

*Accelerating sustainable and diverse food systems
through participatory organic plant breeding*



Participatory breeding in the organic and agroecological perspective

Summer School



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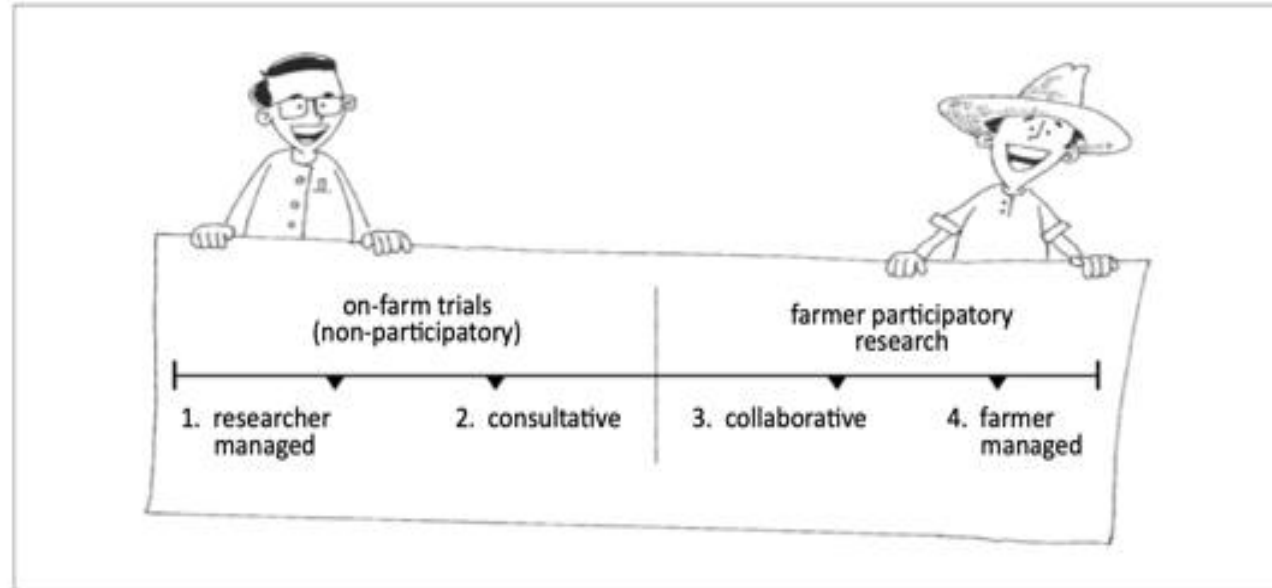
-
- **Definition of Participatory Plant Breeding (PPB)**
 - **Global history of PPB**
 - **PPB in Organic and Agroecological context**
 - **Emergence of PPB in organic agriculture**
 - **Examples of the spectrum of PPB projects**
 - **Reflections & Discussion**

Participatory plant breeding

Participatory plant breeding (PPB) is an approach to plant breeding that involves stakeholders, particularly farmers, working with formal breeders in the breeding process.



Spectrum of Participation



Source: Gonsolves et al., 2005

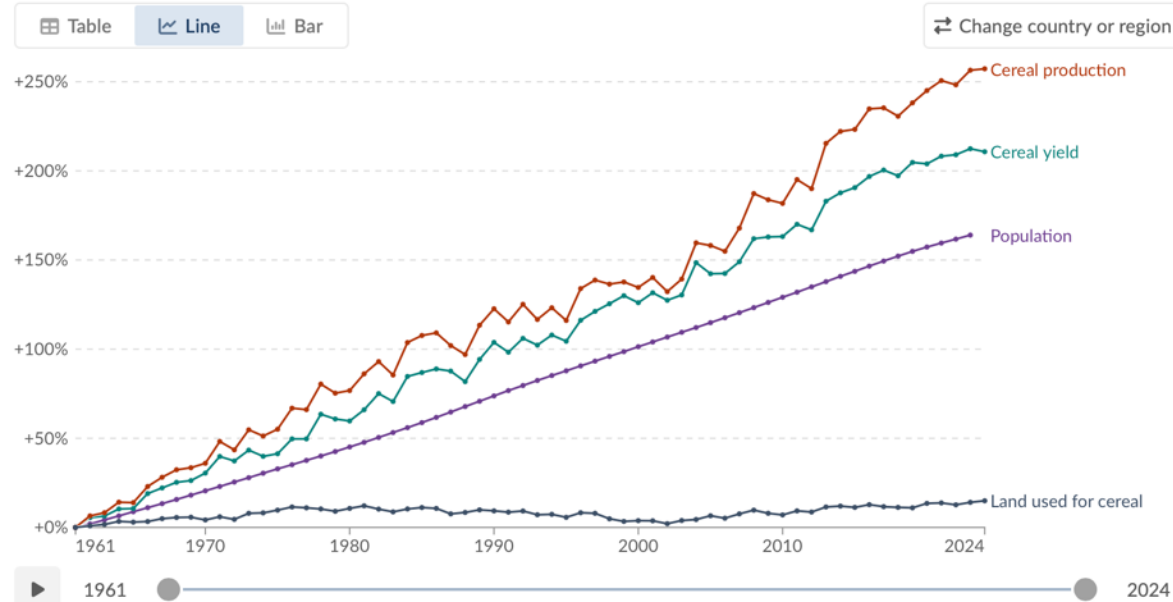


PPB Motivations - Green Revolution

Change in cereal production, yield, land use and population, World

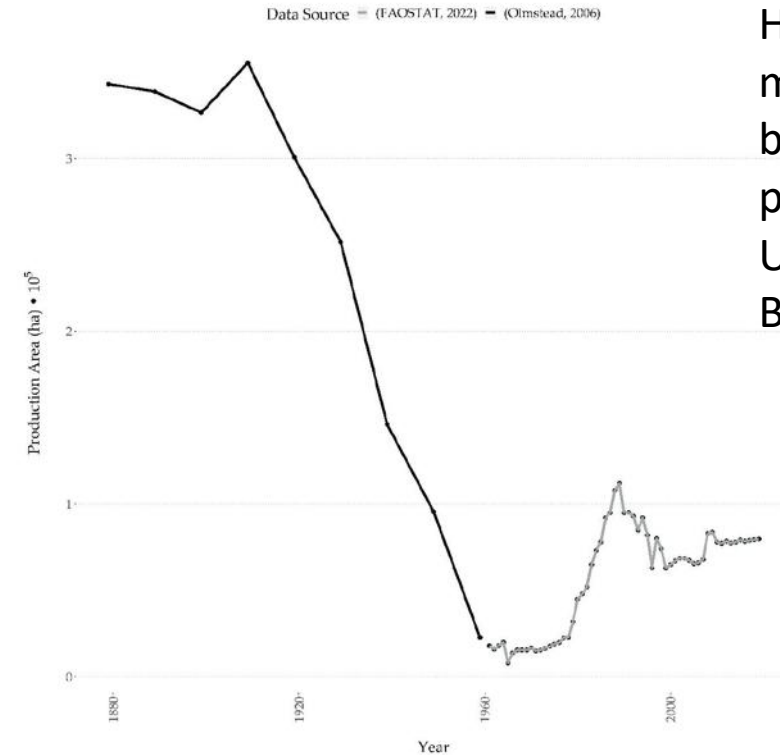
All figures are indexed to the start year of the timeline. This means the first year of the time-series is given the value zero.

Our World
in Data



Data source: Food and Agriculture Organization of the United Nations (2025); HYDE (2023); Gapminder (2022); UN WPP (2024) - [Learn more about this data](#)

OurWorldinData.org/crop-yields | CC BY



Historical and modern buckwheat production in the US. Source: Breslauer, R. 2024.



Green Revolution Consequences



Increasing homogeneity in global food supplies and the implications for food security

Colin K. Khoury^{a,b,1}, Anne D. Bjorkman^{c,d}, Hannes Dempewolf^{d,e,f}, Julian Ramirez-Villegas^{a,g,h}, Luigi Guarino^f, Andy Jarvis^{a,g}, Loren H. Rieseberg^{d,e,i}, and Paul C. Struik^b

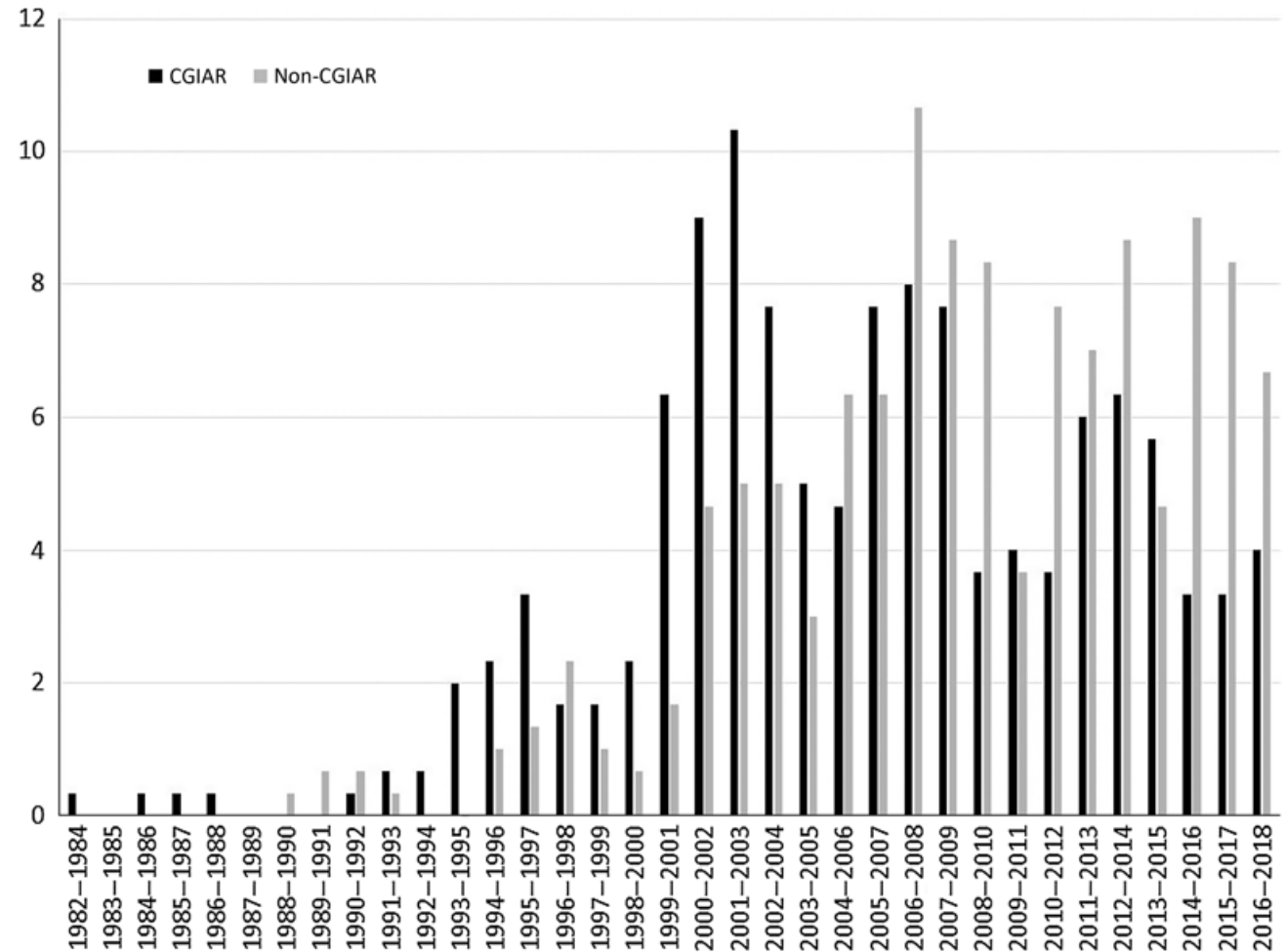
^aInternational Center for Tropical Agriculture, Apartado Aéreo 6713, Cali, Colombia; ^bCentre for Crop Systems Analysis, Wageningen University, 6708 PB, Wageningen, The Netherlands; Departments of ^cGeography and ^eBotany, ^dThe Biodiversity Research Centre, University of British Columbia, Vancouver, BC, Canada V6T 1Z4; ^fGlobal Crop Diversity Trust, 53115 Bonn, Germany; ^gCGIAR Research Program on Climate Change, Agriculture, and Food Security, Cali, Colombia; ^hInstitute for Climate and Atmospheric Science, School of Earth and Environment, University of Leeds, Leeds LS2 9JT, United Kingdom; and ⁱDepartment of Biology, Indiana University, Bloomington, IN 47405

Edited by Stephen Polasky, University of Minnesota, St. Paul, MN, and approved January 29, 2014 (received for review July 17, 2013)

The most vital consideration may be about local agro-ecosystems and what they can offer, rather than applying technologies that are developed detached from the local systems. Agro-ecosystem development may be more important than any revolution. Africa still has that legacy, which can be further improved with appropriate and people-based technology.

History of PPB

- Green Revolution
- Consultive Group for International Agricultural Research (CGIAR)
- Farmer-participatory research
- Breeding for low input, subsistence agriculture



PPB emerged in response to limitations in the Green Revolution's ability to serve decentralized, subsistence farmers globally.

Organic principles

*"Organic Agriculture is a production system that sustains the health of **soils, ecosystems and people**. It relies on **ecological processes, biodiversity and cycles adapted to local conditions**, rather than the use of inputs with adverse effects. Organic Agriculture combines **tradition, innovation and science** to benefit the shared environment and promote **fair relationships** and a good **quality of life** for all involved."* (www.ifoam.bio)

IFOAM's 4 basic principles:



The Principle
of Health.



The Principle
of Ecology.



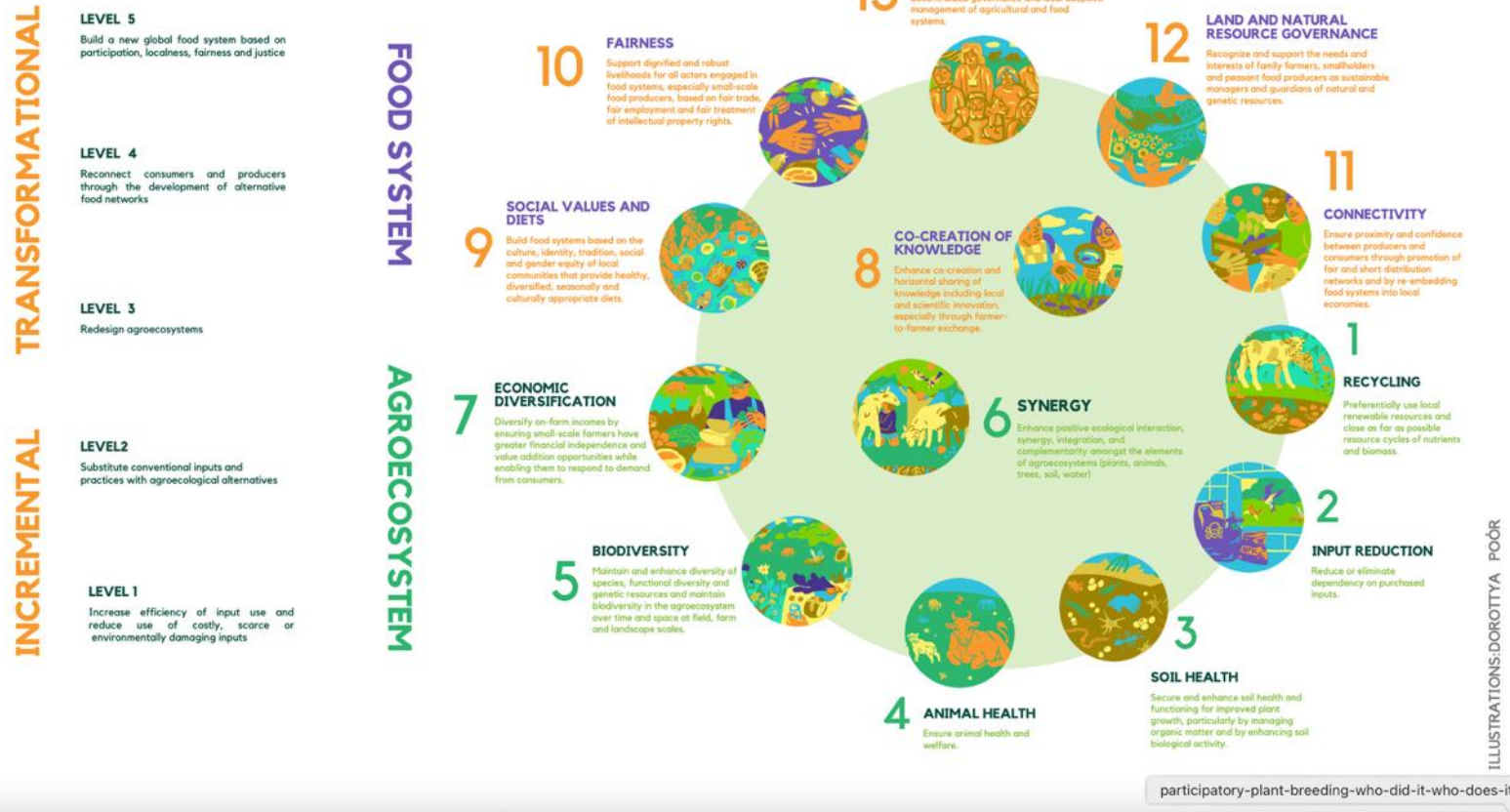
The Principle
of Fairness.



The Principle
of Care.



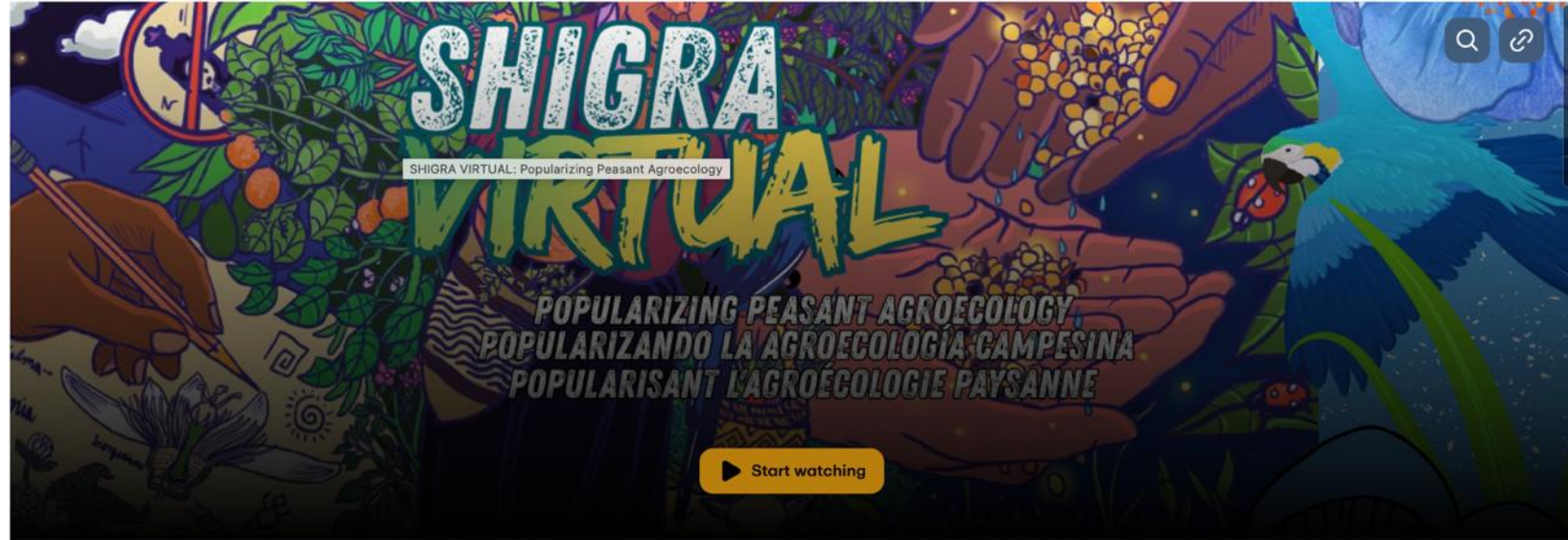
Agroecological principles



1. Recycling
2. Input Reduction
3. Soil Health
4. Animal Health
5. Biodiversity
6. Synergy
7. Economic Diversification
8. Co-creation of Knowledge
9. Social Values and Diets
10. Fairness
11. Connectivity
12. Land and Natural Resource Governance
13. Participation

Agroecology International Context

For La Via Campesina (LVC), agroecology cannot exist without popular education; without the participation of women and young people, because **agroecology must permeate the productive chain**, as an organisational-political practice that makes solidarity, autonomy, popular agrarian reform, work, income and thus food sovereignty possible.



PPB, Organic Agriculture, and Agroecology

Participatory Plant Breeding:

- Value farmers' knowledge
- Enhance insitu conservation/ seed stewardship
- Breeding for decentralized, heterogenous, and low-input environments

Organic agriculture:

- IFOAM principles: health, ecology, fairness and care
- Absence of synthetic inputs, leveraging natural processes
- Regulated certification systems



Agroecology:

- Draws upon traditional agricultural methods
- Leverages synergistic relationships and agrobiodiversity
- Emphasis on farmers' food and seed sovereignty

Key message

Plant breeding in the Participatory, Organic and Agroecological contexts hold overlapping, yet distinct, principles and breeding goals.

Emergence of PPB in Organic Agriculture

The Journal of Agricultural Science

cambridge.org/ags

Crops and Soils Review

Exploring the emergence of participatory plant breeding in countries of the Global North – a review

M. R. Colley^{1,2} , J. C. Dawson³, C. McCluskey³, J. R. Myers⁴, W. F. Tracy³
and E. T. Lammerts van Bueren²

- 47 Projects across US, CA, Europe
- 22 species, more crop types
- **Key motivations:** organic adaptation, seed sovereignty, agrobiodiversity, genetic diversity conservation, preservation of culturally significant crops, community engagement in seed systems



Agronomic Conclusions:

- Projects motivated by gaps in seed access.
- Trait priorities for organic systems differ from conventional.
- Varieties differ in patterns of adaptation to low and high yielding environments.
- Breeding in organic conditions preferable when possible.
- Regional/ local adaptation important in organic systems.



Social Conclusions

- PPB Networks facilitate adoption of organic seed.
- Developing alternative socio-economic and market models critical.
- Key motivations preservation of agrobiodiversity, seed sovereignty, preservation of cultural food pathways, and access to diverse, nutritious, and flavorful foods.
- Knowledge exchange and expanded awareness key strengths of PPB.
- Participatory decision making, flexibility, adaptability critical to success.



Challenges/ Tensions

- Re-skilling farmers in seed.
- Sustainable funding.
- Institutional pressures to publish and retain IPR.
- On-farm capacity/ feasibility.
- Balancing diversity and conditioning for uniformity.
- Dissemination pathways critical to expanded access.





PPB implementation spread to organic agriculture due to environmental and social parallels with global subsistence agriculture

Examples of PPB

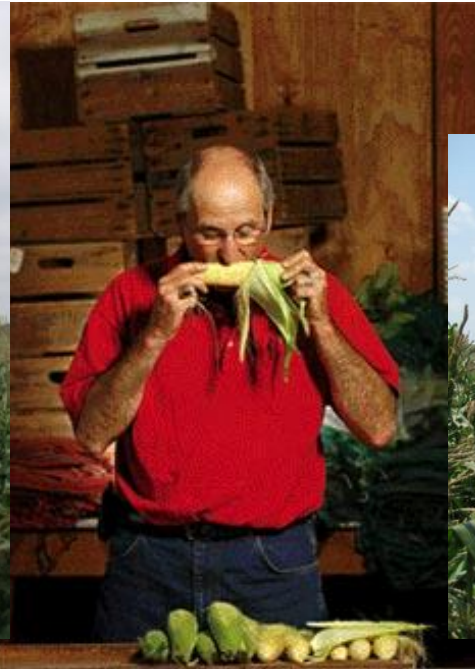


CONSIDER HOW THE FOLLOWING EXAMPLES REFLECT
ORGANIC AND/OR AGROECOLOGICAL CONTEXTS

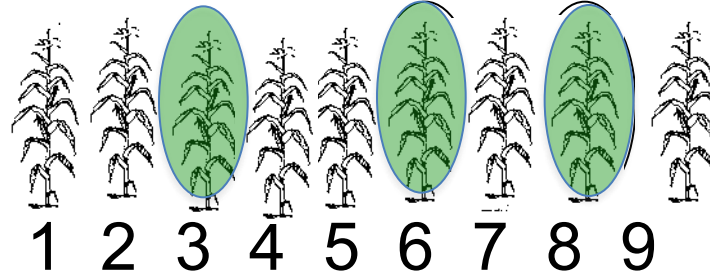
Sweet Corn PPB



United States Department of Agriculture
National Institute of Food and Agriculture

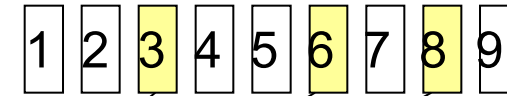


Summer:
trial and select

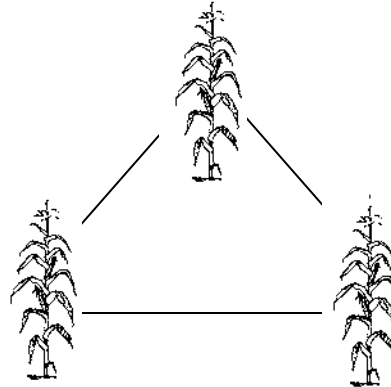


Spring:
plant part of winter seed
and save part

Fall:
Seed to nursery based
on summer selects



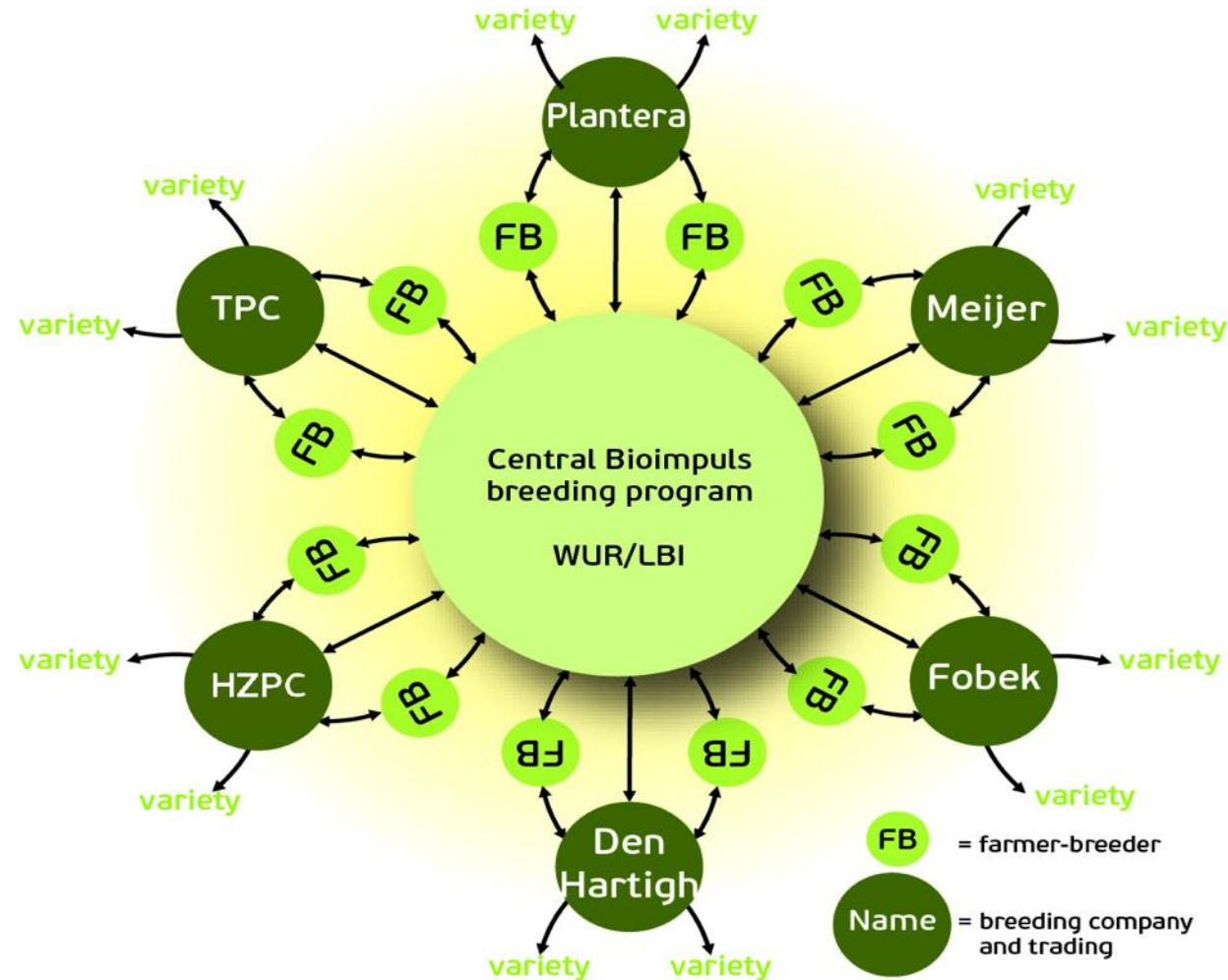
Winter:
recombine selected



'Who Gets Kissed?'



PPB - Dutch : Organic Potato, BIOIMPULS Project



PPB Potato Breeding Model



Breeding company clonal reproduction and variety release

Introgress LBR wild materials with elite materials (4 cycles back crossing)



MAS to test for multi-genic resistance, then make crosses and produce seed for distribution

Advanced lines 300+ crosses/yr

Yrs 4-8: Advanced trials at seed companies to ensure quality.

Repeated cycles of testing and selection

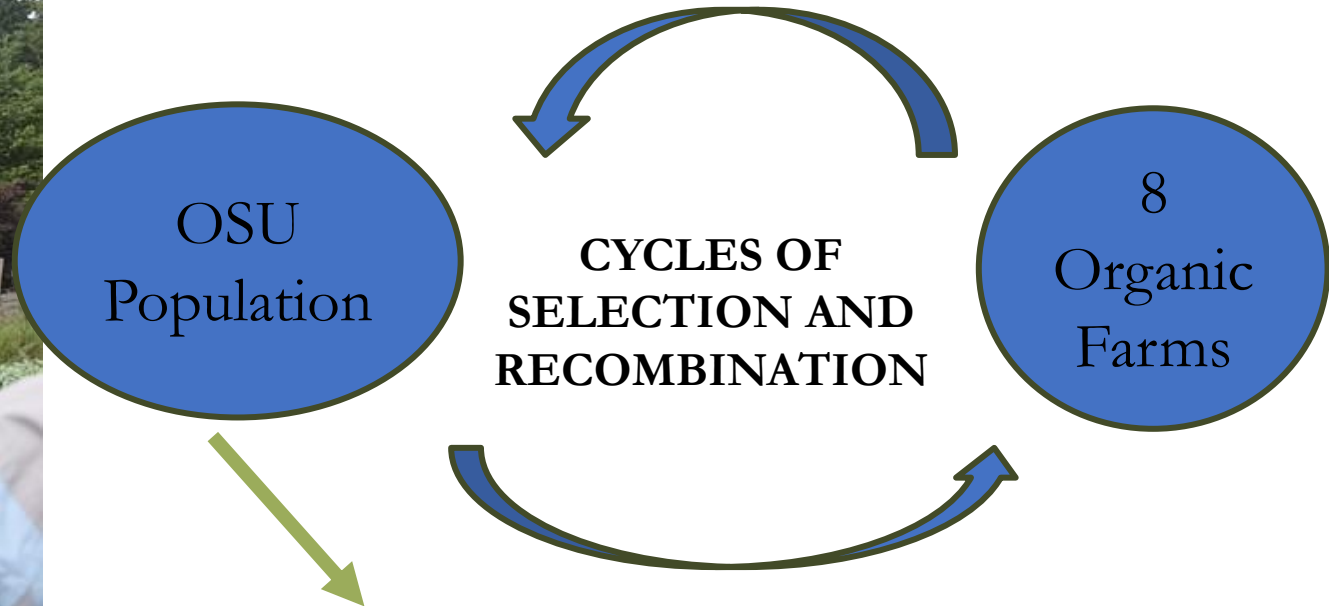


3 yrs on-farm selection



On-farm testing, participatory evaluations

Evolutionary PPB – Broccoli



- 2 Commercial PPB Var – US
- Many on-farm populations
- F1 hybrid parental test cross
- Registered Variety in NL

More Bang for your Buckwheat



Nutritious, Sustainable Food for Everyone

Our goal is to bring more affordable, great tasting bread to the world one loaf at a time. Or maybe faster than that.





ORGANIC BUCKWHEAT PANCAKE MIX

MANUFACTURED BY CASCADE MILLING
310 CAMELIA ST NE
ROYAL CITY, WA 98057
marketing@cascadeorganicflour.com
www.cascadeorganicflour.com

NET WEIGHT 25 LB (11.34 KG)

Made in collaboration with Washington State University in support of Washington farm-to-school programs. Click QR code below for project information. And Enjoy!

Nutrition Facts	
277 servings per container	
Serving size 6.5 Cup (16g)	
Amount Per Serving	
Calories	160
Total Fat	4%
Sodium	8%
Total Sugar	8%
Dietary Fiber	8%
Total Protein	11%
Total Carbohydrate	11%
Total Fat	12%
Total Sugar	12%
Total Protein	12%
Total Carbohydrate	12%
Total Fat	12%
Total Sugar	12%
Total Protein	12%
Total Carbohydrate	12%

BUCKWHEAT PANCAKES:

- 1 Cup Pancake Mix
- 2/3 Cup Warm Water

COOKING INSTRUCTIONS:

Pancakes
Mix 1 C pancake mix with 2/3 cup of warm water. Pour 1/3 cup of batter for each pancake onto a hot, oiled skillet. Cook for 1-2 min, turning when edges brown and surface bubbles. Continue 1-2 min more or until golden brown. Recipe makes 3 pancakes (3 servings).

Sheet Pan
For 28" x 16" pan, combine 10 C mix with 6-2/3 C warm water. Thoroughly grease sheet pan, pour. Bake for 15-20 minutes or until inserted toothpick comes out clean. Recipe makes 30-32 bars.

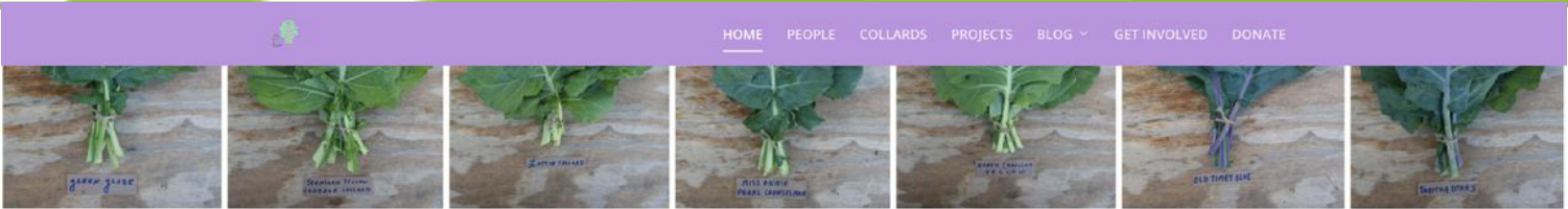
Visit this link, or the QR above for school whole grain meal pattern info: <https://tinyurl.com/sxxvzmma>

INGREDIENTS: Organic Buckwheat Flour, Organic Whole Wheat Flour, Organic Granulated Sugar, Organic Dry Milk Powder, Sea Salt, Leavening (SAPP, Baking Soda)

CONTAINS: Dairy, Wheat



Community-based PPB



COLLARDS

THE HEIRLOOM COLLARD PROJECT IS WORKING FOR THE RECOGNITION AND RESPECT OF COLLARDS AS A KEY COMPONENT OF AMERICAN FOOD CULTURE SO THEIR SEEDS AND STORIES WILL NEVER BE FORGOTTEN.

WE ARE A COLLABORATION OF COLLARD LOVING PEOPLE AND ORGANIZATIONS – A CROCK POT OF SORTS, WHERE THE INGREDIENTS ARE EACH RESPECTED, BUT THE TRUE MAGIC IS IN THE POT LIKKER.



IRA WALLACE

Ira Wallace is an organic grower, author, speaker, visionary and worker/owner of the cooperative Southern Exposure Seed Exchange where she coordinates outreach, education, and new seed grower contracts. The list of Ira's accolades is long, and she has inspired many people and projects, but we are extremely proud to call Ira Wallace the godmother and matriarch of The Heirloom Collard Project. It was her vision and passion for sharing the seeds and knowledge of these varieties that launched the project, and her wisdom and guidance continues to direct our work as we embrace more and more collard people into the fold.

All Artist Chefs Farmer HCP Admin Researcher Seed Steward The People



ALEXANDRA ANTOINE
Artist



SARAH ROSS
Chefs, Farmer, Seed Steward



ED DAVIS
Researcher



TONY VANWINKLE
Seed Steward



JACOB RUTZ
Seed Steward



NATE KLEINMAN
Farmer, Researcher, Seed



CONNIE AND MILLARD
LOCKLEAR



KRISTEN EGGEN
Artist



GET INVOLVED

WE ARE EXCITED TO EXPAND THE NETWORK OF COLLARD ENTHUSIASTS. THE HEIRLOOM COLLARD PROJECT WANTS TO CONNECT WITH GROWERS AND GARDENERS, CHEFS AND COOKS, SEED SAVERS AND SEED COMPANIES. BELOW ARE SOME WAYS TO GET INVOLVED, BUT FEEL FREE TO CONTACT US WITH MORE IDEAS.



PPB models range widely from farmer-initiated, single farm projects, to multi-actor collaborative programs.



**What participatory methods
will you use in your project?**



What are the strengths and limitations to the PPB methods you will use?



PPB applies methodologies, but is truly a dynamic practice. Consider how your mindset and personality may evolve with experiences in PPB.

I welcome your reflections, questions, and imagination to inform our collective perspectives on PPB.

Thank you - Micaela Colley, Assistant professor of participatory plant breeding. colleym@wsu.edu



FiBL
Europe



 LiveSeeding
 @LiveSeeding
 LiveSeeding
 www.liveseeding.eu

Sister project on organic
 fruit breeding:
www.InnOBreed.eu



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LiveSeeding

