

Concepts and Values in organic agriculture relevant to plant breeding techniques

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The Netherlands, OSA 2008



Plant breeding techniques

OA and its certification system are process based.

So, also the breeding process should comply with OA principles

> How to assess, what criteria?



Outline of this presentation

- Societal context of ethical discussions in Europe
- Concept of naturalness
- Concept of integrity of plants
- Consequences for organic plant breeding



Developments in EU Organic Agriculture

■ Ban on GMOs

- required underlying viewpoints and criteria to assess also other breeding techniques on their compatibility for organic plant breeding (*in-vitro* techniques, etc)

■ New generation of GMO techniques (cis- or intragenesis, etc).

- How to assess them for OA? Product or process based?

Ethical discussions in agriculture in NL

- 1981 intrinsic value of animals became an issue in Dutch politics
- 1992 concept of integrity of animals was introduced;
- 1993 State Commission explored ethical aspects of plant biotechnology;
- 2007 Animal Party in Dutch parliament!

Societal context

There is an ongoing shift in society towards a biocentric bio-ethical frame work of action:

- Anthropocentric – (only) people are ethically relevant
- Zoocentric - also higher animals
- Biocentric - all living entities
- Ecocentric - including ecosystems

Ethically relevant

Ethically relevant implies, that:

- respect for their 'otherness', their dignity, their autonomy, or their intrinsic value is taken into account.

And that has consequences for the way of interference/handling in agriculture.



Concept of naturalness

Organic agriculture claims to be more 'natural' than conventional agriculture.

The concept of naturalness includes
(Verhoog et al., 2002):

- non-chemical approach;
- agro-ecological approach;
- integrity of life approach.

Non-chemical approach

- Soil bound production, no artificial growing media
(no hydroponics, no *in-vitro* culture);
- Organic fertilizers
(no mineral fertilisers; no synthetic growth hormones);
- Organic crop protectants
(no synthetic-chemical pesticides);
- Organic seed treatments
(no post-harvest chemical treatments);
- Mechanical weed management
(no chemical-synthetic herbicides).

Agro-ecological approach

- Managing a farm as an agro-ecosystem
- Striving for a closed nutrient cycle
- Stimulating a high degree of internal self regulation
- Exploiting and supporting biodiversity at all levels:
 - farm
 - crop
 - between and within varieties.



Integrity of life approach (1)

- Integrity of life is the operational dimension of the concept of intrinsic value (value or worth of a living entity as such vs the extrinsic/instrumental value),
- Integrity of cultivated plants refers to their inherent nature, wholeness, completeness, species-specific characteristics, and their being in balance with their (organically farmed) environment.

Integrity of life approach (2)

In organic chicken husbandry respect for integrity of life leads to:

- no debeaking
- free range,

so that chicken can act according to their natural behavior.



Integrity of plants

Integrity of life on four levels:

- life-typic - autonomy, self-regulation & self-reproduction ability
- plant-typic - ability to adapt to & interact with its environment
- genotypic - reproductive barriers
- phenotypic - balanced crop and seed production



Assessment of breeding techniques for OA

Are breeding techniques in compliance with the concept of naturalness?

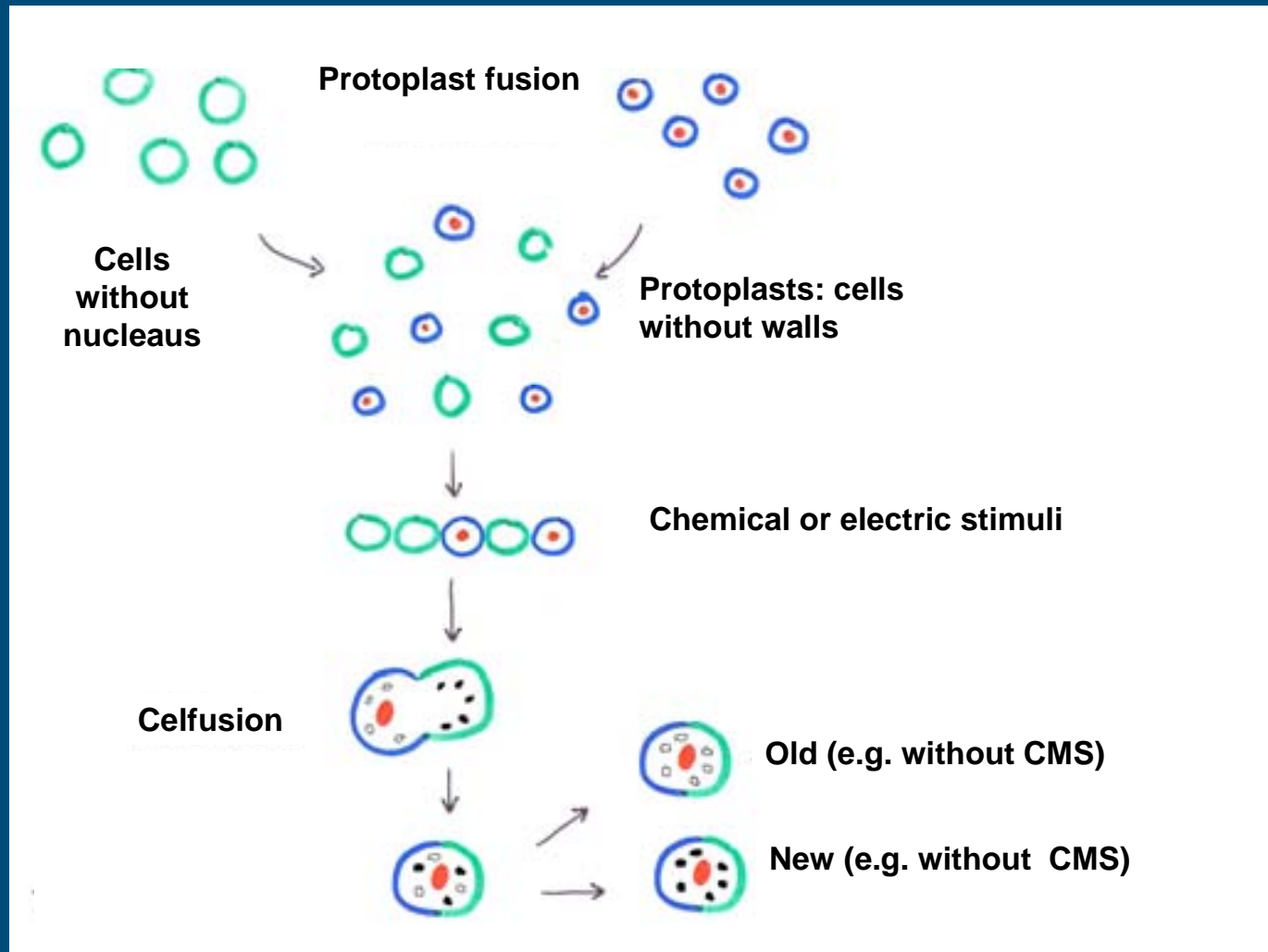


Plant level – yes;

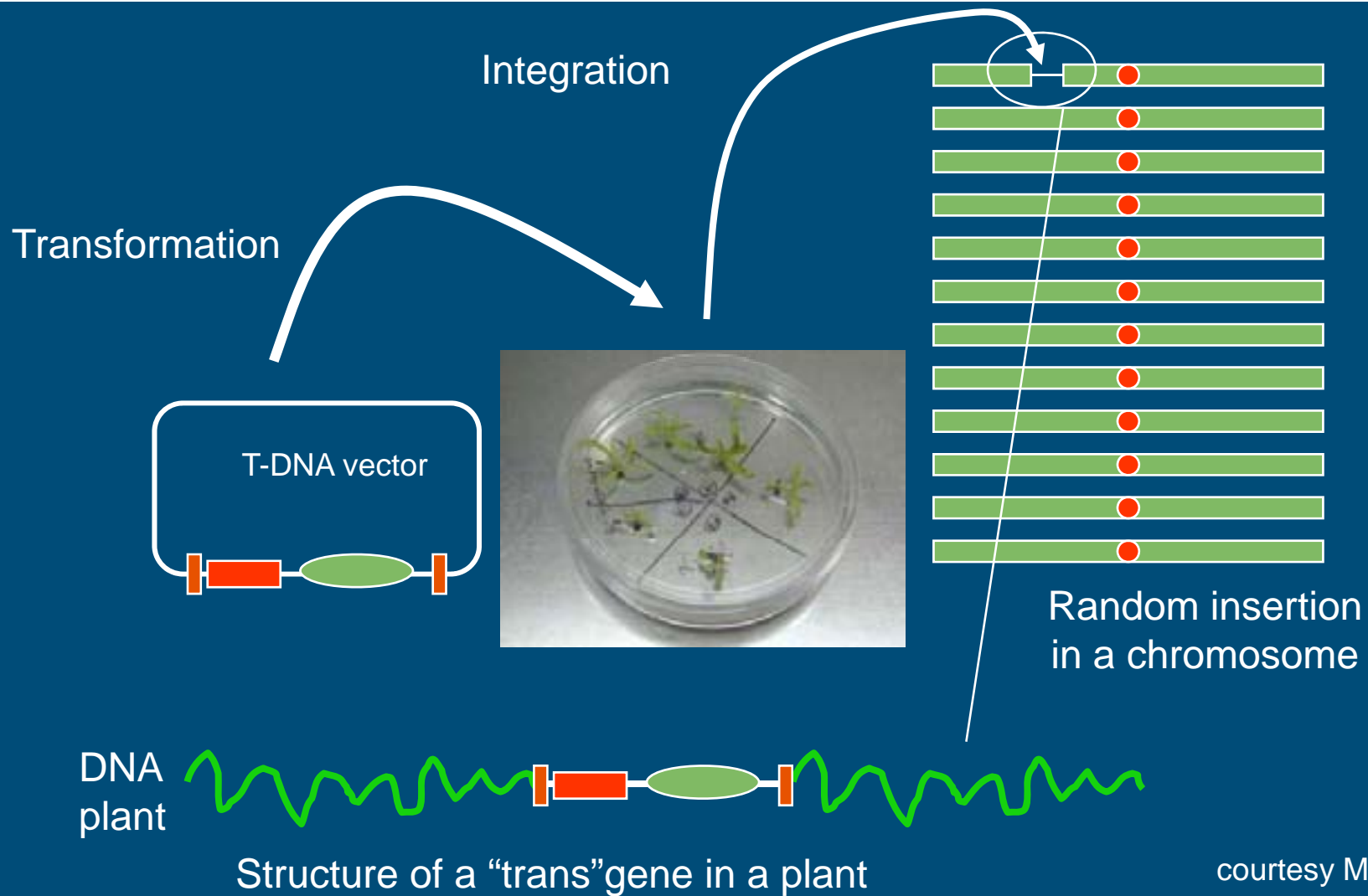


Cell level – doubtful;

Breeding beyond whole cell level: no!



Breeding directly at DNA level: NO!



Applying criteria to plant breeding techniques (1)

Organization level	Approaches (partly cumulative)		
	Non-chemical	Agro-ecological	Integrity
Plant/crop level	+	++	+++
(Organized) cell level	+ or –	+ or – –	– – –
DNA level	–	– –	– – –

Applying criteria to plant breeding techniques (2)

Organization level

Approaches (partly cumulative)

Non-

Agro-

chemical

ecological

Integrity

Plant/crop level

+

++

+++

(Organized) cell level

+ or -

+ or --

DNA level

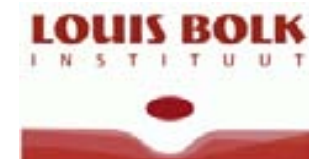
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under discussion



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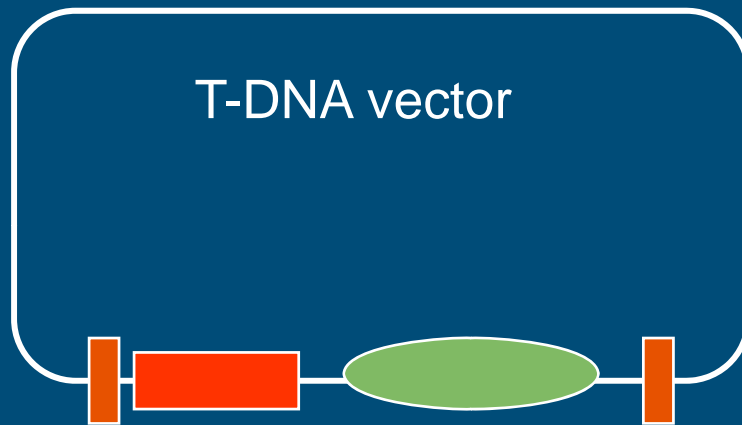


Consequences for IFOAM draft standards (1)

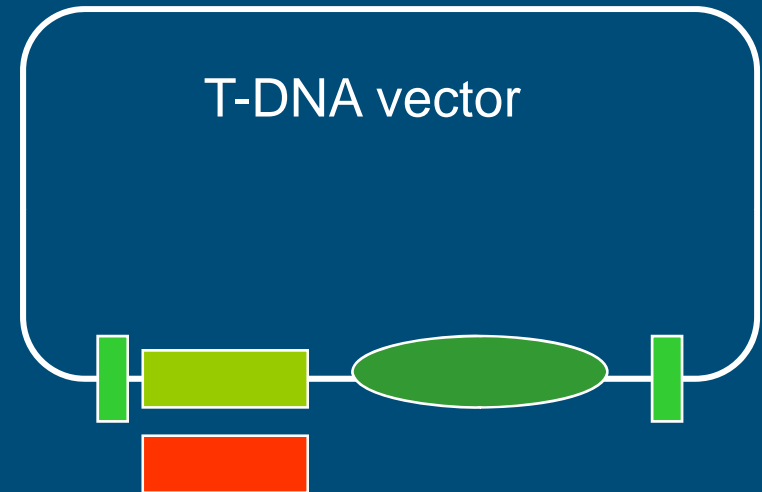
- Breeding, maintenance and propagation under organic conditions;
- Only those techniques that allow crossing, pollination, fertilization and seed formation on the whole plant itself under organic growing conditions;
- Respect for natural crossing barriers;
- No in-vitro techniques, no protoplast fusion, no GMOs;
- No male sterility (cms) without restorer genes;
- No patents on life, and respecting farmers' and breeders' rights.

Novel techniques: Cis- or intragenesis = GM=no

Trans-gene Vector



Cis-gene Vector



 Plant-derived T-DNA transfer fragments

 Plant-derived selection marker

 "Cis" gene

courtesy Michel Haring

Cisgenesis and EU definition of GMO

- EU regulation on GMOs is both product and process based!
- Only two categories: GMO and non-GMO

regulated (transgenesis)

non-regulated
(protoplastfusion,
mutagenesis)



Cisgenesis and EU definition of GMO

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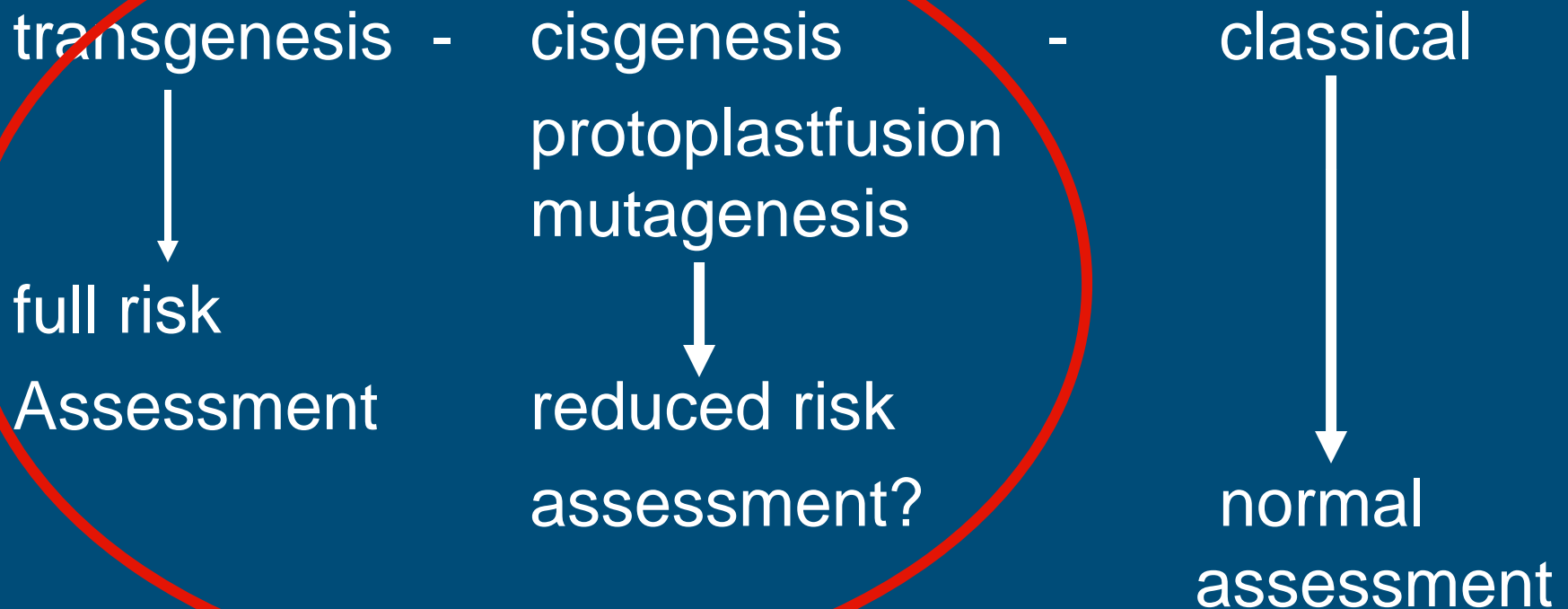
including cisgenesis

?



New GMO categories?

More GMO categories?



Rommens et al., Trends in Plant Science 12 (9): 377-432

Completely new variety assortment?

The degree of overlap between conventional and organic suited varieties depends on:

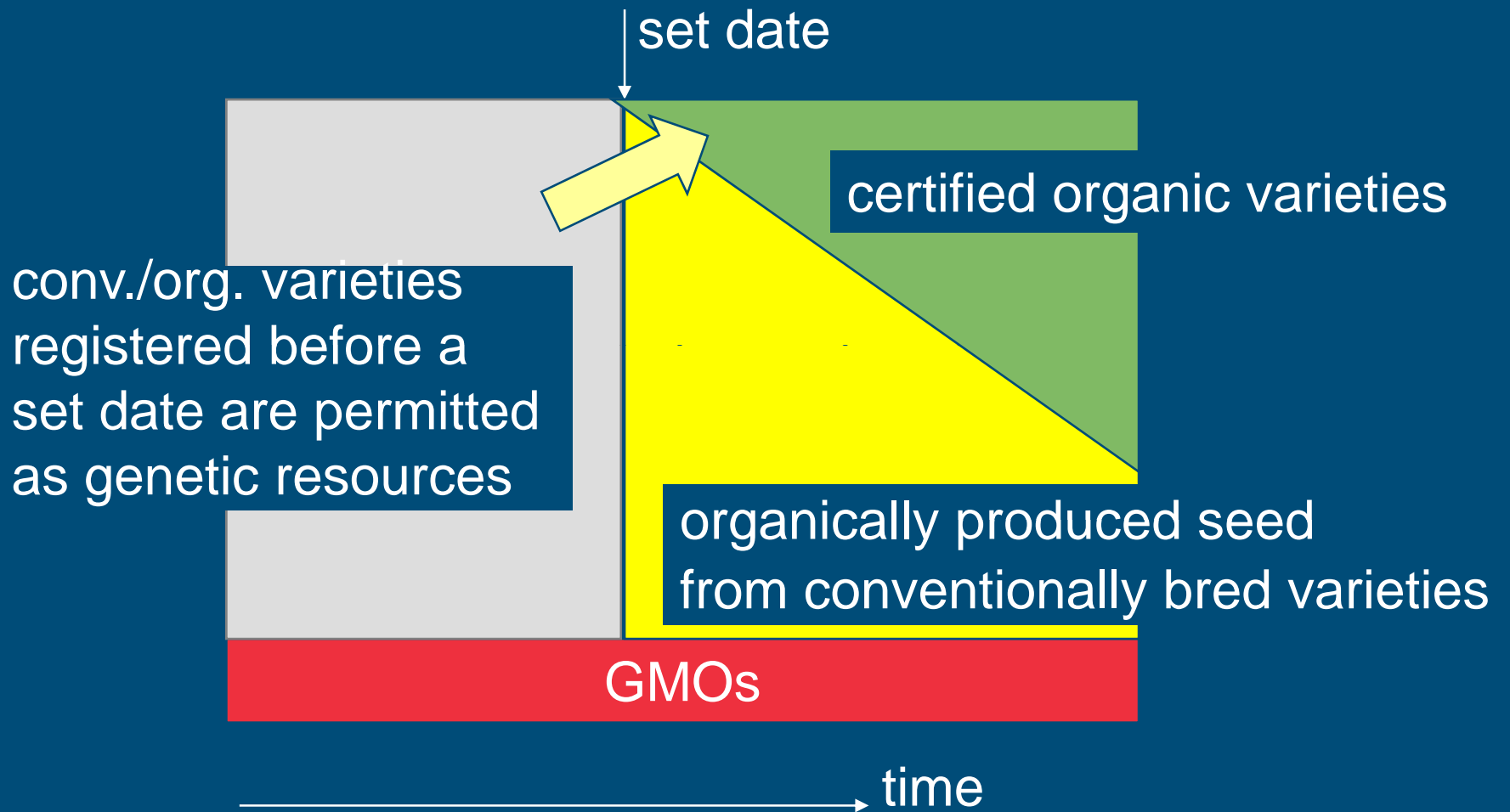
- the crop requirements
- applied breeding techniques



Development over time

Time	Activity	Product
Current	no use of gmo's no chem. seed treatments	conv. varieties, untreated seeds
Short term	organic propagation org. seed treatment	conv. varieties, org. propagation
Mid term	organic variety-testing including ecological criteria in conv. breeding programmes	low-input varieties org. propagation
Long term	whole breeding cycle organic incl. concept of integrity	organic varieties organic seeds

Future?



Pluralism in society: different approaches

- Regulations, norms, standards are derived from underlying values.
- Evaluation of values from time to time, see IFOAM process of Principles 2005.
- Intrinsic value and respect for integrity of living entities only makes sense from a holistic point of view.

Conclusions

- OA is in development and requires improved varieties better adapted to the ecological and ethical principles of OA.
- OA challenges science to support the development of alternative, plant-worthy breeding concepts and strategies!

