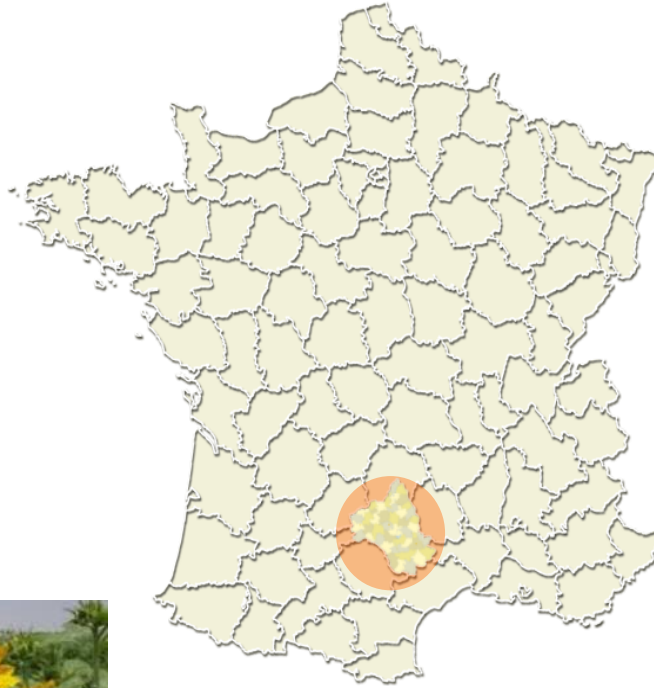




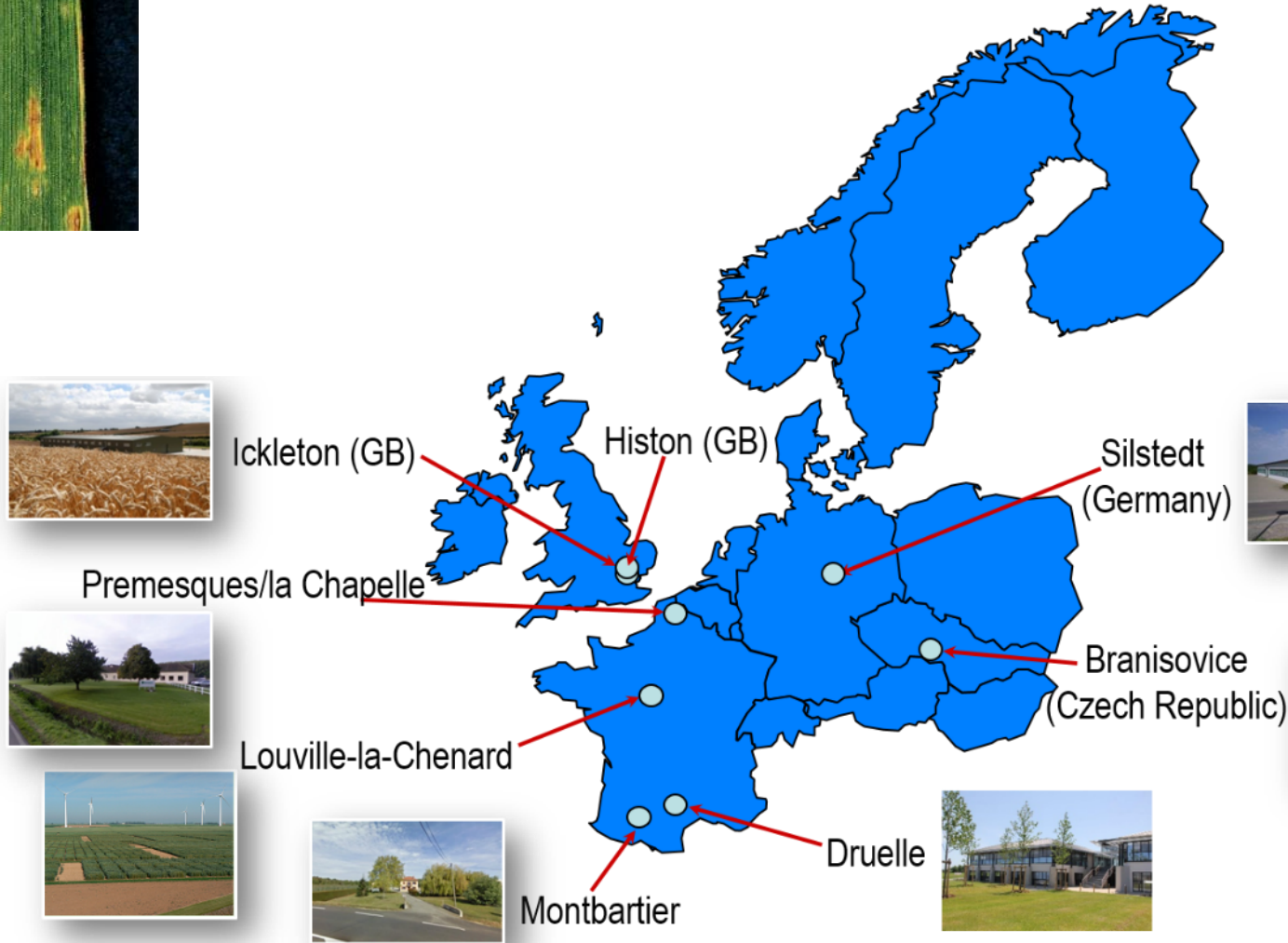
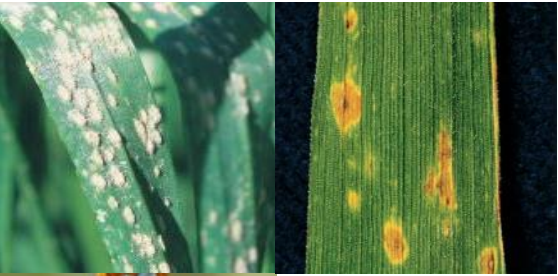
New breeding opportunities for disease resistance

Ruth Bryant - RAGT - rbryant@ragt.fr

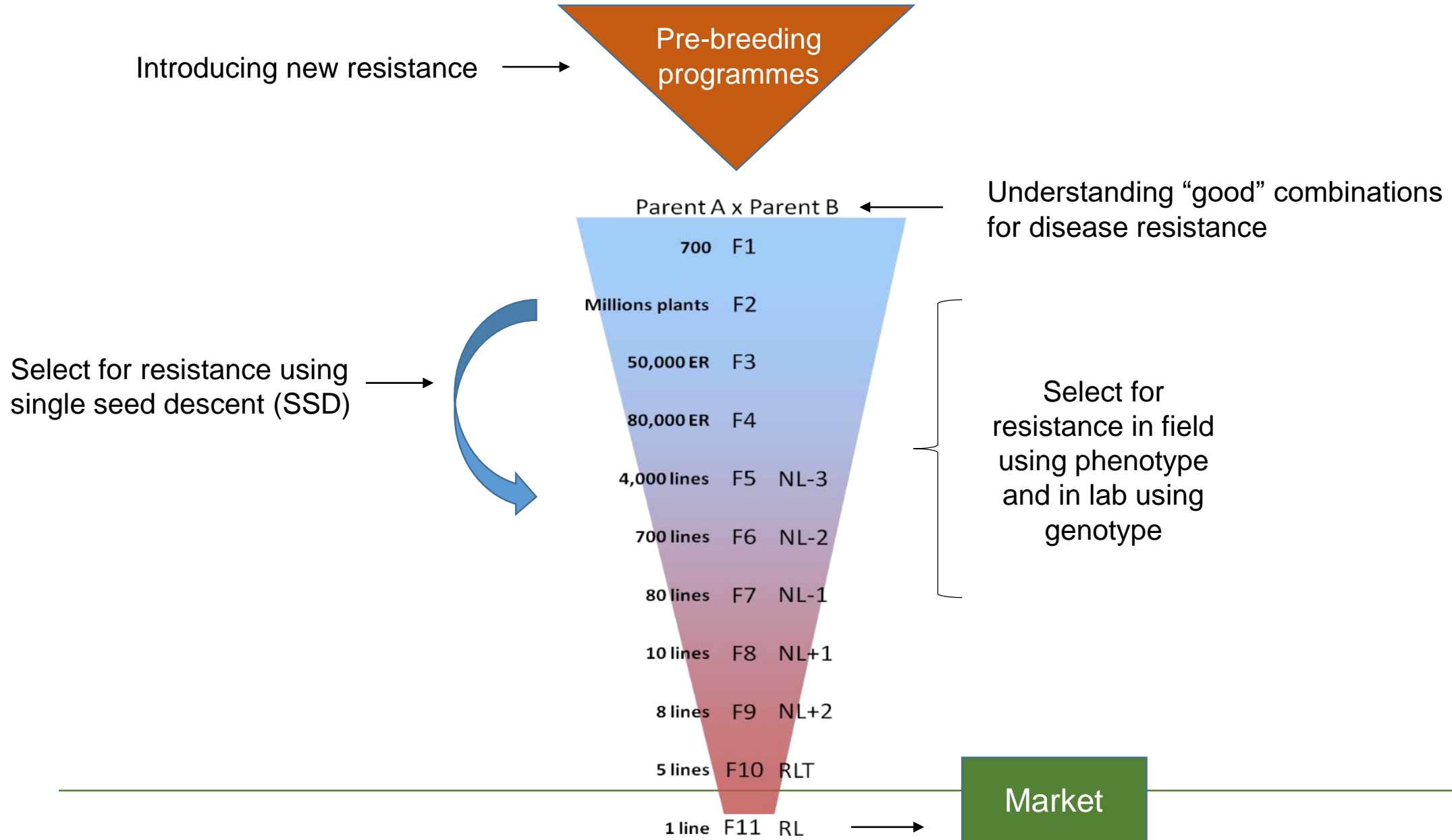
Rouergue, Auvergne, Gévaudan, Tarnais



Breeding programmes



Breeding for resistance



Working with elite material



- Already adapted
- Resistance to most diseases already present
- Genetics behind resistance still poorly understood

Resistance genes/QTL in elite material



Bi-parental populations

GWAS

Bulk segregate analysis

A

B

C

D

F

E

H

G

I

A + B

A + B

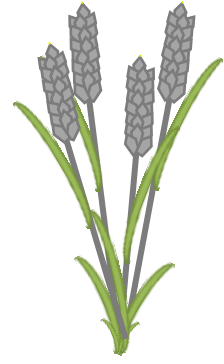
C + G

F

None

C + G + I

B



Variety 1

Variety 2

Variety 3

Variety 4

Variety 5

Variety 6

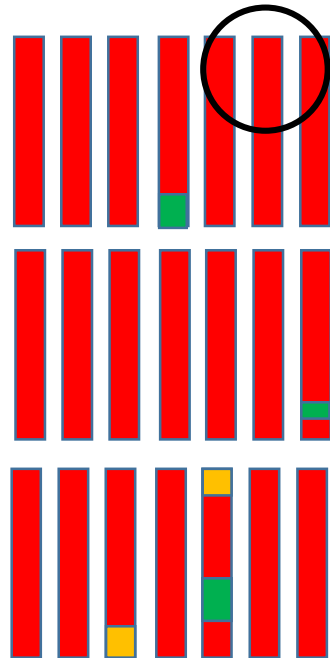
Variety 7

NILs for monitoring resistances

Resistant NIL



Susceptible NIL

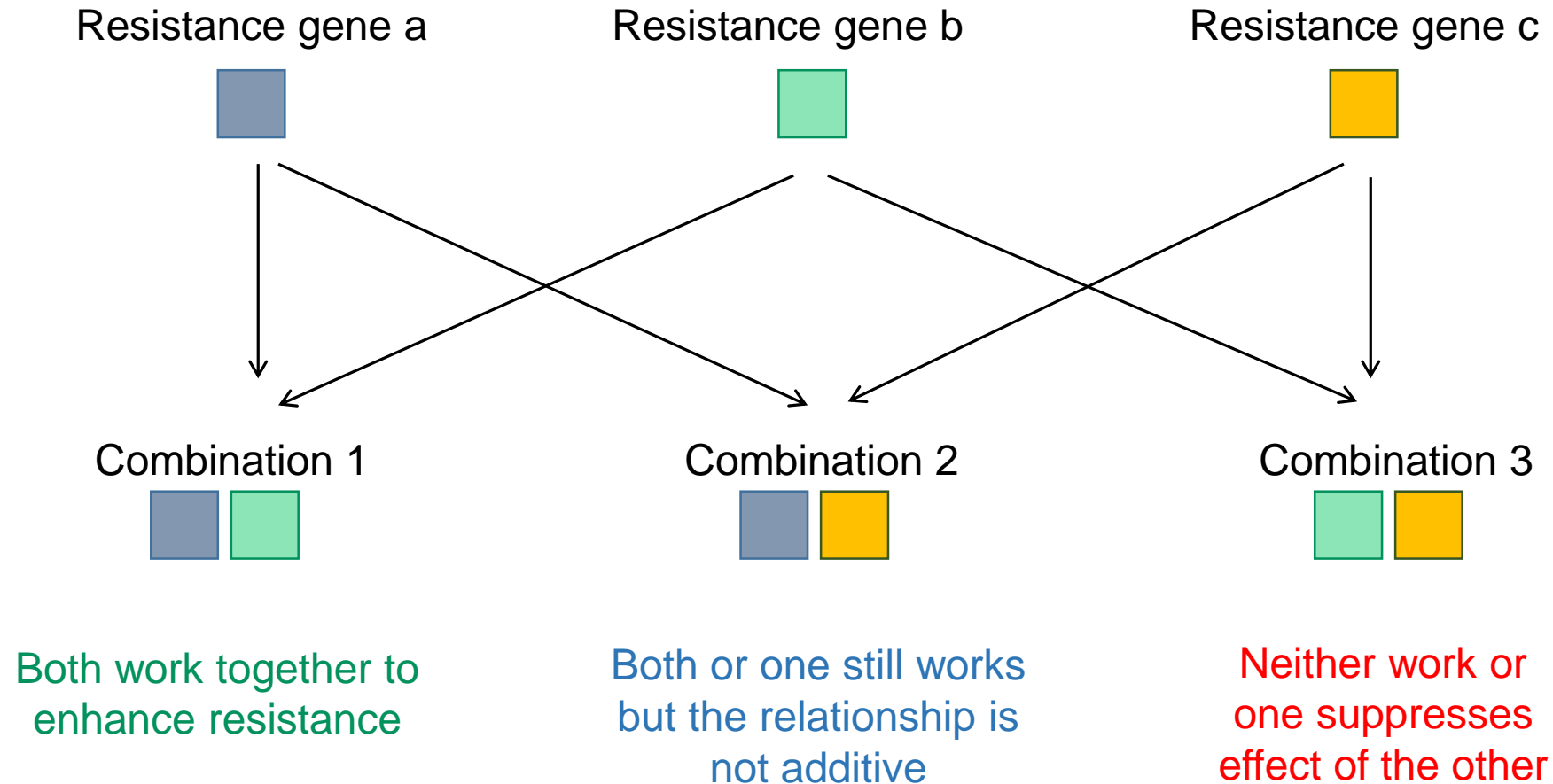


 Resistant parent

 Susceptible parent



Understanding gene/QTL interactions



Negative genes/QTL

Susceptibility factors

Examples:-

MLO

nature
biotechnology

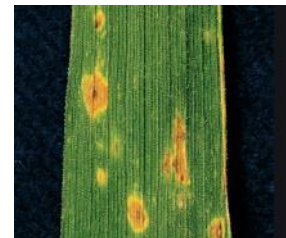
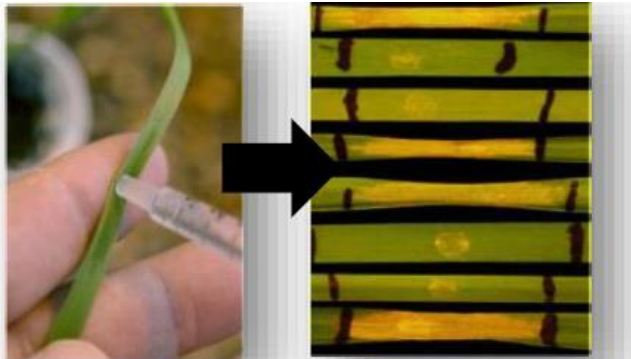
Letter | Published: 20 July 2014

Simultaneous editing of three homoeoalleles in hexaploid bread wheat confers heritable resistance to powdery mildew

Yanpeng Wang, Xi Cheng, Qiwei Shan, Yi Zhang, Jinxing Liu, Caixia Gao & Jin-Long Qiu



Tox-A – Tsn1



Suppressors



Resistant gene
No suppressor

Resistant gene
Suppressor

Scientists sequence wheat genome in breakthrough once thought 'impossible'

Genome able to be used to produce hardier wheat varieties as greater food security needed



the plant journal



Technical Advance |  Open Access |  

Resistance gene enrichment sequencing (RenSeq) enables reannotation of the NB-LRR gene family from sequenced plant genomes and rapid mapping of resistance loci in segregating populations

Florian Jupe, Kamil Witek, Walter Verweij, Jadwiga Śliwka, Leighton Pritchard, Graham J. Etherington, Dan Maclean, Peter J. Cock, Richard M. Leggett, Glenn J. Bryan, Linda Cardle ... [See all authors](#) ▾

First published: 13 August 2013 | <https://doi.org/10.1111/tpj.12307> | Cited by: 127

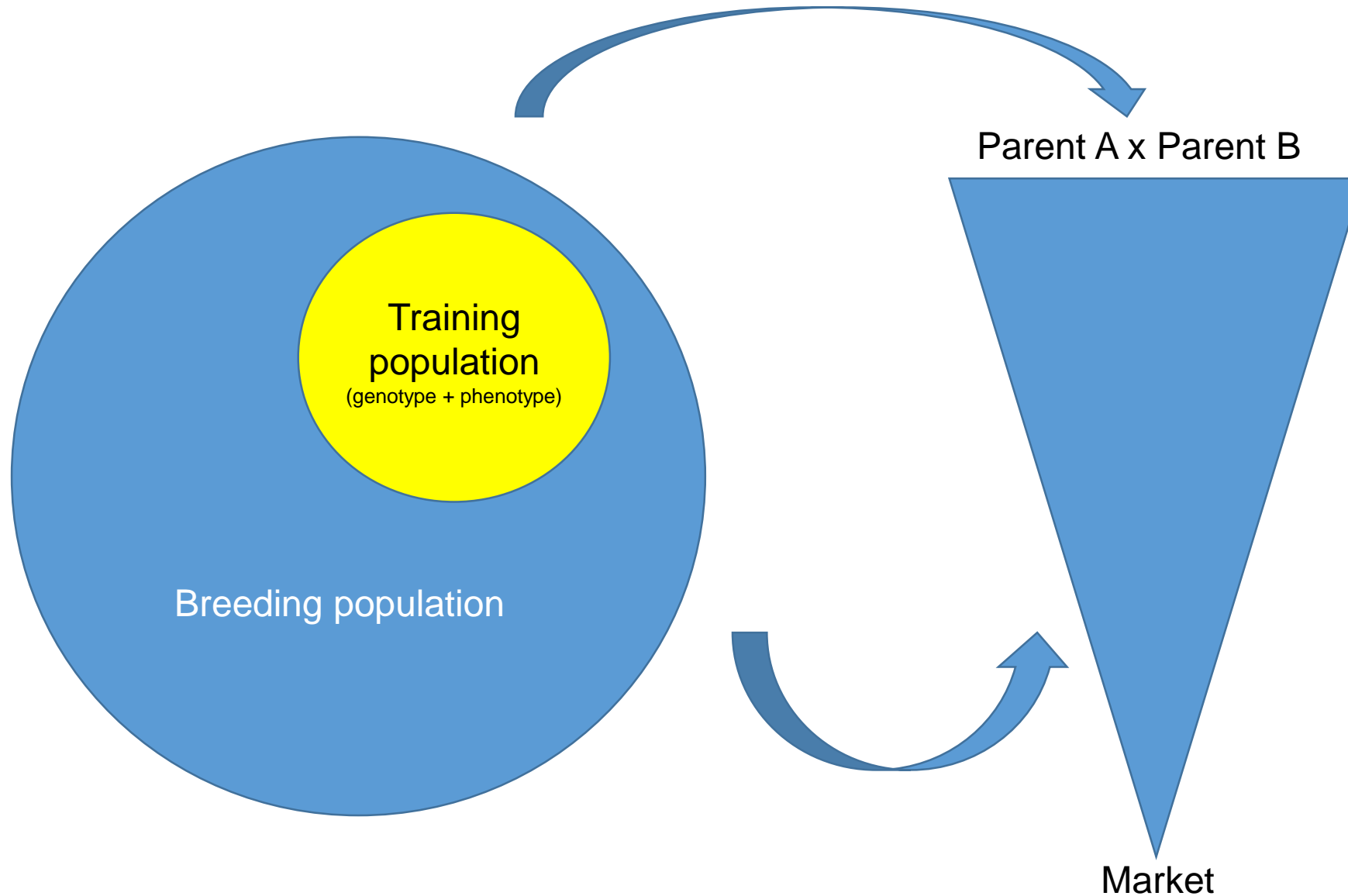


 [ADVANCED SEARCH](#) [SEARCH HISTORY](#)

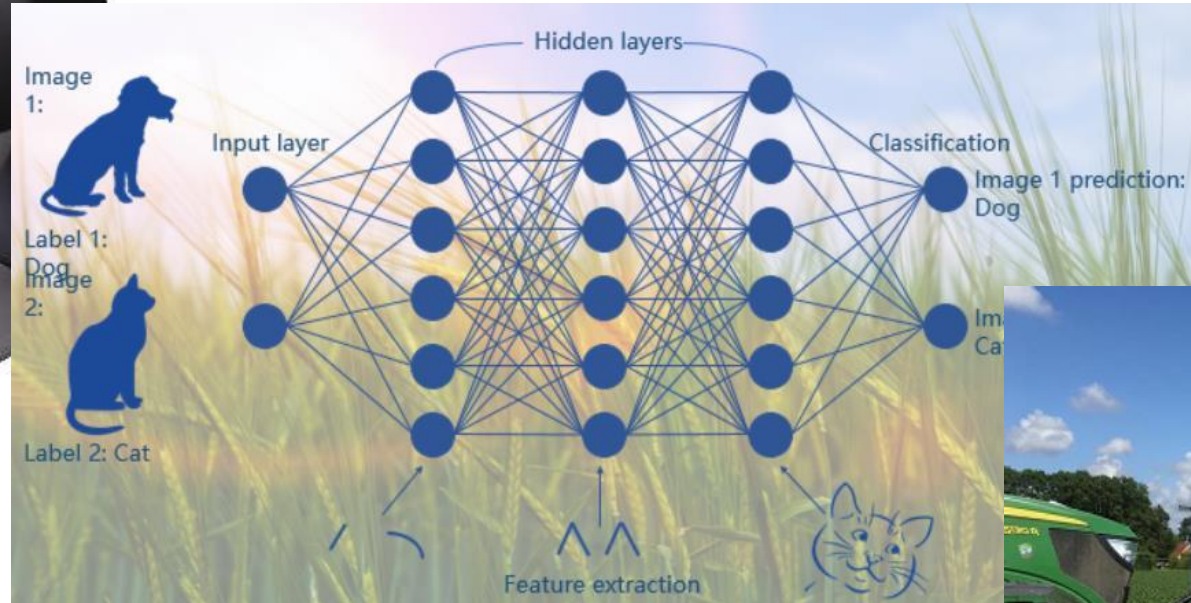
Full record

URL	https://prodinra.inra.fr/record/185046
Title. Subtitle	WAKomics : large-scale functional analysis of the WAK genes involved in the rice Magnaporthe grisea interaction

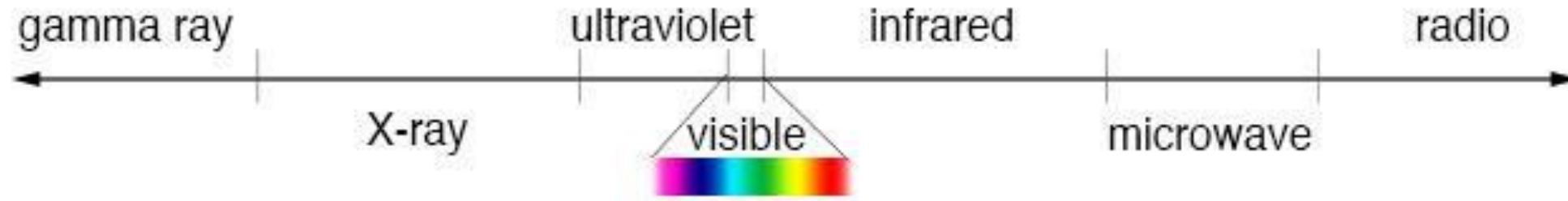
Genomic selection – the way forward?



New phenotyping opportunities



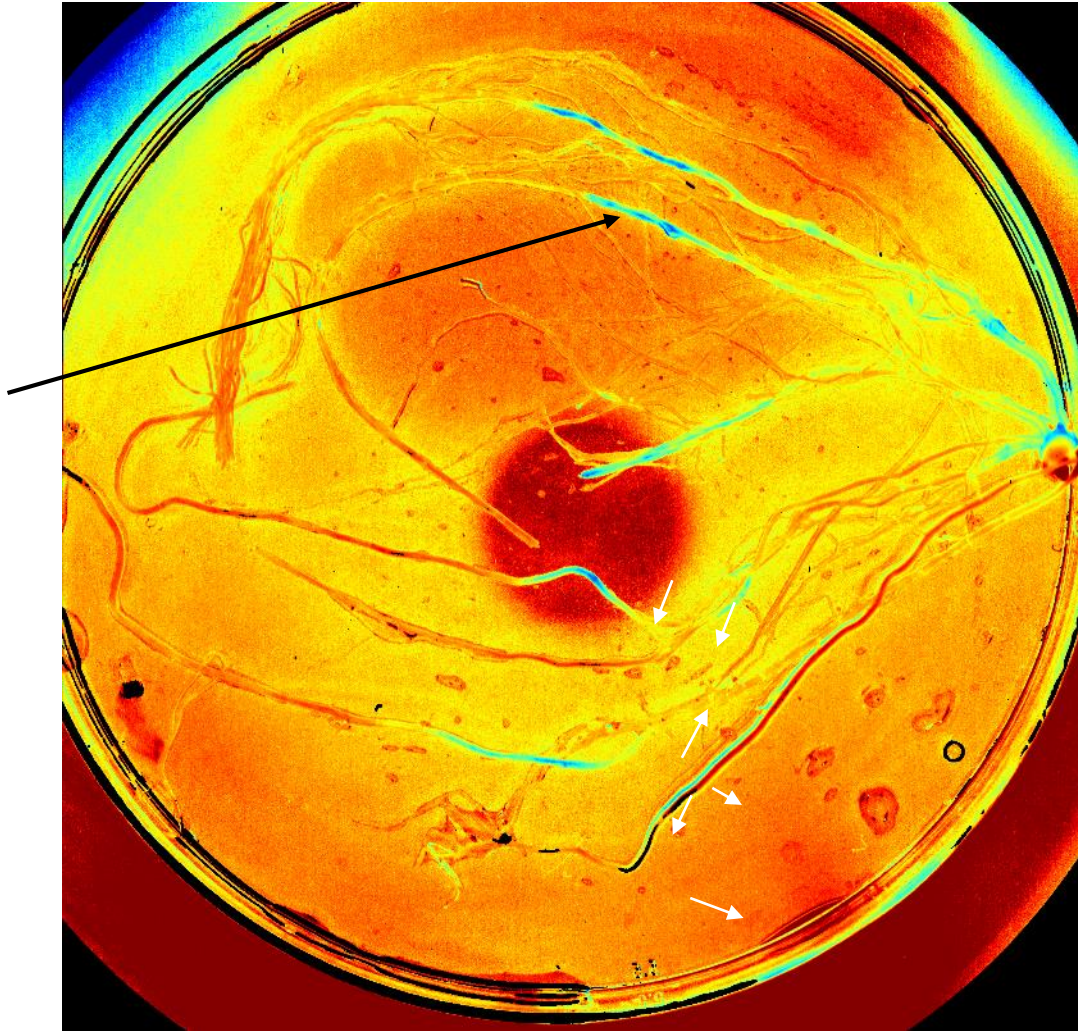
Multispectral imaging



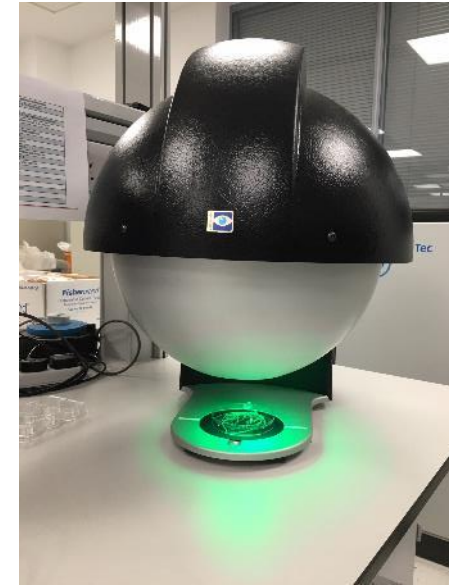
UV-VIS-NIR
Multispectral imaging
analyser from Analytik Ltd

Multispectral imaging

Blue highlights indicate the take-all infections throughout the wheat root system



Root system in a 9 cm petri dish



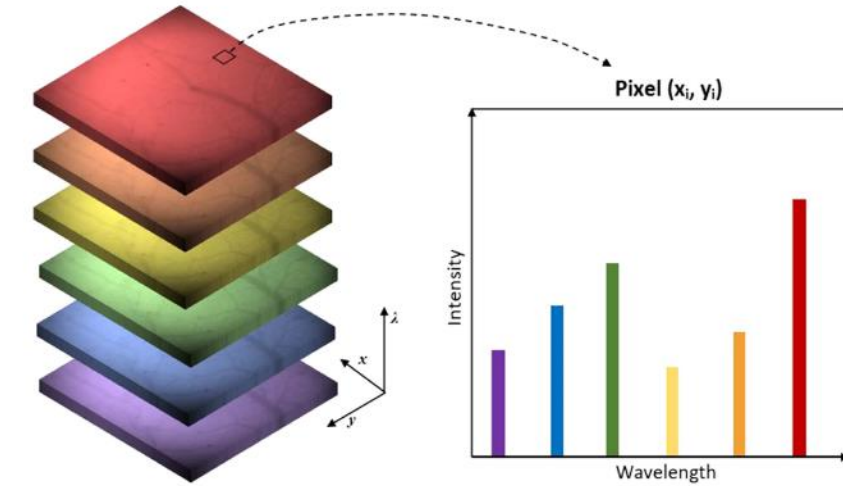
UV-VIS-NIR
Multispectral imaging
analyser from Analytik Ltd



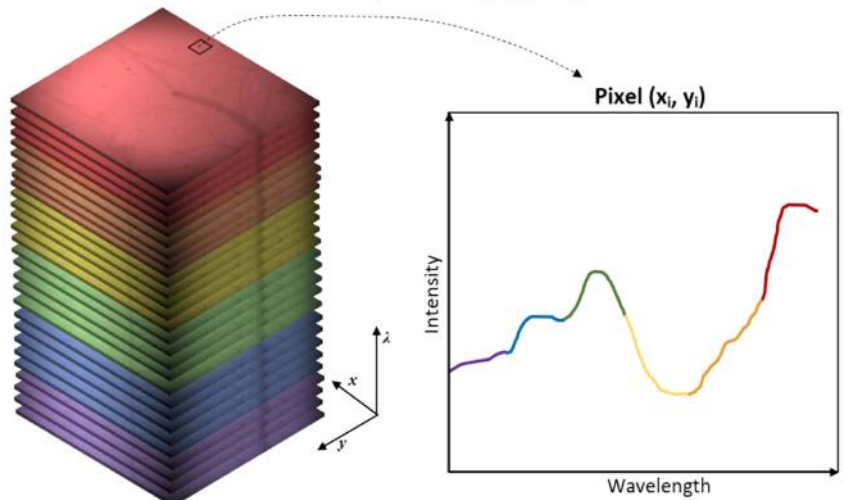
ROTHAMSTED
RESEARCH

Jess Spong (PhD student)
Gail Canning
Kim Hammond-Kosack

Hyperspectral imaging



Multispectral imaging (MSI)



Hyperspectral imaging (HSI)



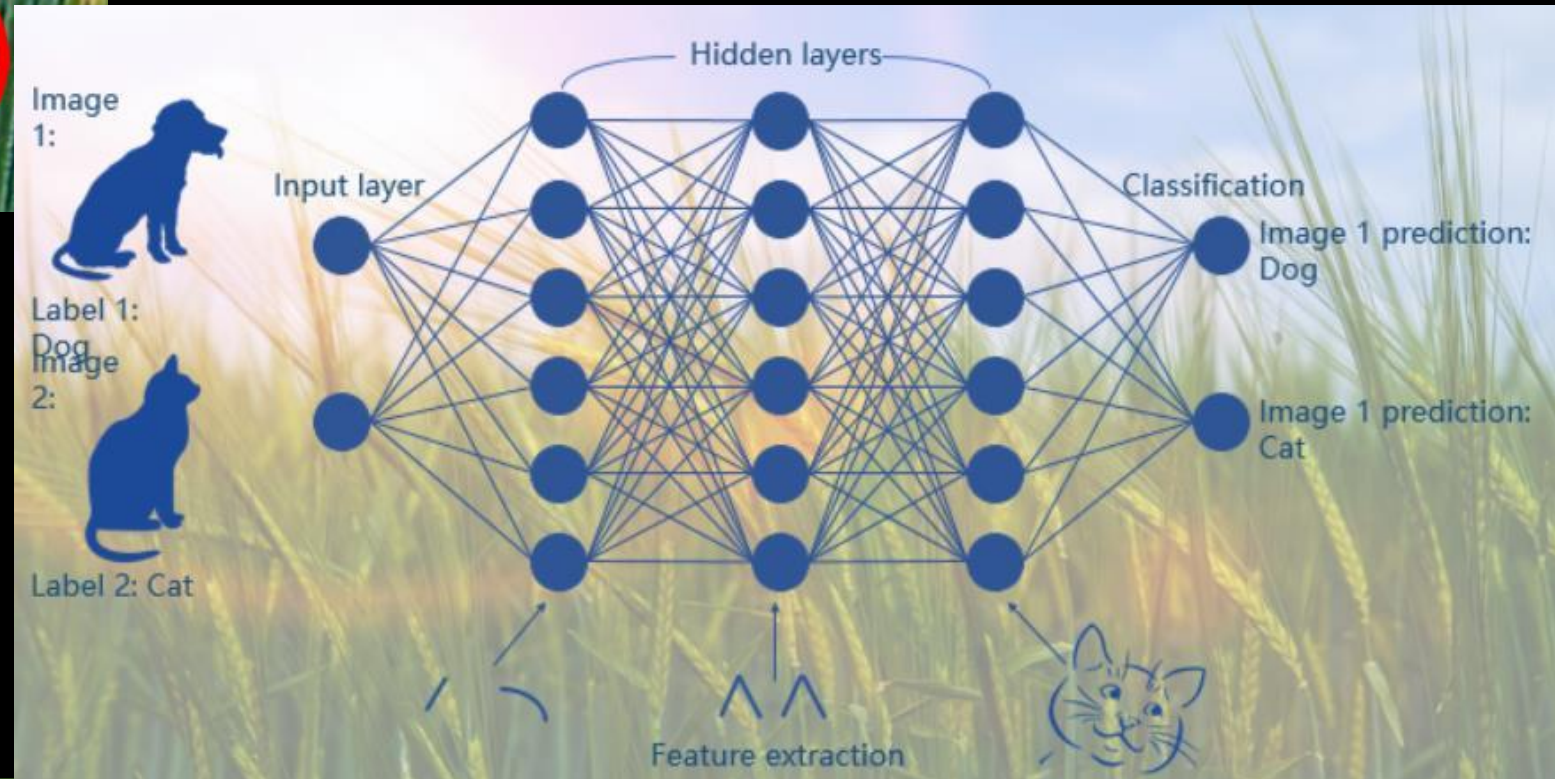
Polder Gerrit, Blok Pieter M., de Villiers Hendrik A. C., van der Wolf Jan M., Kamp Jan, 'Potato Virus Y Detection in Seed Potatoes Using Deep Learning on Hyperspectral Images', 2019, *Frontiers in Plant Science*, Vol. 10.

Hyperspectral imaging solutions for brain tissue metabolic and hemodynamic monitoring: past, current and future developments.

AI and machine learning



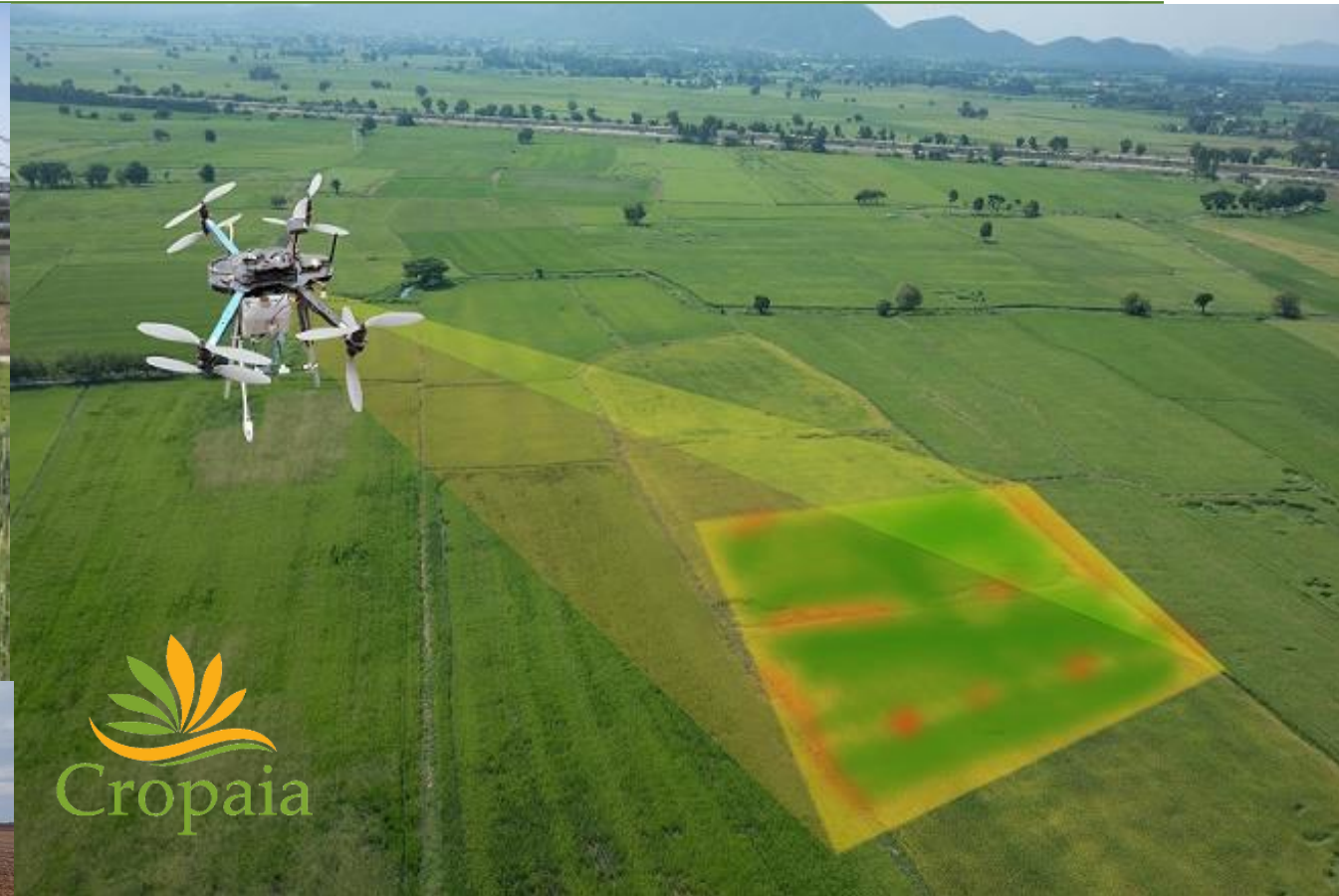
Megan Long
James Brown
Richard Morris



Precision agriculture

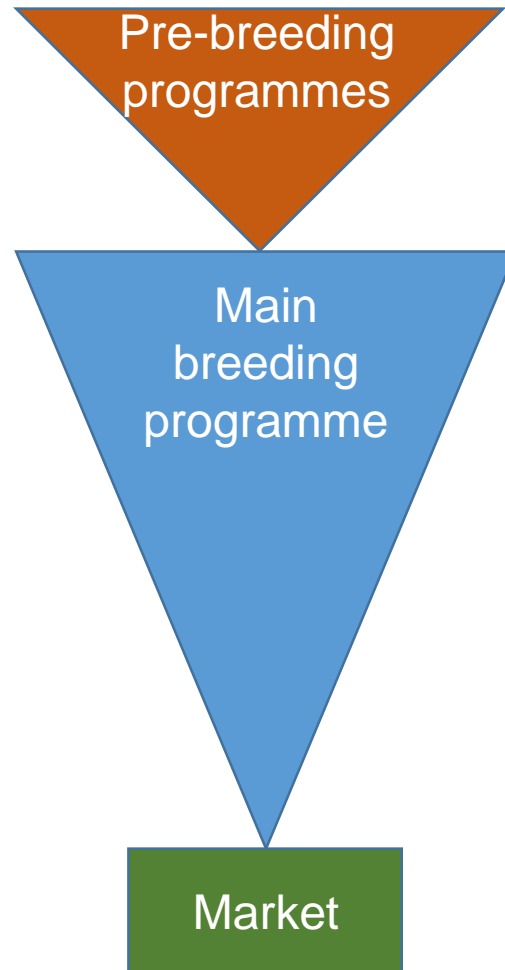


Phenospex – John Innes



Introducing new diversity

Introducing new diversity:-



Choosing the right novel traits



Choosing the right donors



Choosing the right elite parent to cross in the trait



Tracking the novel traits once in the elite programme

New sources of resistance



- The Focused Identification of Germplasm Strategy (FIGS)
- Increased genotyping
- Increased phenotyping

Breeder's Observation Panel



BBSRC Designing Future Wheat

Watkins lines - JIC

Landraces from around the world



Wheat synthetics - NIAB



Wheat wild relative introgressions - Nottingham



Breeder's Toolkit



BTK Selection Committee



Simon Griffiths
Chair



Julie Ellwood
DFW Project Manager



Simon Orford
GRU BTK Coordinator



Jacob Lage
KWS



Chris Burt
RAGT



David Schaefer
LSPB



Phil Tailby
LimaGrain



David Feuerhelm
Syngenta



Mike Kerns
Bayer



Matthew Kerton
DSV



Stephen Smith
Elsoms



Malcolm Hawkesford
DFW WP1



Cristobal Uauy
DFW WP2



Delegated to
JK, AB, or IK
DFW WP3



Rob Davey
DFW WP4



Keith Edwards
Bristol



Alison Bentley
NIAB



Ian and Julie King
Nottingham

Cadenza TILLING population

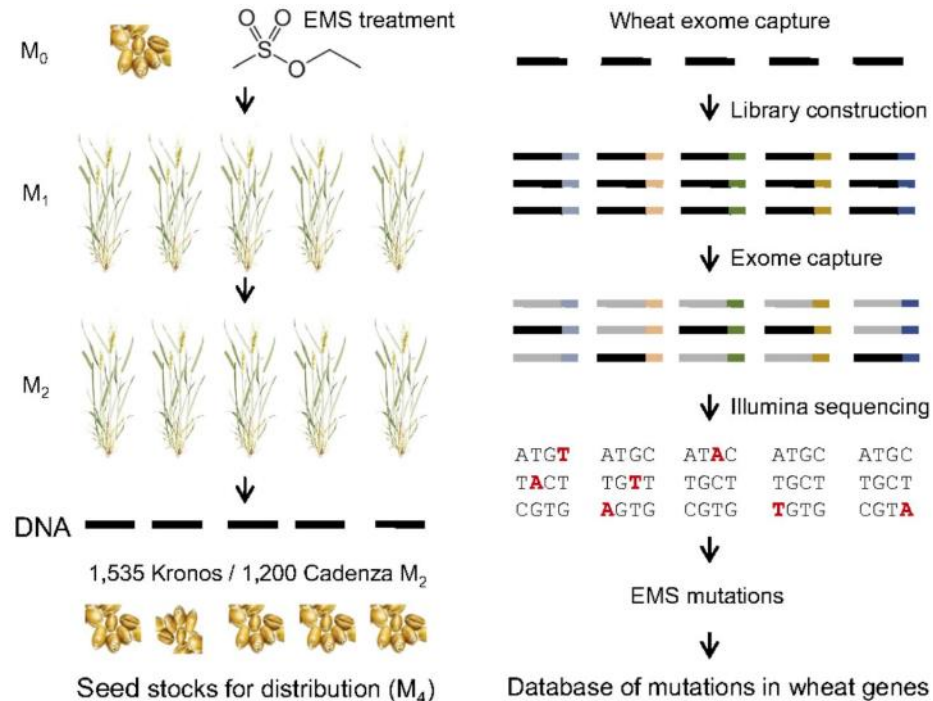
PNAS

Uncovering hidden variation in polyploid wheat

Ksenia V. Krasileva, Hans A. Vasquez-Gross, Tyson Howell, Paul Bailey, Francine Paraiso, Leah Clissold, James Simmonds, Ricardo H. Ramirez-Gonzalez, Xiaodong Wang, Philippa Borrill, Christine Fosker, Sarah Ayling, Andrew L. Phillips, Cristobal Uauy, and Jorge Dubcovsky

PNAS February 7, 2017 114 (6) E913-E921; first published January 17, 2017 <https://doi.org/10.1073/pnas.1619268114>

Contributed by Jorge Dubcovsky, December 20, 2016 (sent for review November 22, 2016; reviewed by Beat Keller and Joachim Messing)



Forward genetics:-



Fiona Doohan
Thalia Christodoulou

Reverse genetics:-



Research Article | [Open Access](#) | [CC](#) | [i](#)

mlo-based powdery mildew resistance in hexaploid bread wheat generated by a non-transgenic TILLING approach

Johanna Acevedo-Garcia, David Spencer, Hannah Thieron, Anja Reinstädler, Kim Hammond-Kosack, Andrew L. Phillips, Ralph Panstruga

Introgression tracking

CerealsDB

Tools for the analysis of the wheat genome.

Home Wheat Seq DArT Markers SNPs (KASP) SNPs (Axiom®) SNPs (iSelect) SNPs (TaqMan®) TGB

Search for Introgressed regions in elite wheat varieties

Using the form below, you can search for introgressions for a particular elite wheat variety that have come from over a hundred wheat relatives and progenitor species.

Enter the wheat variety into the field below and click the submit button.

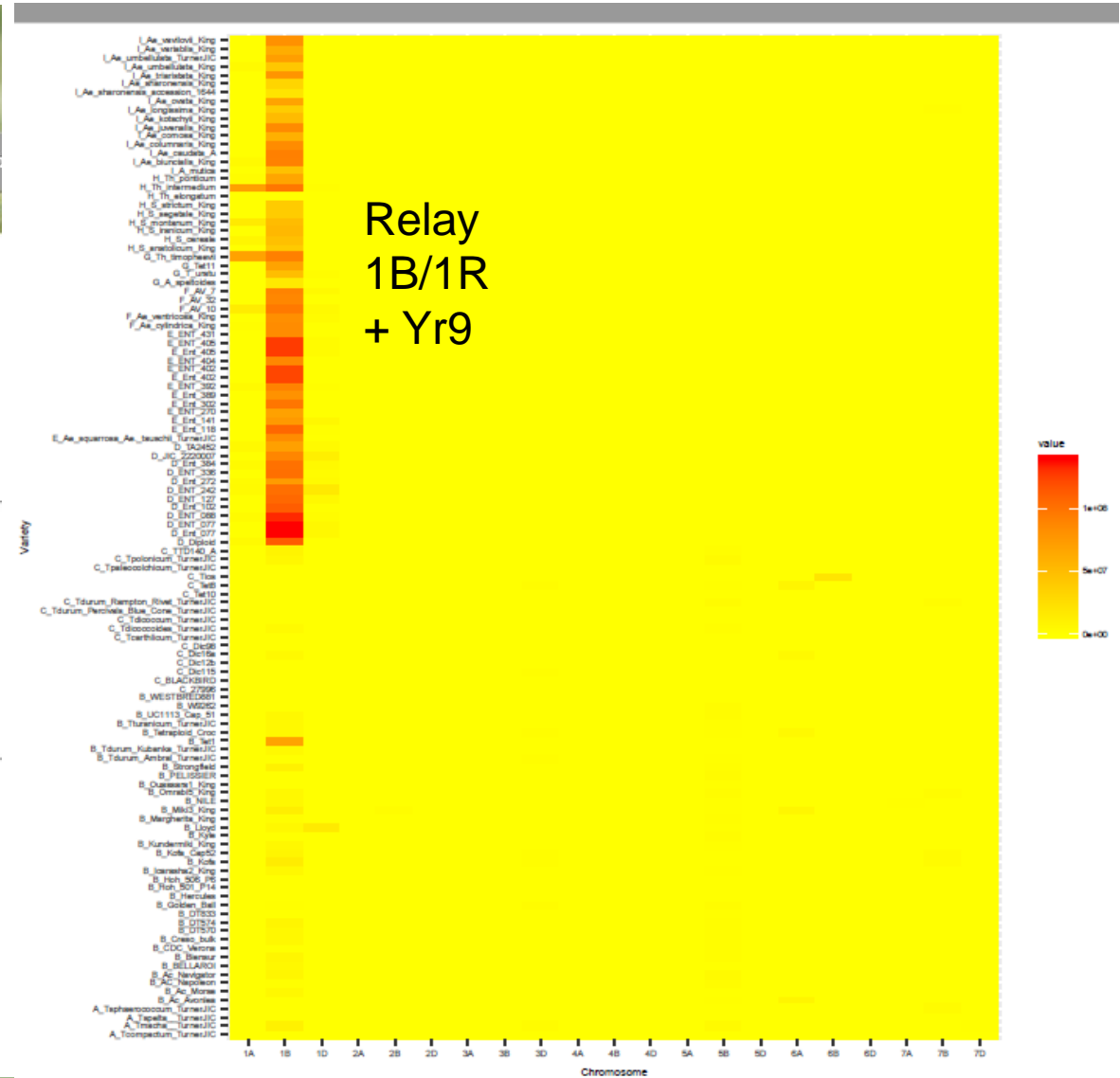
Please enter a **wheat elite** variety in this field - begin typing and the field will auto complete.

Percentage match cutoff: This is the percentage of matching SNP scores to the wheat relative (Default = 40%).

Exclude small introgressions: Yes No

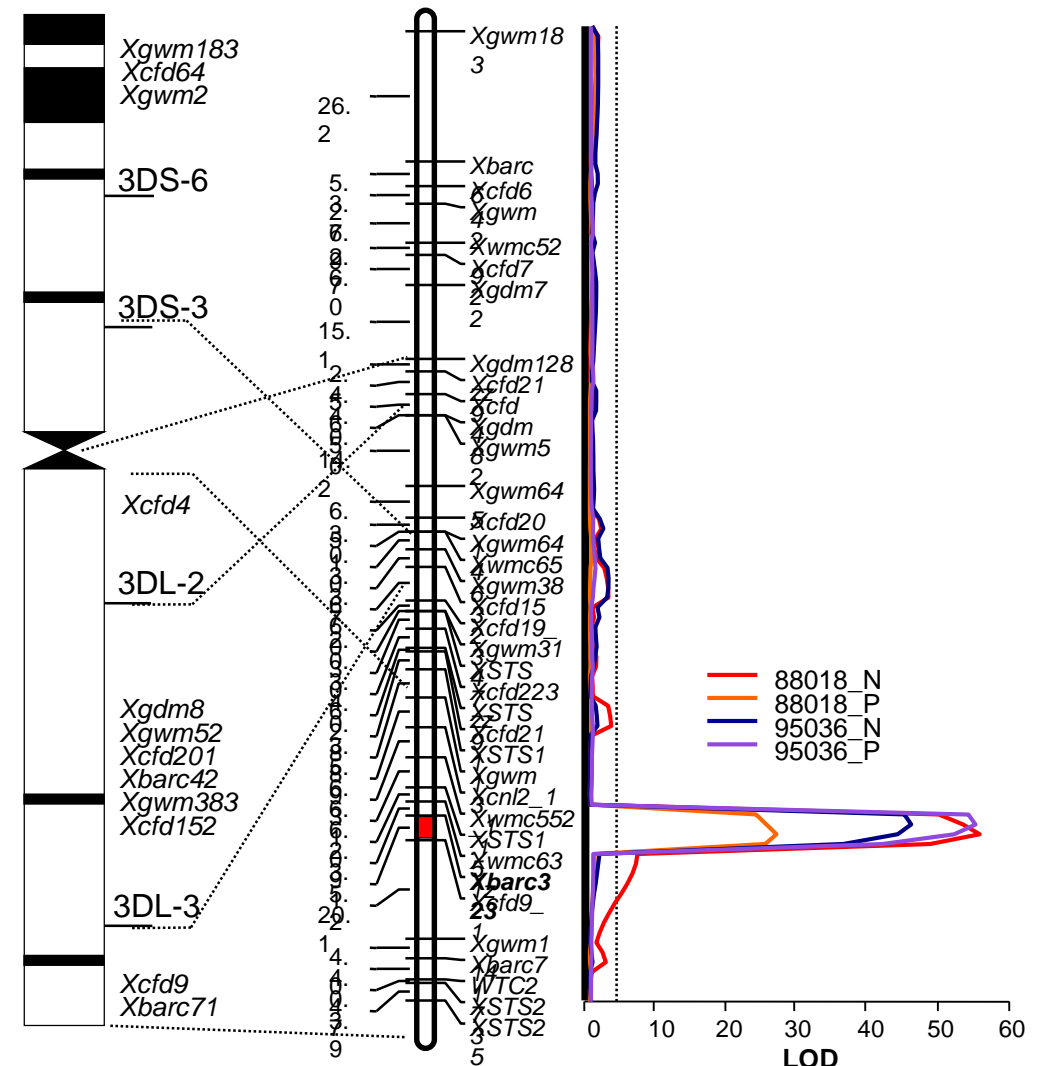
Submit Form

Clear Form



Durability

- Stb16 originated from a synthetic wheat
- Broad spectrum of resistance to multiple isolates
- Located on chromosome 3D
- The gene was introduced into some French elites
- Only recently made it to market
- Broke down last year



Acknowledgments



Chris Burt



Fonds de soutien à l'Obtention Végétale

Cyrille Saintenac
(INRA)



ROTHAMSTED
RESEARCH

Jess Spong
Gail Canning
Kim Hammond-Kosack

CerealsDB

Tools for the analysis of the wheat genome.



John Innes Centre

James Brown
Richard Morris
Megan Long



Fiona Doohan
Thalia Christodoulou

