

Wednesday February 17, 12:00-13:00; Scientific Forum, Stream 5

BIOFACH  
eSPECIAL

# New Plant breeding Techniques and Organic Farming: scientific, regulatory and consumer issues

The LIVESEED project (Improving the performance and competitiveness of the organic sector by boosting organic seed and plant breeding efforts)

We present & discuss the scientific controversies and the regulatory issues related to New Plant Breeding Techniques (NPBTs) as well as the results of a European survey on consumers attitudes and preferences on NPBTs in organic farming.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727230. The information provided reflects the views of the authors. The Research Executive Agency is not responsible for any use that may be made of the information provided.

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# Speakers and Programme

Dr Susanne Padel <i>Thünen Institut</i>	<b>Moderation and Discussion</b>	
Dr. Monika Messmer <i>FiBL Switzerland</i>	<b>Introduction to the Liveseed project and new plant breeding techniques</b>	12:00 to 12:10
Martin Sommer <i>IFOAM Organics Europe</i>	<b>The position of IFOAM Organics International to NPBT and what is at stake</b>	12:10 to 12:20
Prof Raffaele Zanolli and co-authors <i>University of Marche</i>	<b>Results of a European study on consumers attitudes and preferences on NPBTs in organic farming</b>	12:20 to 12:40
All	<b>Questions and Discussion</b>	12:40 to 13:00



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## Lets start with a little exercise

- What comes to your mind, if you think about seed use in organic farming?
- Please type up to 5 words in the slido poll.



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[www.liveseed.eu](http://www.liveseed.eu)

## Boosting Organic Seed and Plant Breeding across Europe (2017-2021)

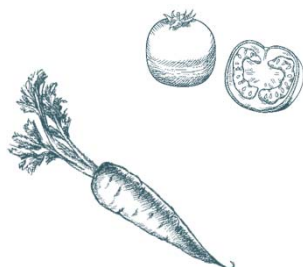
### Highlights & Recommendations

Bram Moeskops & Ágnes Bruszik IFOAM Organics Europe, Project Coordinators

Monika Messmer, FiBL-CH, Scientific Coordinator

**Biofach 2021**

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# LIVESEED in a nutshell

- Budget: 7.4 M EUR EU funding & 1.5 M EUR Swiss funding
- Duration: 4 years
- Coordinator: IFOAM Organics Europe
- Scientific coordinator: FiBL (Switzerland)
- Multi-actor approach: 50 partners in 18 countries
- Goal: **Boosting organic seed and plant breeding in order to improve the performance, sustainability and competitiveness of the organic sector**
- Approach:
  - Inter- and transdisciplinary
  - Policy – economy – science interface
  - Multi-actor & stakeholder involvement
  - Wide geographic representation



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# Aim: Improve integrity and competitiveness of organic sector by reaching 100% organic seed of cultivars suited for Organic Agriculture

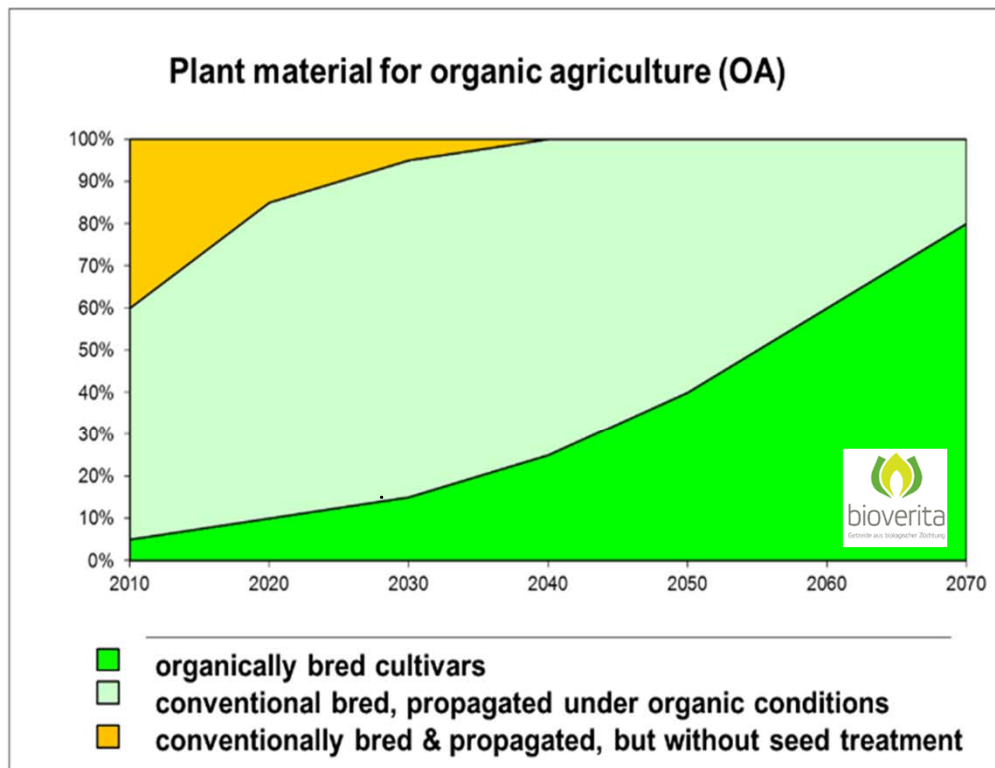
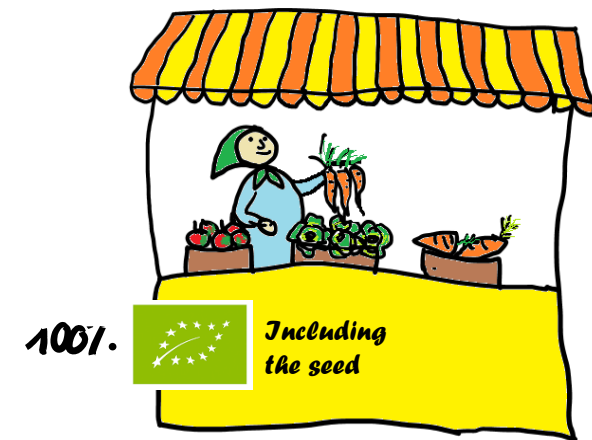
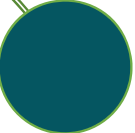

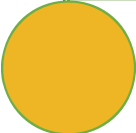
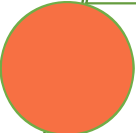
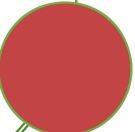


Figure 1 : Schematic time line to reach the goal of 100% organically propagated seed of suitable cultivars (light green) in short term and to foster cultivars specifically bred for organic farming systems (bright green) in the long term



# Scope of activities

-  **Policy & regulation**  
Harmonized Implementation of Organic Regulation with respect to seed
-  **Cultivar testing & seed multiplication & seed health**  
Increase accessibility of organic healthy seed, adoption of new cultivars
-  **Research & development in organic plant breeding** Innovative concepts, strategies and approaches for more resilient cultivars and holistic strategies to widen choice of organic cultivars
-  **Socioeconomic Issues**  
Improve the competitiveness of the organic seed supply chains from breeding to the consumer incl survey on new breeding technologies
-  **Knowledge exchange & network**  
Capacity building, exchange of knowledge, collaboration & awareness raising on the benefits of organic plant breeding and organic seed

# Attitude towards new plant breeding techniques (NPBT)

In 2007 several new plant genetic engineering techniques were summarized as “**new plant breeding techniques (NPBT)**” to discuss their potential commercialisation. The organic sector called them “**new genetic engineering techniques**” in order to avoid confusion

- Oligonucleotide Directed Mutagenesis (ODM)
- Zinc Finger Nuclease Technology (ZFN) comprising ZFN-1, ZFN-2, ZFN-3
- Cisgenesis comprising intragenesis
- Grafting
- Agro-infiltration
- RNA-dependent DNA methylation (RdDM)
- Reverse breeding
- Synthetic genomics

→ **JRC study of 2011**

JRC Scientific and Technical Reports



**New plant breeding techniques**  
State-of-the-art and prospects  
for commercial development

Marta Lusser, Claudia Parisi,  
Damien Plan and Emilio Rodriguez-Cerezo



EUR26000EN - 2011



This pri  
research



## Site directed nuclease (SDN): CRISPR-Cas9 2012

- **SDN-1:** Double strand break at specific site, silencing of a gene, point mutation due to error in DNA repair (induced mutation of a specific gene) = **site directed mutagenesis**
- **SDN-2:** Double strand break & template with desired base pair sequence, targeted replacement of individual bases of the gene, new allele, new trait = **gene editing**
- **SDN-3:** Double-strand break & one or more species-specific or non-species-specific genes are incorporated into genome in a targeted manner (targeted gene transfer at specific site)



*Nobel price winners 2020: Emmanuelle Charpentier & Jennifer Doudna*

# Principles of Organic Agriculture

Based on the principles of **Health, Ecology, Fairness & Care**

**Value based & process oriented** defined by the organic sector

Since several years the compatibility of breeding techniques with organic agriculture has been discussed at different levels considering:

- **Risks** (precautious principle) for human, animals, plants, soil fertility, environment based on techniques and their application
- **Ethical issues** (how far shall it be allowed to modify organisms directly at the DNA level)
- **Socio-economic issues** (IPR, breeders privilege, market concentration, dependency of farmers)
- **Expectation and trust of organic consumers**

# Criteria for Organic Plant Breeding

## Ethical issues of position paper of European Consortium for Organic Plant Breeding (ECO-PB) 2013

- Genom and cell is respected as indivisible entity, no technical/physical intervention (e.g. isolated DNA) → no technical/physical intervention (e.g. cell fusion)
- Maintain reproducibility in species specific manner
- No legal or technical barriers to restrict breeders' prevelige
- Natural crossing barriers are respected
- Promotion of open pollinated varieties as alternative to F1 hybrids to enable farm saved seed
- Transparency



## IFOAM International: Position Paper on New Breeding Techniques 2017

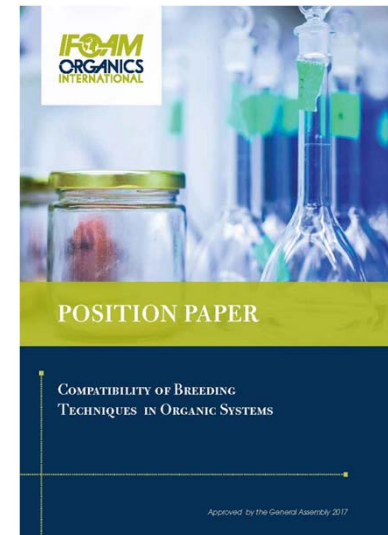
Draft February 2017, consultation and final approval on General Assembly of IFOAM in November 2017

<https://www.ifoam.bio/compatibility-breeding-techniques-organic-systems>

Transparency & traceability to allow freedom of choice for farmers & consumers

**FiBL**

[www.fibl.org](http://www.fibl.org)



# Legal Regulation in Europe

- **European Court of Justice** decided July 2018 that site directed mutagenesis shall be treated as GMO
- In the European Union organic agriculture is **GMO-free by definition**, as the use of GMOs is prohibited in the organic production process, according to the current (Regulation 834/2007, Art. 4), and new organic regulation (Regulation 848/2018, Art. 5).
- **2020 Public consultation on Novel Genomic Techniques** by EU commission – Report expected end of April 2021 in order to decide how NGT shall be regulated

# The position of IFOAM Organics



**Martin Sommer (DE)**

Policy Coordinator on  
GMOs, Patent and Seeds



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# Results of a European study on consumers attitudes and preferences on NPBTs in organic farming

Raffaele Zanoli, Simona Naspetti, Emilia Cubero-Dudinskaya, Serena Mandolesi



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This project received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727230.

# Objective

- Investigate organic consumers' attitudes, preferences and acceptance of New Plant Breeding Techniques (NPBTs) in organic food and farming in selected EU countries.
- We specifically tested the effect on consumer attitudes and preferences of the term “new plant breeding techniques”, which is used by lobbying groups that promote them as “methods that allow the development of new plant varieties with desired traits,” e.g., fruit with higher vitamin C content.



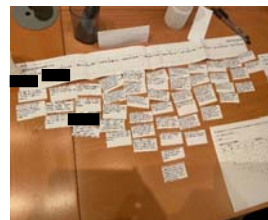
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# Methods and sample

## Focus groups and Q methodology

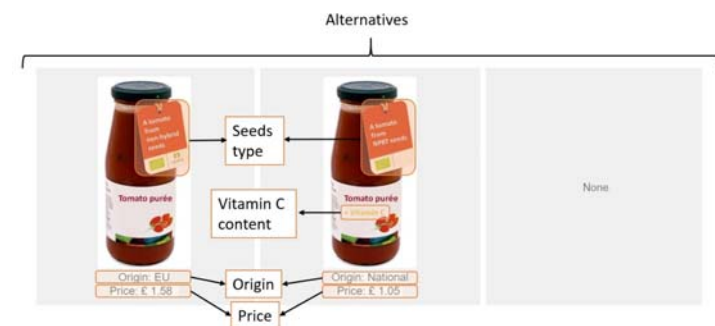
- 11 focus groups and statement sorting
- **102 organic consumers** (20 DE, 10 IT, 8 LT, 15 ND, 24 ES, 14 CH, 11 UK)
- 48% occasional and 54% regular Age: 61% (18-45) - 39% (46-70)
- Gender: 54% Female - 46% Male



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## Online survey

- **11 countries** (DK, FR, DE, HU, IT, LV, NL, SL, ES, CH, and the UK)
- 4.486 respondents in total (around 400 per country)
- Discrete choice experiment (DCE) → 12 choice sets



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# FGs Results 1/2

## Consumer knowledge (before showing the video on NPBTs):

- The majority **didn't know the meaning of "New Plant Breeding Techniques"** but associated production methods (e.g. optimization of processes, improving productivity, using artificial fields, vertical farming etc.). Only few (mainly from DE, ES and IT) identified **the relation with GMOs or genetic engineering.**

## Consumer feelings and attitudes (after the video):

- **Mainly negative feelings** (because of the genetic manipulation for both gene-editing and cisgenesis);
- **Perceived like GMOs and «unnatural»;**
- Generally **no difference between NPBTs and transgenesis technique**, however, for some consumers, both **cisgenesis and gene-editing are preferred over transgenesis.**



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## A minority of organic consumers would accept NPBTs only if...

- NPBTs would improve the quantity and quality of yields
- Reduce environmental impacts (e.g. further reduce the amount of chemicals used in organic farming)
- **BUT**: Not as another tool to produce hybrid seeds.



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# FGs Results 2/2

## Willingness to purchase:

- **The majority would not buy** organic foods derived from NPBTs. Main **motivations** are: **productivity** and **social aspects** (e.g. producing enough food, reducing hunger in the world), **reduction of costs and prices, using new technologies, protecting health and environment.**

## Reasons' for rejection:

- Use of genetic manipulations;
- Ethical and social aspects (*"Then you are going to play for God"*);
- Lack of knowledge among consumers;
- Unpredictable impacts on society and environment;
- Sceptical due to the economical and political purpose.

**For all participants the use of specific and clear labels is necessary.**



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# Q Methodology Results: Description of Factors



## F1 “Risk Averse”

75 Consumers  
of which 56% Regular

### NPBTs rejected:

- Perceived **similar to GMOs** and “**incompatible**” with principles of **organic farming**,
- May have **unpredictable effects** & risks for the environment and human health,
- May cause **contamination of other organic crops**,
- May reduce **biodiversity**.



## F2 “Technological Optimists”

26 Consumers  
Of which 35% Regular

NPBTs seen as a “**useful**” technology.  
Focus on **potential benefits** like:

- Obtaining **seeds and plants more pest resistant**,
- **Reducing the amount of chemicals**,
- **Feeding the world** by organic farming or eliminating hunger,
- **Reacting to climate change**,
- **Helping organic farmers** to compete with the conventional ones.



## F3 “Socially Concerned”

Only 6 organic consumers  
of which 67% regular

The focus is on **negative socioeconomic impacts on the competitiveness** of the whole organic sector.

- They don’t believe that all farmers would benefit by the adoption of NPBTs (only multinationals would),
- NPBTs will **reduce the availability** of different plants reducing the **variety**,
- **Prices will increase**,
- They don’t believe that NPBTs will help feeding the world or reducing hunger.

Consensus (by all factors):

**NPBTs must be subject to traceability and mandatory labelling in all Europe.**



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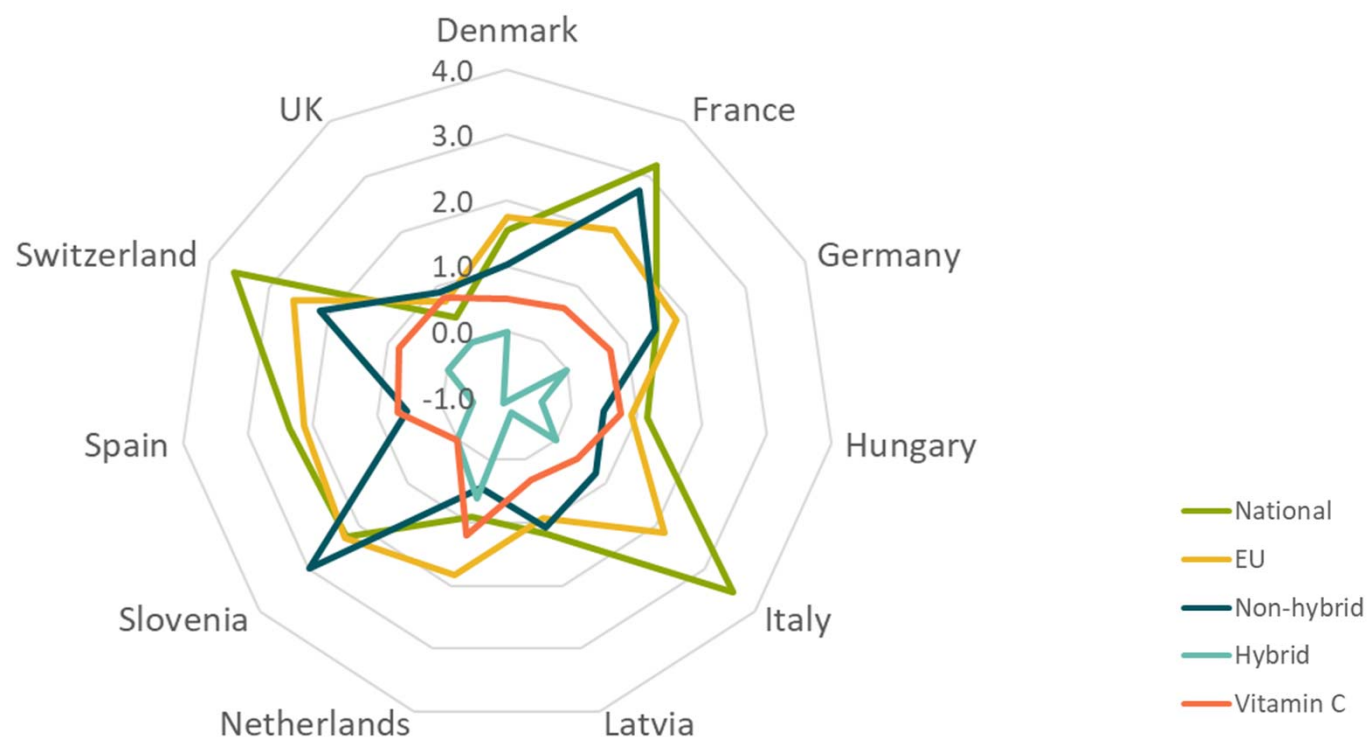


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# Consumers exhibited preferences for locally sourced products from non-hybrid seeds

Willigness to pay (WTP) in euro for origin, type of seeds and Vitamin C content



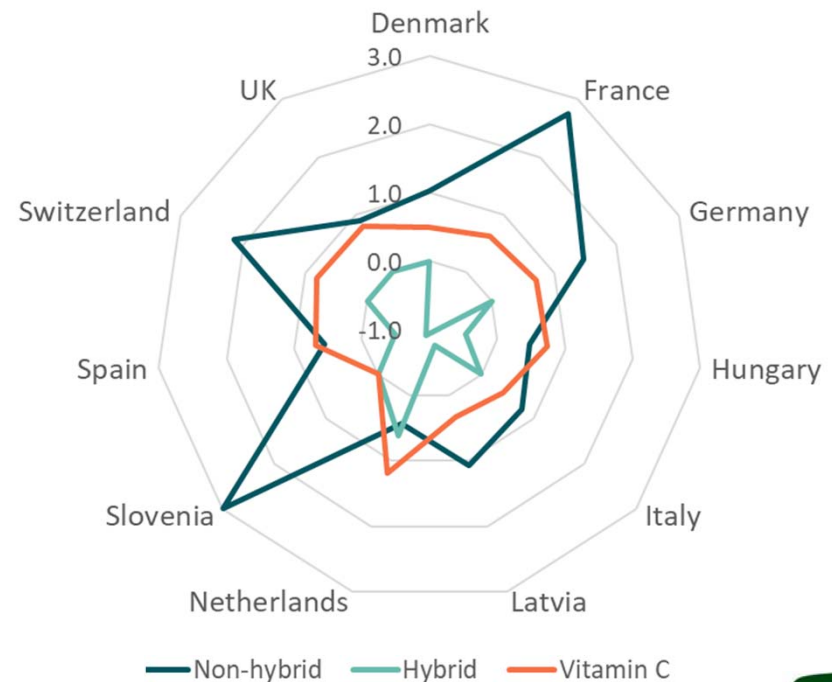
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# Consumers rejected using NPBTs in organic farming

- Preference for “natural” and “not manipulated” food products, no matter the claimed advantages.
- For example: Natural Vitamin C was valued, but not traded off to accept genetic techniques.

Willigness to pay (WTP) in euro for type of seeds and Vitamin C content



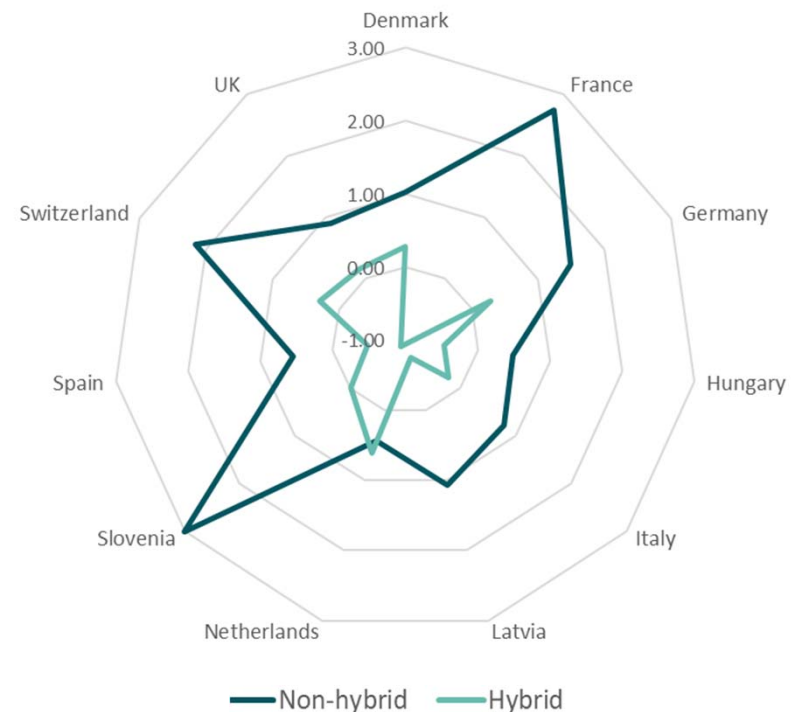
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# Higher preferences for non-hybrid, open pollinated seeds

- Indirectly favoured the use of seed-saving practices allowing the re-sowing of non-hybrid, unpatented seeds and, on average, preferring these to F1 hybrids

Williness to pay (WTP) in euro for type of seeds



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# Attitudes towards NPBT vary by gender, knowledge and organic consumption

- Gender influence attitudes: women are **significantly more hostile** to NPBTs than men.
- Respondents that are **more knowledgeable about organic food** have less favourable attitudes towards NPBTs.
- Being a **regular consumer** of organic food (i.e., more than 50% of household food purchases are organic) increases rejection of NPBTs.
- **Food neophobia** also increases rejection of NPBTs.



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# Consumers demand transparency

- There is a general lack of knowledge and information about NPBTs.
- As for GM food → consumers demand transparency and ask for a labelling scheme if products from NPBT seeds would be allowed on the market.



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## Practical recommendations

- To meet consumer demand → act in a precautionary and **transparent** way concerning the origin and quality of the seeds used.
- Planting **non-hybrid**, farm-saved seed → competitive advantages for farmers.
  - Loyal consumers may be **willing to pay up to 50% more** for final products if these products would be distinguishable on the market.
- Processors and retailers → successfully differentiate by **clearly labelling** food products made of vegetable ingredients from non-hybrid seeds.



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## Now lets vote

- Should organic farming permit the use of New Plant Breeding Techniques?
- Yes / No / I don't know



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# Thank you for listening

## QA and discussion



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