Rice Diversity from Seed to Fork: a Living Lab for Organic Rice in Northern Italy

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4th International Conference Organic Rice Farming and Production Systems
Sendai - Japan
September 4th – 7th, 2023

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The Italian Seed Network

Policy & Paradigm shift

Community & Value chains

Action Research

Community Seed Banks

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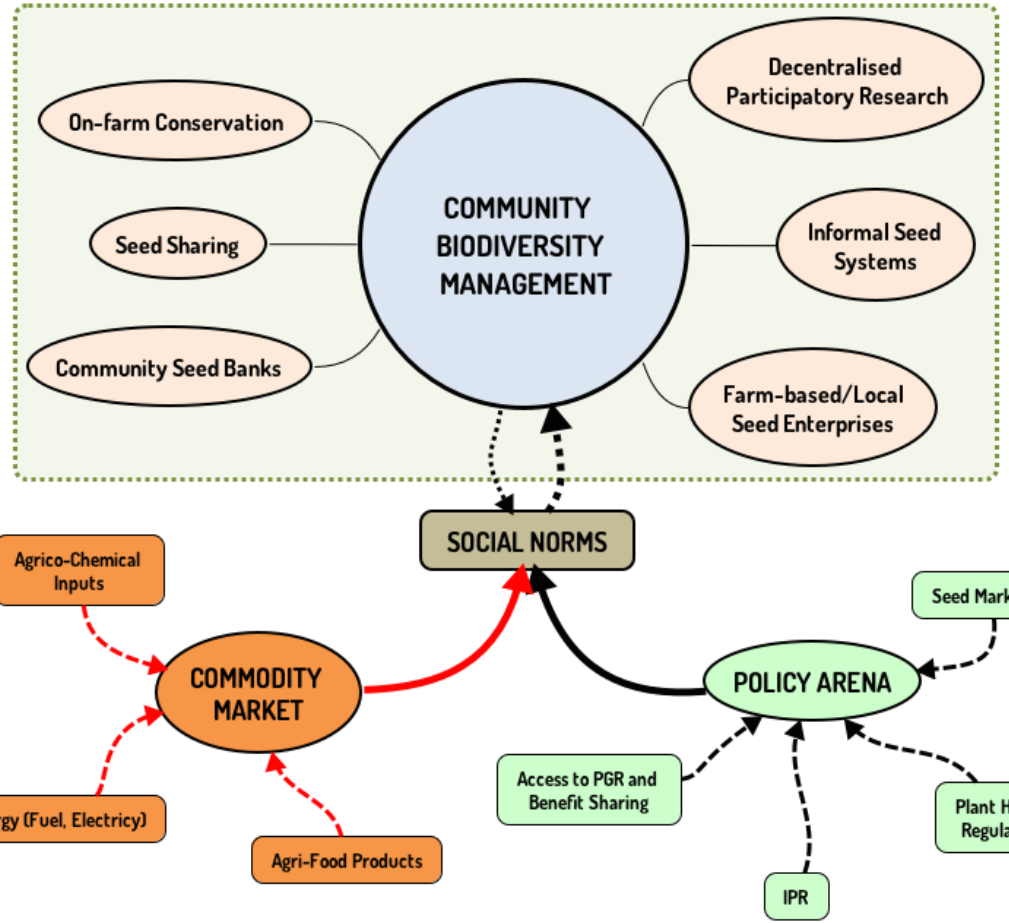

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Diversity of ORFS: Paddy field

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Diversity of ORFS : Dryland rice

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Diversity of ORFS : Green mulch

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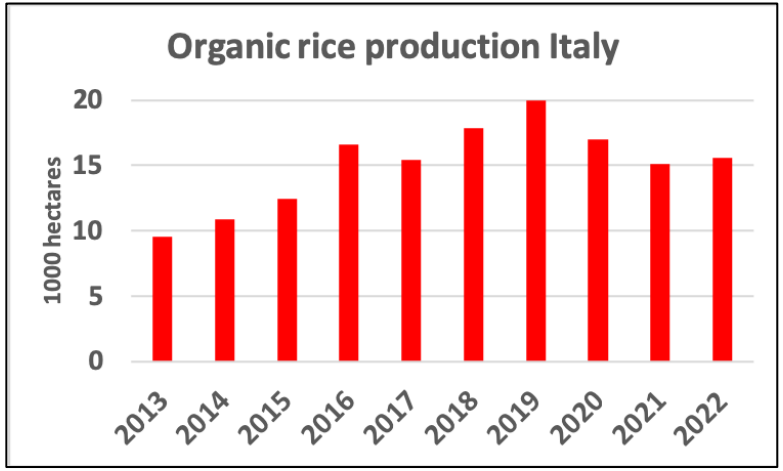
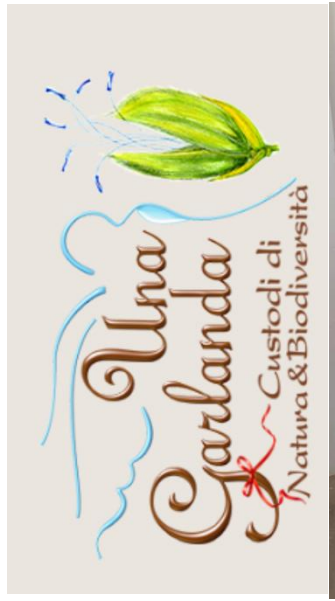
Rice seed in Italy

- 70% of seed production is represented by only 20 varieties;
- Over 40% of the Italian rice seed production relies on herbicide resistant varieties (Clearfield® & Provisia®, FullPage®);
- Despite a thriving organic rice sector, **organic seed production is virtually non-existent**

(with one exception 👉)





Source: Eurostat 2023; Sinab 2023; CREA-DC 2021

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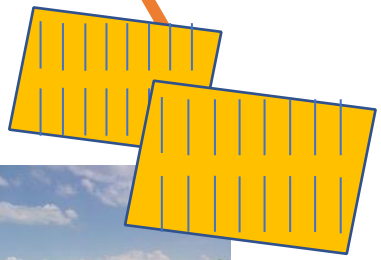
Organic rice network 2018-20

Increase the level of cultivated rice diversity and provide adapted material for organic farms

16 Italian rice accessions from national gene bank CREA and farmers' varieties as controls

Multiplication of the accessions in two farms



Participatory evaluation

Processing and storing seed - RSR Community Seed Bank

2018

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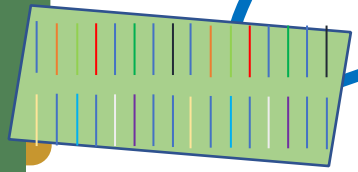
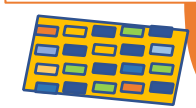
214 Italian rice accessions from IRRI's international gene bank in the Philippines

Multiplication of accessions on one farm



Participatory evaluation

I° participatory field trial (RBD) - 4 farms



I° Morphological and agronomical data collection

Participatory evaluation

2019

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2019: field catalogue with 264 Italian rice accessions

Participatory selection with farmers and researchers

- **Combination of varieties with a high score according to grain type and ripening time**
- **Constitution of 3 mixtures: short, medium and long A grain type**

IRRI

The International Treaty
ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

https://youtu.be/3ujbylwjMv4?si=_Iu06tNqrZd_s8bM

2018

16 Italian rice accessions from national gene bank CREA and farmers' varieties as controls

Multiplication of accessions in two farms

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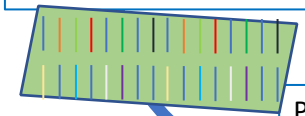


Participatory evaluation

I° participatory field trial (RBD) 4 farms

I° year morphological and agronomical data

Participatory evaluation

Processing and storing - RSR Community Seed Bank

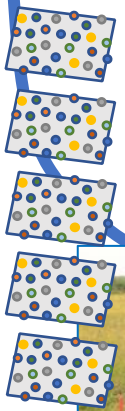
2020

Constitution of **three rice mixtures**: short grain, medium grain long grain type A – **5 farms**

II° participatory field trial **4 farms (RBD)**

II° year morphological and agronomical data

Participatory evaluation



Participatory evaluation of the mixtures – first year of multiplication and adaptation

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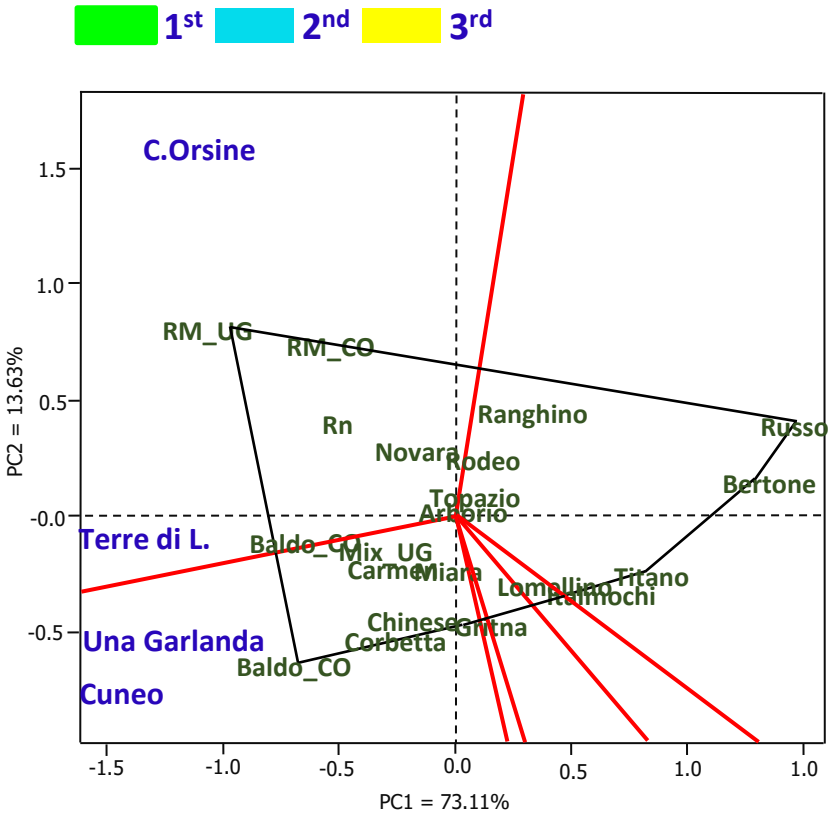
Fondazione CARIPLO

Mean yield - 2 years and 4 farms

Entrata	C.Orsine	Terre di L.	Cuneo	Una Garlanda
Ranghino	1827	2937	2887	5463
Gritna	1121	2640	4855	5513
Alpe	1696	4206	4725	6256
Carmen	1470	4928	4989	5207
Russo	731	1865	1521	3027
Lomellino	1099	2671	4510	4927
Titano	654	2555	3508	4001
Rodeo	1779	3152	3880	5244
Italmochi	763	3208	3654	4615
Topazio	1678	2902	4569	5161
Miara	1294	4046	4244	5421
Baldo	2073	4902	6011	5880
RN	2342	4975	5345	4974
Novara	2047	3646	4614	5290
Corbetta	1291	4472	5392	5797
Bertone	605	2244	1884	3435
RM_Una Garlanda	3060	5915	5262	5629
C. Originario	1147	4911	5002	5137
RM_C. Orsine	2687	4366	4771	5283
Baldo_C.Orsine	1347	5590	5979	5894
Arborio	1486	3747	4111	5078
MIX_Una Garlanda	1582	4563	5032	5385



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Entrata
Ranghino
Gritna
Alpe
Carmen
Russo
Lomellino
Titano
Rodeo
Italmochi
Topazio
Miara
Baldo
RN
Novara
Corbetta
Bertone
RM_Una G
C. Originar
RM_C. Ors
Baldo_C.C
Arborio
MIX_Una C

sustainability

MDPI

Article

Participatory Evaluation of Rice Varieties for Specific Adaptation to Organic Conditions in Italy

Giuseppe De Santis [1], Daniela Ponzini [1], Rachele Stentella [1], Tommaso Gaifami [1], Bettina Bussi [1], Rosalia Caimo-Duc [2], Ugo Stocchi [3], Marco Cuneo [4], Marco Paravicini [5], Riccardo Bocci [1], Matteo Petitti [1] and Salvatore Ceccarelli [6,*]

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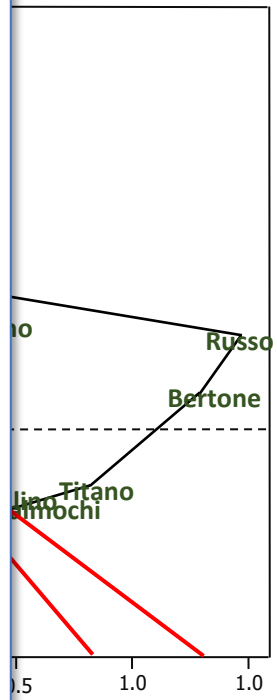
Abstract: Rice is the fourth most important crop in Italy with a growing area under organic management. We conducted a participatory evaluation of 21 rice cultivars (10 old, 10 modern and a mixture) in four organic/biodynamic farms, for two cropping seasons, to assess the extent of varieties × farms and varieties × years within farm interactions and farmers' preferences. There were significant differences between farms and varieties, as well as large interactions between varieties and farms, particularly in the case of plant height and reactions to *Fusarium fujikuroi* Nirenberg (bakanae) and *Magnaporthe oryzae* B Cooke (leaf and neck blast), but also for grain yield. There were also large interactions between varieties and years, which resulted in considerable differences in stability among varieties with one of the old, one modern and the mixture combining high grain yield and stability. Farmers, regardless of gender, were able to visually identify the highest yielding varieties in a consistent way across years, and although accustomed to seeing uniform varieties, they scored the mixture higher than the mean. The results are discussed in the context of a decentralized-participatory breeding program, to serve the target population of heterogenous environments represented by organic and biodynamic farms.

Citation: De Santis, G.; Ponzini, D.; Stentella, R.; Gaifami, T.; Bussi, B.; Caimo-Duc, R.; Stocchi, U.; Cuneo, M.; Paravicini, M.; Bocci, R.; et al. Participatory Evaluation of Rice Varieties for Specific Adaptation to Organic Conditions in Italy.



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3 dynamic rice populations

Medium grain

1	DELLAROLE
2	MARATELLI
3	MARATELLI SELN
4	PRECOCE GALLINA
5	F. RONCAROLLO
6	SANCIO PRECOCE 6
7	VIALONE NERO
8	NOVARA
9	CORBETTA
10	VIALONE NAN
11	LOMELLINO
12	MONTICELLI
13	PIEMONTE
14	PROMETEO
15	ROSA MARCHETTI STOCCHI
16	RIO

Short grain

1	AMERICANO
2	BALILLA GRANA GROSSA
3	BALILLA
4	C. ORIGINARIO
5	CYGALON
6	GREPPI
7	LENCINO
8	NANO
9	RAFFAELLO
10	RANGHINO
11	RUBINO

Long grain (A)

1	ALLORIO_CREA
2	BERTONE (UG)
3	ARBORIO
4	CARNAROLI
5	RB
6	RIBE
7	CHIAPELLI ADELAIDE
8	RIZZOTTO TIPO
9	RAZZA 77
10	ARIETE
11	BALDO (CO)
12	CERVO
13	NERO
14	PIERINA MARCHETTI
15	SANT ANDREA
16	SMERALDO
17	TITANO
18	VENERI/
19	VOLAN
20	ELBA
21	BELGIOIOS
22	SESIA
23	SIRIO
24	PI 275446
25	CARMEN

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3 dynamic rice populations

1	ALLORIO_CREA
2	BERTONE (UG)
3	ARBORIO

Short Communication

SCI

Received: 11 February 2019 Revised: 23 June 2019 Accepted article published: 4 July 2019 Published online in Wiley Online Library:

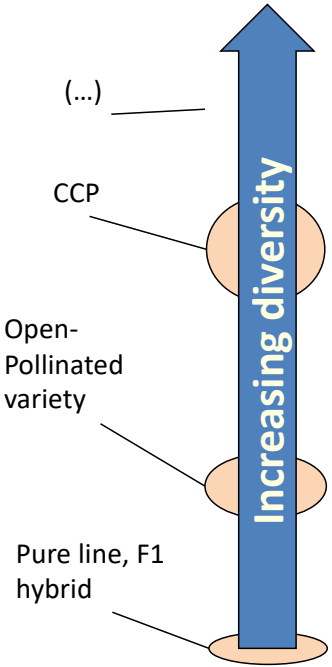
(wileyonlinelibrary.com) DOI 10.1002/jsfa.9906

The increased use of diversity in cereal cropping requires more descriptive precision

Martin S Wolfe[a†] and Salvatore Ceccarelli[b*]

Abstract

BACKGROUND: Until 100 years ago, cereals were grown only as populations with varying amounts of genetic diversity both within and among different crops. However, since the nineteenth century, methods for isolating and reproducing monocultural varieties have become universal, particularly among larger producers, leading to widespread within-field genetic monotony. A range of approaches is now being used to increase genetic diversity within and among crops including bringing back into



- Composite Cross Population
- Dynamic mixture / population
- Farmers' selection (of landraces / populations)

LIVESEED

Deliverable 2.8:

Proposal for a toolbox for identification and description of organic heterogeneous material (WP2, T2.1.3)

10	RANGHIN
11	RUBINO

21	BELGIOIOS
22	SESIA
23	SIRIO
24	PI 275446
25	CARMEN

Organic rice network 2021-22

Una Garlanda
Azienda Goio
Cascina Teglio
Cascina Angiolina
Cascina Dulcamara
Novara
Cascina Gamparina
Azienda Bielli
Cascina Caremma
Vercelli
Cascine Orsine
Pavia
Terre di Lomellina
N
10 km

Rice populations:

- Agronomic value vs uniform varieties
- Rice processing and culinary aspects

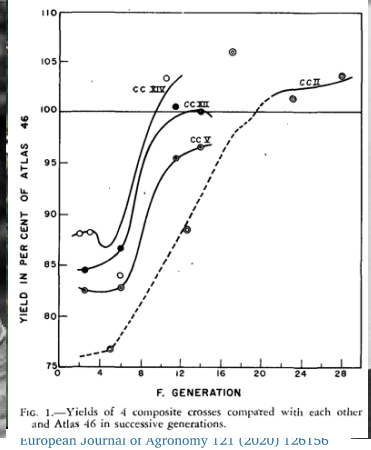
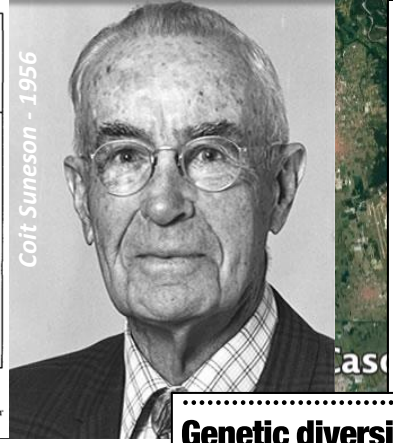


Fig. 1.—Yields of 4 composite crosses compared with each other and Atlas 46 in successive generations.



European Journal of Agronomy 121 (2020) 126156

Contents lists available at ScienceDirect

European Journal of Agronomy

journal homepage: www.elsevier.com/locate/eja

Yield, yield stability and farmers' preferences of evolutionary populations of bread wheat: A dynamic solution to climate change

Riccardo Bocci [a], Bettina Bussi [a], Matteo Petitti [a], Riccardo Franciolini [a], Virginia Altavilla [a], Gea Galluzzi [a], Paolo Di Luzio [b], Paola Migliorini [c], Sandra Spagnolo [d], Rosario Floriddia [e], Giuseppe Li Rosi [f], Modesto Petacciato [g], Vincenzo Battezzato [h], Andrea Albino [i], Giovanni Faggio [j], Carlo Arcostanzo [j], Salvatore Ceccarelli [a,*]

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Agronomie 20 (2000) 813–837
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Original article

Cereal variety and species mixtures in practice, with emphasis on disease resistance

Maria R. Finckh[a]*, Edward S. Gacek[b], Henriette Goyeau[c], Christian Lannou[c], Ueli Merz[d], Christopher C. Mundt[e], Lisa Munk[f], Jadwiga Nadziak[g], Adrian C. Newton[h], Claude de Vallavieille-Pope[c], Martin S. Wolfe[i]

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revised 22 May 2000; accepted 3 August 2000)

nal diversity that limits pathogen and pest expansion, and that makes
s and their pests and pathogens to direct pathogen evolution. Indeed,
risk of resistance break-down and to still make use of defeated resis-
ixtures. The most important mechanisms reducing disease in variety
ffects, and induced resistance. Differential adaptation, i.e. adaptation
nds, may prevent the rapid evolution of complex pathotypes in mix-
losses due to disease; abiotic stresses are also better buffered than in
lly put together, product quality can be enhanced or at least equal that
de is reviewed.

ential adaptation / yield stability / evolutionary plant breeding

Genetic diversity and disease control in rice

Youyong Zhu*, Hairu Chen*, Jinghua Fan*, Yunyue Wang*, Yan Li*, Jianbing Chen*, JinXiang Fan†, Shisheng Yang ‡, Lingping Hu§, Hei Leung‖, Tom W. Mew‖, Paul S. Teng‖, Zonghua Wang‖ & Christopher C. Mundt‖¶

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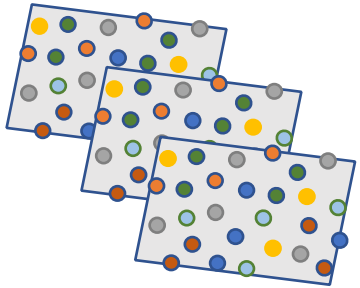
Crop heterogeneity is a possible solution to the vulnerability of monocultured crops to disease[1–3]. Both theory[4] and observation[2,3] indicate that genetic heterogeneity provides greater disease suppression when used over large areas, though experimental data are lacking. Here we report a unique cooperation among farmers,

Work with dynamic populations continues

2021 & 2022



Morphological and agronomic data collection on the **three mixtures** in **5 farms**

- **Plant height and panicle length**
- **Disease presence**
- **Grain yield**

First processing and cooking tests on the three rice mixtures offer encouraging results…

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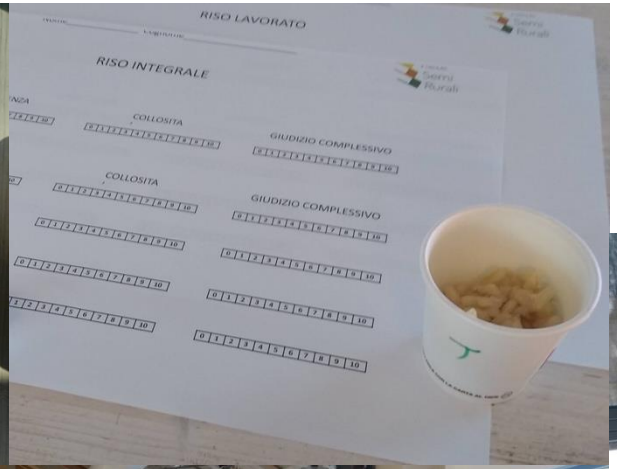
Fondazione CARIPLO

Culinary qualities of rice populations



First panel test with farmers March 2022

Quantitative Descriptive Analysis (QDA) methodology

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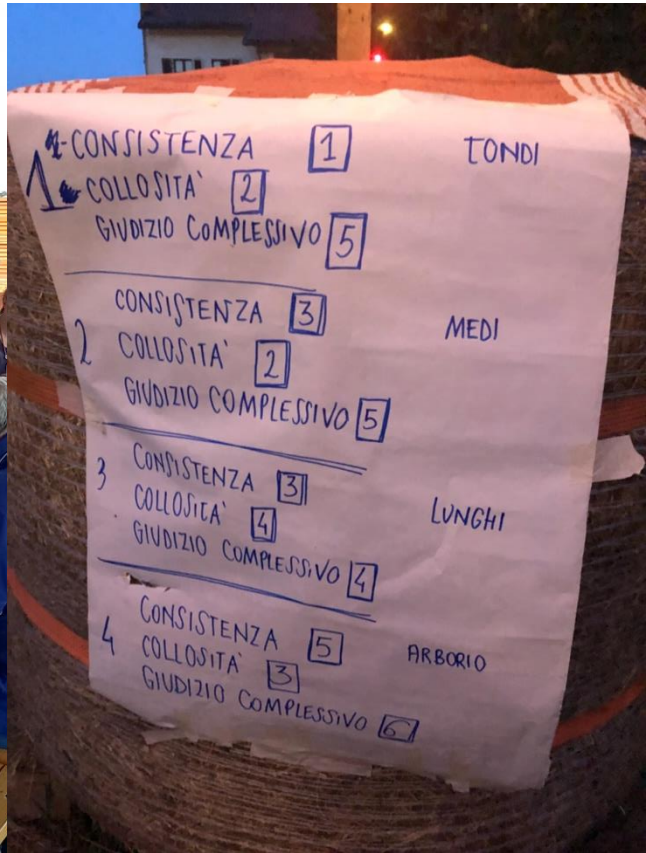
Culinary qualities of rice populations

Panel test with citiziens – DESR, consumer group – summer 2022



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Culinary qualities of rice populations

Panel test with citizens at Una Garlanda field day – Autumn 2022

Risotto prepared by a professional chef

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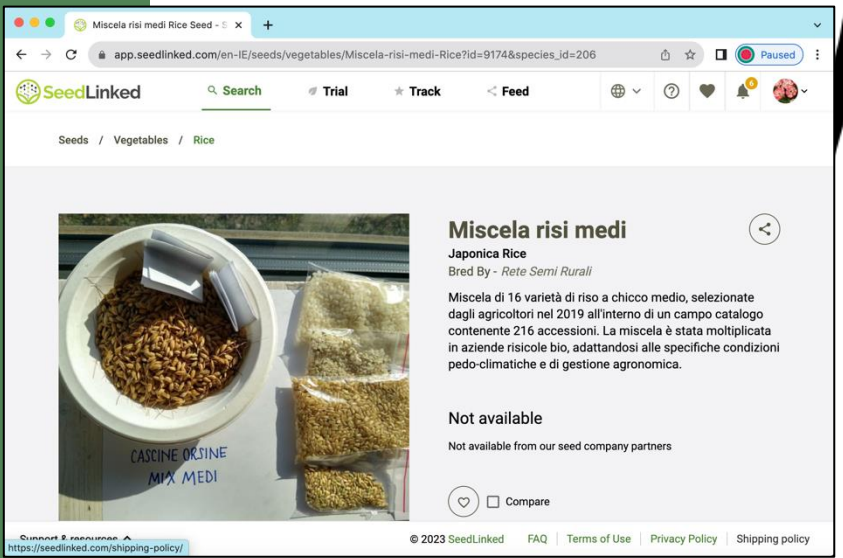
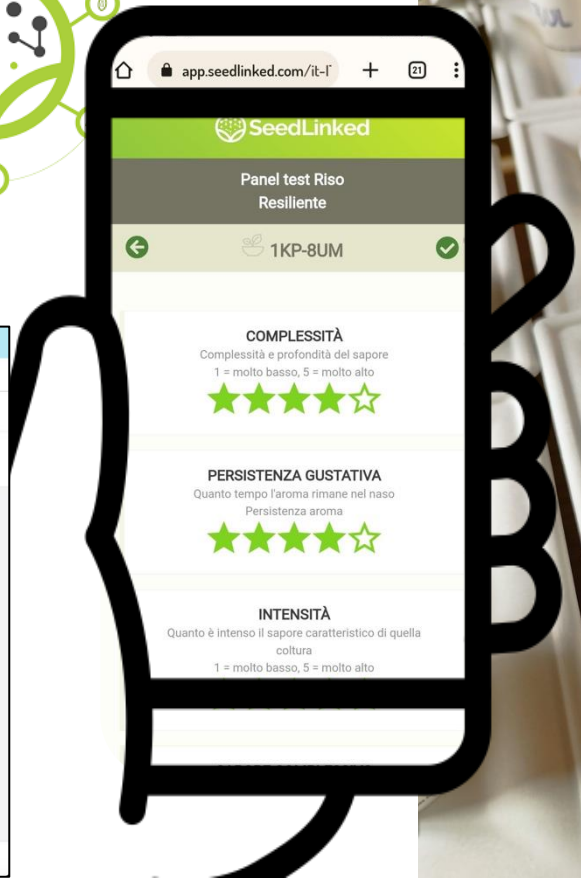
Tasting trial with SeedLinked app

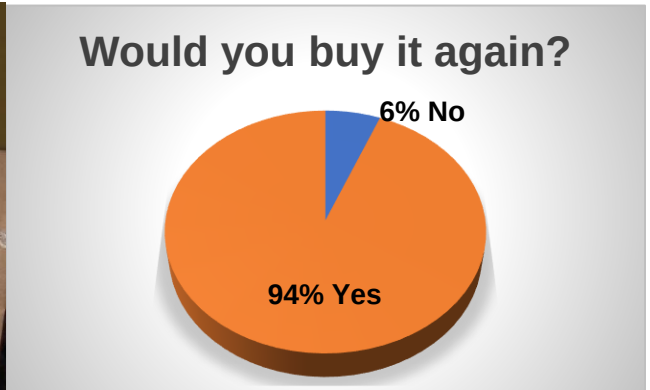
Citizen Science & crowdsourcing platform and app for organic variety trials (March 2023)

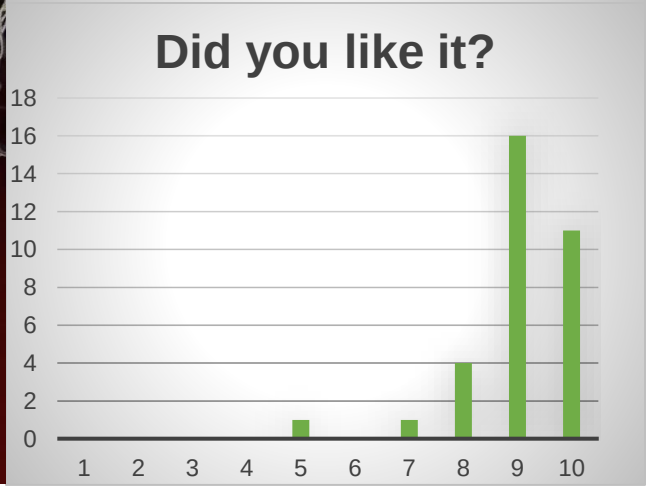




Domestic preparation and tasting

- Distribution through consumer groups
- Sample packets (500g) with QR code for survey
- Cooking and sensory evaluation at home (October 2022 – February 2023)





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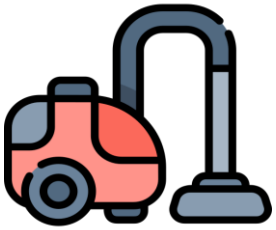
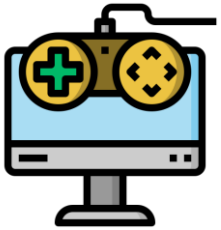
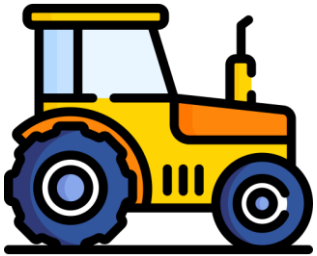
From rice network to Living Lab

What is a Living Lab?

- Living Labs started to emerge in the late 1990s early 2000s as a **user-centred methodology to test new technologies in home-like constructed environments**.
- The scope expanded to a multitude of domains ranging **from ICT to farming**, so that a LLs can be defined as "**open innovation environment/ecosystems in real-life settings in which user-driven innovation is the co-creation process for new services, products and societal infrastructures**"
  (Living Lab Handbook, 2010)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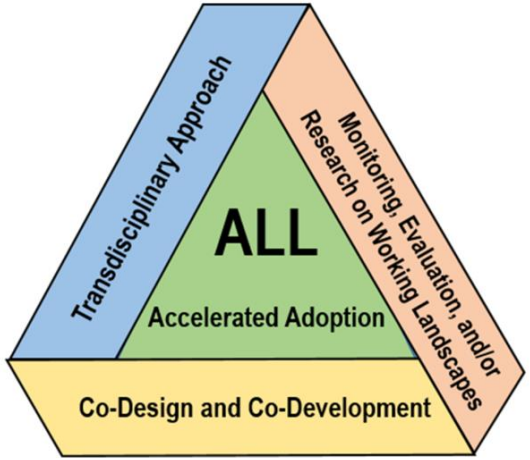
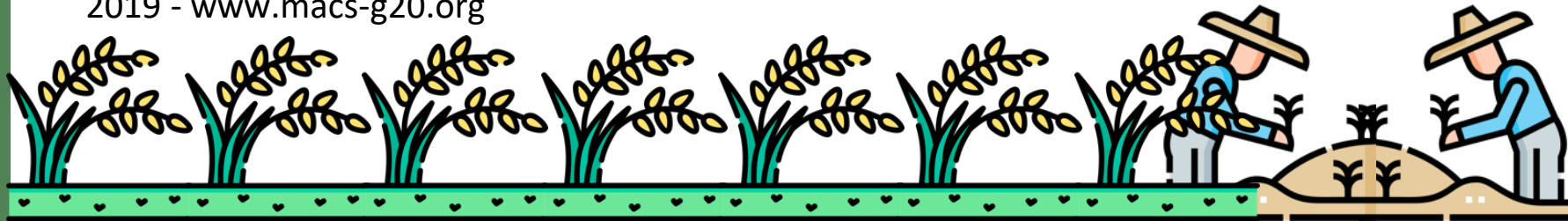
From rice network to Living Lab

Living Lab for Agro-ecology

An agro-ecological Living Lab uses "**Transdisciplinary** approaches which involve farmers, scientists and other actors in the **co-design, monitoring and evaluation** of **new and existing agricultural practices** on working landscapes to improve their effectiveness and **early adoption**"



Agroecosystems Living Laboratories (ALL) Executive Report 2019 - www.macs-g20.org



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From rice network to Living Lab

Citizens & Consumers

Organic seed company

Organic rice miller

Organic rice farmers

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From rice network to Living Lab

Public procurement of organic food by cities

LiveSeeding

DESR
Distretto di Economia Solidale Rurale Parco Agricolo Sud Milano

MILAN URBAN FOOD POLICY PACT

Solidarity Economy Districts
Consumer network

Rete Semi Rurali

Community Seed Bank
& Action-Research facilitation

Universities for organic seed quality research & support

Rete Semi Rurali

Next steps for the rice Living Lab

#1 Register the dynamic rice population for seed marketing as Organic Heterogeneous Material

- The new European organic regulation (EU 848/2018) allows the registration, certification and marketing **of non-uniform plant reproductive material**.
  Entered into force in 2021;
- Public domain: an **Open Source Seed** pledge or licence can be adopted


Queste sementi non sono protette da proprietà intellettuale, acquisendole hai il privilegio di utilizzarle in piena autonomia, con alcune limitazioni.

Questa semente è il risultato di anni di ricerca partecipata.

Rete Semi Rurali
Materiale Eterogeneo Biologico

Il nucleo iniziale è stato costituito nel 2009 all'ICARDA (Centro di ricerca agricola in Siria) su indicazione di Salvatore Ceccarelli mescolando il seme di 2000 linee provenienti da tutto il mondo. Nel 2010 è arrivato in Italia nell'ambito del progetto di ricerca europeo SOLIBAM (2010-2014), grazie ad AIAB partner del progetto. Negli anni successivi, un numero crescente di agricoltori, in collaborazione con Rete Semi Rurali, lo ha coltivato e riprodotto, partecipando alle sperimentazioni volte a valutarne la capacità di adattamento nell'ambito del progetto europeo DIVERSIFOOD (2014-2019), di cui Rete Semi Rurali è partner. La semente SOLIBAM Tenero Floriddia Popolazione è coltivata dal 2010 sulle colline centrali della Toscana, su terreni argillosi.

La commercializzazione di questa popolazione non omogenea è possibile grazie alla Decisione della Commissione Europea 2014/150/EU che permette in via sperimentale la commercializzazione delle sementi di "materiale eterogeneo" di alcuni cereali. Si tratta di una rivoluzione nel settore sementiero perché per la prima volta viene consentita la vendita di sementi di varietà non omogenee, con procedure fitosanitarie adattate a questo nuovo contesto.

IN PARTICOLARE HAI:

1. la libertà di riseminare le sementi in azienda;
2. la libertà di condividere o vendere le sementi ad altri con procedure di certificazione adattate a questo nuovo contesto;
3. la libertà di sperimentare e studiare le popolazioni e di condividere o pubblicare informazioni a loro relative;
4. la libertà di selezionare o adattare le popolazioni, fare incroci con esse o usarle per costituire nuove linee e varietà.

IN CAMBIO, TI IMPEGNI A:

1. non limitare l'uso di queste sementi o dei loro derivati con brevetti o altri strumenti di proprietà intellettuale;
2. ad includere questa dichiarazione in ogni trasferimento di queste sementi o dei loro derivati;
3. a rendere disponibili i prodotti della ricerca fatta partire da questa popolazione.

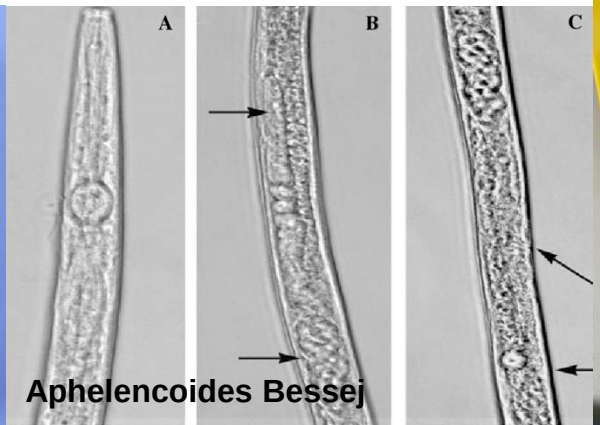
Rete Semi Rurali Materiale Eterogeneo Biologico

Rete Semi Rurali

Next steps for the rice Living Lab

#2 Organic seed treatmets against seed-borne diseases

- **Fusarium fujikoroi (bakanae) fungus;**
- **Aphelencoides Bessej nemathode;**
- Hot water treatment;
- Essential oils treatment;
- Microbiome-based treatments;
- Ozone?



Aphelencoides Bessej

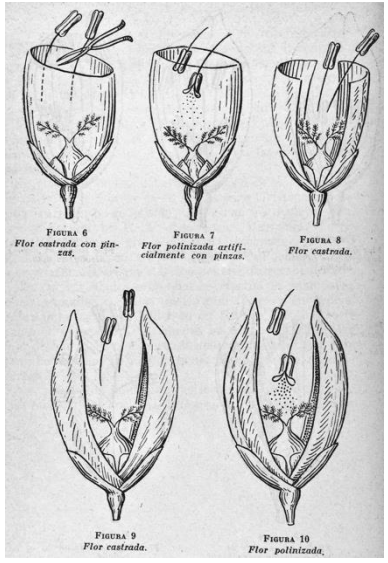
UNIVERSITÀ DI PAVIA

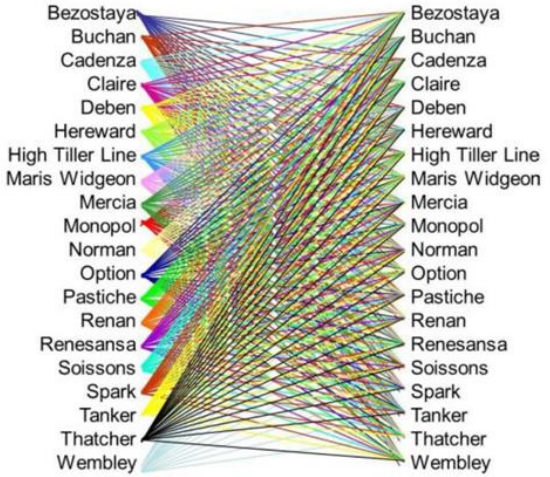
In partnership with the universities of Milano and Pavia, RisoLo project

Rete Semi Rurali

Next steps for the rice Living Lab

#3 Partner with breeders to create a composite cross population from the initial componenents of the dynamic population to increase the genetic diversity and thus the adaptation ability of the population.





The 20 parents and over 190 crosses that make up ORC Wakelyns Population

Rete Semi Rurali

Next steps for the rice Living Lab

#4 Establish a network with similar organisations in Europe and beyond

Dal seme al piatto:
incrocio di esperienze sul riso Biologico

16-17 SettembRe

RovasendaFesta del BiodistRetto del Riso piemontese

Programma

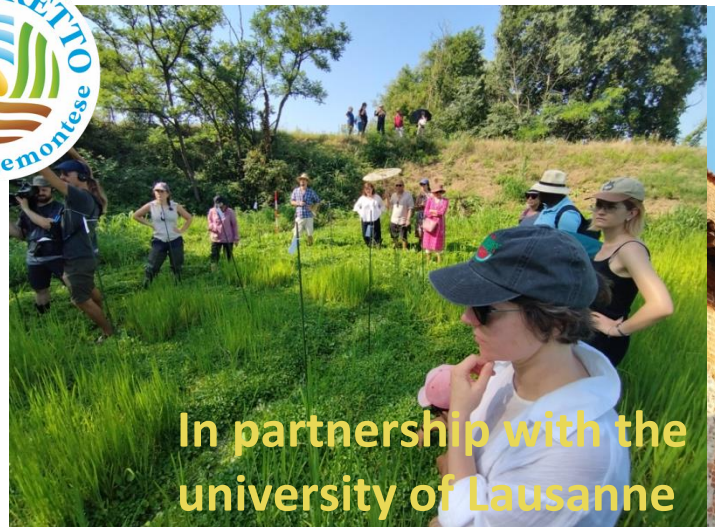
16 Settembre
9:00 Ritrovo presso Cascina Teglio
9:30 Presentazione del Biodistretto del Riso Vercellese e visita al campo sperimentale
10:30 Visita alla riseria presso az. agr. Una Garlanda
11:00 Conferenza stampa presso il Castello di Rovasenda
12.30 Pranzo presso il Castello di Rovasenda*
14:00 – 18:00 International workshop al Castello di Rovasenda (presente il servizio di traduzione).
18:00 Aperitivo presso i giardini del Castello*

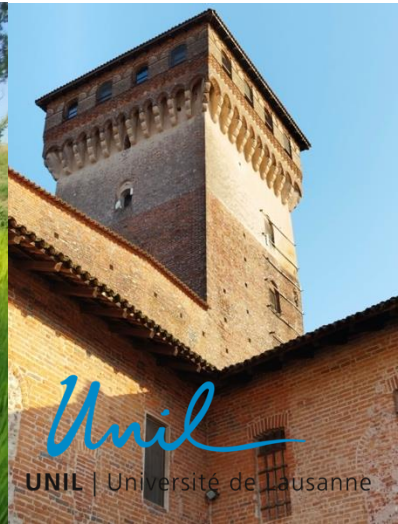
17 Settembre
9:30 – 12:00 International workshop al Castello di Rovasenda

*Prenotazione obbligatoria

LiveSeeding · Rete Semi Rurali · UNIL | Université de Lausanne Institut de géographie et durabilité

Next appointment: **16-17th September 2023** in Rovasenda (Vercelli) - **stay tuned on www.rsr.bio**





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THANK YOU FOR YOUR ATTENTION

https://youtu.be/3ujbylwjMv4?si=_lu06tNqrZd_s8bM

THANK YOU FOR YOUR ATTENTION

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ACKNOWLEDGEMENTS

The Co-authors:

- Giuseppe De Santis
- Salvatore Ceccarelli
- Rachele Stentella
- Michele Salvan
- Bettina Bussi
- Riccardo Bocci
- Daniela Ponzini

The organic rice farms:

- Az. agr. Terre di Lomellina
- Cascina Gambarina
- Cascine Orsine
- Az. agr. Una Garlanda
- Cascina Caremma
- Cascina Dulcamara
- Az. agr. Goio
- Cascina Teglia
- Cascina Angiolina
- Az. agr. Bielli

Funding:

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No. 101059872 and by the Swiss State Secretariat for Education, Research and Innovation (SERI). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union, REA or SERI. Neither the European Union nor SERI can be held responsible for them.