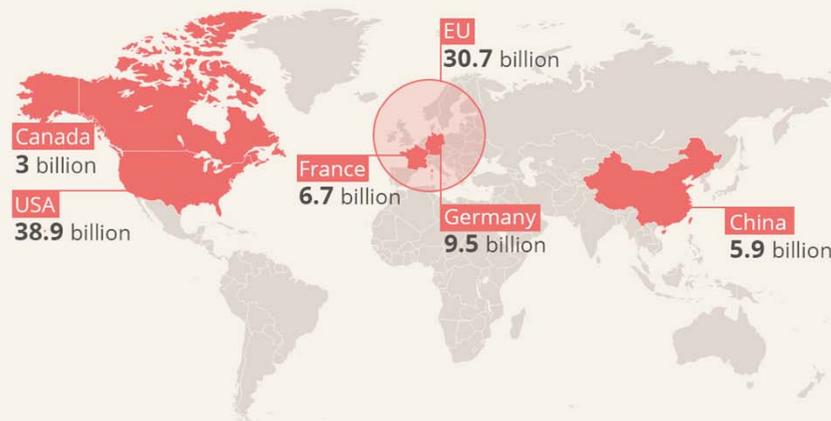
# Organic production and market

- countries with the largest markets are United States, Germany and France
- growing demand for specific foodstuffs, with a yearly increase of over 10%

## THE ORGANIC FOOD MARKET

### WHO CONSUMES THE MOST ORGANIC FOOD?

Retail sales (€) in 2016

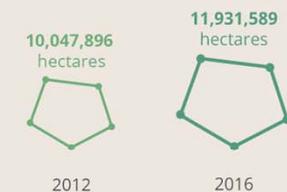


## DEVELOPMENT OF THE EU'S ORGANIC MARKET

Sales  
**+47.7%**



Organic farmland  
**+18.7%**



Organic Trade Organization  
<http://www.ota.com>. 2012



# Organic foods and consumer perceptions

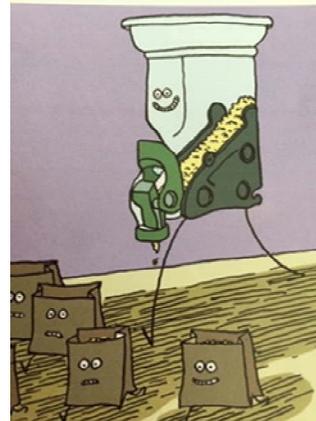
# Organic products and consumer motivations

Health-Minded  
Consumers



Parent and  
Kid Consumers

Label Consumers vs.  
Brand Consumers



Anti-GMO  
Consumers

Sustainable and  
Local Consumers



# Consumer perceptions

- Better quality and taste
- The expected or perceived superior quality frequently linked to freshness and healthiness
  - Safer and easier to trace back

# Consumer characterization

- NutriNet-Santé study, 22,366 participants
- Dietary intakes estimated using a food frequency questionnaire.
- Food choice motives assessed using a validated 63-item-questionnaire gathered in 9 dimension scores:
  - 1- taste > 2- health > 3- absence of contaminants >
  - 4- local and traditional production > 5- price >
  - 6- ethics and environment > 7- convenience >
  - 8- innovation > 9- avoidance for environmental reasons
- 5 clusters

	Standard Conventional Food Small Eaters	Unhealthy Conventional Food Big Eaters	Standard Organic Food Small Eaters	Green Organic Food Eaters	Hedonist Moderate Organic Food Eaters
Number (%)	8819 (39%)	4405 (19%)	5983 (26%)	2640 (11%)	1119 (5%)
Fruit & Veg. & Soups & Juices	Conv. 490.8 ± 293.2 Organic 96.7 ± 129.5	755.3 ± 424.5 89.6 ± 154.3	364.6 ± 265.8 385.7 ± 264.4	218.1 ± 235.0 762.5 ± 431.5	433.6 ± 275.7 205.2 ± 215.4

*Financial support :*  
 BioNutriNet projet, ANR-13-ALID-0001  
 OCAD project, ANR-11-ALID-002-06).

**Baudry et al, 2017, Nutrients**



# The qualities of organic foods vs conventional ones

Are there differences in composition between organic and conventional products?

If they exist, are these differences perceived by the consumer?

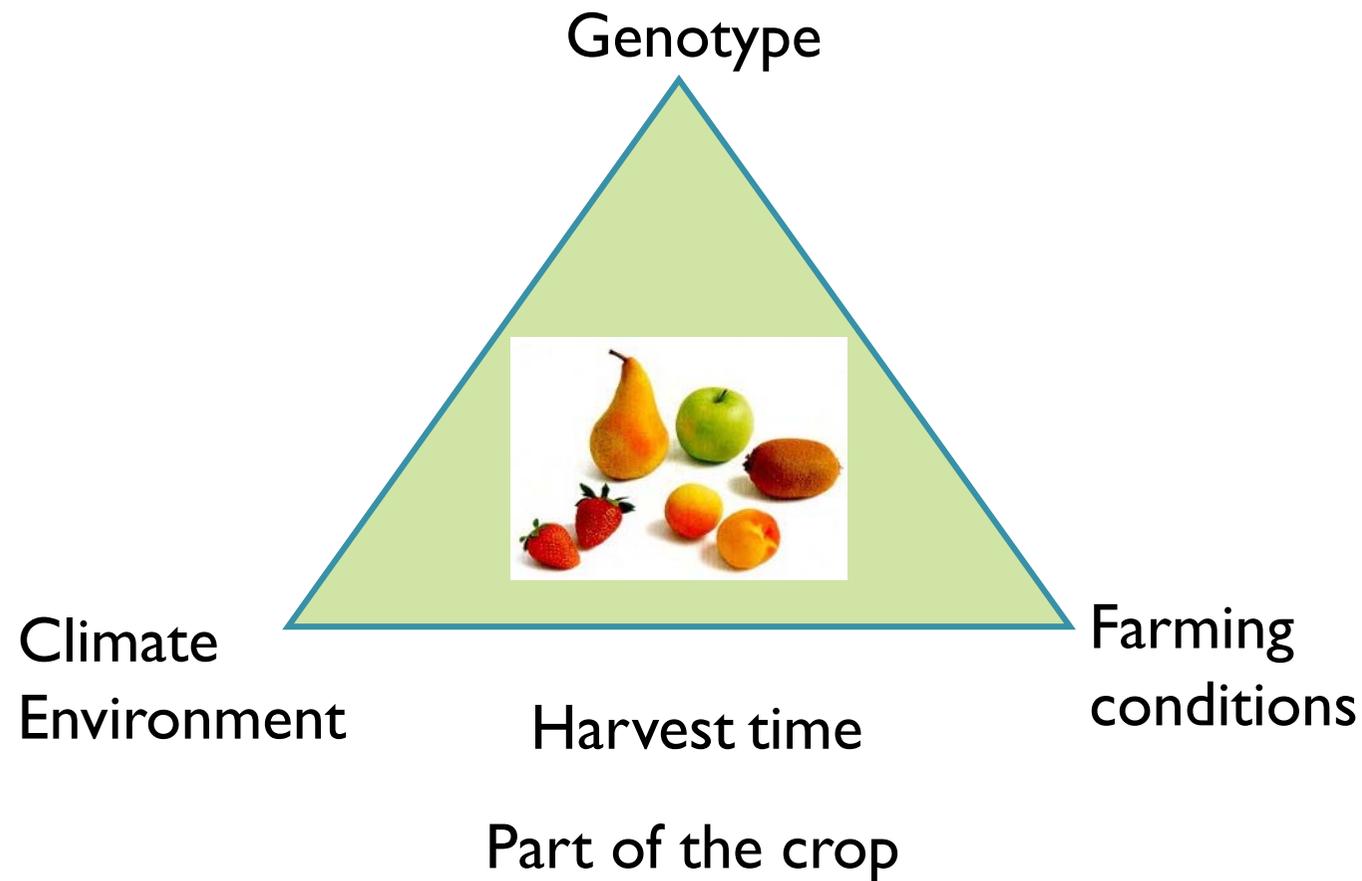


## Different qualities

- Sensorial
- Sanitary
- Nutritional
- Environemental
- Social

Bertrand C, Lesturgeon A, Amiot MJ et al. ...2018  
Alimentation biologique : état des lieux et perspectives  
Cahiers de nutrition et de diététique

## Variations in qualities





# Sensorial qualities of organic foods vs conventional ones

No or slight differences perceived in different products

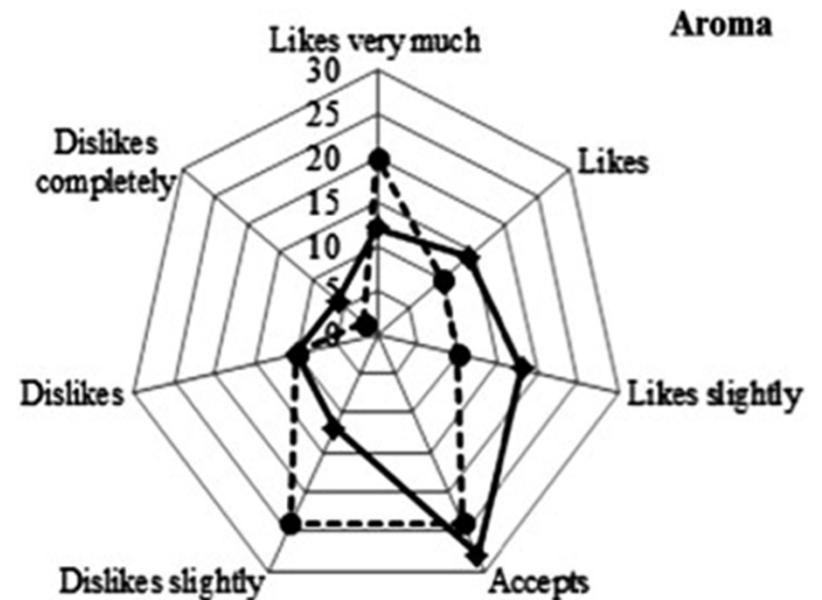
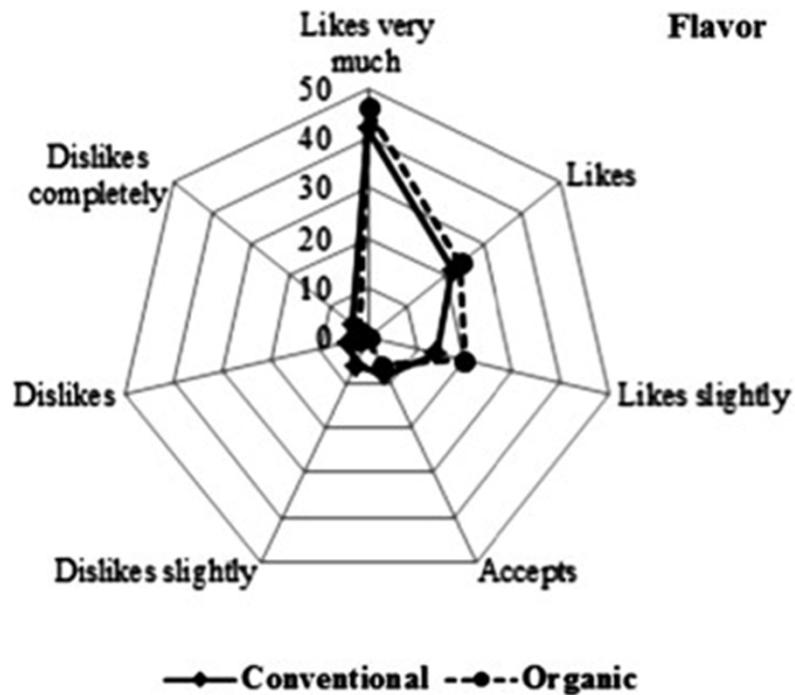
Better perception of taste by consumers for organic fruit probably associated their higher sugar contents

**Rembiałkowska 2007 J Science Food Agriculture**

More bitterness perceived in organic olive oil due to higher phenolic contents

**Barbieri et al 2015 J Food Composition Analysis**

# Organic products: sensorial analysis



Vinha AF et al 2014  
Organic versus conventional tomatoes: Influence on physicochemical parameters, bioactive compounds and sensorial attributes.  
Food and Chemical Toxicology

# Organic products : sanitary analysis

Food safety becomes one of the most issues concerning human health.

Gan et al., 2017, Hurtado-Barroso et al., 2017,  
Mie et al., 2017, Zaanouni et al., 2018.

Phytosanitary products compatible with organic farming are governed by the same regulations as other phytosanitary products,



"organic" phytosanitary products, even if they are mainly of natural origin, are not without risks for human health and the environment.

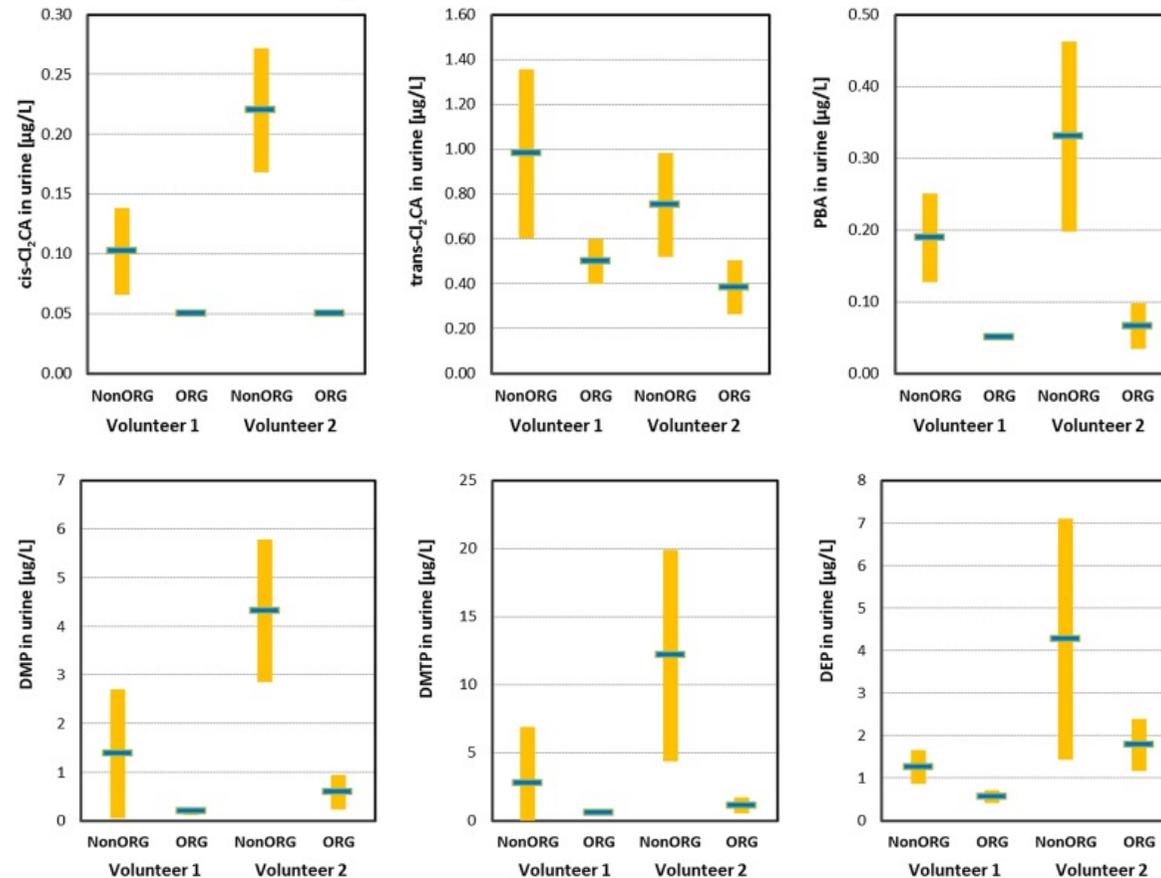
The risk for contamination with detectable pesticide residues was lower among organic than conventional produced (risk difference, -30% [CI, -23% to -37%])

Results of a meta-analysis

Smith-Spangler et al, 2012 –Ann Int Medicine

# Organic products : pesticide analysis

Lower exposure to organophosphate pesticides and pyrethroids for organic diet intervention



Göen et al 2017

Efficiency control of dietary pesticide intake reduction by human biomonitoring.  
International Journal of Hygiene and Environmental Health

Concordant with other studies:

Oates et al. 2014. Bradman et al. 2015. Curl et al 2015. Baudry et 2018



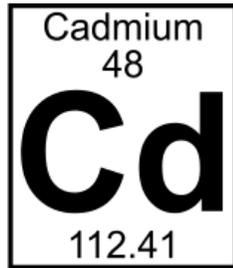
# Exposure to organophosphate and pyrethroid pesticides in French adults Nutrinet-Santé

Significantly lower urinary levels of diethylthio- dimethylthio- and dialkyl- phosphates, and free 3- phenoxybenzoic acid were observed among organic consumers compared to conventional consumers

Baudry et al 2018

*Journal of Exposure Science & Environmental Epidemiology*

# Organic products: Heavy metal analysis



## **Cadmium**

Cereals (< in Organic)

Baranski et al. 2014 British Journal of Nutrition

Lettuce, Tomato (< in Organic)

Strawberry (Conventional = Organic)

Hattab et al, 2019 Food Chemistry, on line



## **Copper**

Lettuce, Tomato (< in Organic)

Hattab et al, 2019 Food Chemistry, on line



## Organic products: Mycotoxins

DON (deoxynivalenol)

No difference between Organic and Conventional cereals

**Bernhoft et al 2010. Food Addit Contam**

T2 and HT2,

Lower concentrations in organic cereals

**Smith-Spangler et al 2012 Annu Intern Med**

# Organic products: nutritional analysis

CLA,  $\omega$ -3 fatty acids

Milk, meat

> Organic



Proteins

cereals

> in Conventional



Vitamin C

Phenolic compounds

Plant products

> in Organic



Popa ME et al 2018 Trends in Food Science & Technology

Bertrand C et al 2018 Cahiers de Nutrition et Diététique

Srednicka-Tober D et al 2016 British Journal of Nutrition

Baranski M et al. 2014 British Journal of Nutrition

# Organic products and other dimensions of sustainability



# Organic products: socio-economical aspects

- Consumers: can pay up to twice as much for organic than conventional foods



Accessibility for all ?



- Producers: life quality improved and diversity of activities

Dupré L, Lamine C and Navarette M 2017

# Organic products: environmental quality

## Organic agriculture

- needs more land than conventional agriculture
- but reduces N-surplus and pesticide use

## Environmental impact of processed organic products ?



Energy saving

Reduction of waste

Reduction of packaging



# Organic food consumption and health effects

# Recent results of the BIONUTRINET project (published in JAMA Intern Med)

## M L'alimentation bio réduit significativement les risques de cancer

La présence de résidus de pesticides dans l'alimentation conventionnelle pourrait expliquer la baisse de 25 % du risque chez les grands consommateurs de bio.

LE MONDE | 22.10.2018 à 17h00 • Mis à jour le 23.10.2018 à 07h13 |

### Vidéos



Studie: Bio-Lebensmittel reduzieren das Krebs-Risiko



**Il cibo bio riduce il rischio di cancro: lo conferma uno studio francese**  
Blasting News - 25 oct. 2018

Il cibo bio riduce il rischio di cancro: lo conferma uno studio francese ... 70 mila individui nel corso di quattro anni e mezzo, lo studio NutriNet-Santé, che ha ... sul consumo di alimenti organici e sulle abitudini alimentari in generale. ... riguardo due tipologie di tumore: il linfoma, che si è ridotto del 76%, ed il ...

Le FIGARO · fr  
Particulier

## Manger bio diminue de 25 % le risque de cancer

Web Figaro Par Stéphanie ALEXANDRE Modifié le 23/10/2018 à 14:22 / Publié le 23/10/2018 à 14:17

The New York Times

## Can Eating Organic Food Lower Your Cancer Risk?

In a study, those who ate more organic produce, dairy, meat and other products had 25 percent fewer cancer diagnoses over all, especially lymphoma and breast cancer.



# Organic food consumption and cancer

- In a population-among high consumers of organic food. based cohort study of 68 946 French adults (BIONUTRINET) a significant reduction in the risk of cancer was observed.

cancer	Nb Cases		P for trend *
	Q1- 16471	Q4- 16962	Q4 vs Q1
Postmenopausal* breast cancer	69	50	0.03
Non-Hodgkin lymphoma*	15	2	0.049
All lymphoma*	23	5	0.02
All cancers **	360	269	<0.001

\* After adjustment for age and sex, month of inclusion, occupational status, educational level, marital status, monthly income per household unit, physical activity, smoking status, alcohol intake, family history of cancer, body mass index, height, energy intake, mPNNs-GS, fiber intake, processed meat intake and red meat intake, and (for women) parity, postmenopausal status, use of hormonal treatment for menopause, and use of oral contraception , \*\* previous adjustments + ultraprocessed food consumption, fruit and vegetable consumption, and dietary patterns extracted by principal component analysis.

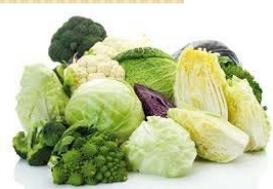
## Some comments on the JAMA Intern Med article

- comparable results with a prospective study of 623 080 middle-aged UK women (no association with all cancers except for Non-Hodgkin Lymphoma risk)

Bradbury et al., Br J Cancer, 2014

- The frequency of organic food intake
  - Need to have the quantity of organic foods consumed (high « organic » consumers eat more fruit and vegetables)
- Lymphoma :
  - The number of cases is limited
  - In Bionutrinet: 3 cases for 10 000 for high frequency of organic foods versus 13 for 10 000 for low frequency
  - Other factors (environment/pollution? Quantity of fruit&Veg...)
    - Need to have more adjustments
    - Need a longer duration
- A recent meta-analysis showed that combined fruit/vegetable consumption (high vs low) was associated with decreased Non-Hodgkin Lymphoma risk (- 21%)

Sergentanis TN, Leuk Lymphoma. 2018



# Other health effects

In Bionutrinet cohort:

A lower exposure to pesticide residues in higher « organic food consumers » may explain a lower probability of being overweight (BMI  $\geq$  25) -23% or obese (BMI  $\geq$  30) -31% after 3 years following (among 62 224 participants)

**Kesse-Guyot E et al. 2017 Br J Nutr**

or having a metabolic syndrome -31% via a cross-sectional analysis

**Baudry J et al. 2017 Eur J Nutr**

## Consumption of organic food during pregnancy the KOALA Birth Cohort Study

- Associated with a more favourable pre-pregnancy BMI and lower prevalence of gestational diabetes
- Plasma level of a favourable fatty acid (vaccenic acid) was higher among women consuming organic food than the reference (participants consuming no organic food) whereas unfavourable trans-fatty acids were lower
- Plasma levels of 25-hydroxyvitamin D were lower in the organic groups than in the reference group

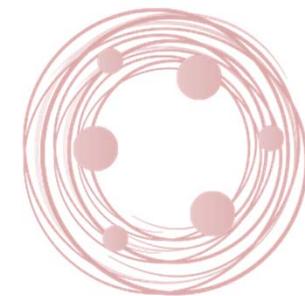


Importance of healthy dietary pattern

Simões-Wüst 2017 Public Health Nutr

# Conclusions and Recommendations

- Concerns about pesticide risks should not discourage the consumption of conventional fruits and vegetables, at least 5 portions per day
- Especially for a large part of the population for whom organic products are inaccessible
- Current recommendations must continue to promote a healthy diet, rich in plant products, whether conventional or organic



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