



## Biggest challenges and research gaps for organic plant breeding in the Global South

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# TiPI: Common Goals to be achieved

- Empower rural areas
- Provide eco-functional intensification that produces food, while harnessing and re-generating eco-system services as well as strengthening resilience to climate change
- Provide food for the health and well-being available to all
- **Plant breeding is key to achieve these goals** but it need to be developed together with improved soil and crop management adjusted to local conditions and demands
- Plant breeding and new technologies like robotics will allow more diverse farming systems optimizing ecosystem services and higher self regulating capacity
- Decentralized participatory breeding approaches strengthens autonomy and self esteem of local farmers

# How can Organic Plant Breeding contribute

## Ecological intensification of organic production through

- Focused breeding for target environments with limited external inputs
- Selection for specific traits, like seed- borne diseases, weed competition
- Meeting market demand and expectation of farmers and consumer
- Alternative breeding programs refraining from genetic engineering and certain breeding techniques

## Enabling more sustainable food production systems through

- Large portfolio of crops on farm level to mitigate risks of crop failure
- Functional biodiversity on field level to reach high level of self regulation and closed nutrient cycle
- Safeguarding and evolving genetic resources for future generations

# Strategies for Organic Plant Breeding

## Combining breeding & agronomic innovations for Organic

### Breeding for increased diversity

- Breeding for diversity within cultivars
- Breeding for mixed cropping systems
- Breeding for improve diversity of associated soil microbes
- Decentralized participatory breeding for local conditions

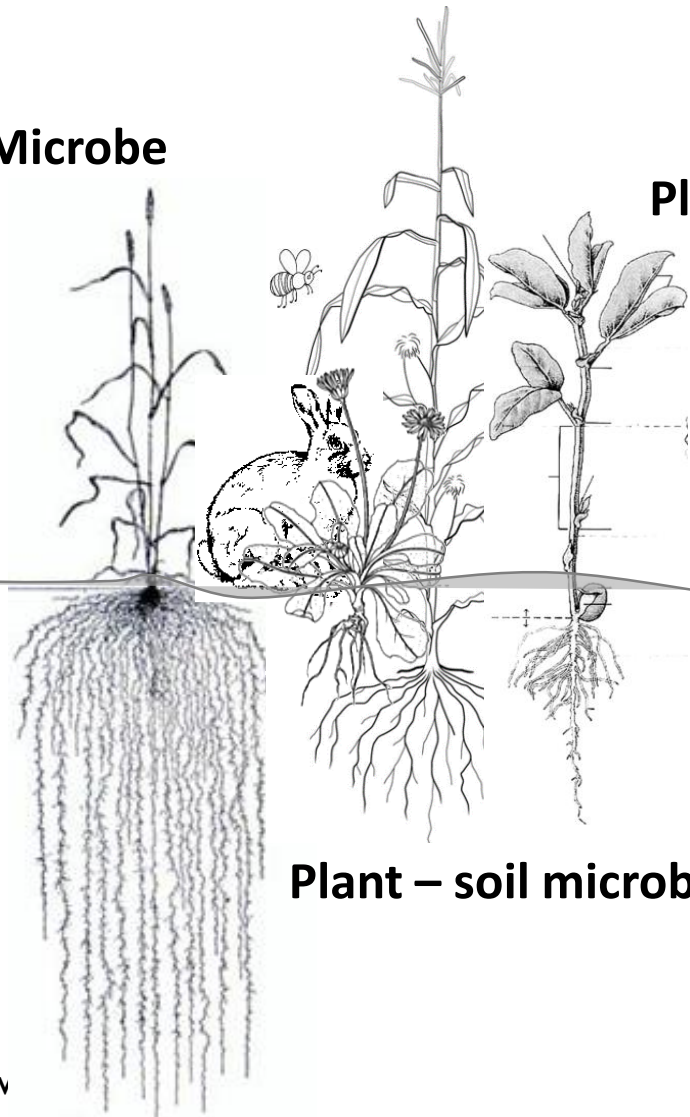
### Embedding diversity into markets

- Involving all stakeholders (farmer, value chain and community driven breeding)
- New concepts for the ownership of cultivars and their financing
- Changing regulatory framework to foster greater agrobiodiversity (official variety testing, seed regulation)
- Valorization of organic plant breeding along the value chain ([www.bioverita.org](http://www.bioverita.org))

# Breeding for mixed cropping systems to improve resilience of the system towards climate change

Plant – Fauna – Microbe  
Interaction

Plant – Plant Interaction



Plant – soil microbe Interaction

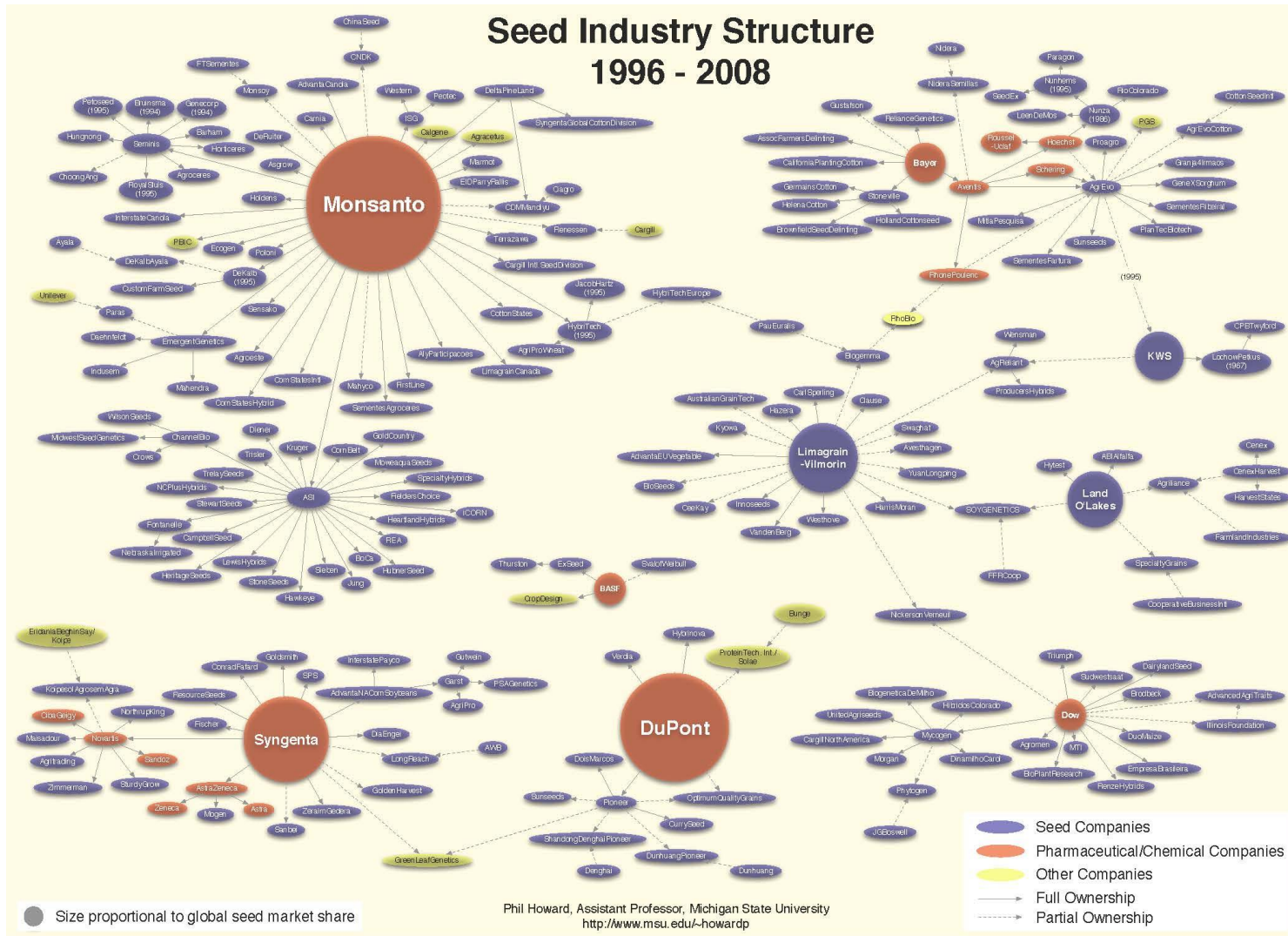
# Main Challenges to obtain high quality seed of cultivars adapted to organic agriculture

- Very limited breeding initiatives to develop improved cultivars that are adapted to organic farming conditions with slow release nutrient supply
- Breeding is dominated by commercial sector while public breeding programs get reduced personnel and financial resources
- Organic breeding initiatives are not well connected with each others and conventional breeders
- Missing funding for organic plant breeding and research as focus is on molecular breeding
- Participatory breeding approaches need to be installed involving the farmers, regional communities and value chain
- Capacity building and empowerment of female farmers
- Improve self esteem of farmers to be proud to be the person who is feeding the society to prevent brain drain to cities

# Main Challenges with respect to access to seeds

- **Concentration on the seed market**
  - Only 10 international companies control more than 60% of the commercial seed market
  - High influential power on seed regulation, UPOV regulation
  - Breeding is done for main crops that give good return of investment
  - Cultivars bred for broad adaptation and mainstream agriculture (one key fits all)
  - Overdominance of F1 hybrids to prevent farm saved seeds

# Concentration on global seed market



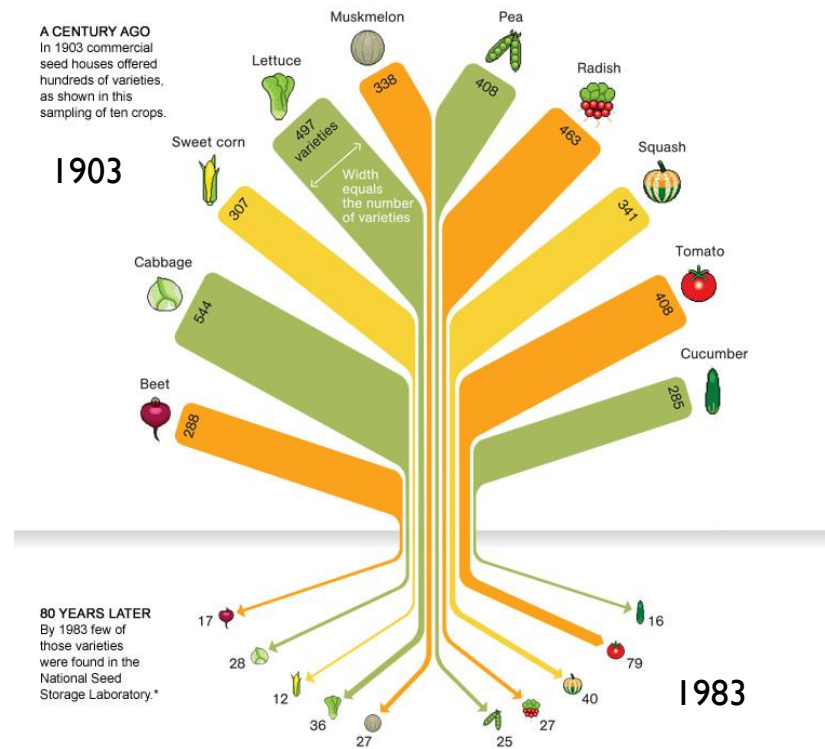
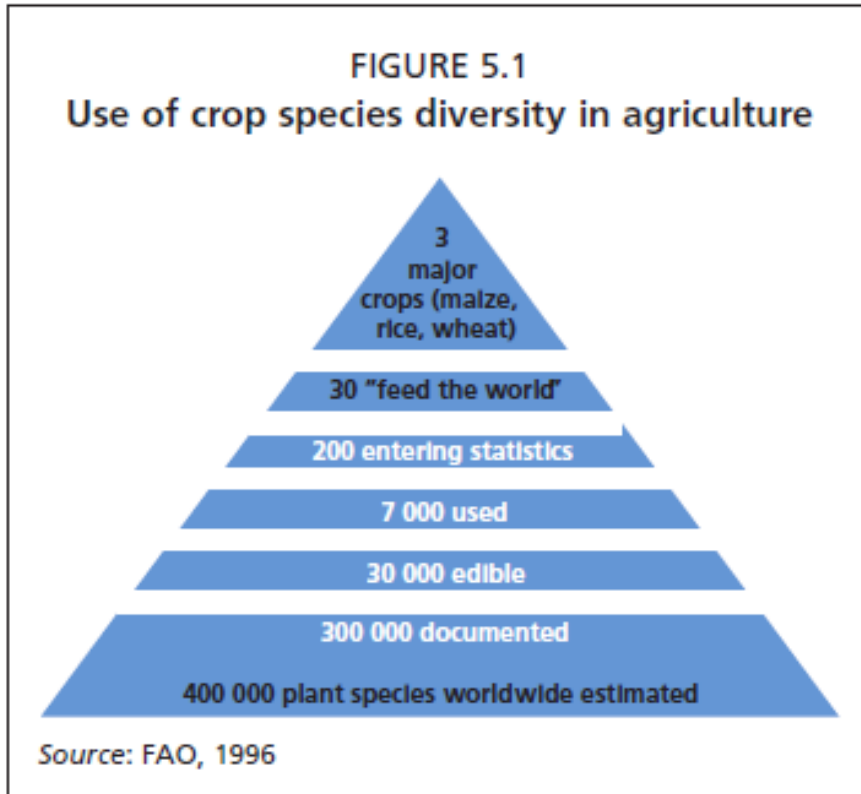
**FiBL** Howard, 2009, Visualizing Consolidation in the Global Seed Industry: 1996–2008 Sustainability  
[www.fibl.org](http://www.fibl.org)



# Main Challenges with respect to access to organic seed of adapted cultivars

- **Loss of genetic resources**
  - Many genetic resources get lost as landraces and farmers get replaced by modern FI hybrids
  - Public institutes withdraw more and more from breeding, seed multiplication, and gene bank collections
  - No systematic collection of farmers landraces and populations with local adaptation
    - If collected farmers are hesitant to provide seed, as they are afraid that it might be patented or someone else is commercialize it without benefit sharing with farmers
  - Small number of accessions are maintained in seed banks for in situ maintenance
  - Lack of secure storage facilities to safe seed (risk to loose a seed during storms, post havest losses (animals, insects, disease) and damage by moisture, heat)

# Reduced number of crops and cultivar per crops



*John Tomanio, NGM Staff Food Icons, Quickhoney, Source Rural Advancement Foundation International*

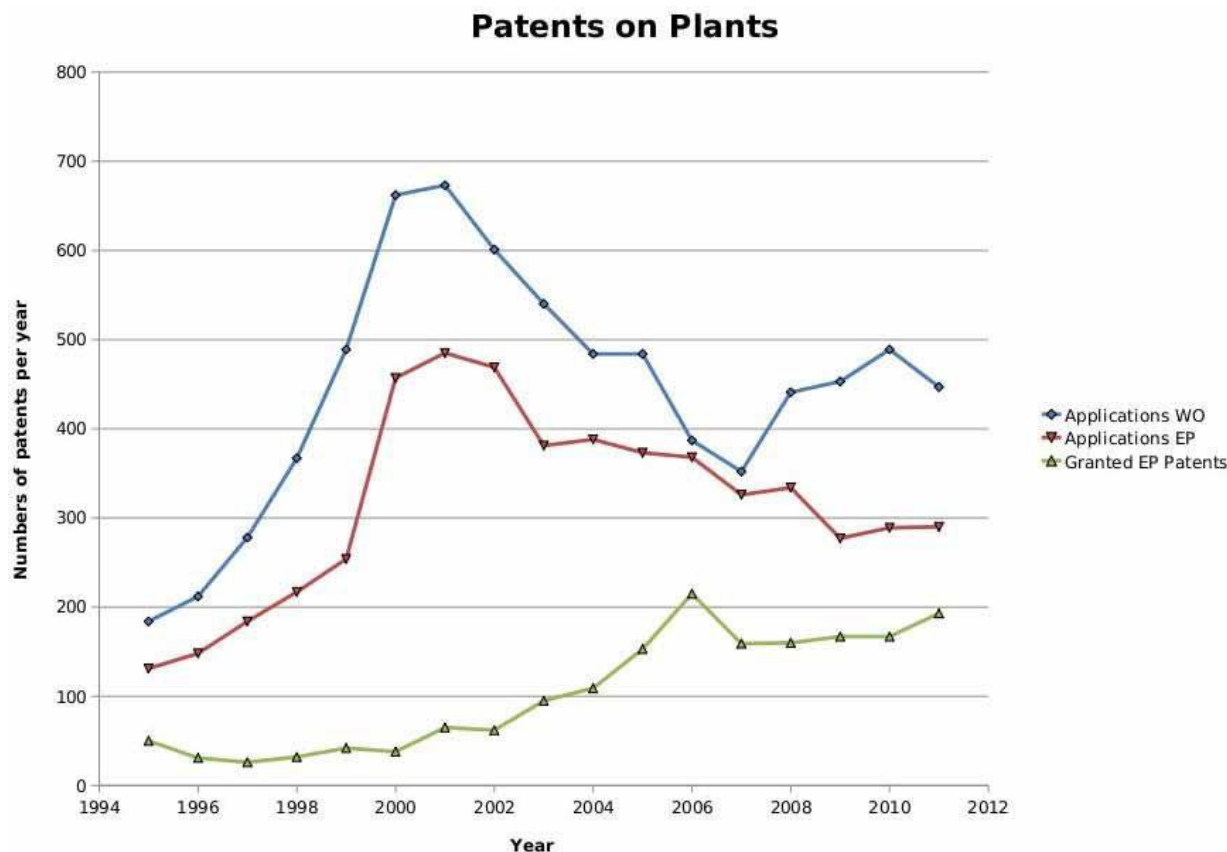
# Main Challenges with respect to access to organic seed of adapted cultivars

- **Legal restrictions as seed business is highly regulated**
  - Nagoya protocol:
    - genetic resources belong to the state, they need to provide permission to collect genetic resources (prior informed permission)
  - International Treaty for Plant Genetic Resources for Food and Agriculture (ITPGRFA) and Standard material transfer agreement (SMTA)
    - Multilateral systems, genetic resources entered there are available to all who participate
    - 1.1% of sales of products need to be paid in FAO funds

# Main Challenges with respect to access to organic seed of adapted cultivars

- **Legal restrictions as seed business is highly regulated**
  - International Union for the Protection of New Varieties of Plants (UPOV)
    - UPOV 1978: breeders privilege and farmers rights for farm saved seed
    - Enforcement of UPOV 1991: breeder privilege, restricted farmers rights, only released varieties can be commercialized
  - Patents on plant species, cultivars, traits, genes, breeding procedures
    - National variety testing
    - New, distinct, uniform, stable (DUS test)
    - Value for cultivation and Use (VCU) tested under high input farming conditions
  - National seed law

# Restriction of exchange of genetic material by IP rights



Overview of patent applications on plants under PCT/WIPO (WO) and at the EPO as well as of patents granted by the EPO. Research according to official classifications (IPC A01H or C12N001582).

Christoph Then & Ruth Tippe March 2012

[www.no-patents-on-seeds.org](http://www.no-patents-on-seeds.org)

**FiBL**

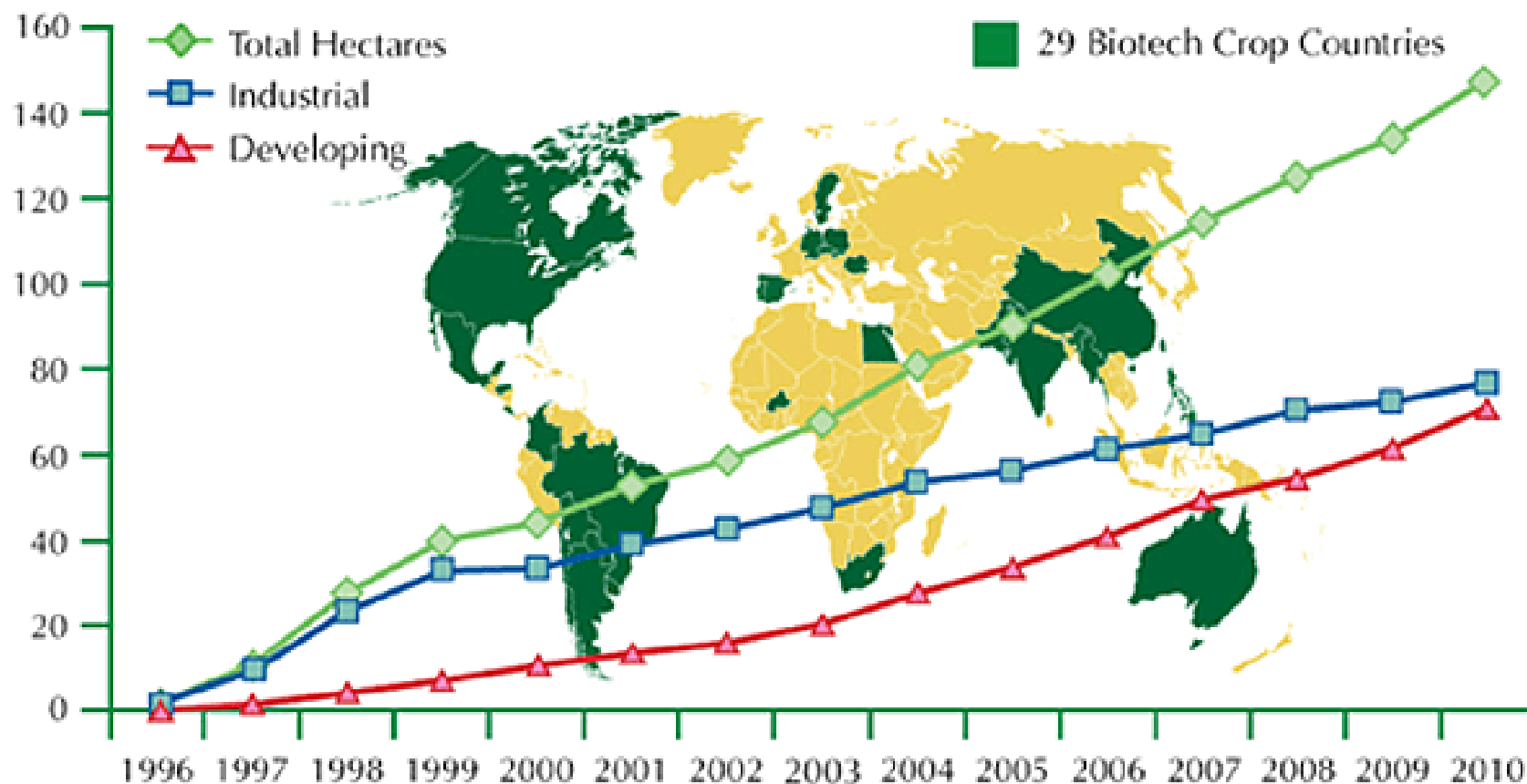
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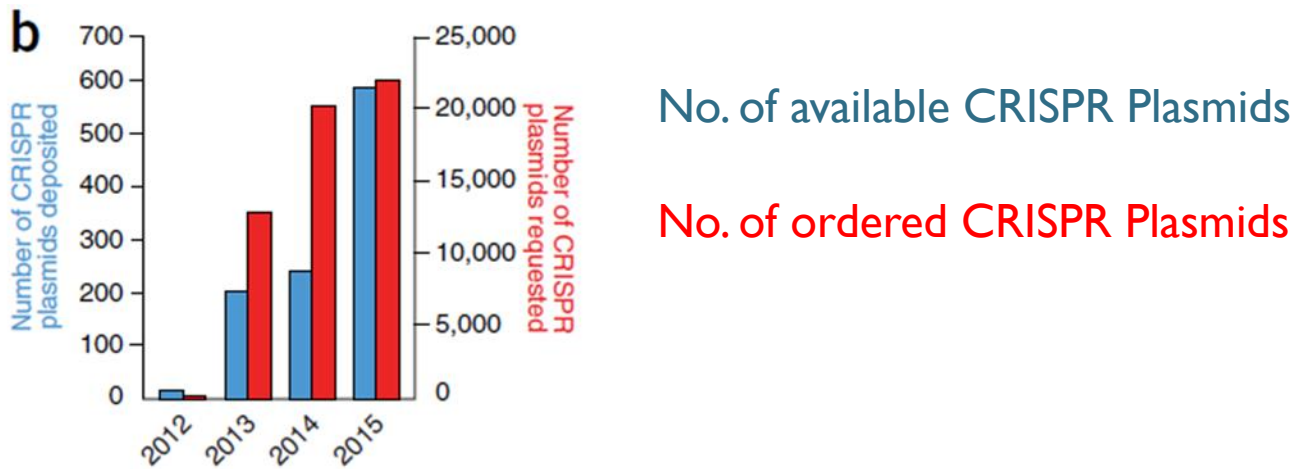
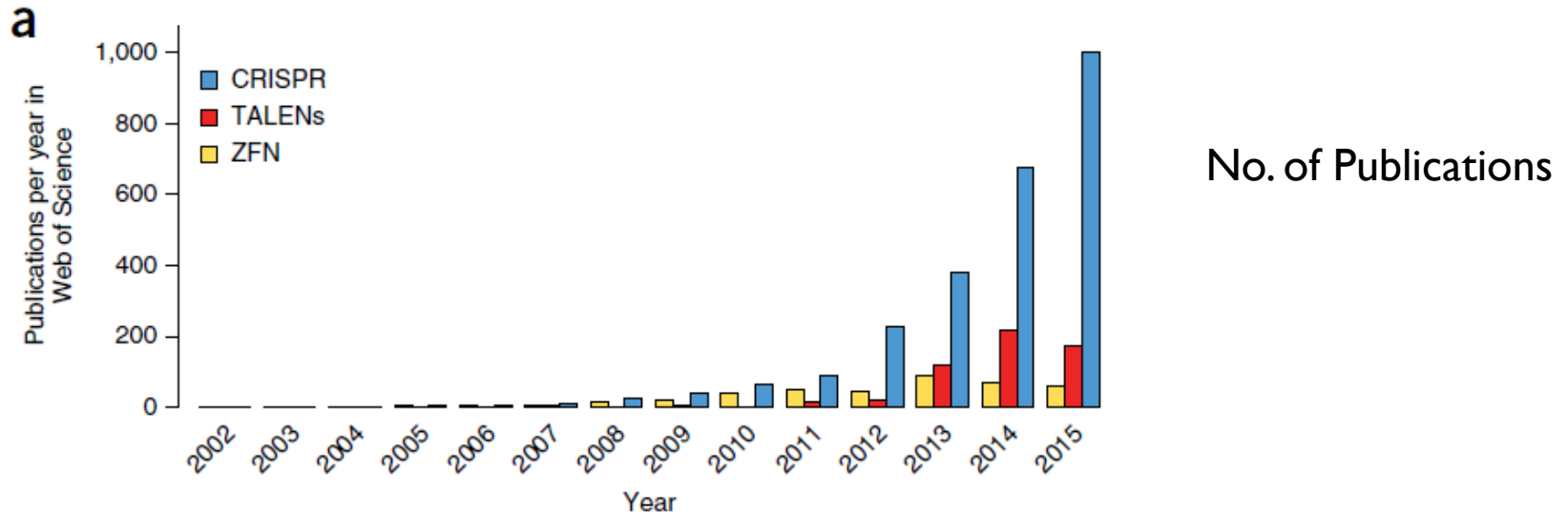
**Who will control the  
*Green Economy?*  
[www.etcgroup.org](http://www.etcgroup.org)**

# Increase of GM varieties

GLOBAL AREA OF BIOTECH CROPS  
Million Hectares (1996 - 2010)



# CRISPR-Cas9 Development



Barrangou R., Doudna J.A. (2016) Applications of CRISPR technologies in research and beyond. *Nature Biotechnology* 34:933

# Main Challenges with respect to access to organic seed of adapted cultivars

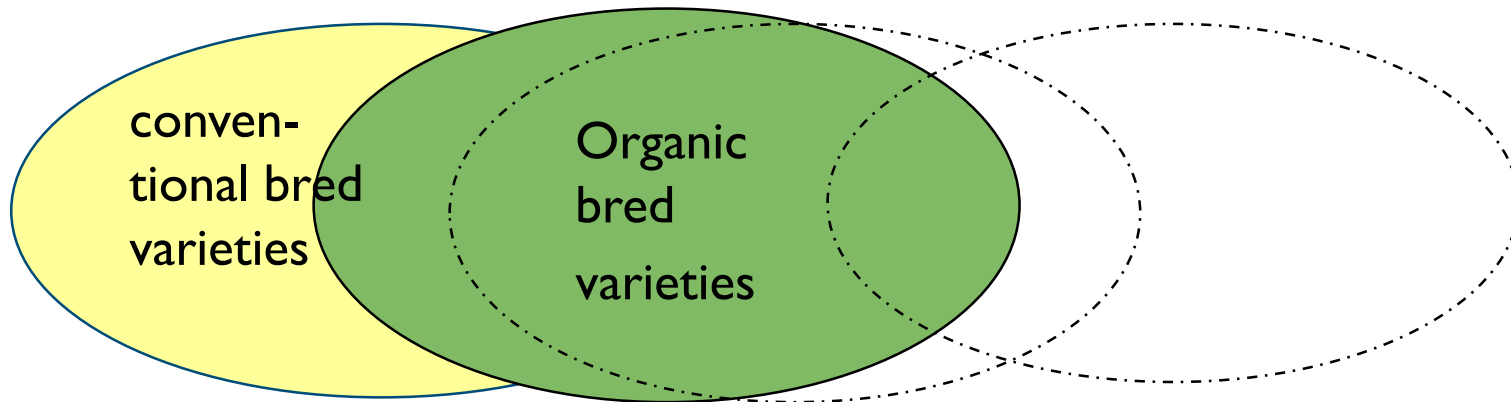
- **Fast spread of cultivars derived from breeding technologies not accepted by IFOAM International**
  - Discussion about these techniques binds many resources
  - Common position on GMO and new genetic engineering techniques
    - But is this position also supported by the organic farmers in different regions, do they know about it? Who informs them?
    - Cell fusion are banned by IFOAM in 2008 but 10 years later only few label organisations in Europe have actually put this ban into force
  - GMO crops take over seed market (e.g. Bt-cotton, RR-soybean, Bt-maize, ...), non GM crops disappear from the local markets
  - Contamination of seed
  - No strategy to main genetic germplasm GMO free



# Drift between conventional and organic plant breeding

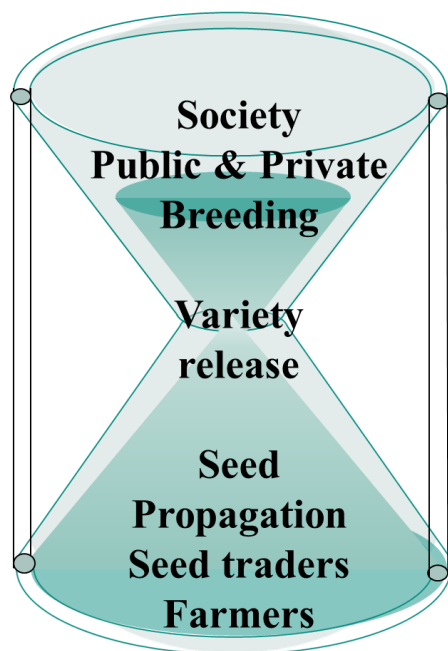
The degree of overlap between conventional and organic suited cultivars depends on:

- Breeding goals & philosophy, Selection environment
- applied breeding techniques



# Participatory Cultivar Evaluation and Participatory Breeding as a viable Alternative to Seed Monopoly

## Formal plant breeding and seed supply



One Way  
Information:  
Scientist

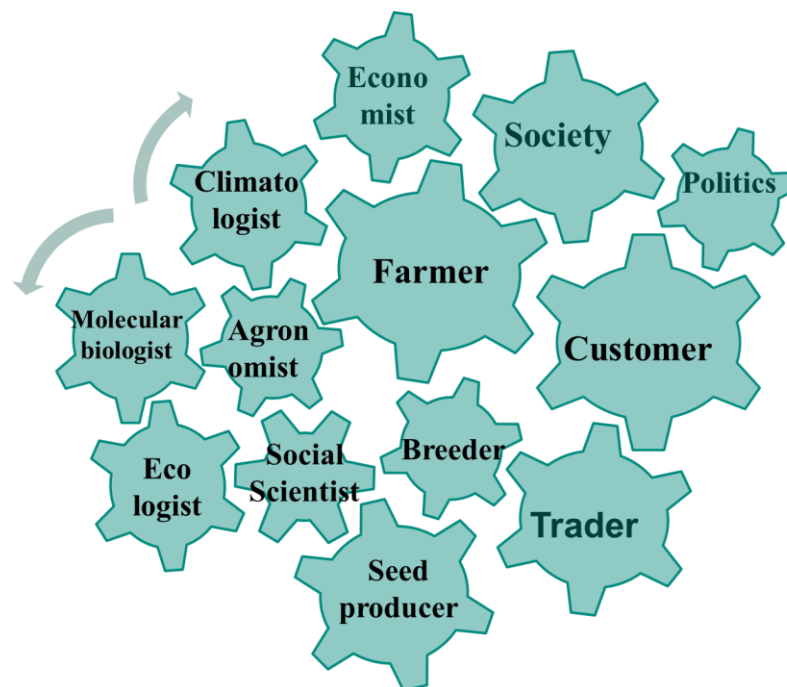


Extension  
Service

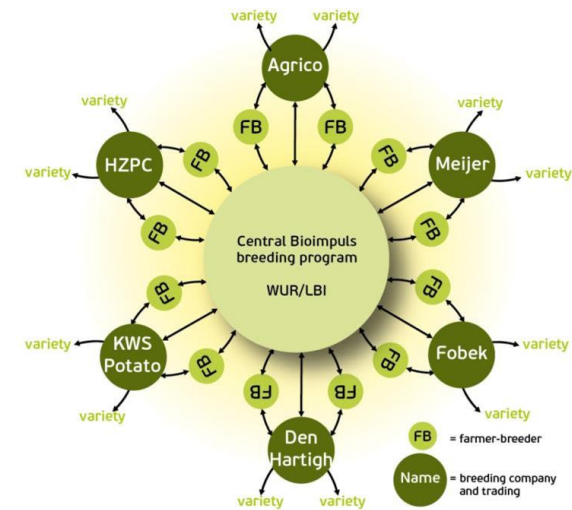
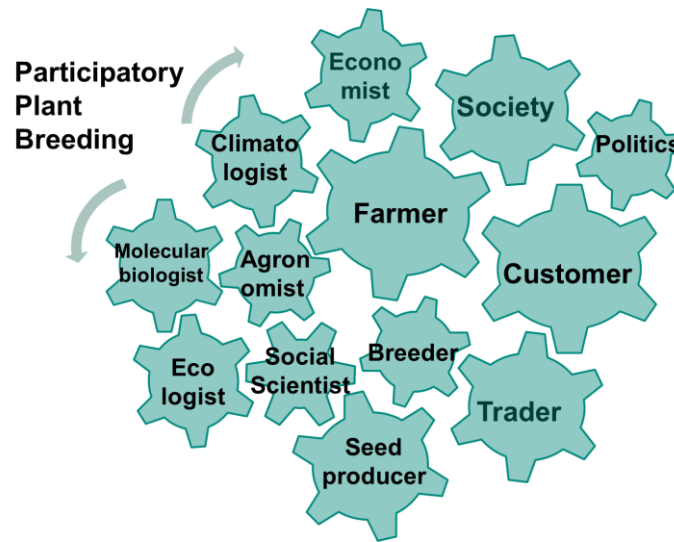


Farmer

## Participatory plant breeding and seed multiplication



# Decentralized Participatory Plant Breeding



**Needs strong facilitator** to steer collaboration process, identify common goals and conflict of interest, translate between different actors, keeping collaboration and exchange moving

Green Cotton Project (2013-2021): Participatory cotton breeding in India  
[www.greencotton.org](http://www.greencotton.org)

Bioimpuls Programme 2009-2013: Perspectives on Phytophthora-resistant potato varieties, *Lammerts van Bueren et. al. 2013 Brochure*

# Capacity building





**founded as a result of last Pre-conference on Organic Seed in Istanbul in 2014 to move forward on the issue of seed and plant breeding in Organic Agriculture**

- Support IFOAM World Board on all topics related to seed and plant breeding
- Connecting different seed and breeding initiatives
- Start global discussion on relevant topics
- Join forces for lobbying
- Integrate seed topics in IFOAM World Conferences
- Membership open for organisations (individuals) on all continents for good representation of the organic seed and plant breeding issues

**IFOAM Seeds Platform <info@seeds.ifoam.bio>**  
<https://www.ifoam.bio/pt/sector-platforms/ifoam-seeds-platform>

# Coordinated research for organic seed and plant breeding



**35 partners**  
**14 linked parties**  
**18 countries**

23 breeding & research institutes  
7 breeding companies  
8 seed companies  
11 organic associations

# Roadmap for organic seed of locally adapted cultivars

- Mobilise resources and finances!!!!
- Political lobbying for organic farming and the need for special cultivars
- Political awareness for improvement of legal regulations to improve access to seed and planting material
- Local capacity building and international networking
- Define priorities of crops and breeding goals for given region
- Identify local farmers and stakeholders to set up a seed and breeding network
- Identify enthusiastic facilitator !!

Normal people just see a seed:



Gardeners see the dreams within:



Joseph Tychonievich

**Thanks a lot for  
your attention**

**Come and visit us at the special  
exhibition on organic plant and  
animal breeding**

**ORGANIC RIGHT FROM THE  
START!**

**And meet several breeding initiatives  
and presentations on breeding**

**Messe Entrance: Mitte Foyer**



# seed summit

OCTOBER 7TH 2016  
HAMBURG

## SEEDING & BREEDING THE FUTURE OF ORGANIC COTTON



# Main Challenges with respect to access to organic seed of adapted cultivars

- **Financing of organic plant breeding programs**
  - Who owns the seed: open source, common good of defined community, national authorities, commercial companies, NPO
  - Who pays for plant breeding: until now farmers pay licences on seed sale to finance investment in breeding
  - For organic breeding initiatives 0 to max 15% is covered by licence derived from seed sale, more than 70% foundations

# Contact

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# Level of participatory research

## Conventional

Research managed on station  
or on farm trials

## Consultative

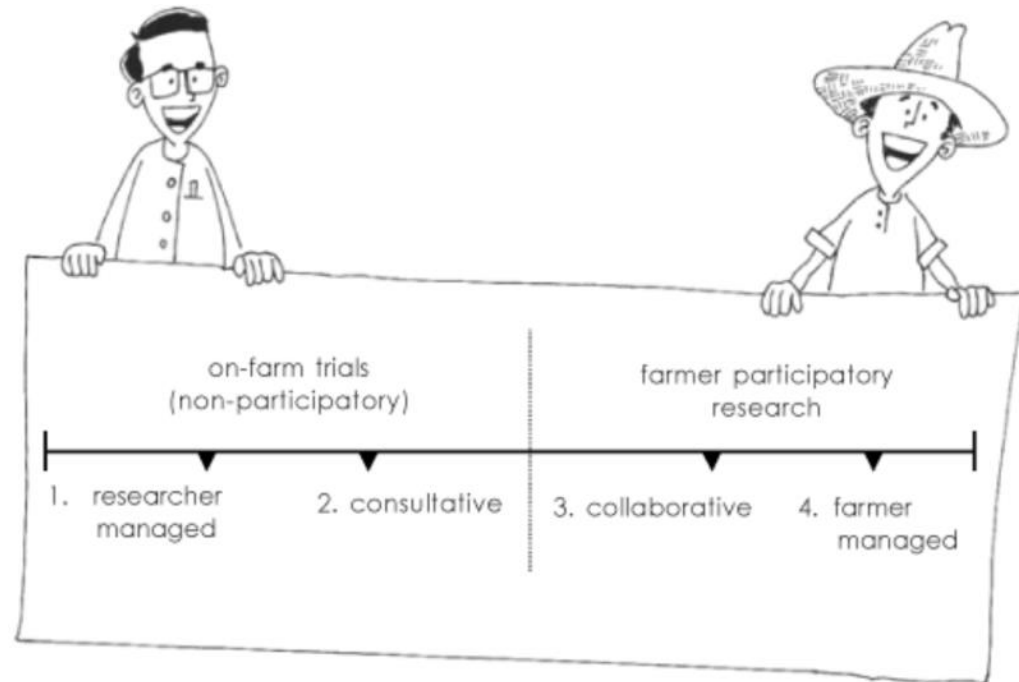
Information sharing, farmers are  
consulted scientists take decision

## Collaborative

Task sharing between farmers  
and scientists

## Farmer managed

no scientists involved



*Gonsolves et al. 2005*

→ **Collegial: collective decision in group process,  
sharing responsibility and accountability**