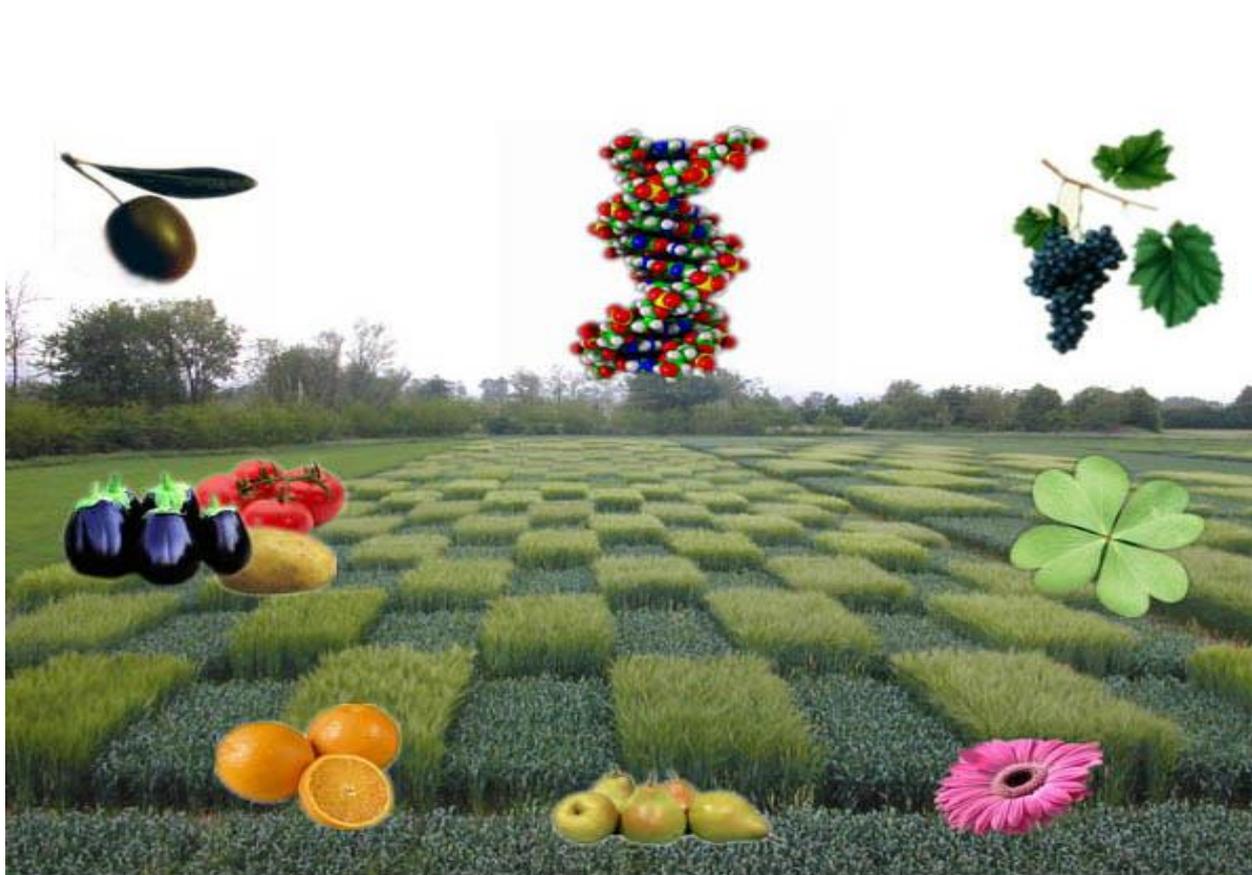
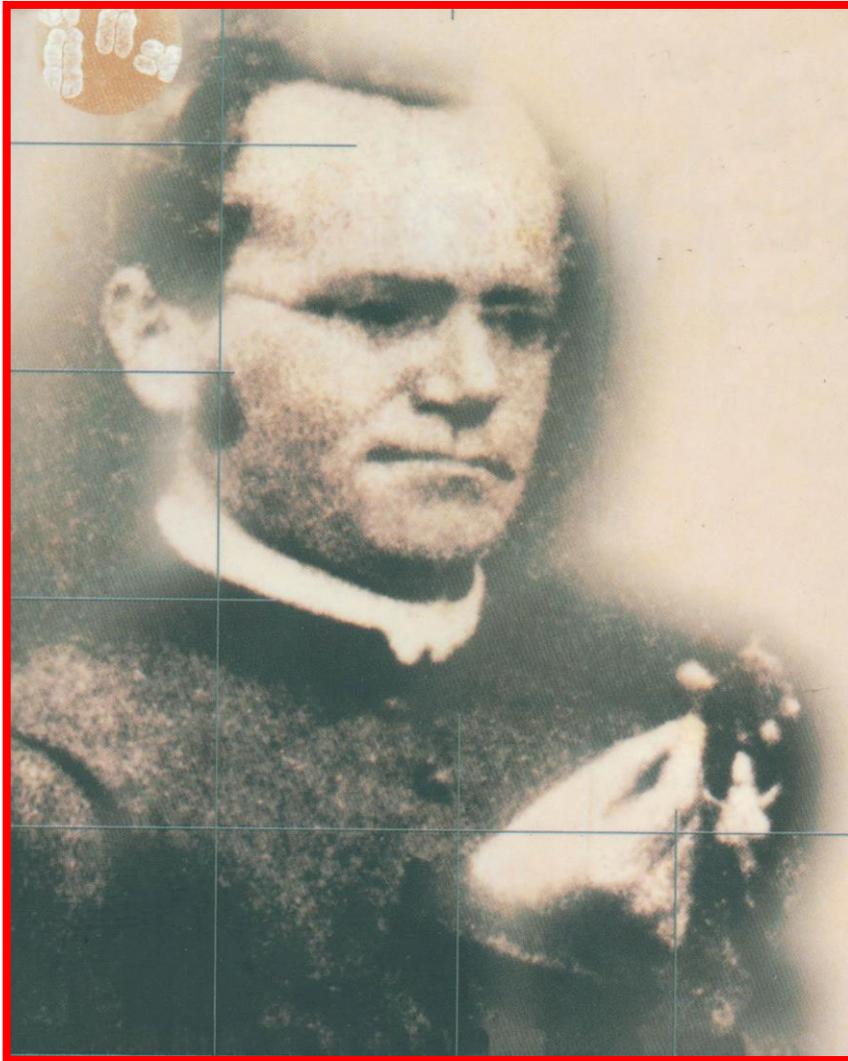




*NBT e Ricerca: da Mendel alla Genomica per
un' Agricoltura Innovativa*
Roma 22-02-2018



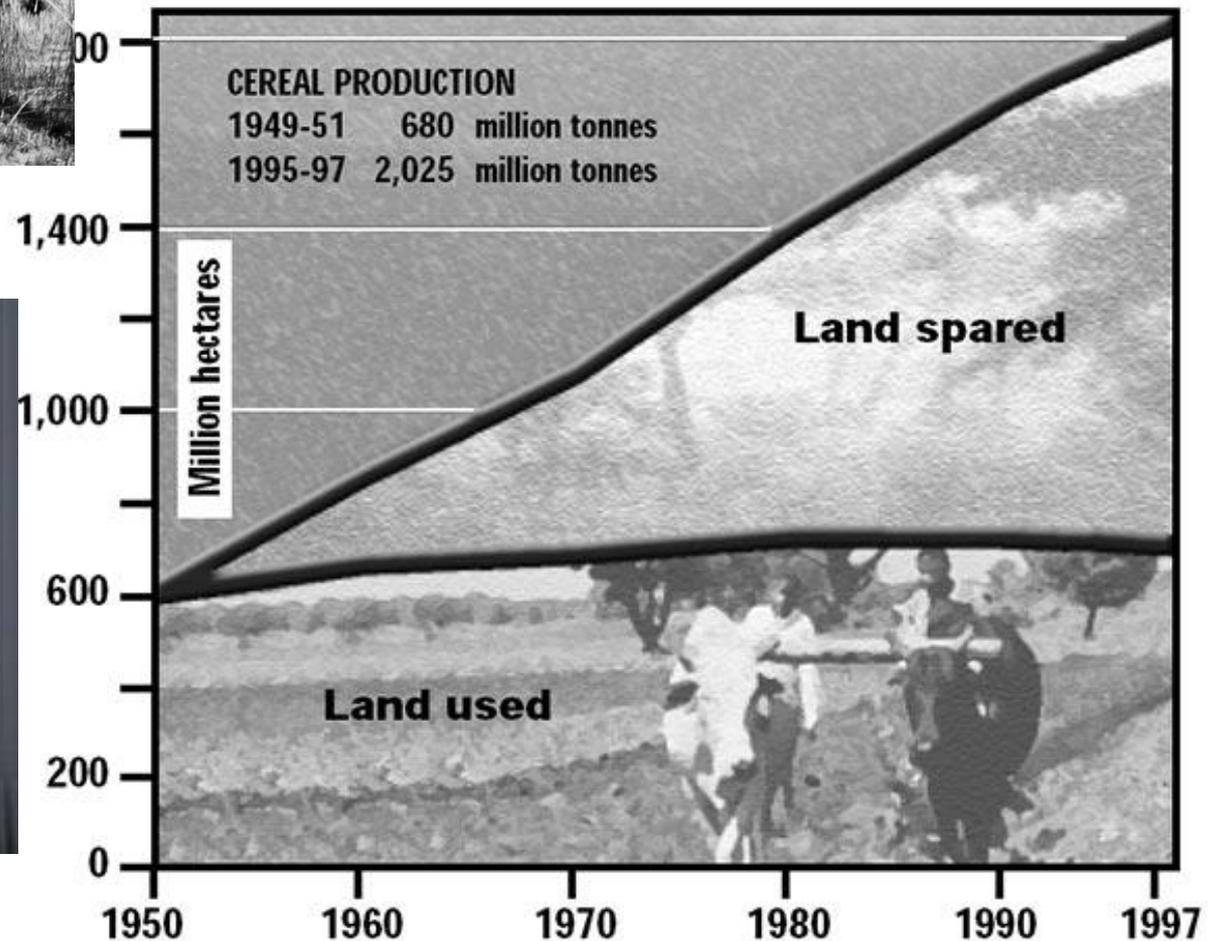
Michele Stanca
- UNASA – Accademia dei Georgofili
UNIMORE



Nazareno Strampelli

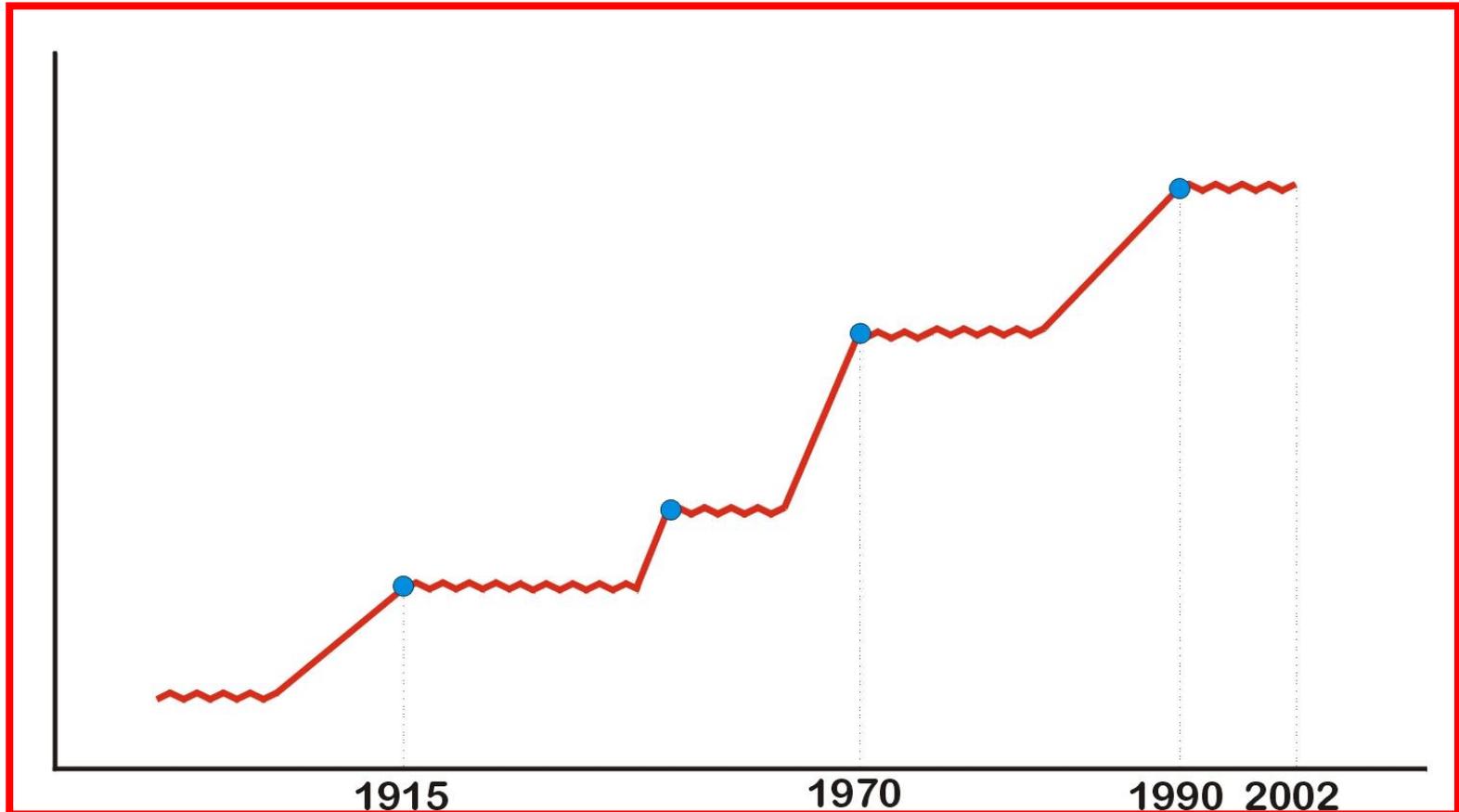


Mendel



Norman Borlaug

Model of the Breeding progress in the last 100 years



Neolitico

500

semi/m²

1-1.5 q/ha

Post-
Mendel

8.000

semi/m²

25 q/ha

Oggi

20.000

semi/m²

90-100 q/ha

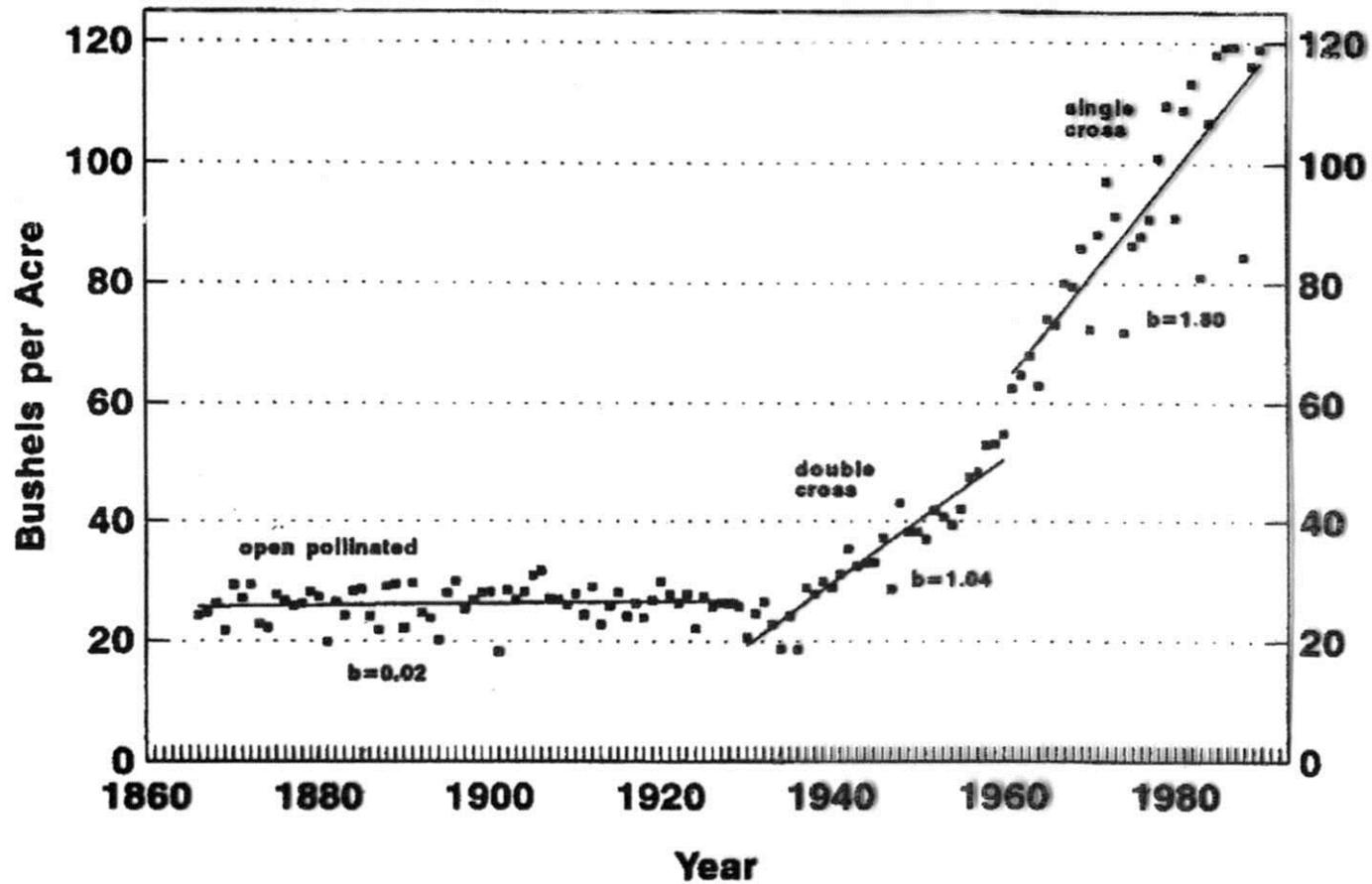
Towards the molecular basis of heterosis.

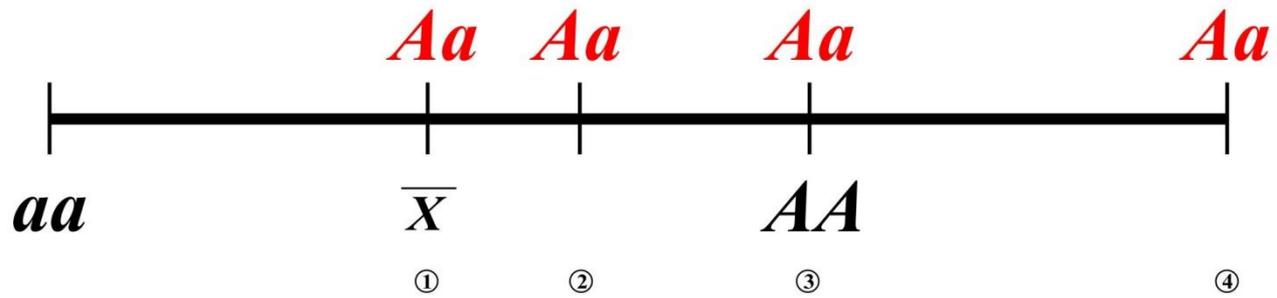
Phenotypic manifestation of heterosis

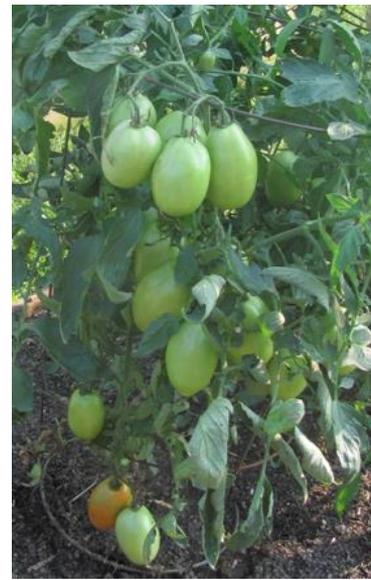


TRENDS in Plant Science













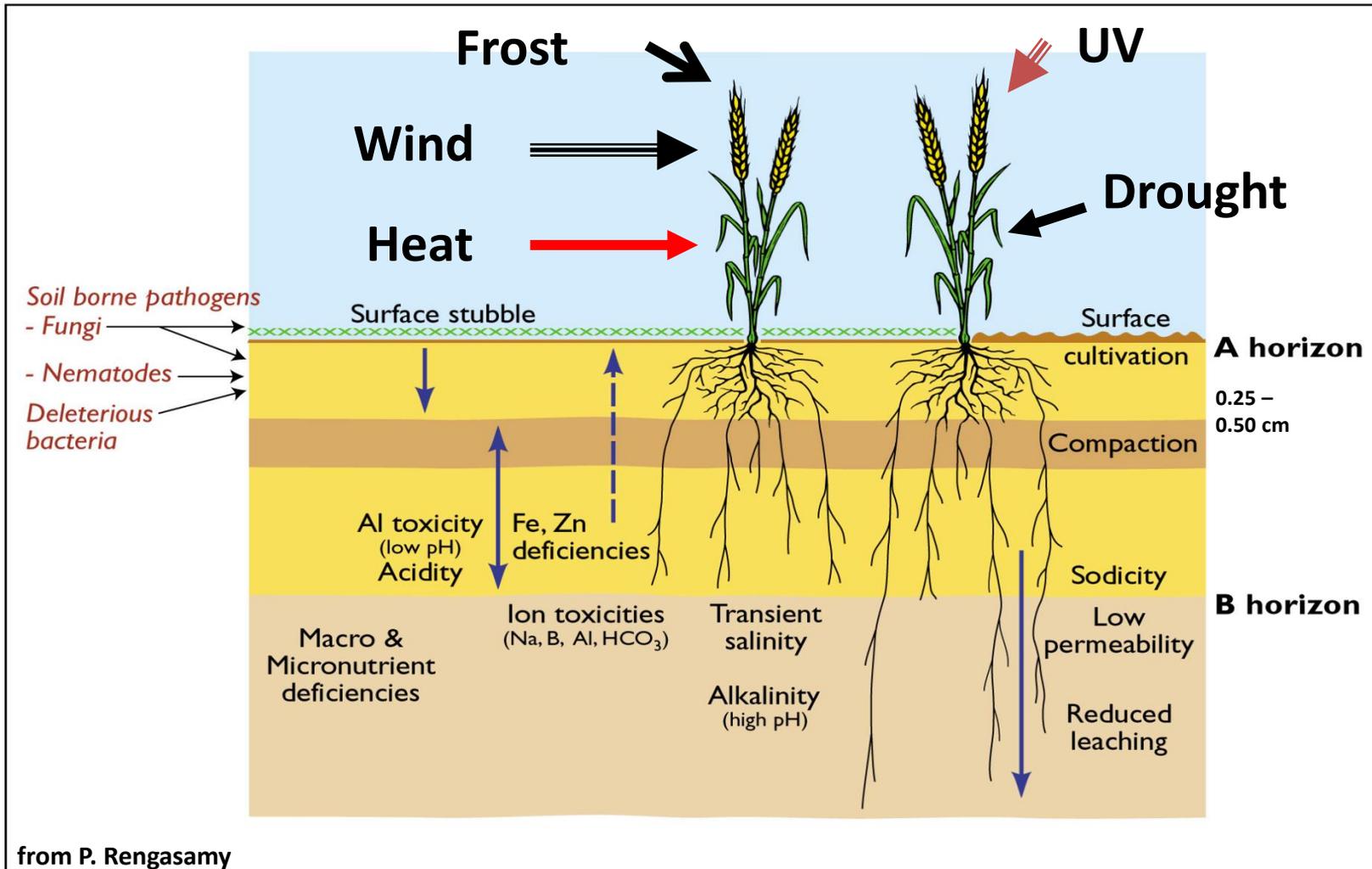
Modifica dell'architettura della pianta e della capacità di fioritura in *Osteospermum*





**Laxatum five anthers
(lax-a)**

Factors limiting productivity in low yielding environments





GENETICA



GENOMICA



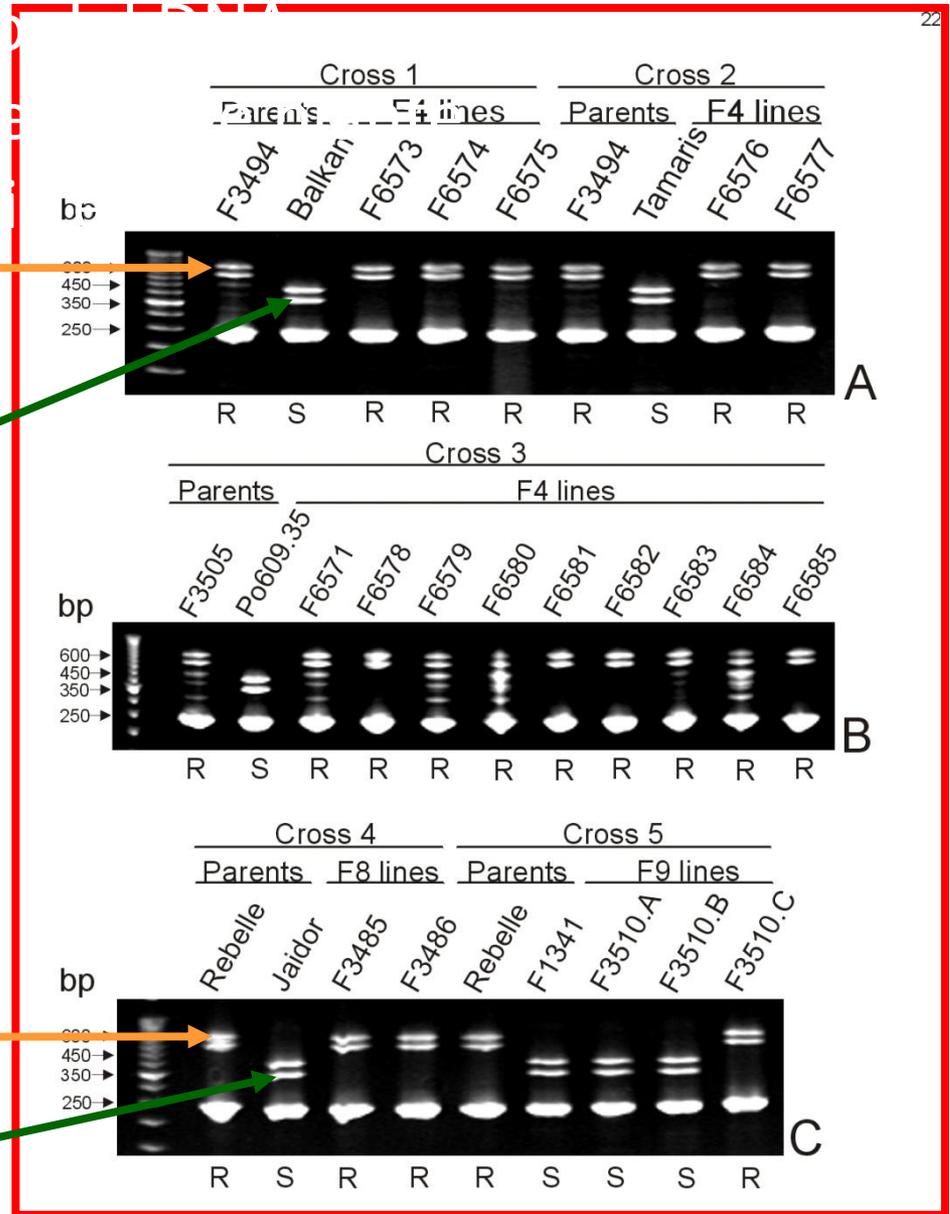
studia il Genoma
(l'intero contenuto di DNA di
una Cellula)

Piante resistenti

Piante suscettibili

Piante resistenti

Piante suscettibili





1. Prelievo dei campioni

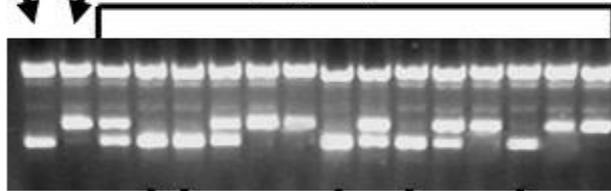


2. Estrazione del DNA dal tessuto

MAS=Molecular Assisted Selection

Controllo Resistente	Controllo Suscettibile
----------------------	------------------------

Piante segreganti per il carattere



4. Selezione delle piante desiderate in base al profilo del DNA

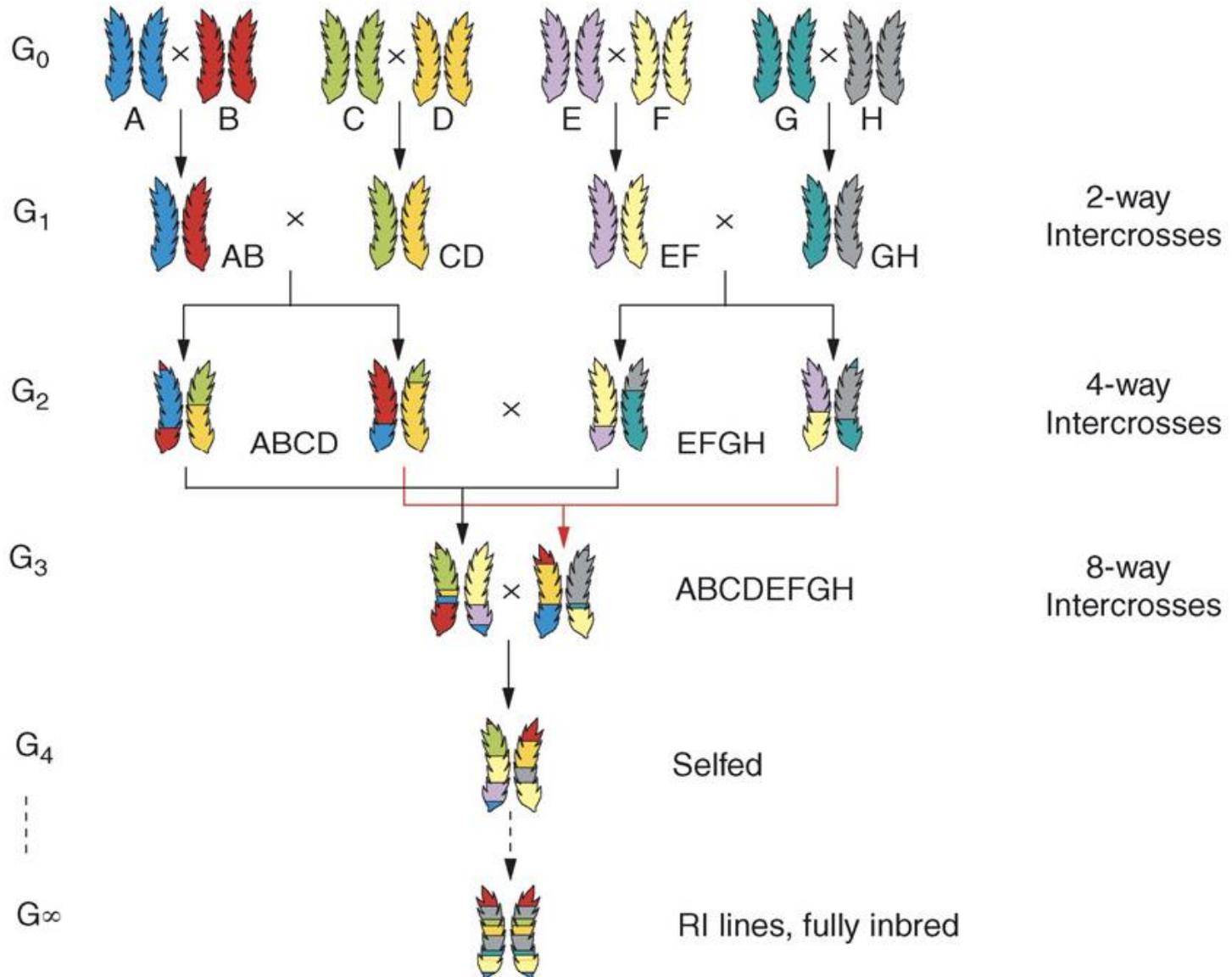


3. Reazione PCR con i marcatori molecolari associati al carattere d'interesse



5. Esecuzione di nuovi incroci "mirati"

Multi-parent Advanced Generation Inter-Cross (MAGIC)



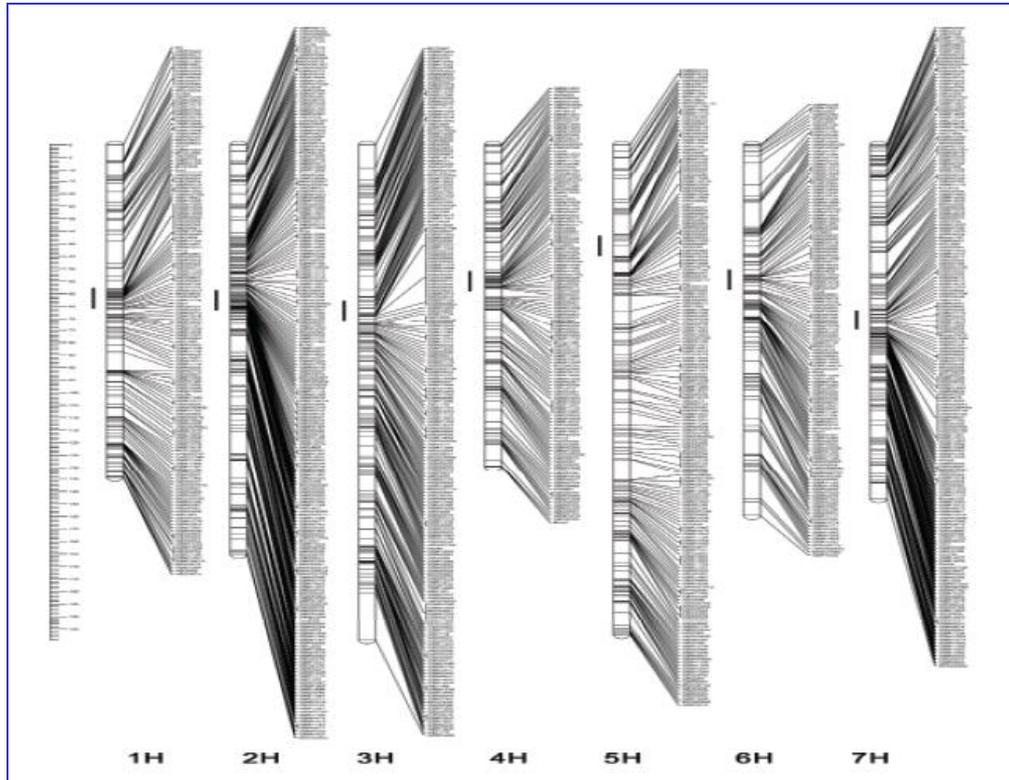


Dell'Acqua...Frascaroli...Morgante....PE'

Genetic properties of the MAGIC maize population: a new platform for high definition QTL mapping in *Zea mays*

Genome Biology 2015, **16**:167

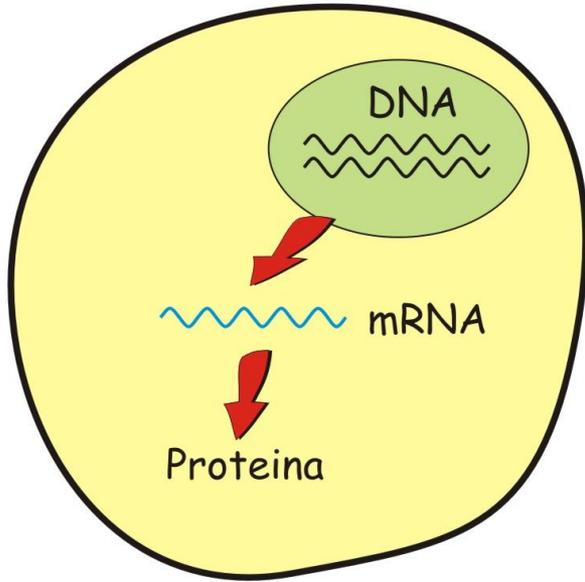
GAS = Genomic Assisted Selection



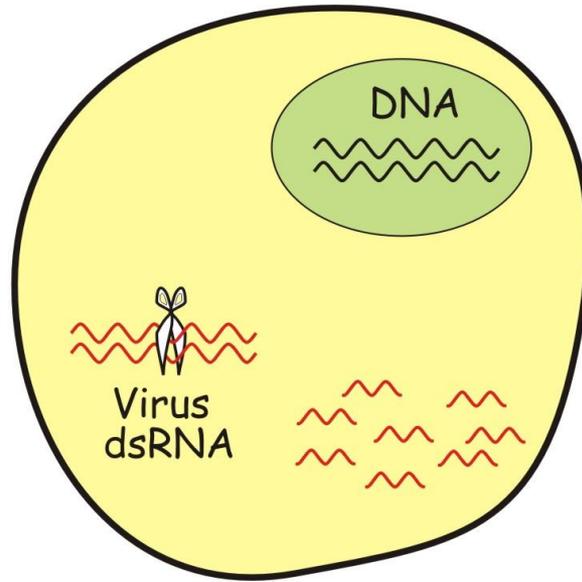
Selezione basata su migliaia/decine di migliaia di tratti di DNA



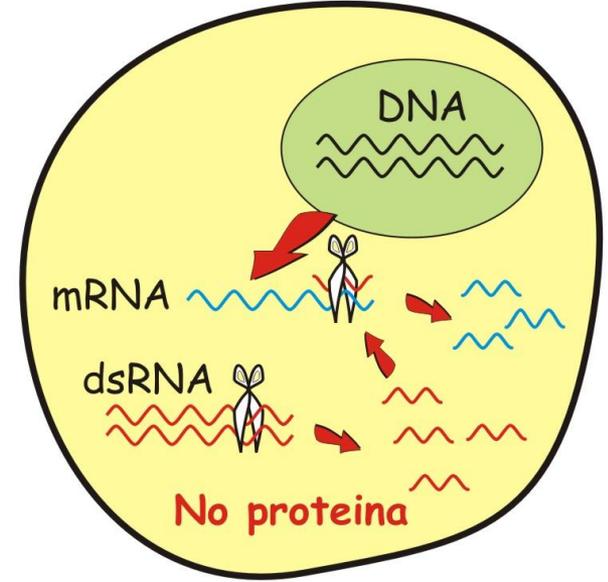
A



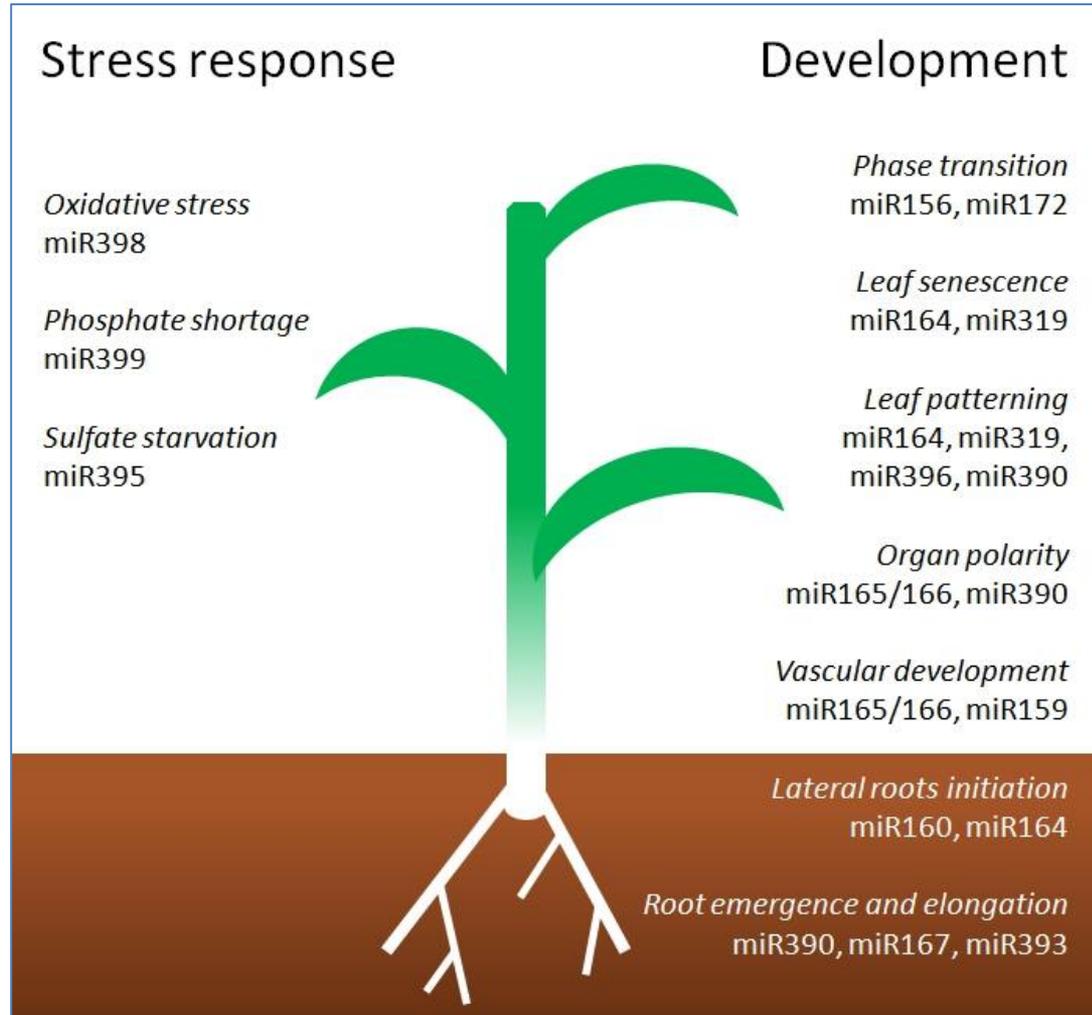
B

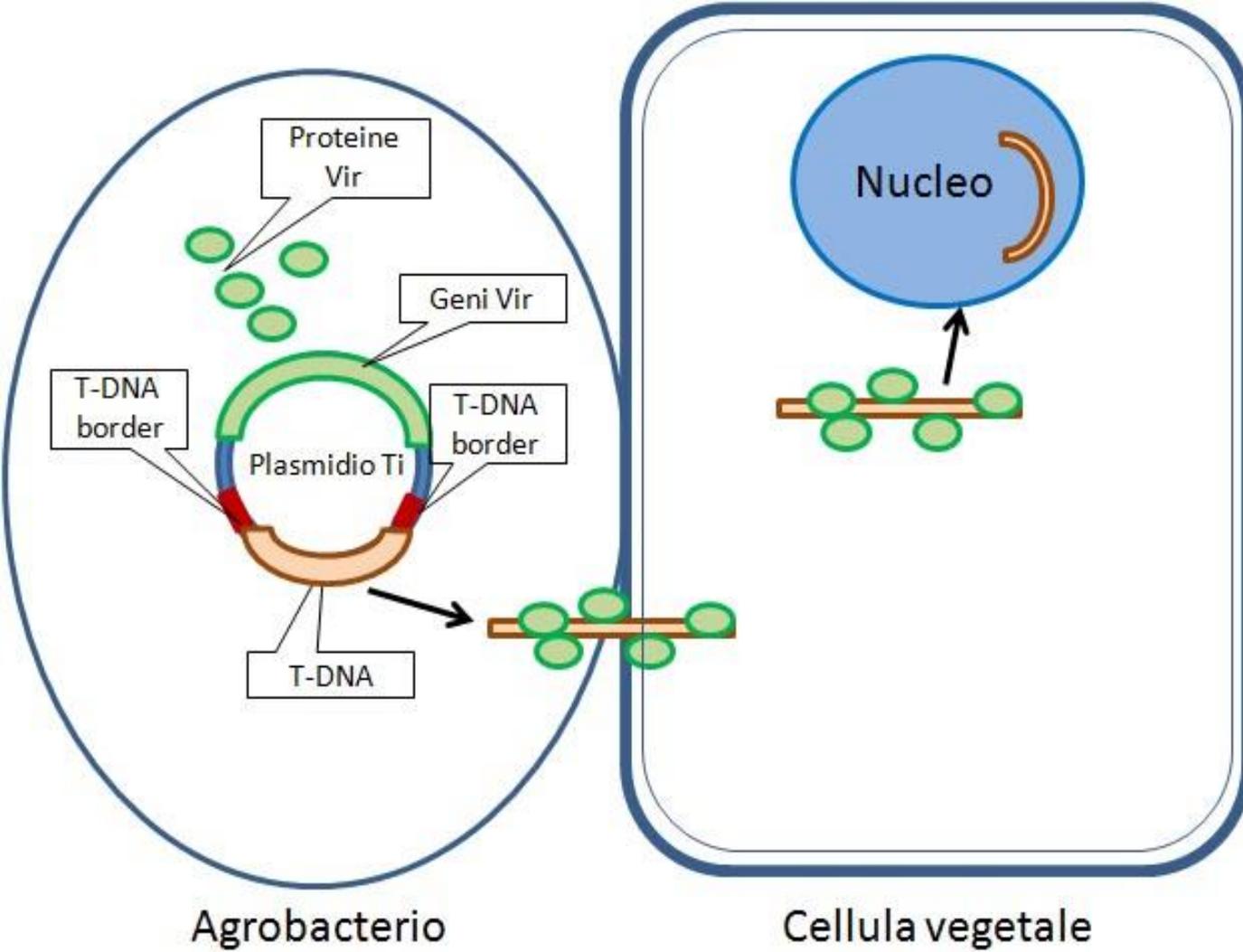


C



Plant microRNAs







TIME

THIS RICE COULD SAVE A MILLION KIDS A YEAR

...but protesters believe such **genetically modified** foods are bad for us and our planet. Here's why.

PHOTOGRAPH BY [unreadable]

SCIENTIFIC AMERICAN

Know Your DNA

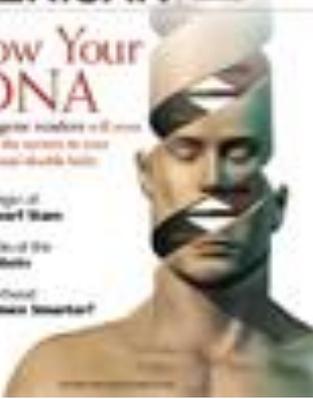
Discover gene insights and more about the science of your personal health facts

The New Origin of Brown-Eyed Men

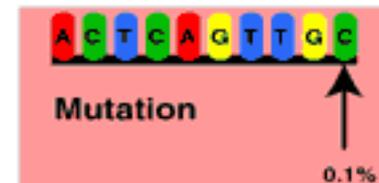
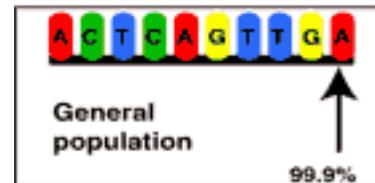
Worship Totems of the Missing Link

Does Motherhood Make Women Smarter?

Answers to
Your Top
100 Questions



Genomi low cost



Tab.2 Dimensione dei Genomi di alcune specie vegetali e di un fungo micotossigenico.

Specie	Dimensione Genoma (milioni di bp)*	Numero di geni	Rivista	Anno
Arabidopsis	125	26.500	Nature	2000
Mais	2.000	32.000	Science	2009
Riso	430	37.544	Science	2002
Vite	475	30.434	Nature	2007
Pomodoro	900	35.000	Nature	2012
Patata	844	39.031	Nature	2011
Frumento tenero	17.000	124.000	Science	2014
Frumento dicoccoides	10.500	67.185	Science	2017
Orzo	5.000	39.734	Nature	2017
Arancio	300	25.000	Nature Biot.	2014
Pesco	265	27.852	Nature Gen.	2013
Melo	742	57.386	Nature Gen.	2010
Quinoa	1.450-1.500	33.365	Nature	2016
Fusarium langsethiae	37.5	12.232	I. J. Food. Microbiol.	2016
Pioppo	520	41.000	Science	2006
Melanzana	833	38.498	DNA Research	2014
Melone	450	27.427	PNAS	2012
Brachypodium	220	36.477	Nature	2010
Soia	1.100	46.430	Nature	2010
Carciofo	1;084	38;726	Nature	2016
Barbabetola	714-758	27;421	Nature	2013

* Paia di basi

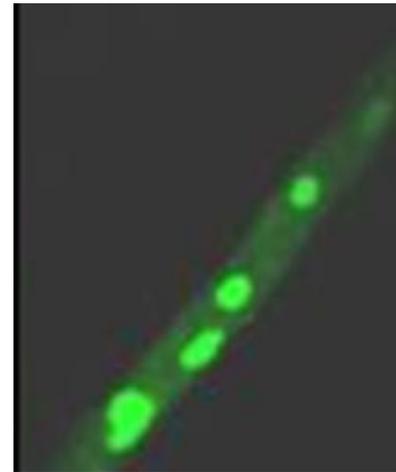
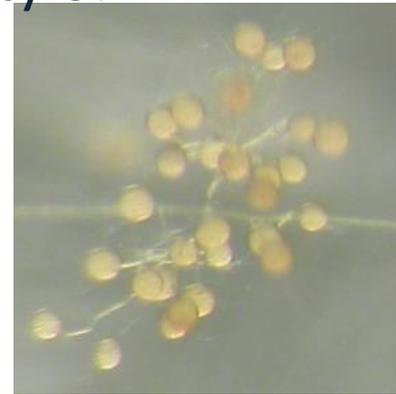
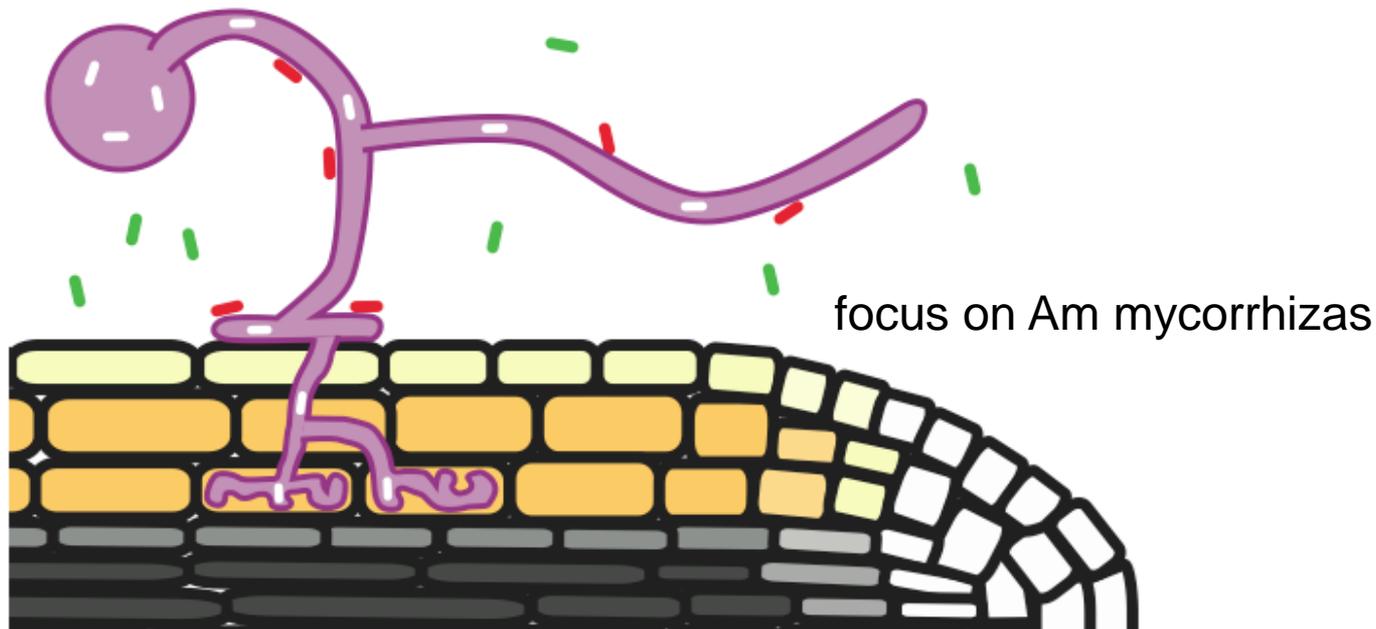
GENOMES to Limiting Land Use and improving Nutrition Security- The Strategy of the African Orphan Crop Consortium

- The world population is predicted to rise to 9.6 billion by the year 2050.
- We will need to produce 70% more food to guarantee universal food security in the same area of land.
- Since 1930 ,the yield of orphan crops has not changed.
- The Consortium is sequencing, assembling and annotating the the Genomes of **101** African “Orphan Crops “.
- Plant Breeders from Africa will use the Genomic data to breed cultivars of these crops to have higher yield,higher nutritional content, better climatic adaptability and better disease resistance.
- Nature 2017

- Italian Project on Epigenetics in Plants

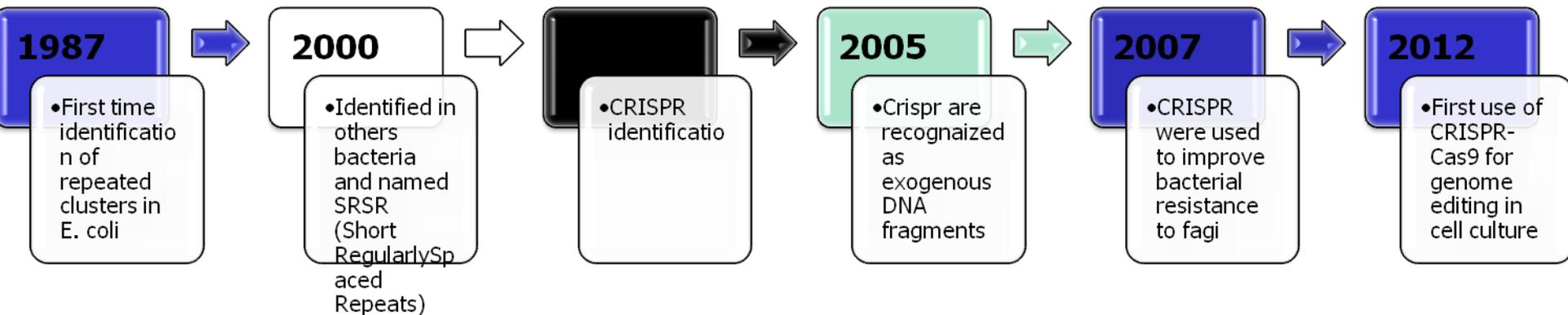
Plant-microbe interaction

Beneath the surface of the earth, an influential community of microbes mingles with plant roots



A brief history of CRISPR

(clustered regularly interspaced short palindromic repeats)

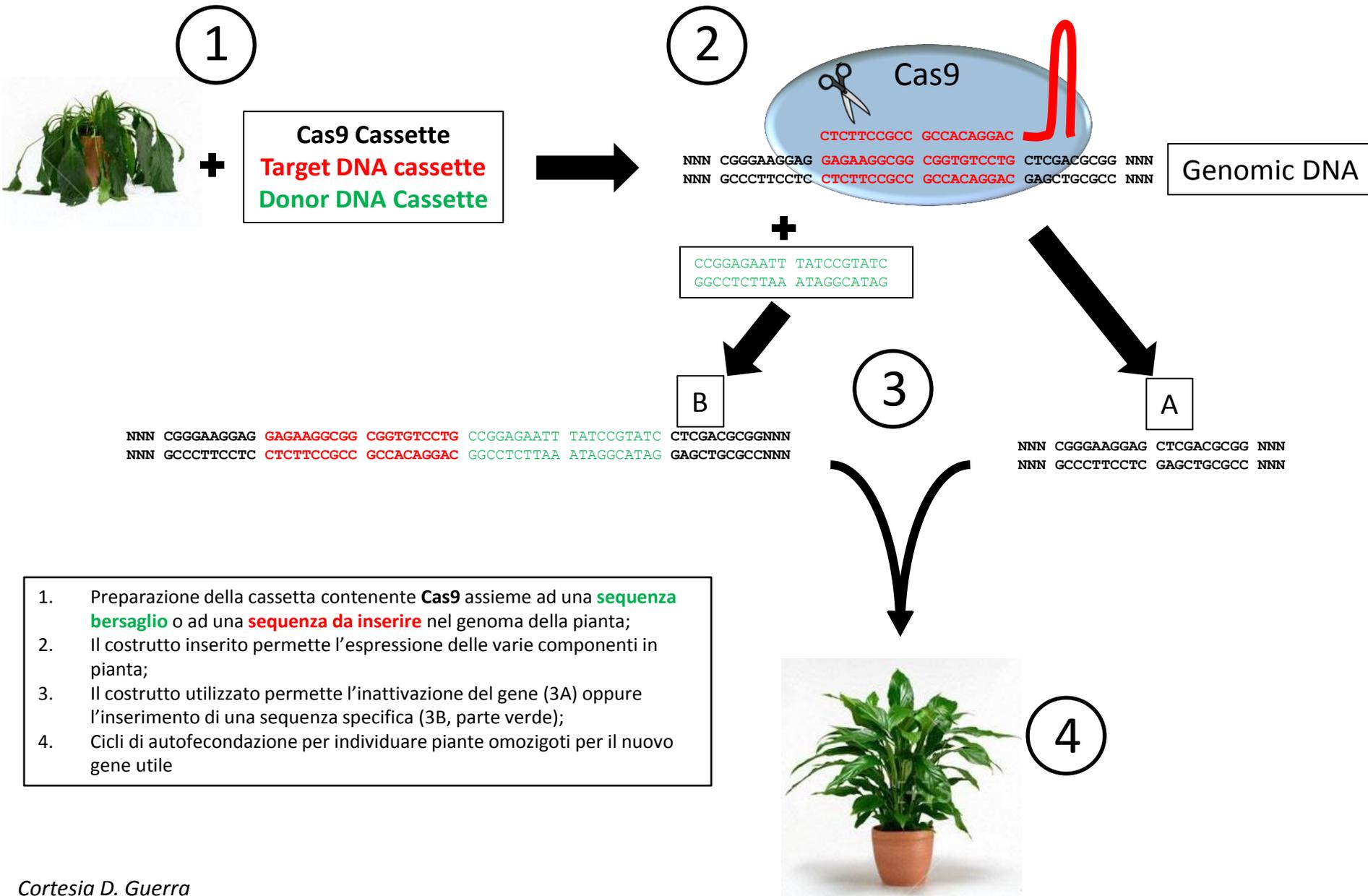


2016:

DNA-free genome editing methods for targeted crop improvement

(Nagamangala et al., 2016)

Genome Editing for pre-breeding advancement



Genome Editing in Plants

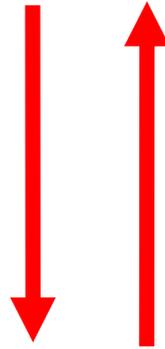
- Low Frequency of Plant Regeneration is one of the biggest Bottlenecks for the Practical Implementation of Gene-Editing in Plant Breeding
- Development of an efficient Genotype-independent Plant Regeneration System is necessary for broad Application of GE

- **Gene-Editing Tools to Generate Yeast that cannot breed successfully with their wild counterparts**
- MASELKO: "We want something that's going to be identical to the original in every way, except it's just genetically incompatible"
- The technology could be used to keep edited plants from spreading genes to non-edited crops and weeds.
- Work will soon commence in plants, mosquitos, nematodes.
- NATURE 2018

***Design the Plant for the Future
for***

FEEDING TEN BILLION

GENOTYPING



PHENOTYPING



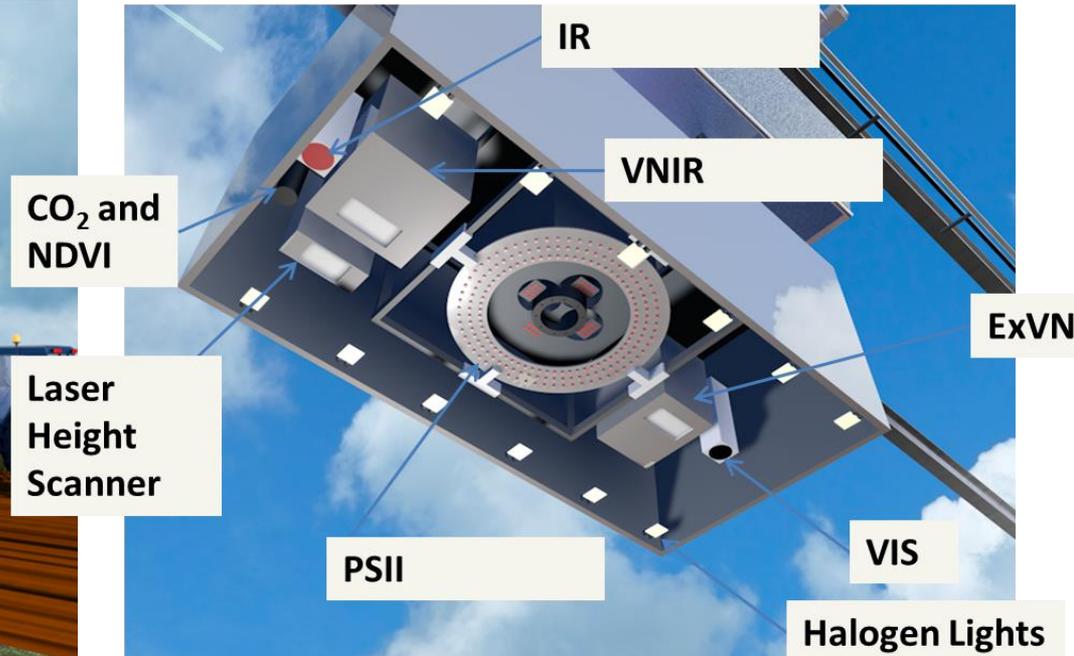
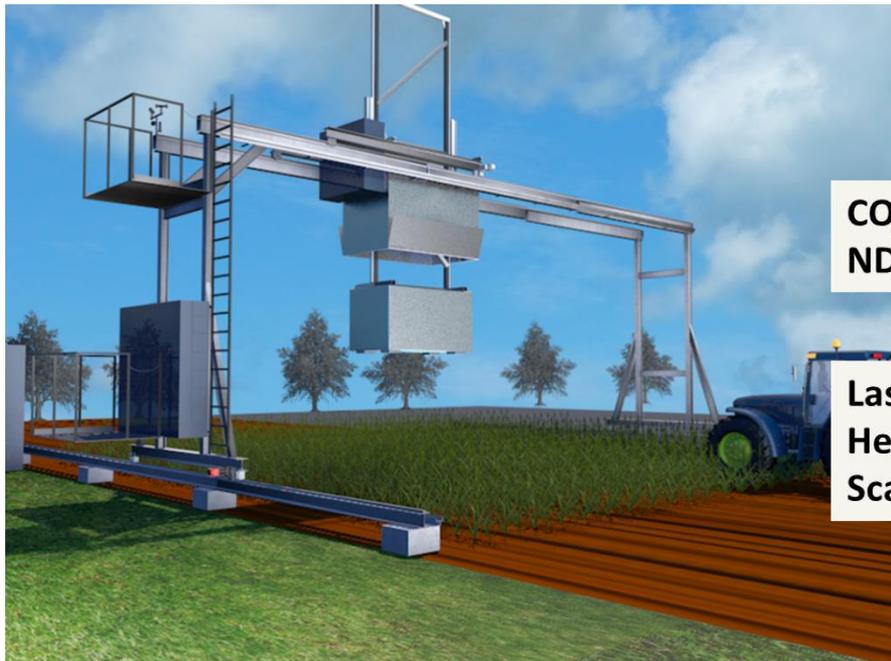
Without a platform for
PHENOTYPING

Molecular investigations are
considered as Basic Research
And intellectual exercise

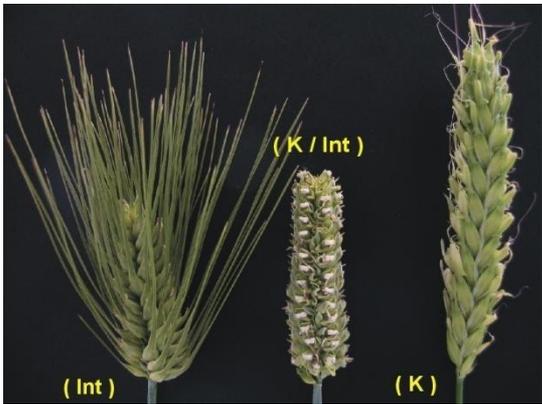
Intensive field HTP phenotyping



ROTHAMSTED
RESEARCH







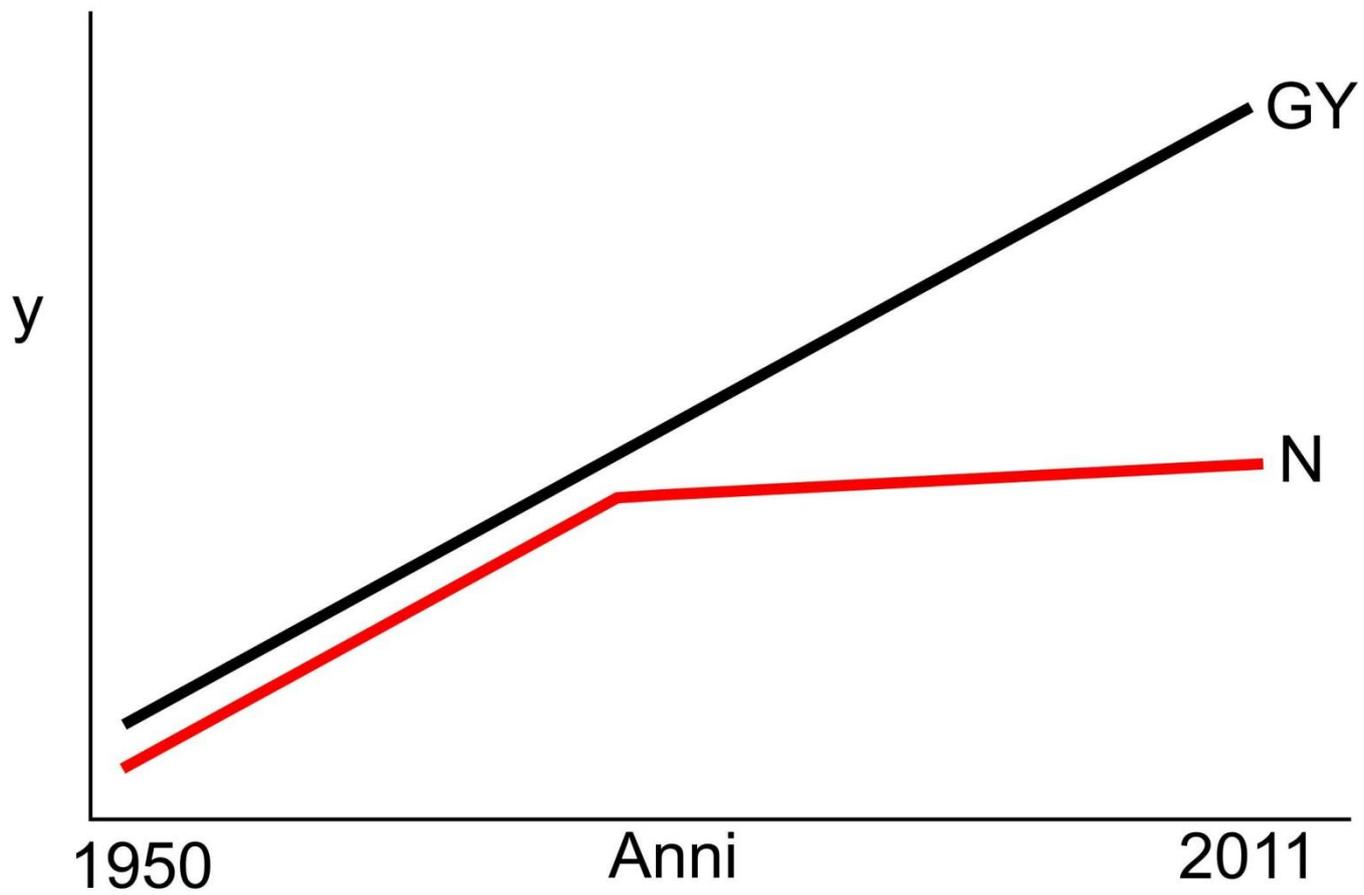
Barley Genetic Stocks

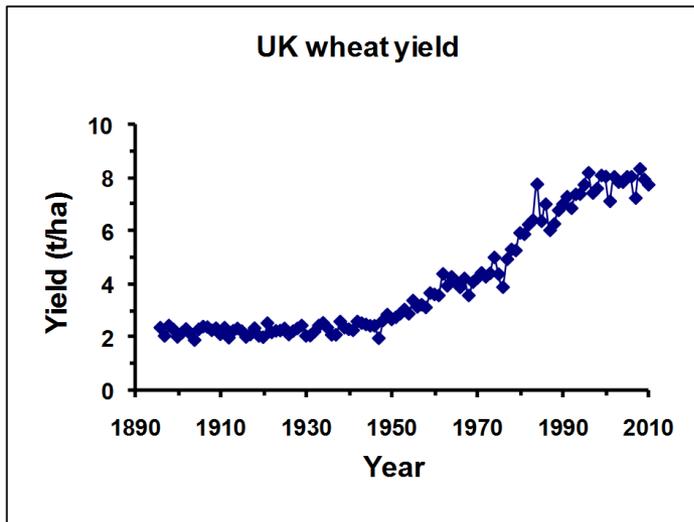
16 semi SH





FEEDING TEN BILLION





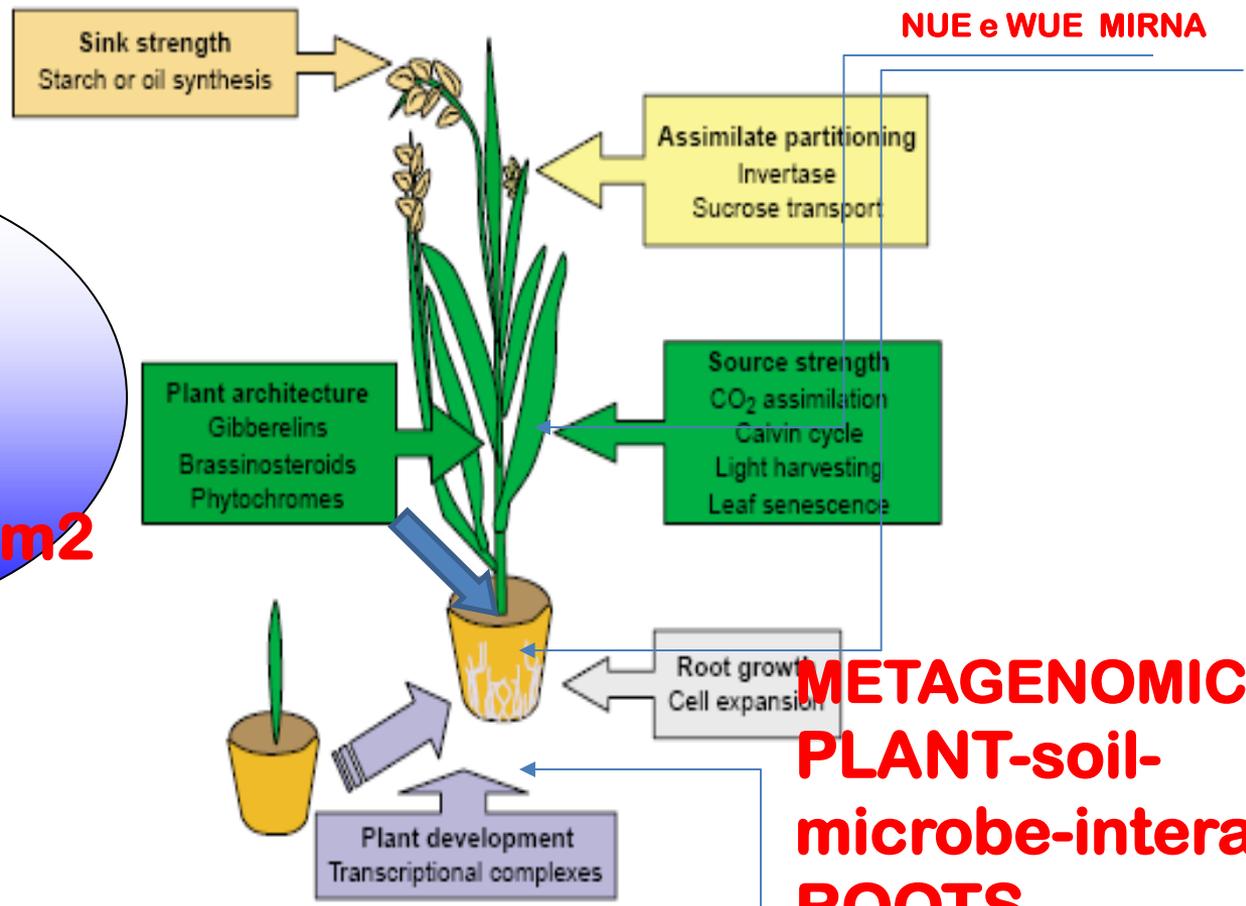
20:20 Wheat[®] aims to provide the knowledge base and tools to increase wheat yield potential (in the UK) to **20 t.ha⁻¹** within the next **20 years**



PLANT for the Future

Potenzialità e Stabilità

25-30000 semi/m²
120-130q/ha



Grazie