



UNIVERSITÀ DI PARMA

**Progetto Bio2:
Valutazione delle componenti bioattive
in varietà di *Triticum* e in popolazioni evolutive**

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Ruolo nel progetto



1. Caratterizzazione compositiva delle granelle (varietà in purezza, EP, annate 2017 e 2018)
2. Caratterizzazione compositiva delle farine (EP)
3. Caratterizzazione compositiva dei pani (lievito da forno, madre acida)
4. Bioaccessibilità «in vitro» di micronutrienti

Asparagina

Composti fenolici

Alchilresorcinoli

Fibra

Vitamine del gruppo B

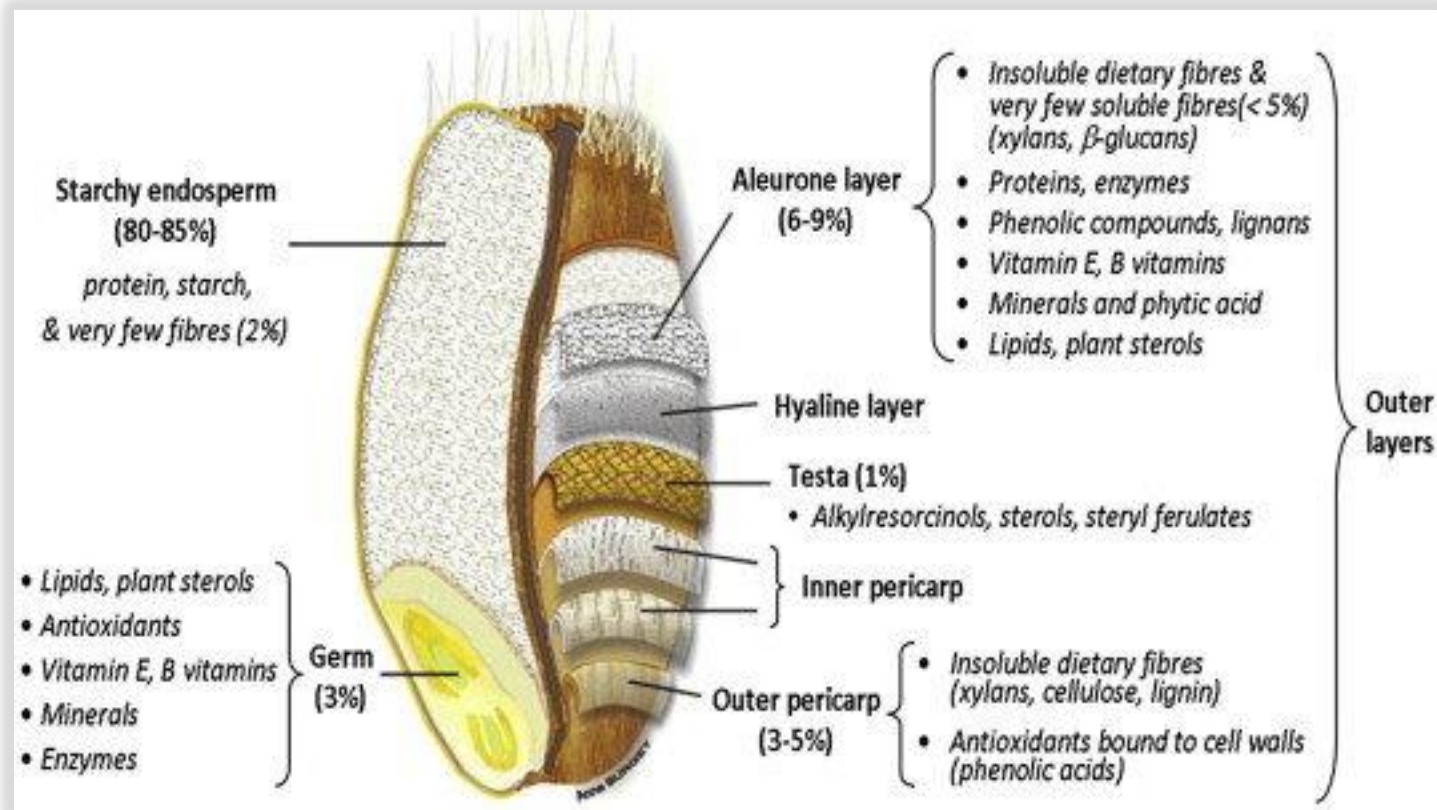
Grassi

Oligoelementi

Proteine

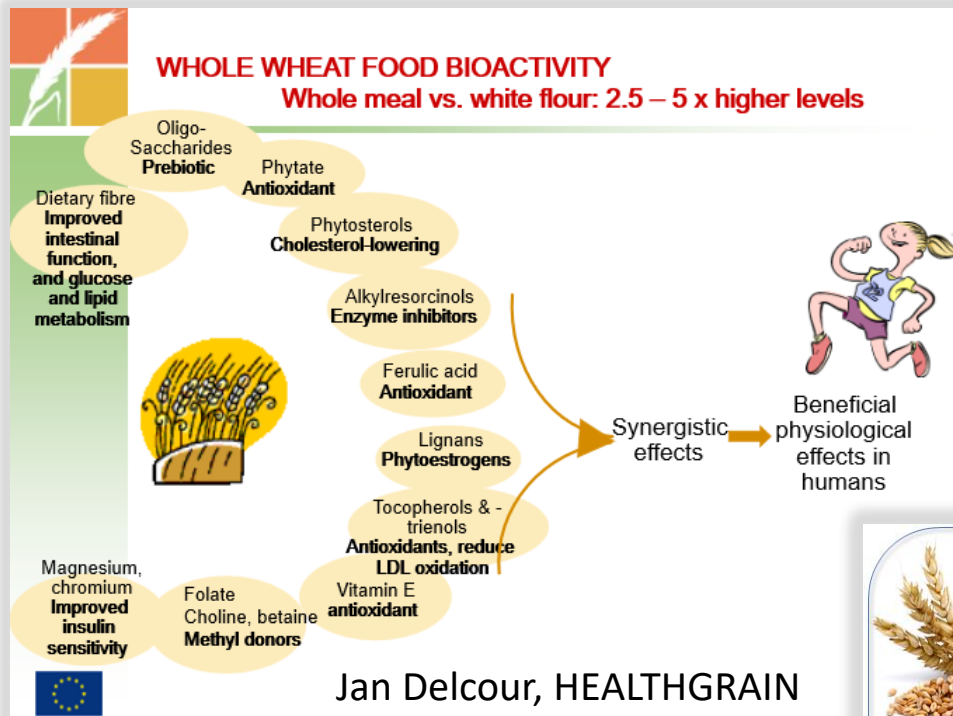


Componenti bioattive nel frumento



I composti bioattivi sono localizzati negli strati più esterni della cariosside, in cui si trova anche la maggiore concentrazione di fibra.

Componenti bioattive nel frumento



Gli effetti salutistici dei cereali integrali sembrano principalmente legati alla presenza di fibra e di composti bioattivi



PROCESSING

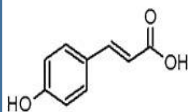
Diminuzione del contenuto di bioattivi
Effetto sulla bioaccessibilità

DIFETTI SENSORIALI

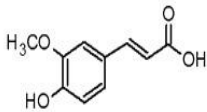
Texture, colore, sapore

Quali composti bioattivi?

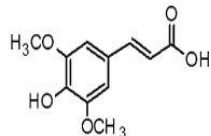
Acidi fenolici



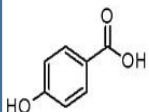
Ac. p-Cumarico



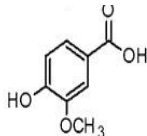
Ac. Ferulico



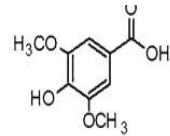
Ac. Sinapico



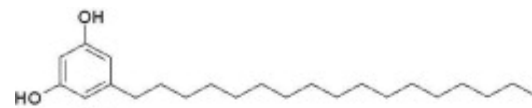
Ac. 4-idrossibenz.



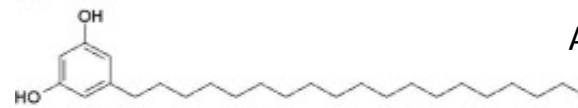
Ac. Vanillico



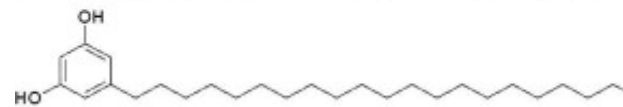
Ac. Siringico



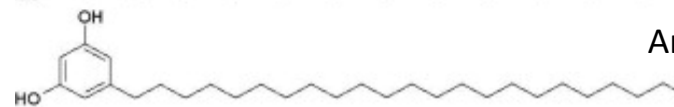
Ar17



Ar19

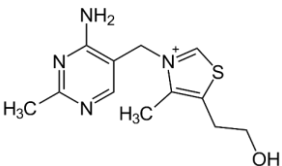


Ar21

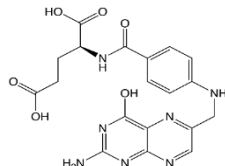


Ar23

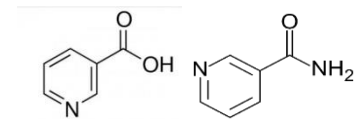
Alchilresorcinoli



Tiamina
B1



Acido Folico
B9



Acido nicotinico Nicotinamide
Niacina
B3

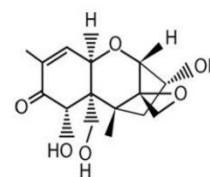
Vitamine del gruppo B

Selenio
Manganese
Ferro
Zinco

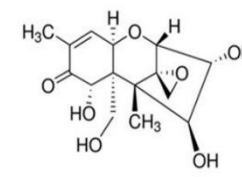
Oligoelementi

Fibra insolubile alto MW
Fibra solubile alto MW
Fibra solubile basso MW

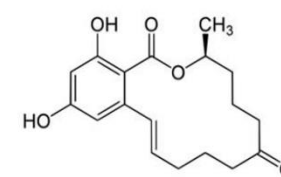
Fibra dietetica



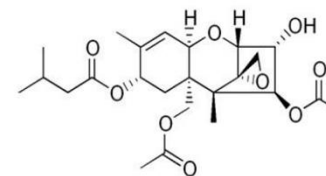
Deossinivalenolo



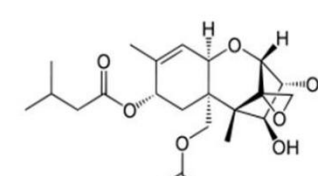
Nivalenolo



Zearalenone



T2



HT2

Micotossine

Farine e pani ottenuti da EP

Varietà	Resa macinazione (%)	Ceneri (% s.s.)
---------	-------------------------	--------------------

EP BIO ² teneri	66,2	0,68
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EP "Grossi"	64,8	0,74
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EP Icarda	64,7	0,71
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Bologna 00	67,7	0,43
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Bologna 1	-	0,80
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Ingredienti	Lievito di birra	Lievito madre
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Farina	3kg	2,5kg
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Lievito	2%	25%
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Sale	2%	2%
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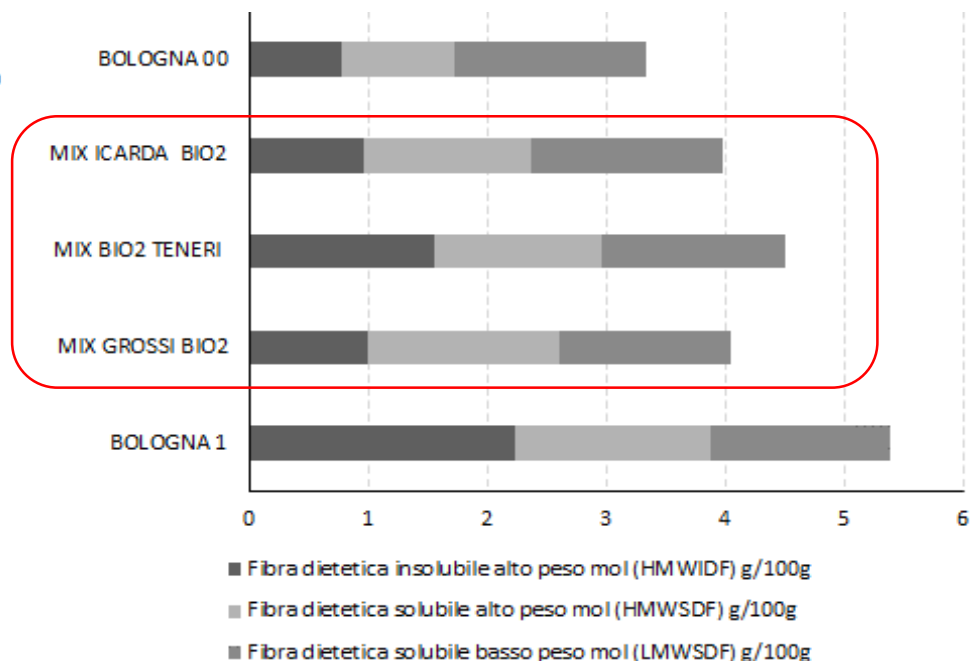
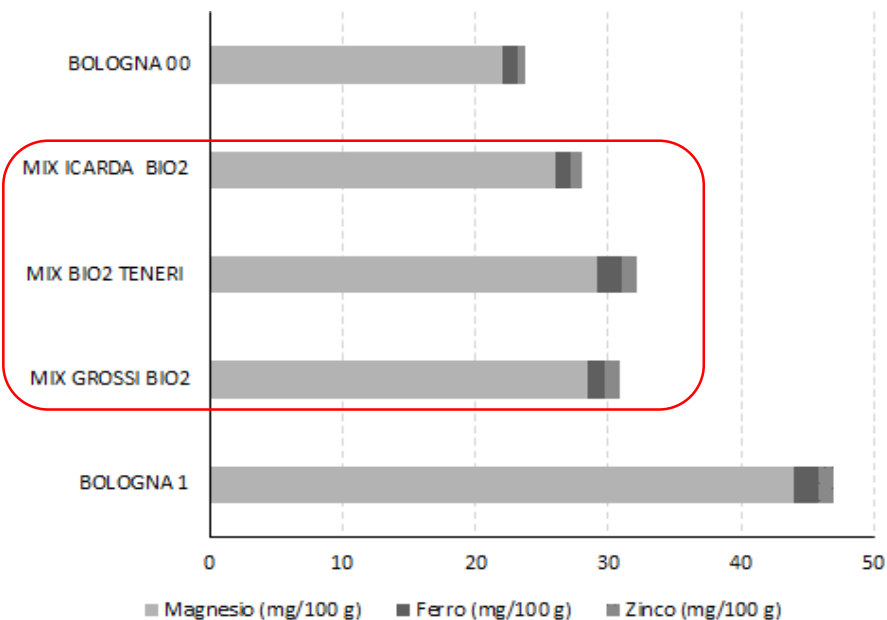
Malto	1,5%	1,5%
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Olio d'Oliva (EVO)	1%	1%
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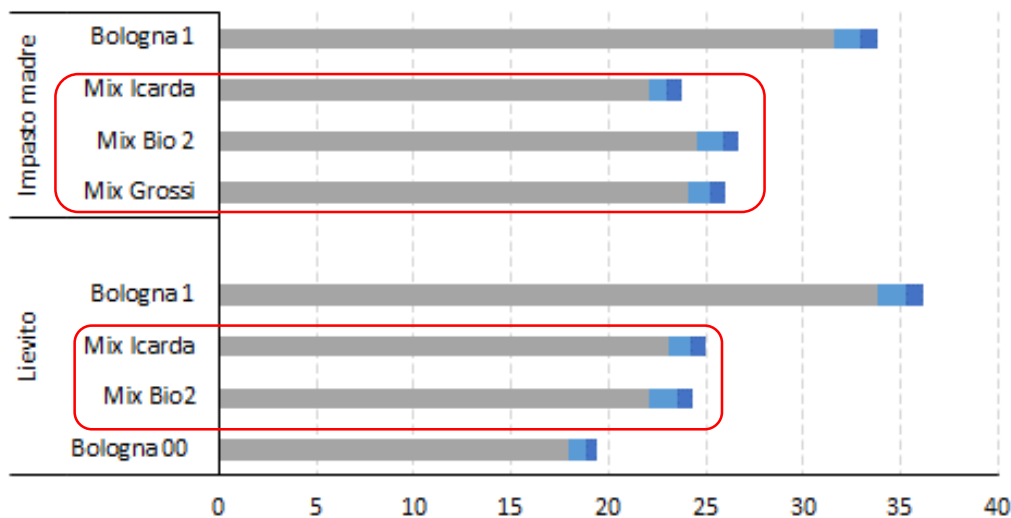
Acqua	50% - 60%	50% - 60%
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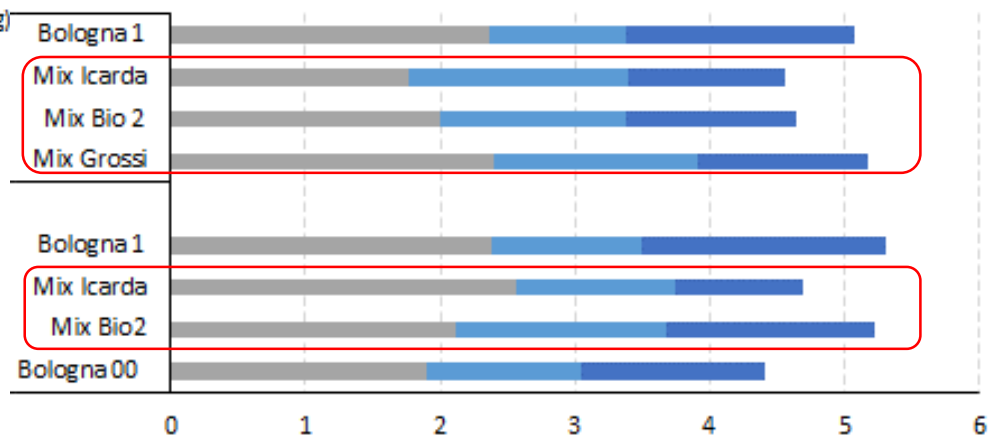
Farine e pani da EP: caratterizzazione



Farine e pani da EP: caratterizzazione



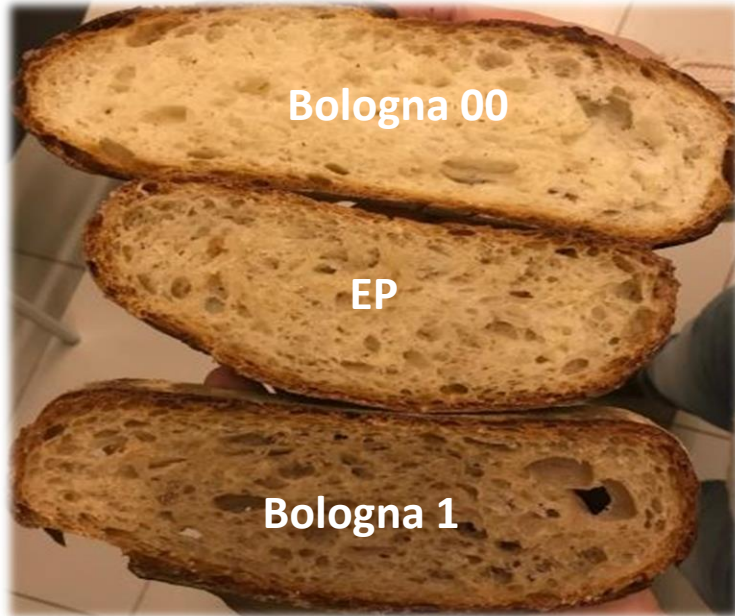
■ Magnesio (mg/100 g) ■ Ferro (mg/100g) ■ Zinco (mg/100g)



■ Fibra dietetica insolubile alto peso mol (HMWIDF) g/100g
 ■ Fibra dietetica solubile alto peso mol (HMWSDF) g/100g
 ■ Fibra dietetica solubile basso peso mol (LMWSDF) g/100g



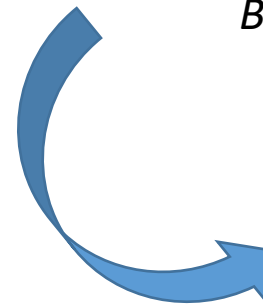
Farine e pani da EP: caratterizzazione



Il profilo in bioattivi dei pani si colloca tra controllo positivo (Bologna 1) e controllo negativo (Bologna 00)

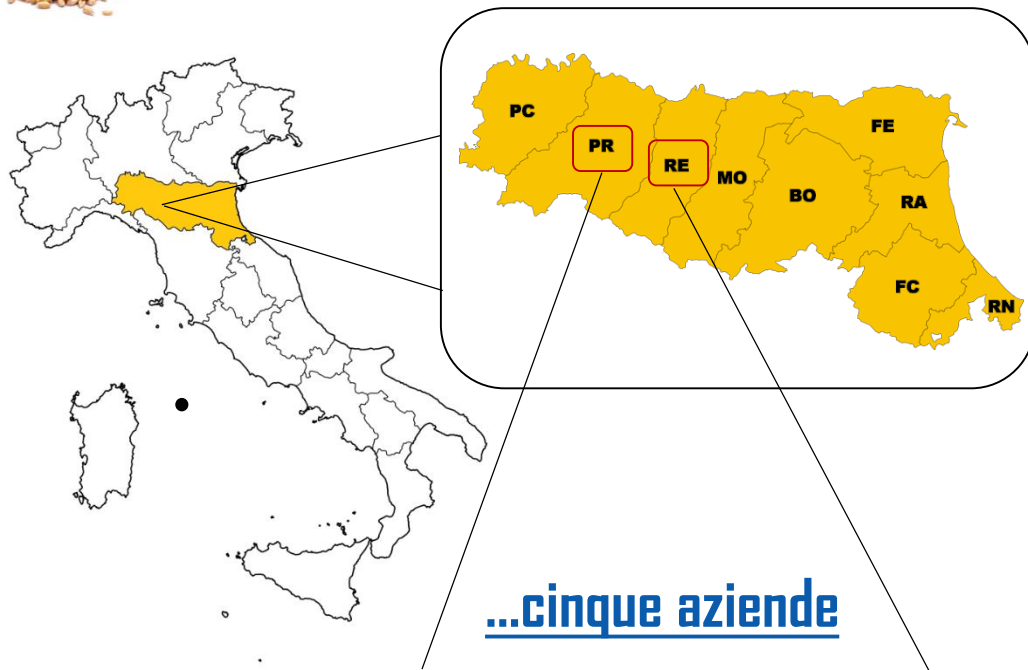


IL **PANE EP** MANTIENE *CARATTERISTICHE ORGANOLETTICHE* PROSSIME AL PANE COMUNE, MA CON UN *CONTENUTO IN BIOATTIVI* PIU' ELEVATO



**VALIDA ALTERNATIVA
AL PANE COMUNE**

I nostri materiali



Grossi
Angus di Marcora
Cunial

Le Piagne di Casali
Bismantova

24 varietà in purezza

T. aestivum (storico e moderno)
T. Durum (storico e moderno)
T. Turanicum
T. Turgidum
Monococco
Dicocco
Spelta

6 EP

ICARDA (SOLIBAM)
Bio2 teneri
Bio2 duri
"Grossi"

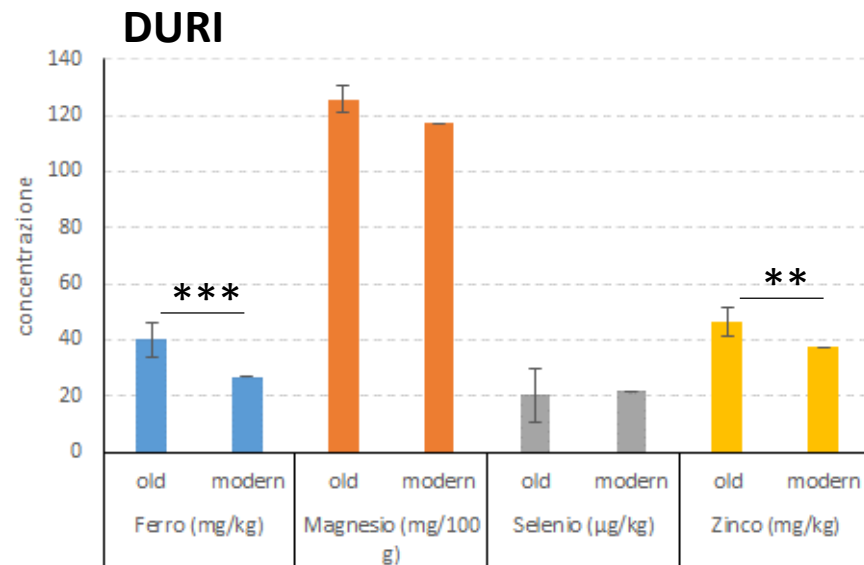
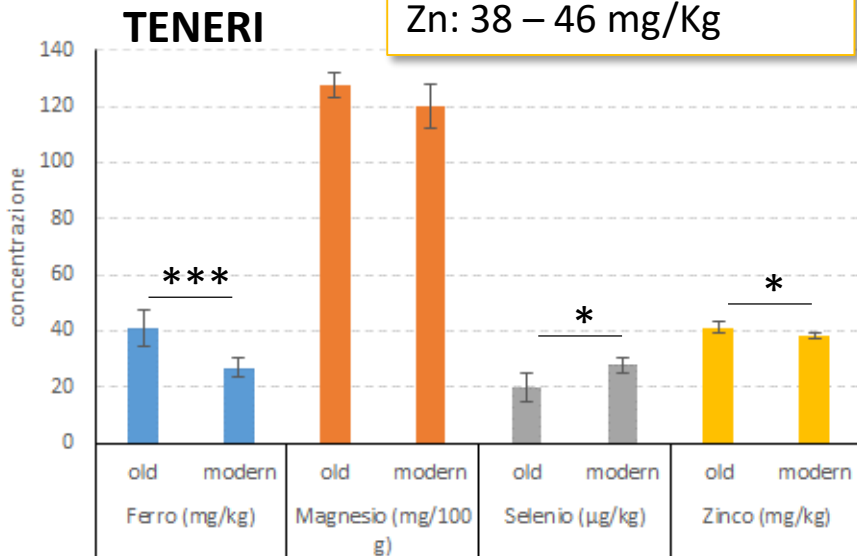


Parcelle sperimentali e su larga scala (10 and 1000 m²)

Singole varietà: oligoelementi



Fe: 24 – 57 mg/Kg
Mg: 114 – 131 mg/100g
Se: 11 – 30 µg/Kg
Zn: 38 – 46 mg/Kg



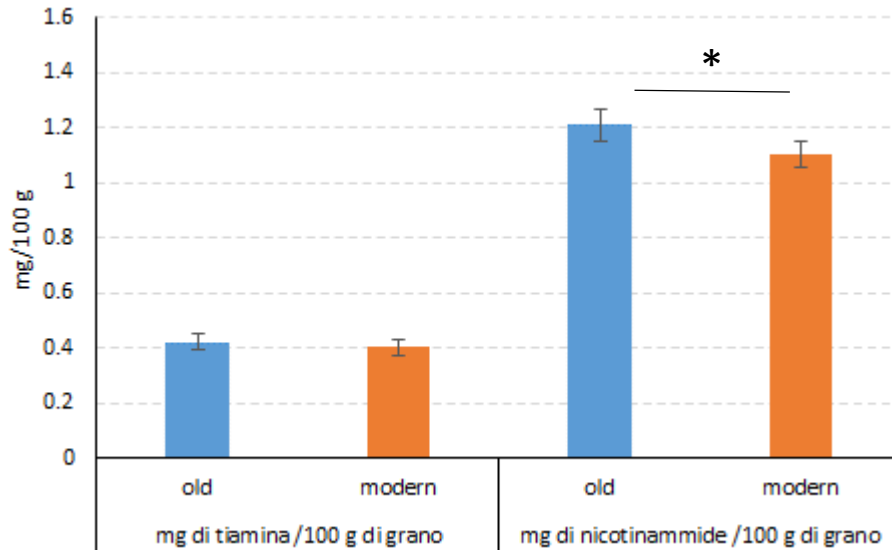
Fe: 26 – 47 mg/Kg
Mg: 116 – 132 mg/100g
Se: 14 – 43 µg/Kg
Zn: 38 – 55 mg/Kg

Singole varietà: vitamine del gruppo B

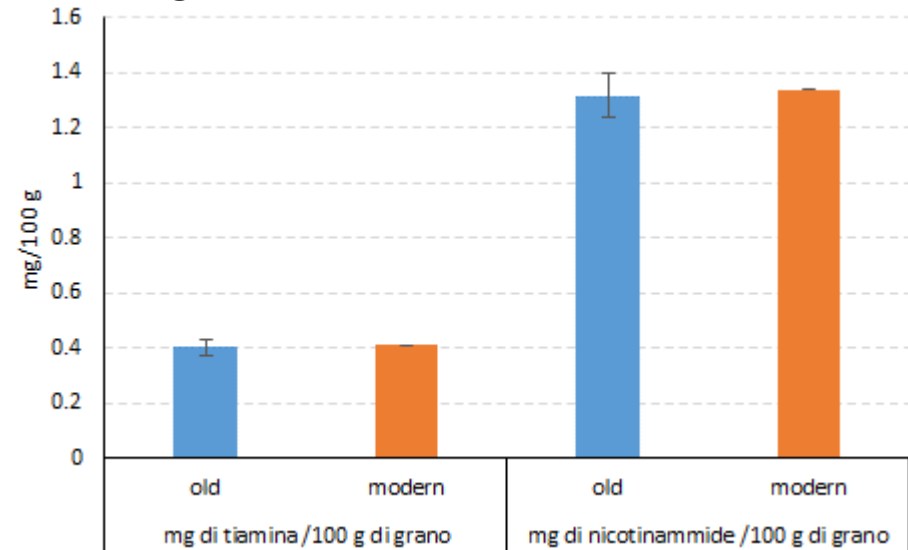


Tiamina: 0.38-0.46 mg/100 g
Nicotinamide: 1.1-1.4 mg/100 g

TENERI



DURI



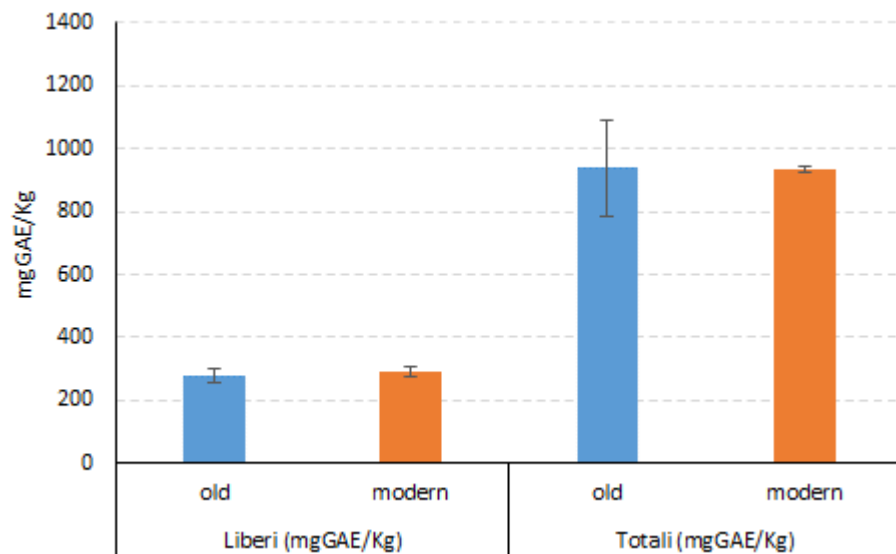
Tiamina: 0.36-0.46 mg/100 g
Nicotinamide: 1.1-1.5 mg/100 g

Singole varietà: composti fenolici

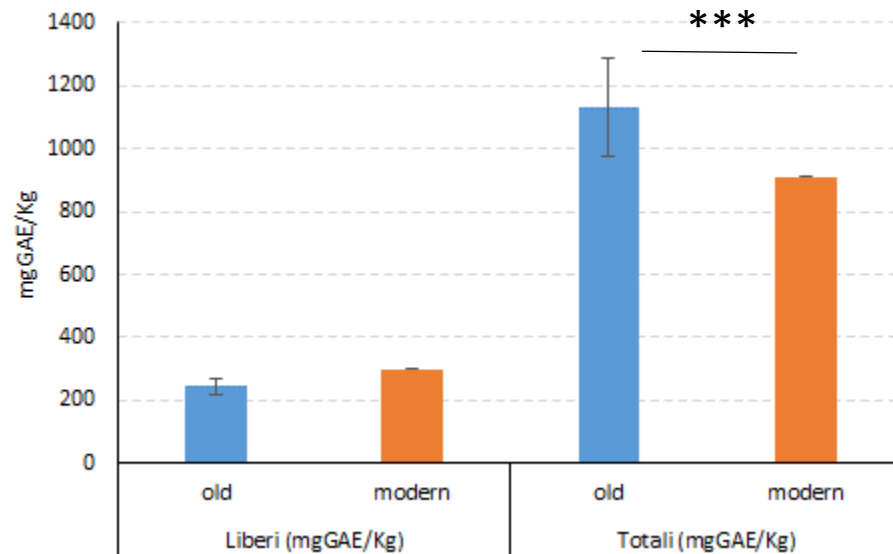


Polif liberi: 249-353 mgGAE/Kg
Polif totali: 813-1347 mgGAE/Kg

TENERI

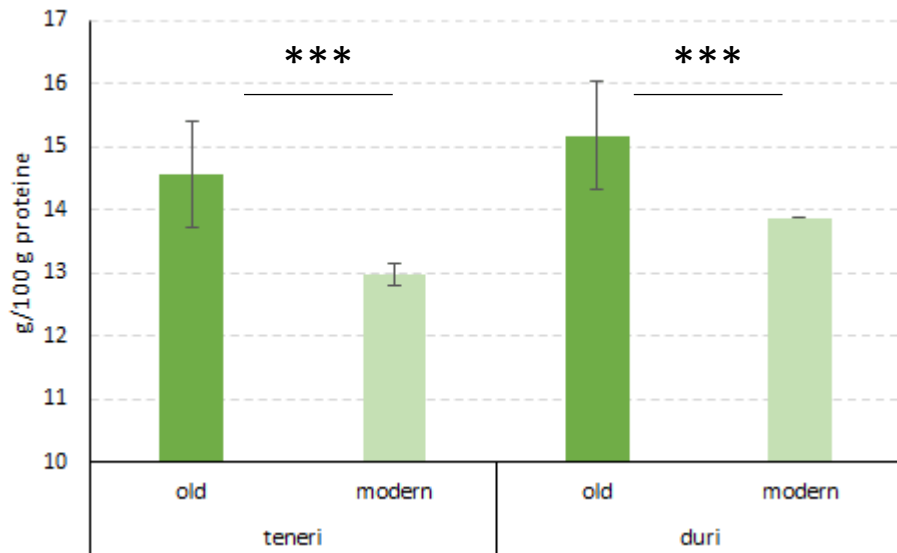


DURI



Polif liberi: 213-321 mgGAE/Kg
Polif totali: 783-1280 mgGAE/Kg

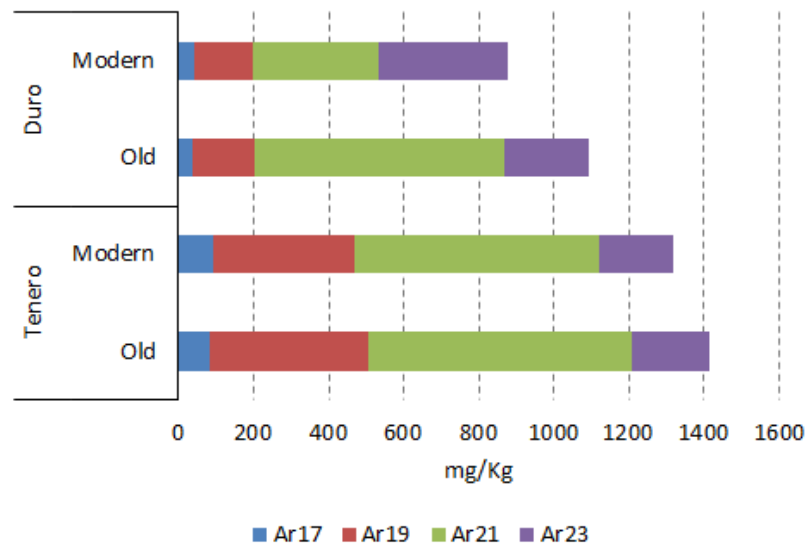
Singole varietà: proteine ed alchilresorcinoli



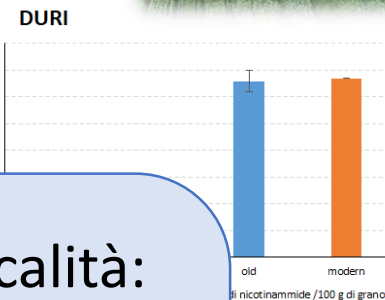
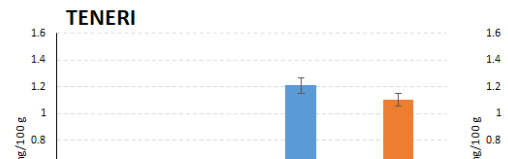
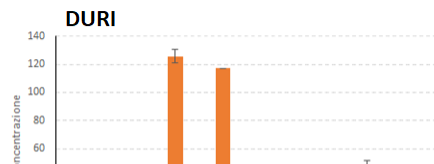
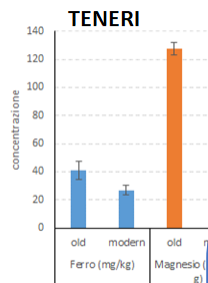
Proteine:

DURI 14.3 – 17.3 g/100g

TENERI 12.8 – 16.5 g/100g

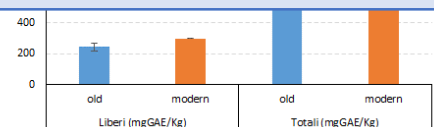
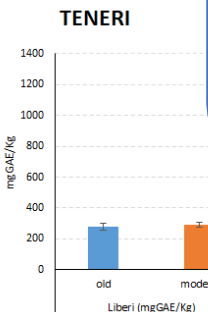


Singole varietà: teneri e duri

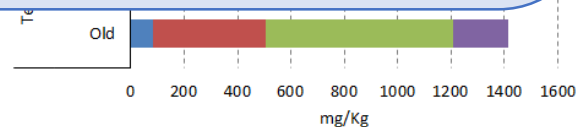


In generale, su due anni di studio e diverse località:

1. Elevata variabilità (*annata colturale*)
 2. Storici \geq moderni
- MA**
3. Minime differenze

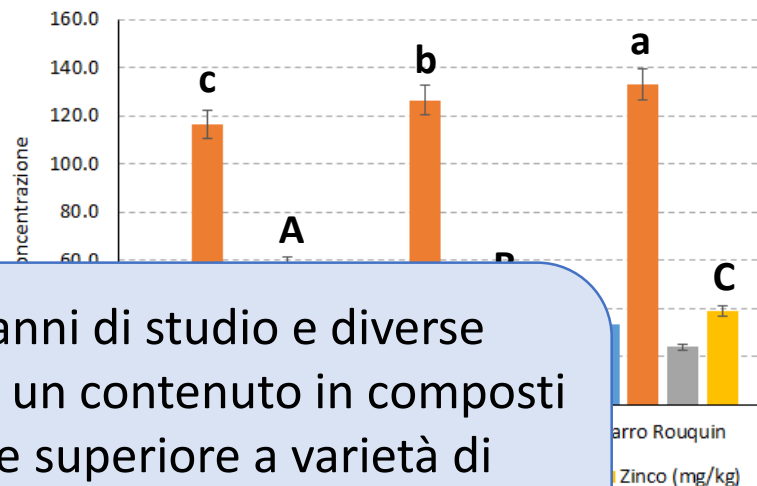
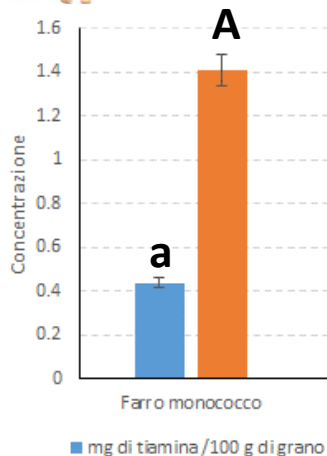


Composti fenolici



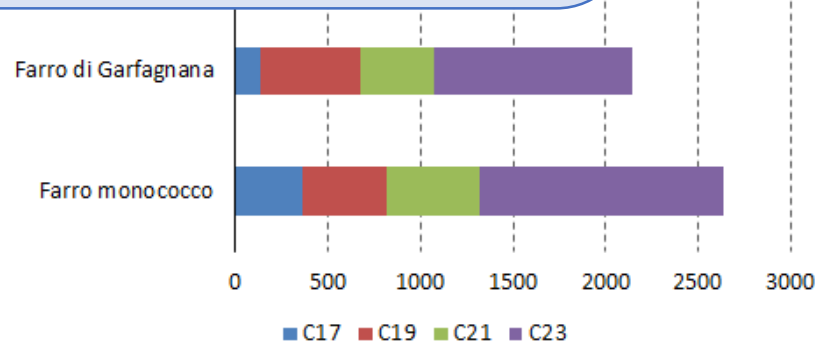
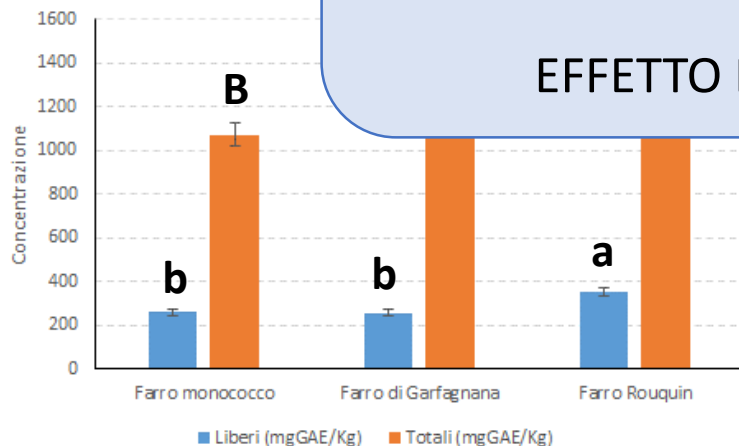
Alchilresorcinoli

Singole varietà: farri



In generale, su due anni di studio e diverse località, i farri mostrano un contenuto in composti bioattivi mediamente superiore a varietà di frumento tenero e duro

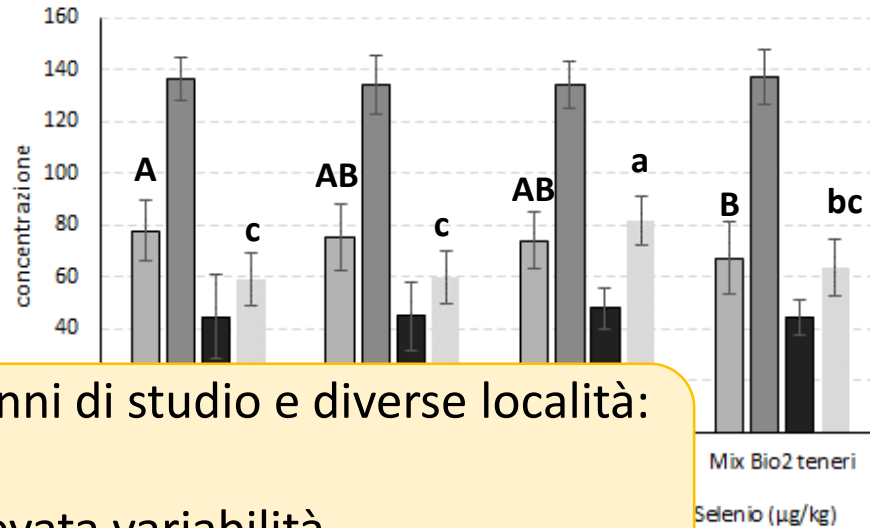
EFFETTO DELL'ANNATA COLTURALE





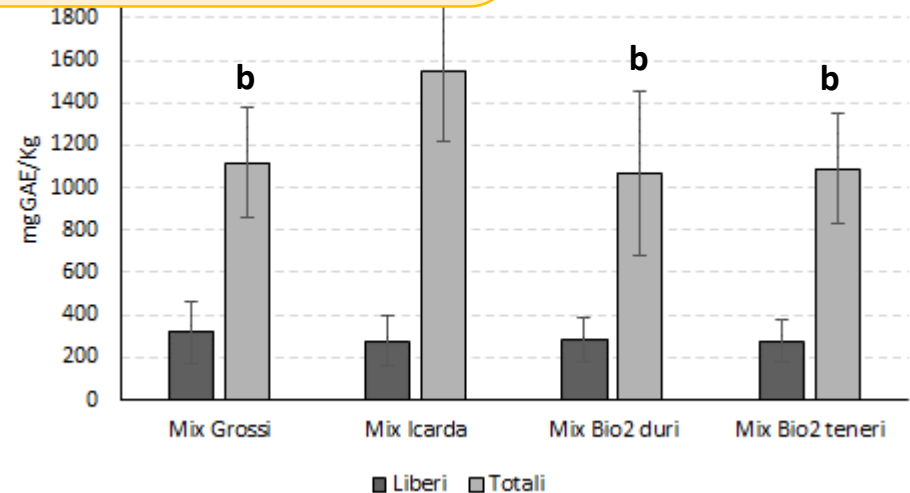
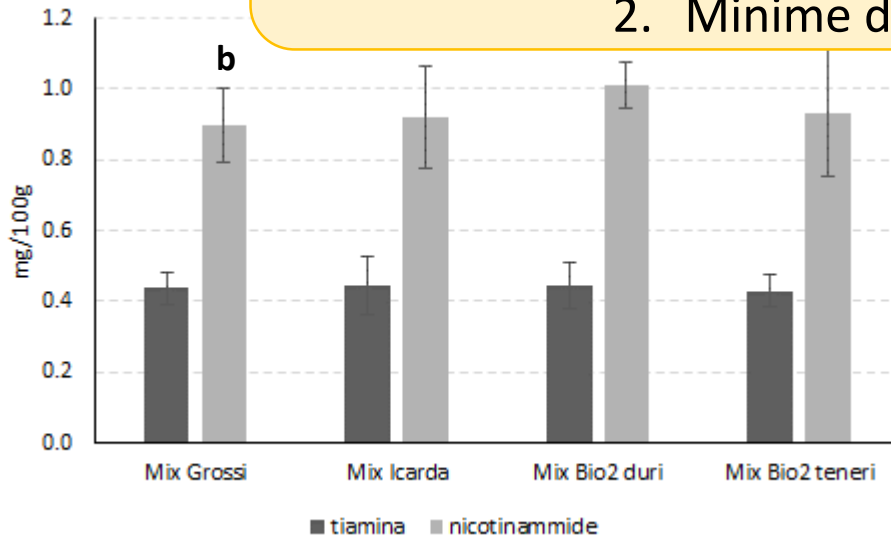
Caratterizzazione delle popolazioni evolutive

	Proteine (%)
EP Grossi	15.2
EP Icarda	15.0
EP Bio2 duri	15.5
EP Bio2 teneri	



In generale, su due anni di studio e diverse località:

1. Elevata variabilità
2. Minime differenze



Caratterizzazione delle popolazioni evolutive



Factorial MANOVA



Stagione colturale
(annata)



Varietà
(EP)



Territorio
(azienda agricola)

FATTORE SIGNIFICATIVO



+ significatività



- significatività

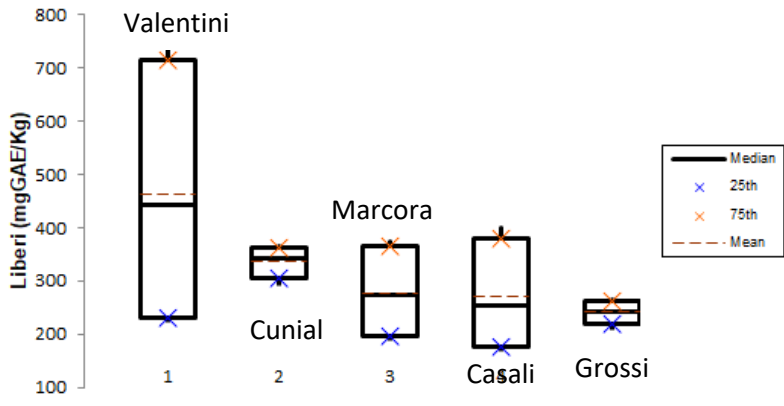
Le EP stanno adattandosi al territorio, modulando le proprie caratteristiche in base al proprio «intorno»

Territorio
Territorio x varietà
Territorio x stagione colturale
Territorio x stagione colturale x varietà

Caratterizzazione delle popolazioni evolutive

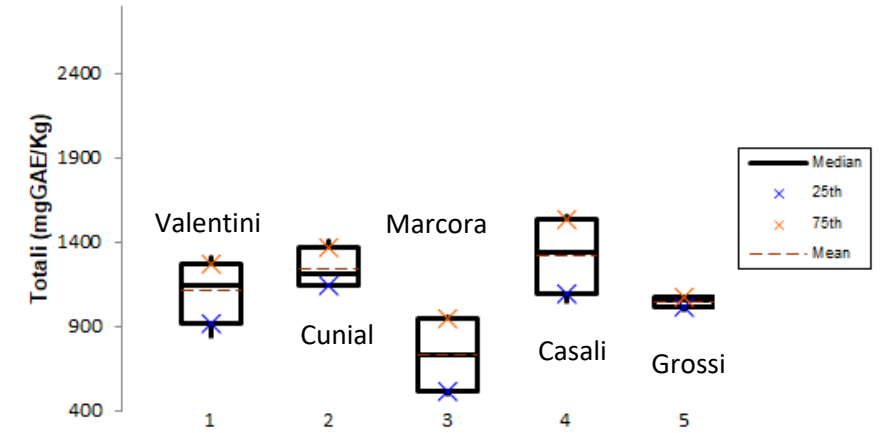
POLIFENOLI LIBERI

EP «Grossi»



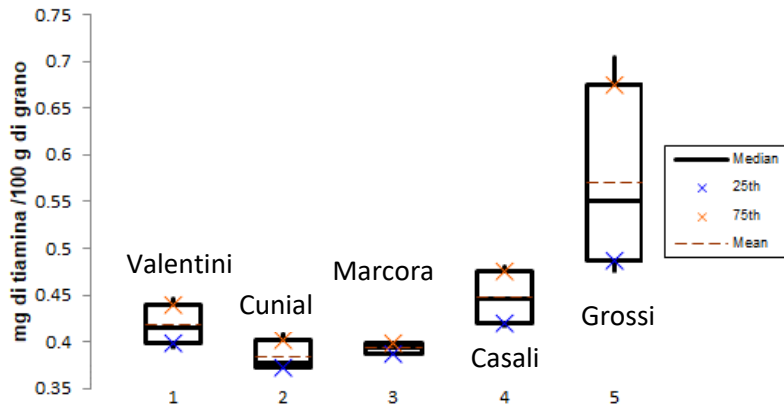
POLIFENOLI TOTALI

EP «Bio2 teneri»



TIAMINA

EP «Icarda»



Per tutte le componenti valutate, ogni EP mostra un andamento diverso nelle 5 aziende in esame.

Ogni **BINOMIO** EP-azienda rappresenta una **UNICITA'**

Dai dati raccolti... quale valore?

VALORE NUTRIZIONALE



BIODIVERSITA'

Grani antichi: un argomento molto attuale

Electrophoresis 2018, 39, 2001–2010

2001

Alessandro Di Loreto¹
Sara Bosi¹
Lidia Montero²
Valeria Bregola¹
Ilaria Marotti¹
Rocco Enrico Sferrazza¹
Giovanni Dinelli¹
Miguel Herrero^{2*}
Alejandro Cifuentes²

Research Article

Determination of phenolic compounds in ancient and modern durum wheat genotypes

OPEN ACCESS Freely available online

PLOS ONE

Phytochemical Profile and Nutraceutical Value of Old and Modern Common Wheat Cultivars

Emanuela Leoncini¹, Cecilia Prata¹, Marco Malaguti¹, Ilaria Marotti², Antonio Segura-Carretero³, Pietro Catizone², Giovanni Dinelli², Silvana Hrelia^{1*}

of Agroenvironmental Science and Technology, Granada, Spain

Italian Journal of Agronomy 2016; volume 11:750

page press

Nutritional characteristics of ancient Tuscan varieties of *Triticum aestivum* L.

Lisetta Ghiselli¹, Eleonora Rossi¹, Anne Whittaker¹, Giovanni Dinelli², Adriano Pasqualino Baglio¹, Luisa Andrenelli¹, Stefano Benedettelli¹

¹Department of Agrifood Production and Environmental Sciences, University of Florence, Florence; ²Department of Agricultural Sciences, University of Bologna, Bologna, Italy

Trends in Plant Science

CellPress

Opinion

Back to the Future – Tapping into Ancient Grains for Food Diversity

C. Friedrich H. Longin^{1,†,*} and Tobias Würschum¹

Research Article

SCI

Received: 10 February 2016 Revised: 13 April 2016 Accepted article published: 2 May 2016 Published online in Wiley Online Library: 7 June 2016

(wileyonlinelibrary.com) DOI 10.1002/jsfa.7782

Environment and genotype effects on antioxidant properties of organically grown wheat varieties: a 3-year study

Raffaella Di Silvestro,^{a,b*} Alessandro Di Loreto,^a Sara Bosi,^a Valeria Bregola,^a Ilaria Marotti,^a Stefano Benedettelli,^c Antonio Segura-Carretero^{d,e} and Giovanni Dinelli^a

Research Article

SCI

Received: 29 July 2011 Revised: 13 December 2011 Accepted article published: 14 December 2011 Published online in Wiley Online Library: 25 January 2012

(wileyonlinelibrary.com) DOI 10.1002/jsfa.5590

Health-promoting phytochemicals of Italian common wheat varieties grown under low-input agricultural management[†]

Raffaella Di Silvestro,^a Ilaria Marotti,^a Sara Bosi,^a Valeria Bregola,^a Antonio Segura Carretero,^b Ivana Sedej,^c Anamarija Mandic,^c Marijana Sakac,^c Stefano Benedettelli^d and Giovanni Dinelli^{a*}

Journal of Cereal Science 65 (2015) 236–243

Contents lists available at ScienceDirect



Journal of Cereal Science

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



Review

Do “ancient” wheat species differ from modern bread wheat in their contents of bioactive components?



Peter R. Shewry^{a, b, *}, Sandra Hey^a

^a Rothamsted Research, Harpenden, Hertfordshire AL5 2JQ, UK

^b University of Reading, Whiteknights, Reading, Berkshire RG6 6AH, UK

UNIVERSITÀ
DI PARMA



VALORE NUTRIZIONALE

Le differenze in componenti bioattive non sono tali da supportare differenze significative su prodotto finito.



Necessità di studi approfonditi, di lungo raggio e *ben disegnati*

BIODIVERSITA'

Diversità anche minime nei profili compositivi sono espressione di una diversità biologica che è risorsa e patrimonio.

Come tale, deve essere MAPPATA, TUTELATA e VALORIZZATA



Wrapping Up



I grani antichi e le varietà storiche:

1. risorsa in termini di tutela della biodiversità agroalimentare,
2. alternativa valida alle coltivazioni standard nelle aree impervie o difficilmente raggiungibili

Le popolazioni evolutive hanno mostrato un'ottima capacità di adattamento al territorio e potrebbero rappresentare un'opportunità in termini di UNICITA' gastronomica e territoriale.

**TAKE
THE
NEXT
STEP...**



Tutela del «local biological heritage»

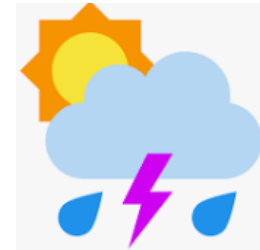


Thesaurus della biodiversità



Correct communication

...e le micotossine??



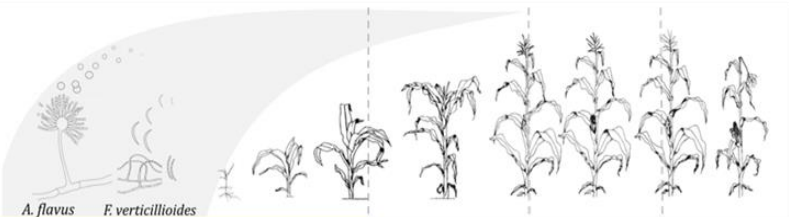
2017

2018



Possibili motivi:

1. Buone pratiche agronomiche
2. Caratteristiche pedoclimatiche delle zone montane
3. Tratti di «resistenza»



Crop debris & soil management

Hybrid selection & Pest/disease control

Irrigation

Kernel humidity

Drying

Storage

Processing

Pre-harvest

Post-harvest

Diverso cross-talk
pianta-patogeno
?

(Courtesy of: Palumbo et al., 2019, accepted for publication)

DEPARTMENT OF FOOD AND DRUG UNIVERSITY OF PARMA

Gianni Galaverna
Francesca Scazzina

Laura Righetti
Margherita Dall'Asta
Marco Spaggiari

Martina Cirlini
Tito Damiani

...e tutti i laureandi che hanno partecipato

Thank
You



Le Aziende Agricole
che hanno reso
possibile il progetto



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