

# Principles and pathways in breeding for organic agriculture

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# What is organic breeding?

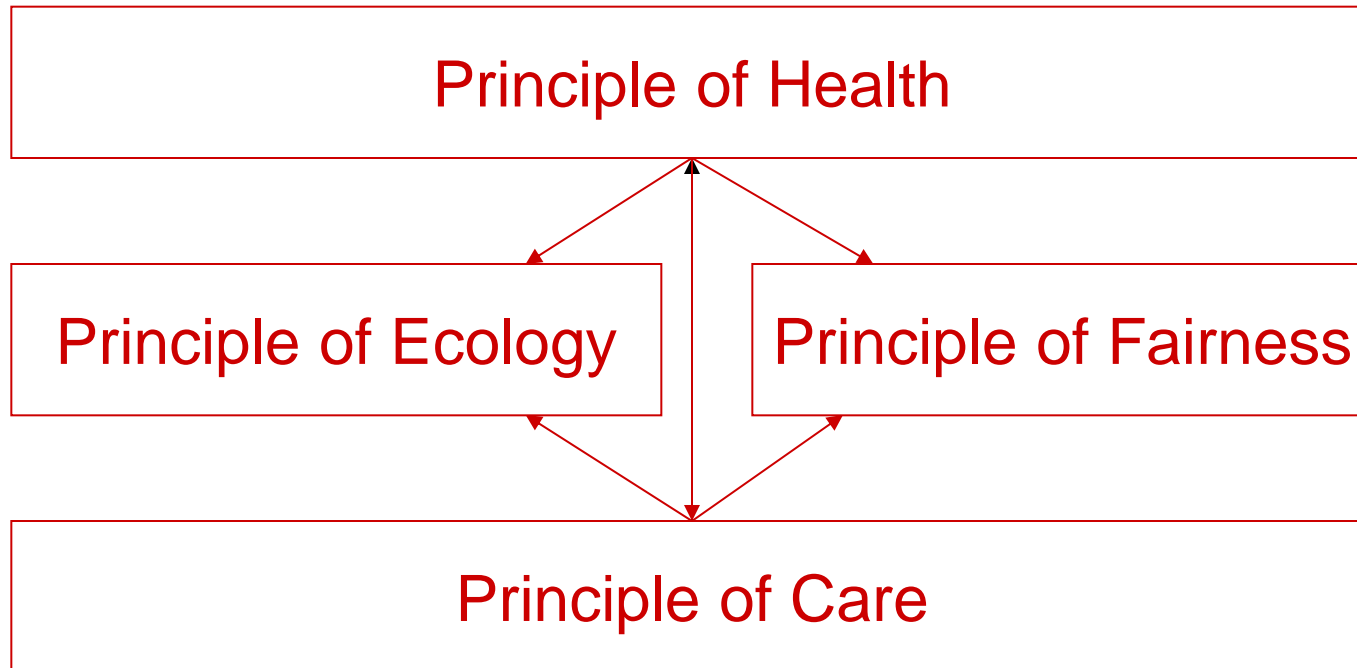


- Translation of IFOAM principles to plant breeding
- Type of varieties used in organic farming
- Developments in plant breeding
- Possible pathways for organic breeding

# The four IFOAM principles



What is the result when applying the IFOAM principles to plant breeding?



# Translating the four IFOAM principles in plant breeding



- Varieties that can do without chemical fertiliser & pesticides
- Varieties that produce high quality, nutritious food

## Principle of health

Respect for integrity of the plant, ecosystems *and* society from a holistic perspective

Principle of ecology

Principle of fairness

Principle of care

# Translating the four IFOAM principles in plant breeding



- Nutrient efficient varieties adapted to local environments
- Varieties that are beneficial to the environment and contribute to diversity

Principle of health

**Principle of ecology**  
Integrated approaches  
Maintain diversity

Principle of fairness

Principle of care

# Translating the four IFOAM principles in plant breeding



- Breeding approaches that involve all value chain actors
- Maintenance of diversity for future generations
- Access to genetic resources (no patents)

Principle of health

Principle of ecology

**Principle of fairness**  
Include socio-economic aspects

Principle of care

# Translating the four IFOAM principles in plant breeding



- Precautionary approach to breeding (e.g. no GMOs)
- Transparent and participatory / collaborative processes

Principle of health

Principle of ecology

Principle of fairness

**Principle of care**

Prevention of risk

Integration of scientific and practical knowledge

# What type of varieties are used in organic farming?



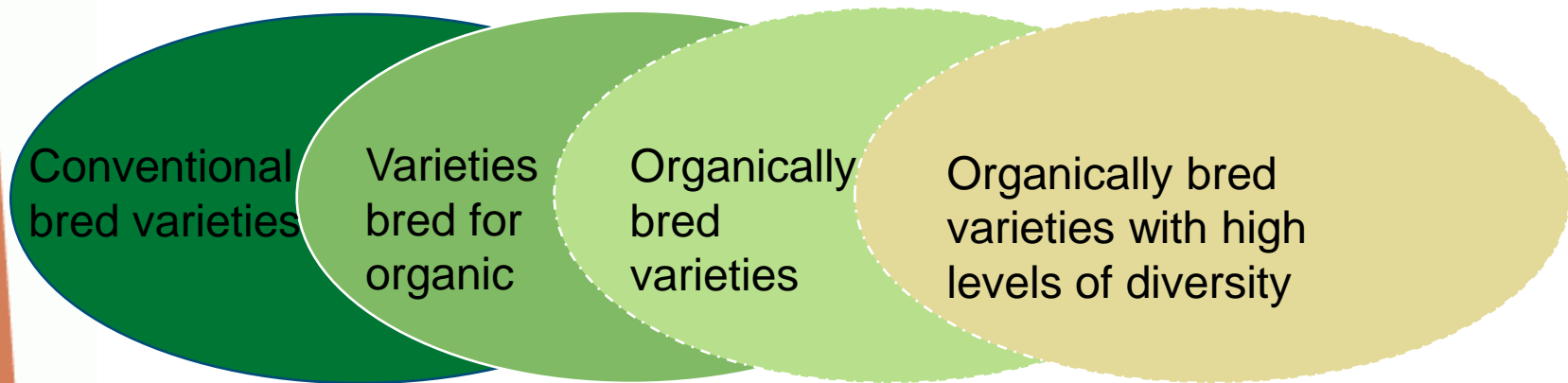
- Conventional bred varieties (without GMO)
  - Often F1 hybrids, exception for artificial Cytoplasmatic Male Sterility (CMS) based on cytoplasm fusion
  - Seeds organically produced or untreated
- Varieties bred for organic farming
  - Often F1 hybrids, without artificial CMS
  - Organically produced
- Organically bred varieties
  - Often Open Pollinated (OP) varieties
  - Heterogenous material (CCPs): Bred with 'alternative' breeding approaches aimed at more diversity
  - Organically produced
  - By organic breeders and/or farmers



# Some overlap between these groups



- The degree of overlap between the types of varieties depends on:
  - Diversity in applied breeding techniques
  - Diversity in breeding goals / philosophy
  - Diversity in crop traits aimed for



# Current developments in plant breeding



- Breeding is becoming more and more technical / molecular science, focused on improving traits
  - From open to closed system (e.g. patents)
    - Regulations first to protect the farmer/community, now to protect the companies
  - From many small to a few big players
  - From low-cost to increasingly capital-intensive
- These developments are not in favour of organic breeding

And also not in favour of conventional breeding

# Breeding costs increase rapidly



## Example: Estimated breeding costs for potato in the Netherlands

Year	Real (in k€)	3% inflation since 1990 (in k€)	Real increase in costs since 1990
1990	25	25	
2000	50	34	49%
2010	125	45	177%
2020 (prognosis)	250	61	312%

- Estimated annual increase in potato yield through breeding is **0.1%**

# Possible pathways for organic breeding



- Perspectives on breeding approaches
- Integrating socio-economic aspects

# From focus on traits to systems



## Aggregation levels in breeding

Systems breeding



Plant breeding



Trait breeding

A challenge  
for the  
future

# Systems varieties: a holistic perspective



for weed suppression



for straw, compost



for healthy food



for soil structure  
and quality

# Can we build bridges between breeding approaches?

Systems breeding

Plant breeding

Trait breeding



Society / policy

Systems  
breeding

Plant/Crop  
breeding

Trait/gene  
breeding

# New models, new approaches



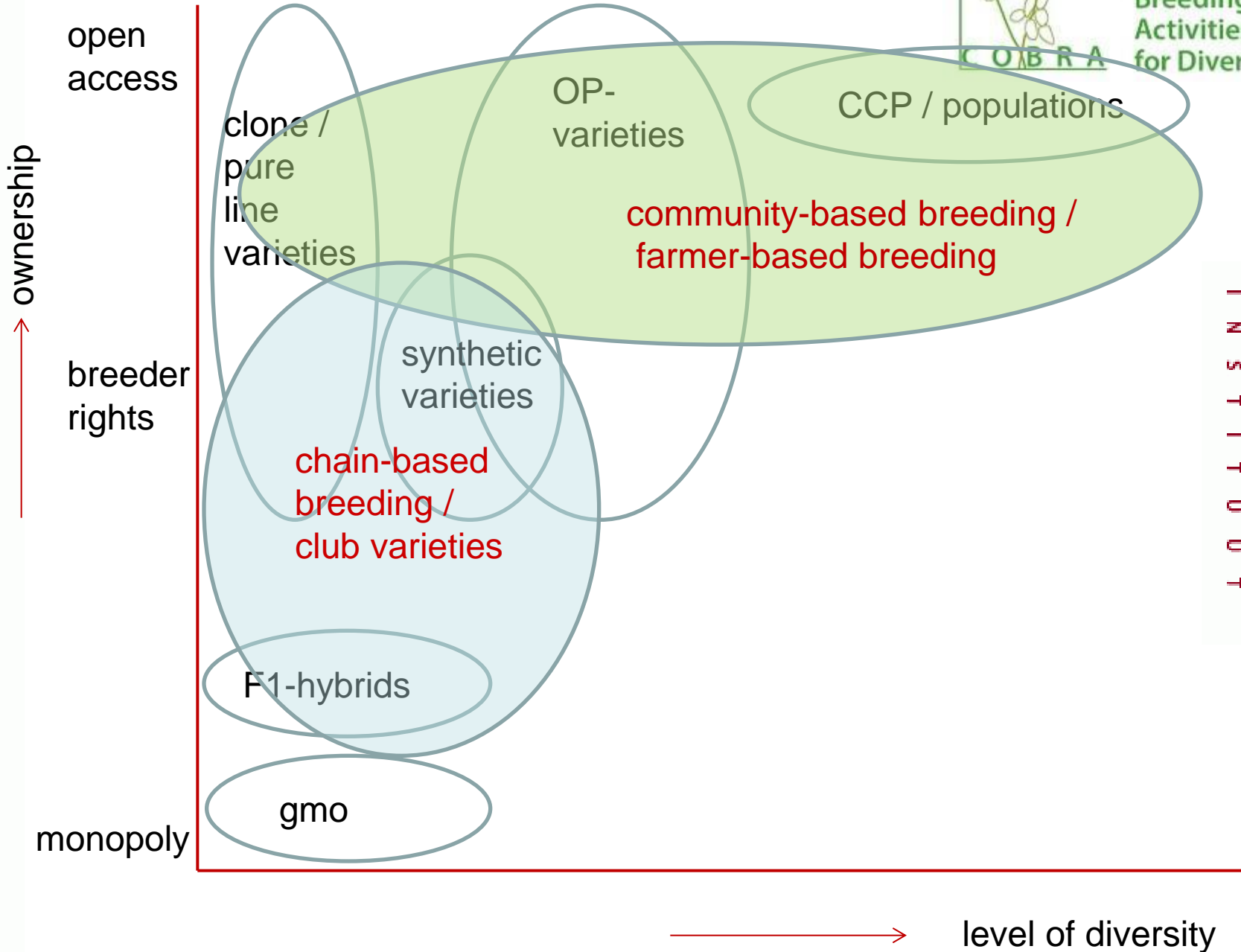
- How to stimulate breeding for organic agriculture?
- How to organise and finance breeding?
  - for more diverse, regional adapted varieties?
- Need for new pathways / models, such as:
  - Chain-based breeding
  - Community-based breeding, for example:
    - Farmer-based breeding
- Can be considered different types of system breeding



# Two main alternative models

- Chain-based breeding
  - Shared economic interest
  - Design approach, aimed at particular product
  - Example: club varieties tomato / apple
- Community-based breeding
  - Shared culture
  - Idea driven, multiple options, process important
  - Example: Kultuursaaf in Germany
- Often, crop specific models needed

# Various pathways in breeding



# Any Questions?



**LOUIS BOLK**  
I N S T I T U U T