Rice diversity from seed to plate: Practical experiences of sensory evaluation in participatory plant breeding

Daniela Ponzini & Matteo Petitti
Rete Semi Rurali
daniela.ponzini@rsr.bio – matteo.petitti@rsr.bio
www.rsr.bio

Organic rice network 2018-23

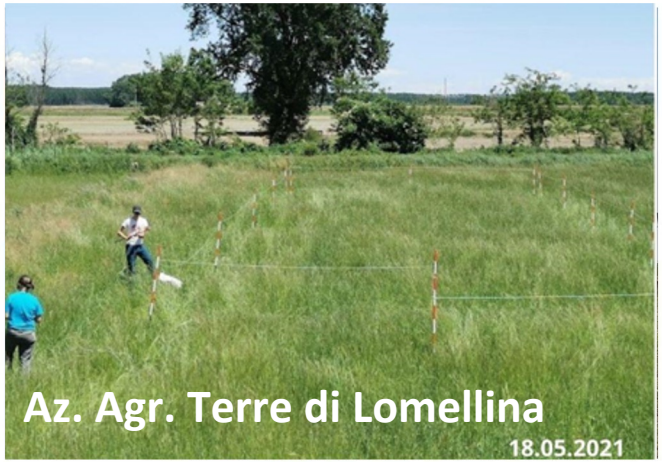
Diversity of ORFS: Paddy field

Rete Semi Rurali

Diversity of ORFS : Dryland rice

Rete Semi Rurali

Diversity of ORFS : Green mulch

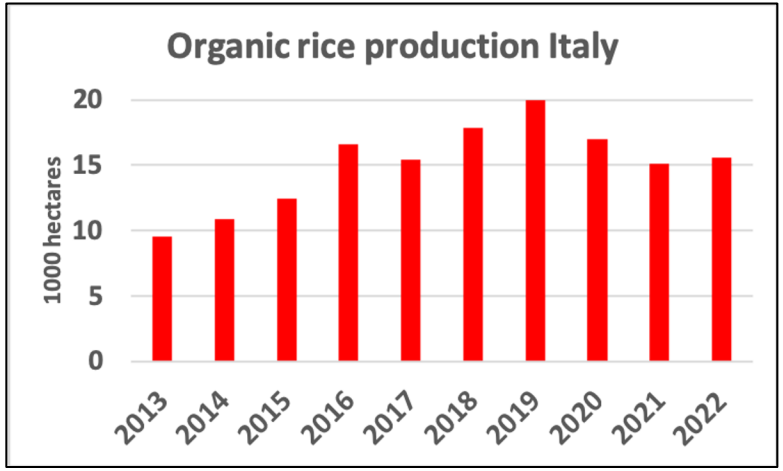


Rete Semi Rurali

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

Rete Semi Rurali

Merceological classification

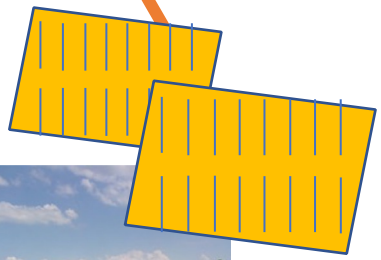
Rapporto Lunghezza/Larghezza \ Lunghezza	< 5,2 mm	Tra 5,2 e 6 mm	> 6 mm
< 3	TONDO	MEDIO	LUNGO A
> 3			LUNGO B (o indica)

National Rice Institute (ENR) and variety cataloge [REGISTROVARIETALEcampagna2023-2024_784_105857.pdf (enterisi.it)]

Rete Semi Rurali

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

Multiplication of the accessions in two farms



Participatory evaluation

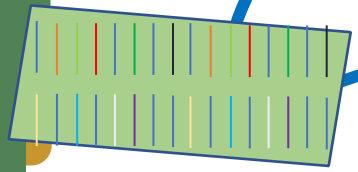
Processing and storing seed - RSR Community Seed Bank

2018

Rete Semi Rurali

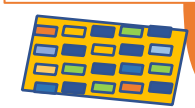
214 Italian rice accessions from IRRI's international gene bank in the Philippines

Multiplication of accessions on one farm



Participatory evaluation

I° participatory field trial (RBD) - 4 farms



I° Morphological and agronomical data collection

Participatory evaluation

2019

Rete Semi Rurali

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

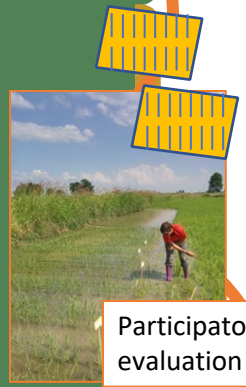
The International Treaty
ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

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



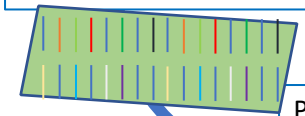
Participatory evaluation

Processing and storing - RSR Community Seed Bank

2019

214 Italian rice accessions from international gene bank IRRI

Multiplication of accessions on one farm



Participatory evaluation

I° participatory field trial (RBD) 4 farms

I° year morphological and agronomical data

Participatory evaluation

Processing and storing - RSR Community Seed Bank

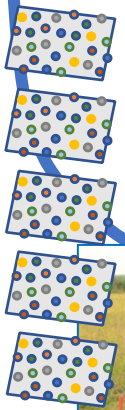
2020

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

Rete Semi Rurali

Fondazione CARIPLO

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,*]

1 Rete Semi Rurali, Scandicci, 50018 Metropolitan, Italy
2 Azienda Terre di Lomellina, Candia di Lomellina, 27031 Pavia, Italy
3 Azienda Una Garlanda, Rovasenda, 13040 Vercelli, Italy
4 Cascina Gambarina, Abbiategrasso, 20081 Milano, Italy
5 Azienda Cascine Orsine, Bereguardo, 27021 Pavia, Italy
6 Independent Researcher, 63100 Ascoli Piceno, Italy
* Correspondence: ceccarelli.salvatore83@gmail.com

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.

check for updates

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

Rete Semi Rurali

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

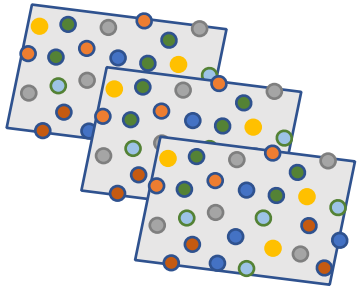
Long grain (A)

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	VOLANO
20	ELBA
21	BELGIOIOSO
22	SESIA
23	SIRIO
24	PI 275446
25	CARMEN

Rete Semi Rurali

Work with dynamic populations continues

2021 & 2022



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

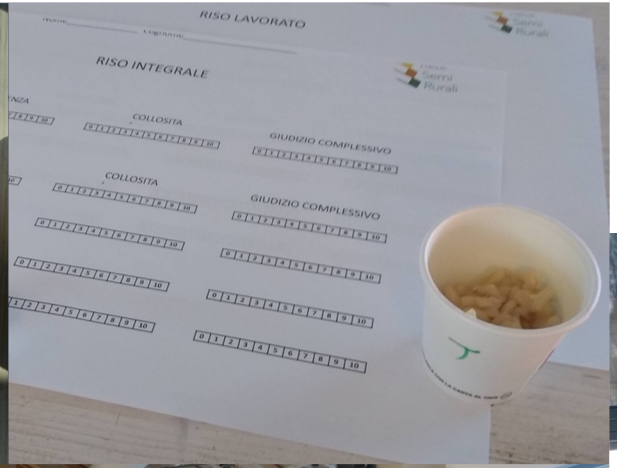
- **Plant height and panicle length**
- **Disease presence**
- **Grain yield**

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

Rete Semi Rurali

Fondazione CARIPLO

Culinary qualities of rice populations



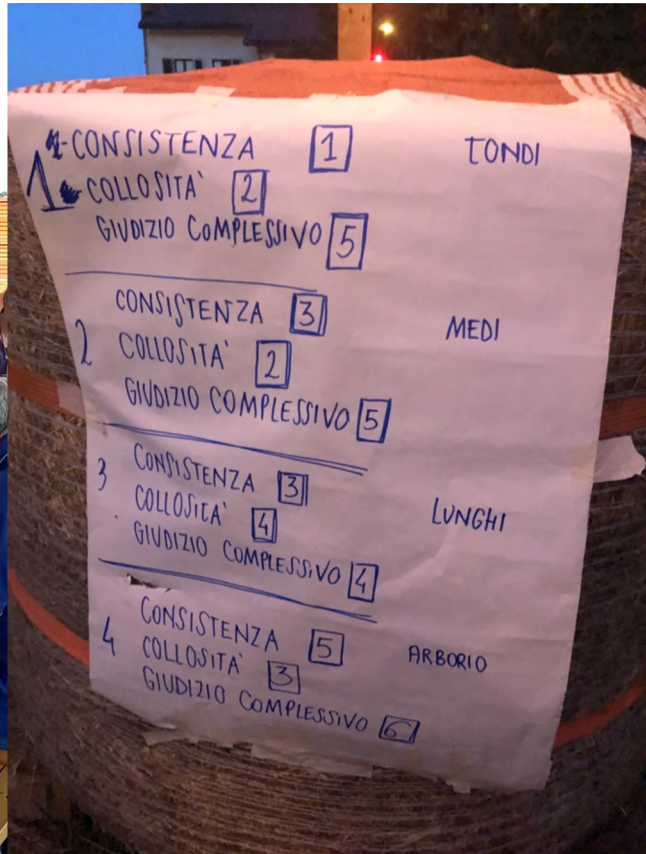
First panel test with farmers March 2022

Quantitative Descriptive Analysis (QDA) methodology

Rete Semi Rurali

Culinary qualities of rice populations

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



Rete Semi Rurali

Culinary qualities of rice populations

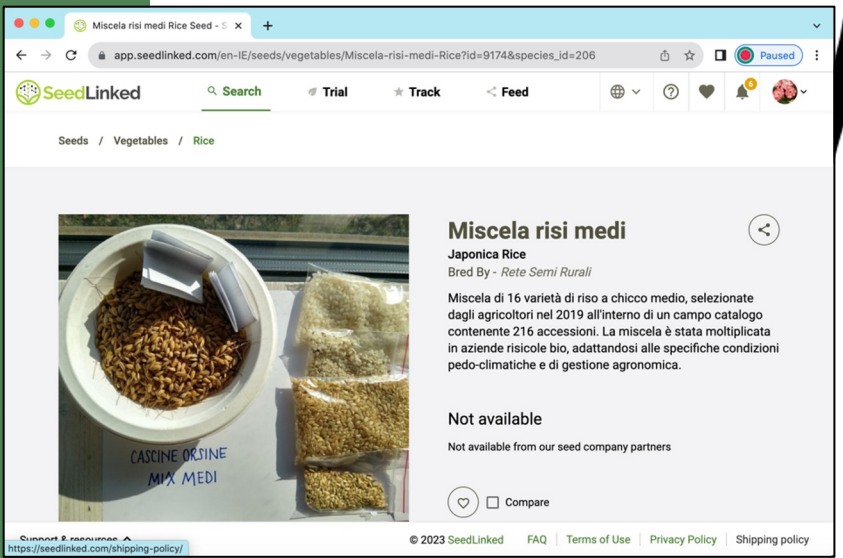
Panel test with citizens at Una Garlanda field day – Autumn 2022

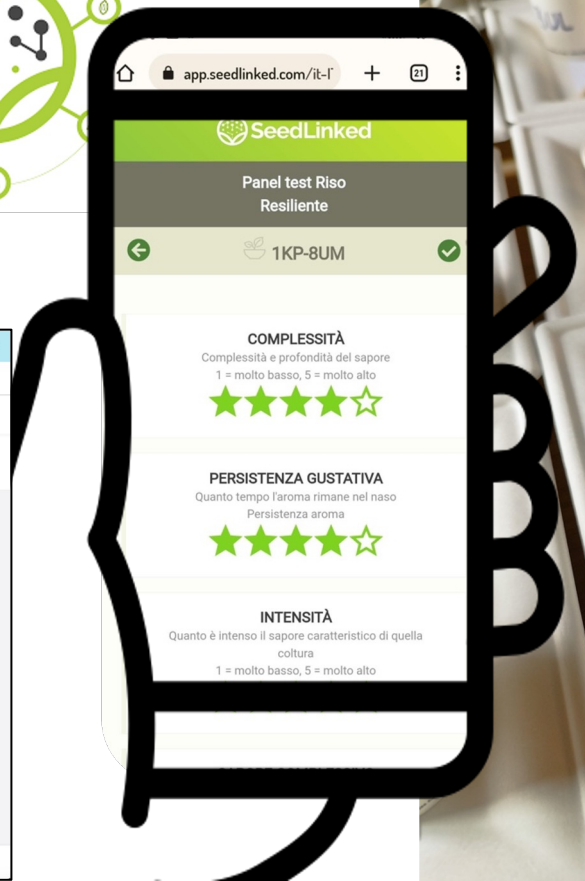
Risotto prepared by a professional chef

Rete Semi Rurali

Tasting trial with SeedLinked app

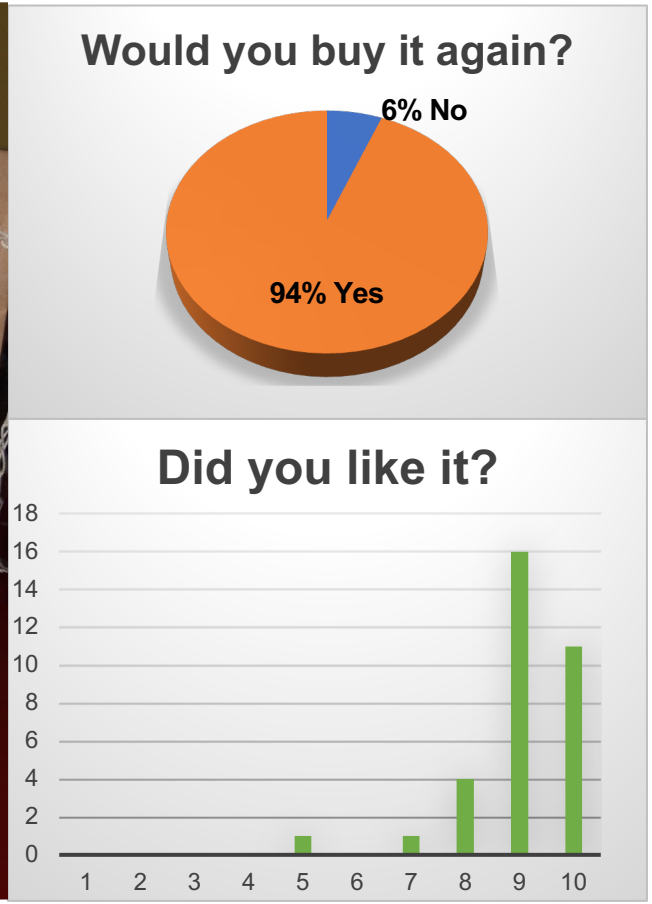
Citizen Science & crowdsourcing platform and app for organic variety trials (March 2023)





Domestic preparation and tasting

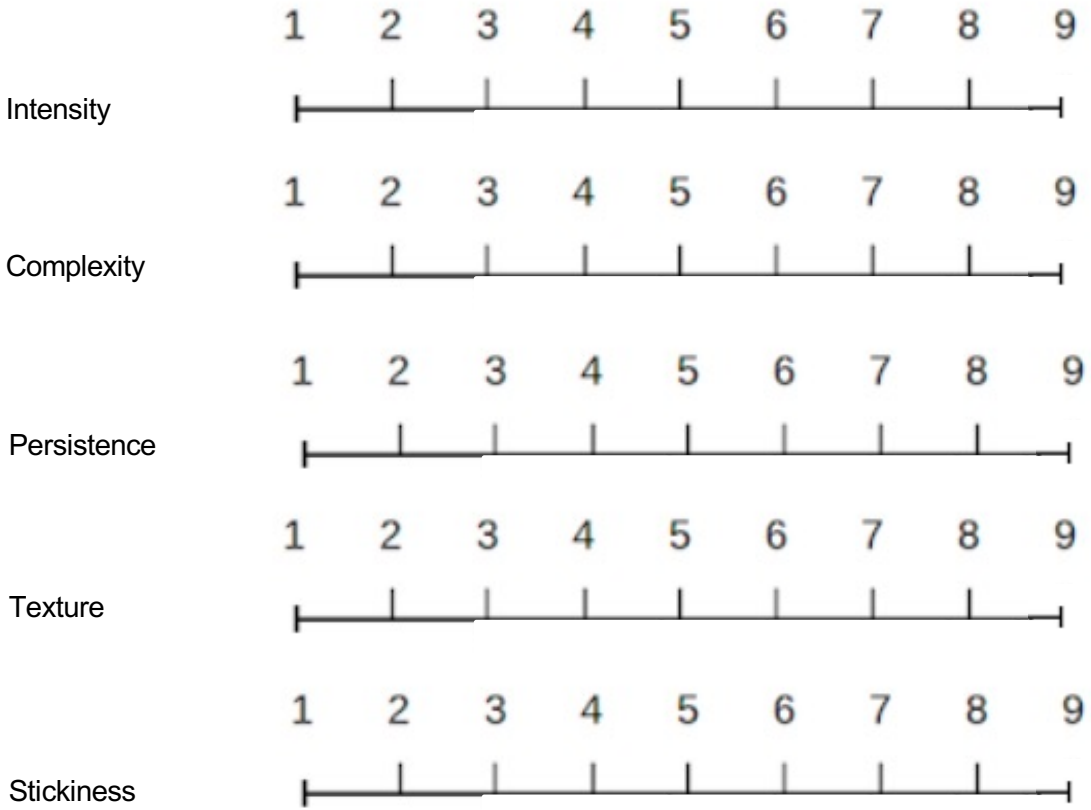
- Distribution through consumer groups
- Sample packets (500g) with QR code for survey
- Cooking and sensory evaluation at home (October 2022 – February 2023)



Rete Semi Rurali

Rice dynamic mixture soon available

Rete Semi Rurali



Rete Semi Rurali

A

B

C

D

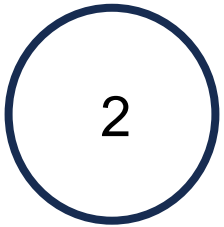
E

ECO·PB European Consortium for Organic Plant Breeding

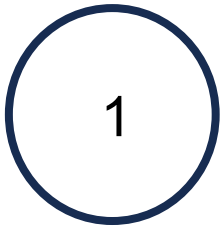
LET'S LIBERATE DIVERSITY!

Rete Semi Rurali

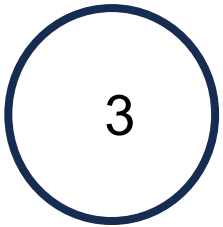
Emma
Carnaroli
Mix M
Rancido



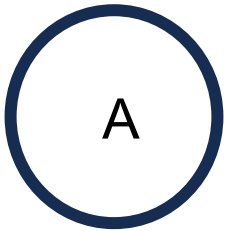
Carnaroli al dente



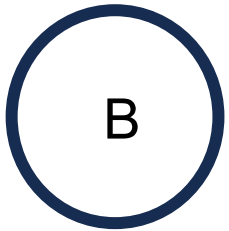
Carnaroli al dente



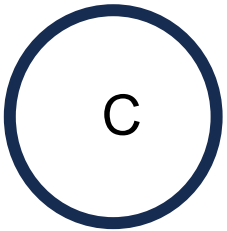
Carnaroli scotto



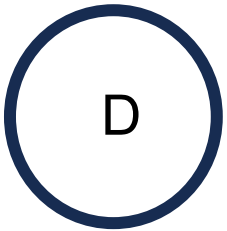
Carnaroli



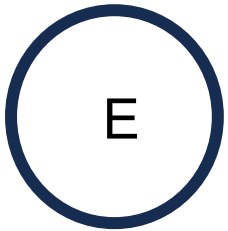
Rosa Marchetti



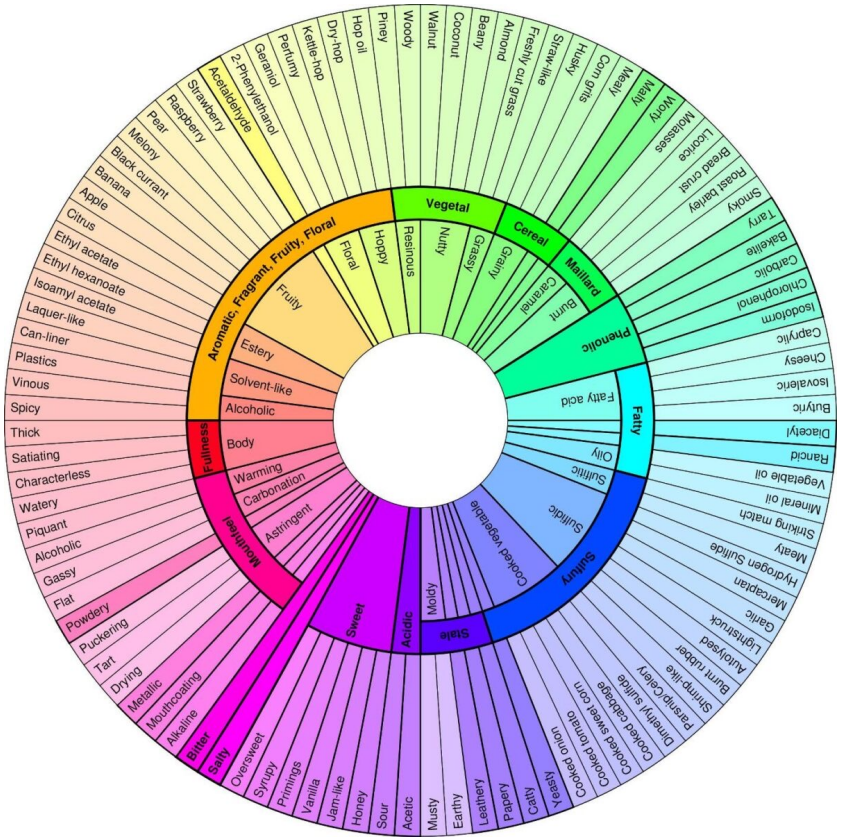
Mix M

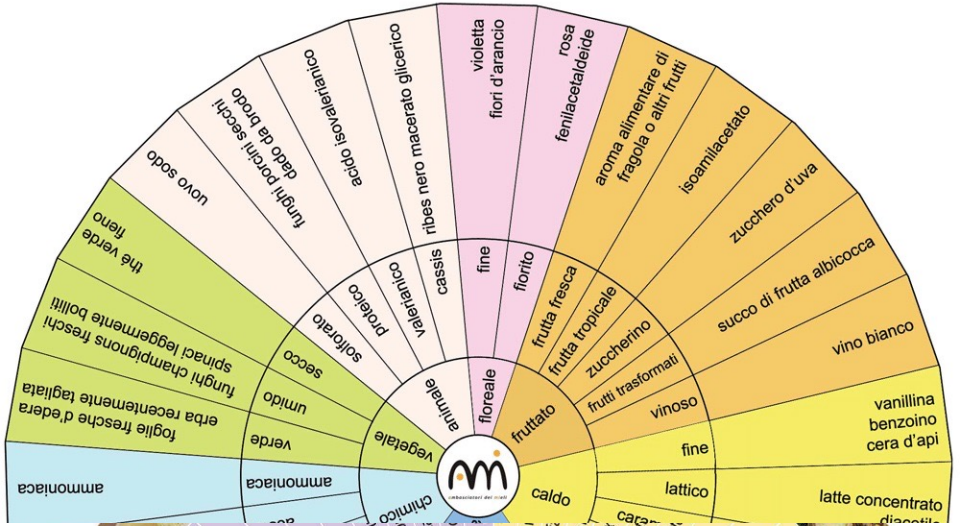


Chinese
Originario



Apollo


Vegetal
Cereal
Maillard
Phenolic
Fatty
Sulfury
Stale
Acidic
Sweet
Bitter
Salty
Mouthfeel
Fullness
Aromatic, Fragrant, Fruity, Floral
Resinous
Nutty
Grassy
Grainy
Caramel
Burnt
Fatty acid
Oily
Sulfur
Sulfidic
Cooked vegetable
Moldy
Floral
Hoppy
Fruity
Estery
Solvent-like
Alcoholic
Body
Warming
Carbonation
Astringent
Walnut
Coconut
Beany
Almond
Freshly cut grass
Strawberry
Husky
Corn grits
Malty
Worty
Molasses
Licorice
Bread crust
Roast barley
Smoky
Tarry
Bakelite
Carbolic
Chlorophenol
Isodoric
Caprylic
Cheesy
Isovaleric
Butyric
Diacetyl
Rancid
Vegetable oil
Mineral oil
Striking match
Meaty
Hydrogen Sulfide
Mercaptan
Garlic
Lightstruck
Autolysed
Burnt rubber
Shrimp-like
Dimethyl sulfide
Parsnip/Celery
Cooked cabbage
Cooked sweet corn
Cooked tomato
Cooked onion
Musty
Earthy
Leathery
Papery
Catty
Yeasty
Oversweet
Syrupy
Primings
Vanilla
Jam-like
Honey
Sour
Acetic
Metallic
Mouthcoating
Alkaline
Pear
Melony
Black currant
Banana
Apple
Citrus
Ethyl acetate
Ethyl hexanoate
Isoamyl acetate
Laquer-like
Can-liner
Plastics
Vinous
Spicy
Thick
Satiating
Characterless
Watery
Piquant
Alcoholic
Gassy
Flat
Powdery
Puckering
Tart
Drying
Strawberry
Raspberry
Acetaldehyde
2-Phenylethanol
Geraniol
Perfumy
Kettle-hop
Dry-hop
Hop oil
Piney
Woody


animale
vegetale
floreale
fruttato
caldo
chimico
ammoniaca
verde
umido
secco
solforato
proteico
valerianico
cassis
fine
fiorito
frutta fresca
frutta tropicale
zuccherino
frutti trasformati
vinoso
fine
lattico
ammoniaca
foglie fresche d'edera
erba recentemente tagliata
fungi champignons freschi
spinaci leggermente bolliti
thé verde
fieno
uovo sodo
fungi porcini secchi
dado da brodo
acido isovalerianico
ribes nero macerato glicerico
violetta
fiori d'arancio
rosa
fenilacetaldeide
aroma alimentare di
fragola o altri frutti
isoamilacetato
zucchero d'uva
succo di frutta albicocca
vino bianco
vanillina
benzoino
cera d'api
latte concentrato

Arômes
du pain
Céréales
Graines sèches
Fruits
Fruits transformés
FRUITÉ
Levure
Levain
FERMENTÉ
Légèrement torréfié
Malté
Grillé
Brûlé
TORRÉFIÉ
Vert
Terreux
Boisé
VÉGÉTAL
Épices
Floral
ÉPICÉ
Saveurs
Trigéminal
GOÛT
Cire ux
Animal
Huiles-graisses
Défauts
AUTRES
noix
noisette
cacahuète
amande
châtaigne
pomme
ananas
noix de coco
poire
banane
fruits fermentés
fruits secs
levure sèche
levure fraîche
acide
acide lactique
acide acétique
zwieback
mélasse
caramel
sauce de soja
toasté
tabac
fumée
charbon
gout
vanille
clou de girofle
poivre
pain d'épice
rose
miel de fleur
salé
sucré
acide
amer
piquant
astringent
brûlant
persistant
cire d'abeille
résine
beurre
oeuf
huile d'olive
huile de friture
pop corn
moisi
rance