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## **Joint Bachelor Course on Organic Agriculture 2014**

# **Lecture 10: Food quality and food processing, Part II**

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# Food processing

**Food processing** is a set of methods and techniques used to transform raw ingredients into food or to transform food into other forms for consumption by humans either in home or by food processing industry.

Source: Bellinghouse 2009

## Aims of food processing:

- › Ensure microbiological and chemical safety of foods.
- › Adequate nutrient content and bioavailability.
- › Preservation (stabilization, extended shelf life).
- › Convenience and ease of preparation for consumers.
- › Variability of food supply.

# Organic food processing

International Federation of Organic Agriculture Movements (IFOAM, 2010)  
basic guidelines for organic processing:

- › **“Organic processing and handling provides consumers with nutritious, high quality supplies of organic products and organic farmers with a market without a compromise of organic integrity of their products.”**
- › **“Organic food is processed by biological, mechanical, and physical methods in a way that maintains the vital quality of each ingredient and finished product.”**

The EC Organic Regulation (EC) N 834/2007 states the following aim (Article 3)

- › **“Producing a wide variety of foods and other agricultural products that respond to consumers’ demand for goods produced by the use of processes that do not harm environment, human health, plant health or animal health and welfare.”**

# Regulatory public and private framework

There are three essential sources that serve as basis for a good practice in organic food production:

- › **EU Regulation (EC) No 834/2007.** However, in some countries additional regulations or requirements may also exist.
- › **Agreements under private standards** (IFOAM Basic Standards 2012, COROS or other private standards).
- › **‘Promise’ and the commitment of the organic food sector** to give consideration to consumers’ demands for organic food.

# Aims of regulations and standards for organic food production

- › Production of high-value organic food that complies with the standards.
- › Ensuring that no mixing of non-organic and organic products takes place.
- › Preventing mistakes in the production of organic foodstuffs.
- › Establishing transparency through traceability and verification of production methods.
- › Protecting market participants from deception.

# Principles applicable to processing of organic food, (EC) No 834/2007

- › The production of organic food from organic agricultural ingredients, except where an ingredient is not available on the market in organic form.
- › The restriction of the use of food additives, of non organic ingredients with mainly technological and sensory functions and of micronutrients and processing aids, so that they are used to a minimum extent and only in case of essential technological need or for particular nutritional purposes.
- › The exclusion of substances and processing methods that might be misleading regarding the true nature of the product.
- › The processing of food with care, preferably with the use of biological, mechanical and physical methods.

# Requirements to products and substances for use in the production of processed organic food

**EU Regulation (EC) No 889/2008, Annex VIII** lists the possible materials that can be used in organic food processing.

- › **Section A:** Food additives, including carriers.
- › **Section B:** Processing aids and other products, which may be used for processing of ingredients of agricultural origin from organic production.

# Requirements to operators

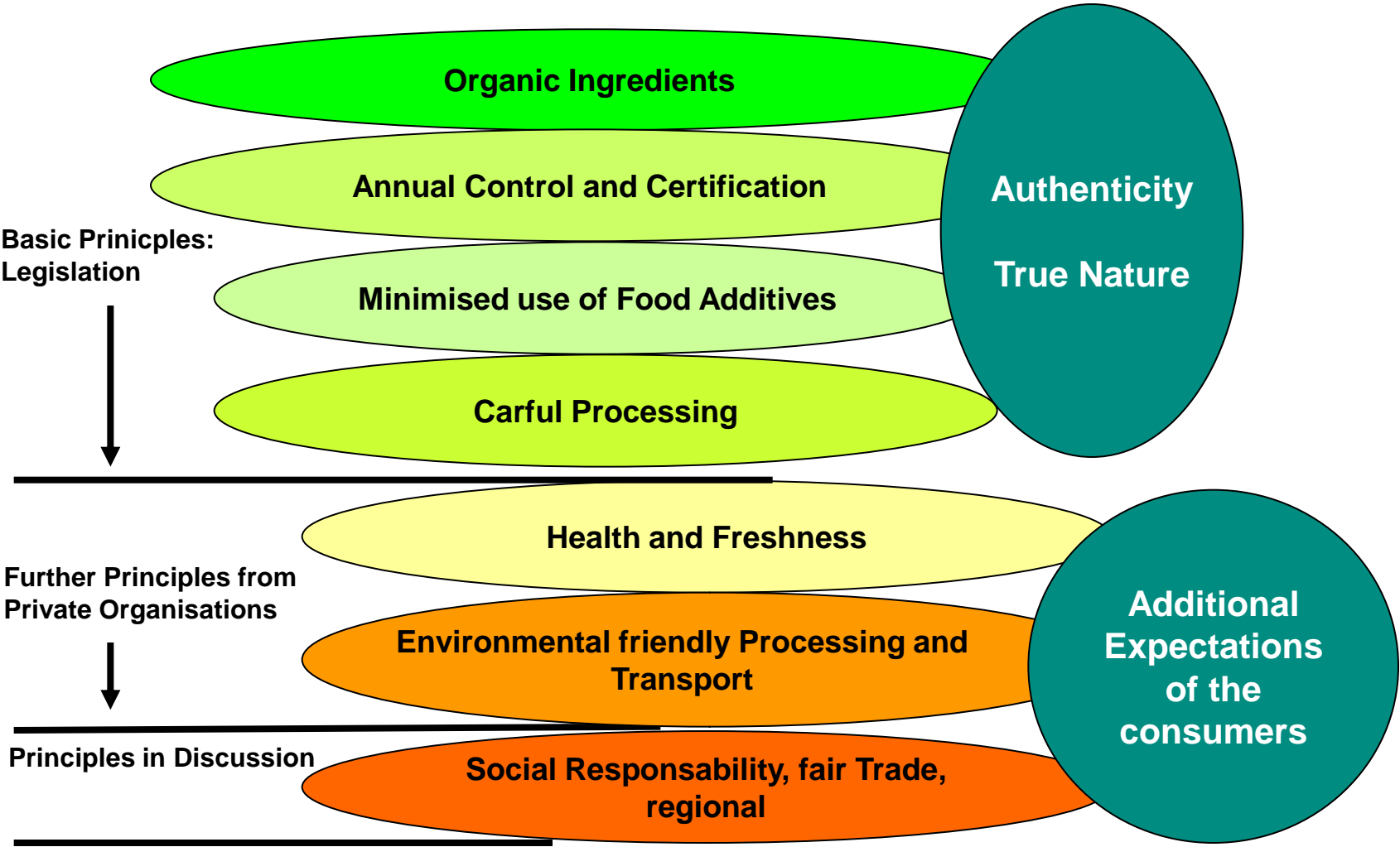
- › Use of organic ingredients and products.
- › GMOs and products produced from or by GMOs shall not be used in the production of organic food.
- › Prohibiting artificial flavor and colorants.
- › Using only non-organic agricultural ingredients authorized by the Commission or EU Member States.
- › Using only a very limited number of additives or processing aids, which are authorized, under certain conditions, by the Commission.
- › Ensuring organic and non-organic food ingredients are stored, handled and processed separately at all times.
- › Identification of process lots and maintenance of adequate records.
- › Prevention of external contamination.
- › The use of ionizing radiation for the treatment of organic food or raw materials used in organic food is prohibited.



# Requirements to processing equipment and operations

- › The processing of organic products must be done in such a manner as to prevent contamination or accidental substitution of organic and non-organic food products.
- › Processing of organic foods should take place in separate and dedicated sites using separate and dedicated equipment.
- › Equipment used for processing should be made from non-porous food-grade materials.
- › Cleaning with chemicals is allowed followed by rinse with potable water to remove any residuals of the cleaning chemicals.
- › Processing of organic food should be performed in a way that keeps the true nature of ingredients and final products as much as possible.

# Concept of organic food processing



# Organic food processing is strongly associated with “minimal processing” and “careful processing”

## Minimal Processing

The concept of minimal processing in food production covers a wide range of technologies that:

- › Use processing procedures that change the inherent fresh-like quality parameters as little as possible or techniques which have a limited impact on the nutritional and sensory properties of the food.
- › Endow the product with a shelf life sufficient for its transport from the processing plant to the consumer.

Source: Schmid *et al.* 2004

# Minimal non-thermal processing for production of organic foods: Specific technologies

- › Ultrafiltration: uses a membrane filter that removes microorganisms, but allows nutrients to pass through.
- › Pulsed electric fields: sterilizes milk/liquid substrate by passing electric pulses at a slightly elevated temperature, inactivating microorganisms, but leaving nutrients largely unaffected.
- › Low pH and increased levels of sugar or salt versus sorbates used as preservatives.

Source: Ohlsson and Bengtsson 2002  
Ramaswamy and Marcotte 2005

# High pressure processing (HPP)

- › Application of high pressures (100-1000 MPa) for inactivation of microorganisms and enzymes
- › Widely used for the procession of fruits, vegetables and related products, yogurt, ready-to-eat meat
- › Influence on food quality
  - › Only slightly lowering the nutritional value of food
  - › High pressures have little effect on the vitamin contents (Indrawati *et al.* 2003)
  - › Tender meat products (Brooker 1999)

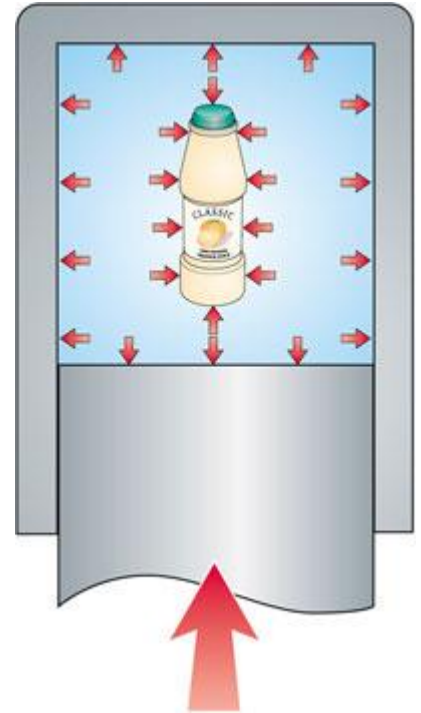


Image Credit:  
Avure Technologies, Inc.

# Some more advantages of high pressure processing



Image Credit: Avure Technologies, Inc.

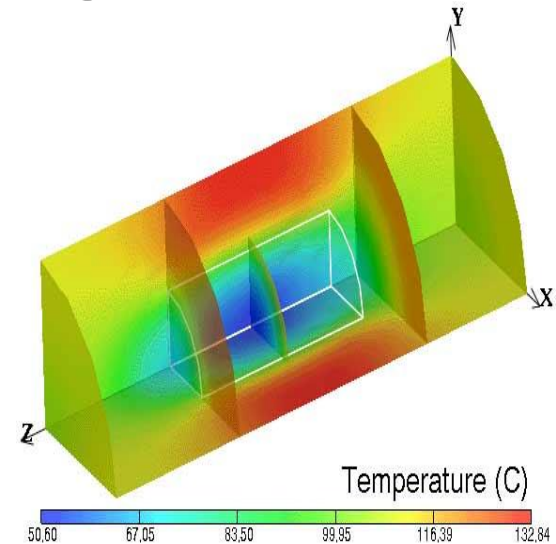
## Disadvantages:

- Relatively expensive equipment
- Can lead to texture changes and enhanced lipid oxidation (Indrawati *et al.* 2003)

# Minimal thermal processing for production of organic foods: Specific technologies

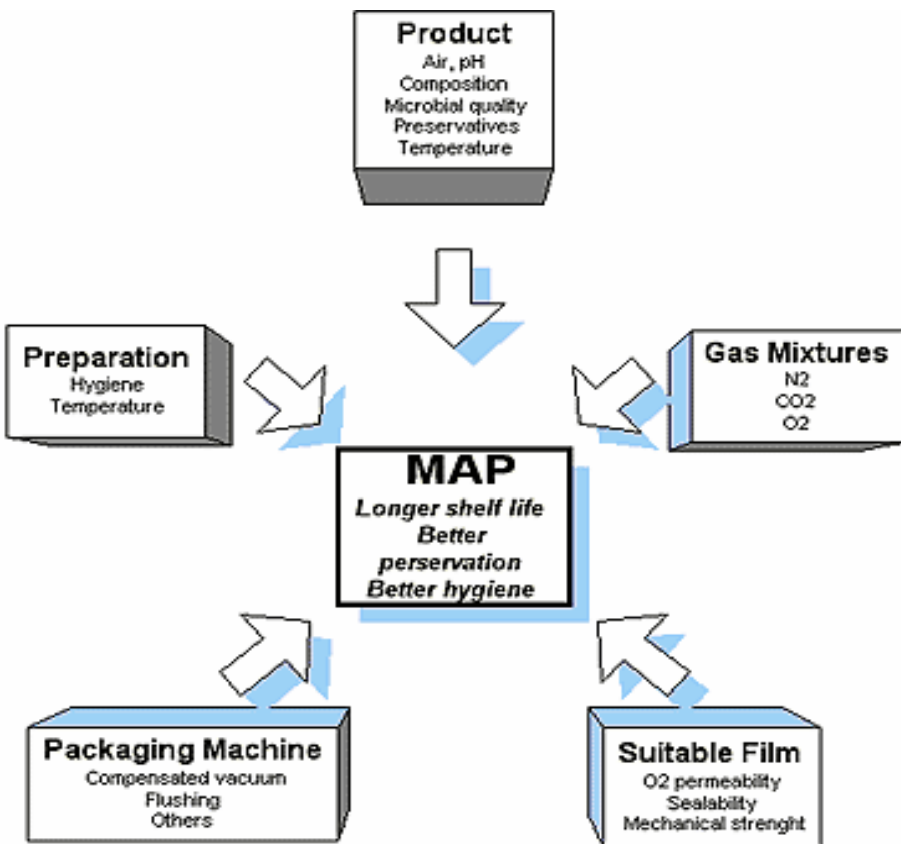
**Ohmic heating:** Internal generation of heat due to the electrical resistance of food components to the passage of an electric current (Pereira and Vicente 2010)

**Sous-vide cooking:** A method of cooking food sealed in airtight plastic bags in a water bath for longer than normal cooking times (72 hours in some cases) at an accurately regulated temperature much lower than normally used for cooking, typically around  $55^{\circ}\text{C}$  to  $60^{\circ}\text{C}$  (Ohlsson and Bengtsson 2002)



# Minimal processing for packaging of organic foods: Specific technologies

- › **Modified atmosphere packaging (MAP):** A process by which the shelf-life of a fresh or processed product is increased significantly by enclosing it in an atmosphere that slows down the growth of microbial organisms. Packaging gases such as E290 carbon dioxide, E938 argon, E939 helium, E941 nitrogen and E948 oxygen are allowed under European Commission regulation EU-VO 889/2008 for organic products.



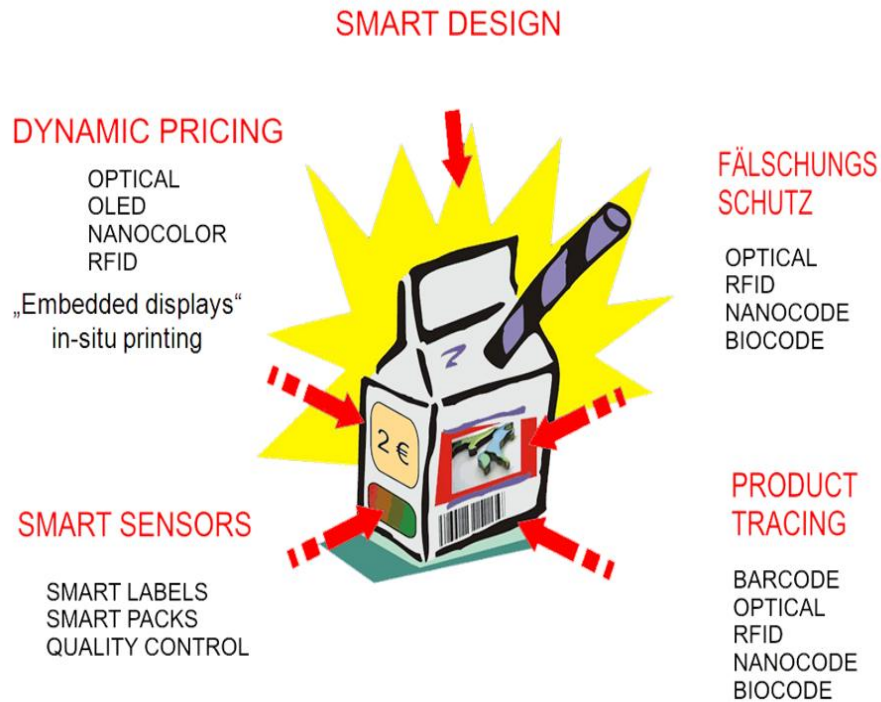
Advantages	Limits
<ul style="list-style-type: none"> <li>• Longer shelf life (2 to 5 times that under air)</li> <li>• Mechanical protection of products against crushing (fragile products)</li> <li>• Ease of use for the consumer (prevents sliced products from sticking)</li> <li>• A specific approach for certain products (eg. red meat color meat)</li> <li>• Attractive packaging</li> <li>• Reduced use of some additives</li> <li>• Low gas cost (ratio of 1/10/100 between gas/film/product)</li> </ul>	<ul style="list-style-type: none"> <li>• A modified atmosphere slows down reactions which cause product deterioration, but does not block them</li> <li>• Map is not a miracle technique - a product of poor quality at the outset will still be of poor quality, whatever the gas mixture used</li> <li>• For most products, a modified atmosphere must always go along with strict adherence to the cooling chain</li> <li>• To date, there is no satisfactory modified atmosphere for plant products with high respiration such as fruits</li> </ul>

Source: <http://www.soal.com/en/food-beverages-1/applications-1/modified-atmosphere-packaging->



# Minimal processing for packaging of organic foods: Specific technologies (cont.)

- › **Intelligent packaging:** Equipment which monitors the condition of packaged food or the environment surrounding it.



- › **Vacuum packaging:** Vacuum packaging is a means of improving the quality of food during its natural life rather than a means of increasing its shelf life.



Source: International Trade Center 2012: Packaging for organic foods

## **Advantages of minimally processed foods**

- › Convenience
- › Increased functionality
- › Fresh-like characteristics
- › Minimal loss of vitamins and antioxidants
- › Little or no change of the nutritional value

## **Disadvantages of minimally processed foods**

- › Decreased shelf-life
- › Easier deterioration of color and texture
- › Spore-forming bacteria may not be eradicated
- › Increased risk of pathogenic and spoilage microorganisms propagation

# Some selected examples for innovative solutions in organic food processing

Problems	Solutions
Naturalness of foods	Methods for cold pressed oil and the protection of the oils against oxidation. (Use of peeled seeds, the “oxygard” method and others.)
Use of flavours	Development of new tasty varieties of fruit yoghurts without added isolated flavours by new innovative blends and e.g. by the fresh production of the fruit preparation directly in the dairy plant.
Whole cereal bread bakery products with a good volume	Use of new methods of production, addition of acerola cherry powder (instead of synthetic ascorbic acid) or oxygen (O <sub>2</sub> ) application.
Problems of using ion exchange resins in starch syrup.	Develop purification systems based on accepted processing aids
Homogenization of milk	Reduce the level of homogenization to the possible minimum by avoiding unforeseen homogenization effects and by reducing of the application of pressure to the minimum as it is needed for pasteurized milk.
Oxidation of potato's after peeling	Use of organic acids as antioxidants and optimization of handling and packaging.
Quality of meat products	Development of new processing technologies based on meat from “older” pigs and presents a new type of product on the market with new ripening technologies.
Problems with conventional starter cultures	Development of starter cultures which are multiplied on substrates from organically produced compounds
Pest management in storage and processing facilities	Concepts for ecological pest management in combination with new physical and biological control methods / elimination techniques.

Source: Schmid *et al.* 2004

# Careful processing concept in organic food guidelines

## Careful processing

- › The maximum to keep important compounds and the maximum to avoid undesired compounds or nutritional losses

## Including

### › carefulness to the **product**

Processing methods/assessment, nutrition, taste, shelf life, ethics, traceability, food safety

### › carefulness to the **people**

Working environment, assessment of working conditions, organization of work, education, competencies

### › carefulness to the **environment**

Cleaner technologies, LCA, energy, water, waste



# Product types and labeling

Indications of organic status is based on the proportions of organically produced ingredients:

- › A product can only be described as ‘organic’ or ‘organically produced’ unless **95%** of agricultural ingredients have been organically produced (Council Regulation (EC) No 834/2007)
- › Regional variation
  - › e.g. UK: product with ‘Made with X% “organic” or “organically produced” ingredients’ unless 70% of the agriculture ingredients have been organically produced (United Kingdom Register of Organic Food Standard, 2003)
- › Products not featuring this amount must not carry any indications of organic status of the ingredients, whether in the product name, the ingredients panel or on the sales literature.

# Made with X% “organic” or “organically produced” ingredients products

- › The remainder of the agricultural ingredients can be **non-organic**, provided that they are authorized by the Commission or EU Member States.
- › Any processing aids used in the production, such as releasing oils and flushing gases, and so on, must be authorized by the Commission or EU Member States.
- › Any ingredients of non-agricultural origin, such as additives, yeasts, minerals, and so on, must be authorized by the Commission or EU Member States, though the quantities used in the production of organic food are not limited.
- › The ingredients must not have been subject to treatments by ionizing radiation or be derived from genetically engineered plants and products.
- › Where any approved non-organic ingredients are present, they should be differentiated from organically produced ingredients in the ingredients panel. This is often done by means of an asterisk against the organic ingredients with the definition – \*organically produced ingredients – elsewhere in the panel.



## EU-logo for organic products Commission regulation (EU) N 271/2010

### Compulsory indications:

- **Code number** of the control authority
- **Origin of raw material** (if > 2%) on pre-packaged food:  
“EU Agriculture”, “non-EU Agriculture”, “EU/non-EU Agriculture”

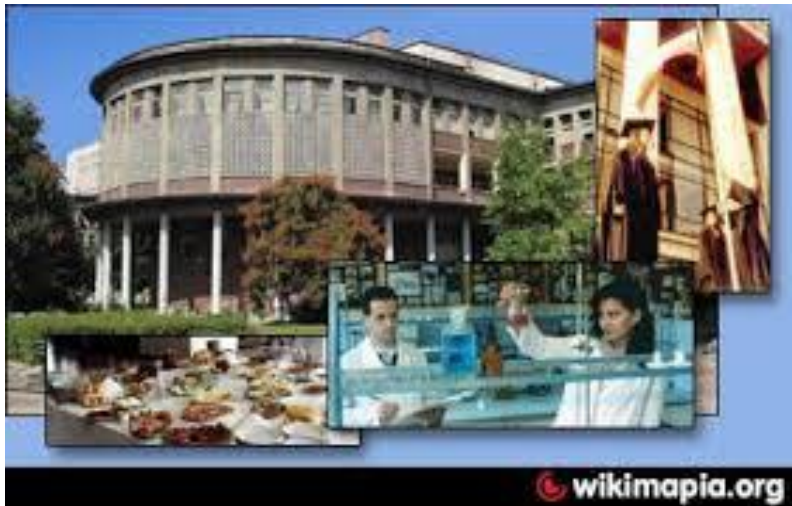
**Obligatory** for all organic **pre-packaged** food products within the European Union.

**Voluntary** for **non pre-packaged** organic goods produced within the EU or any organic products imported from third countries.

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# Thank you!

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# Acknowledgement

**This lesson was prepared within the project „Advancing training and teaching of organic agriculture in South-East Europe (Albania, Bosnia and Herzegovina, Kosovo, Bulgaria and Hungary)“ , funded by the Swiss National Science Foundation (SNFS) within the SCOPES program 2009-2012 (project No. IZ74Z0\_137328).**