

WGIN : Overview and update on RRes WGIN research

Kim Hammond-Kosack
Rothamsted Research



9th WGIN Stakeholders Meeting 22th November 2011

The Defra Crop Genetic Improvement Networks

Announced July 2002

Dr Donal Murphy-Bokern

**Arable Crop Sciences & Pesticide
Safety Unit**

Science Directorate

Defra



Overall Objectives

- **Each Crop Genetic Improvement Network =**
Virtual Plant Breeding Institute
- **To use crop breeding for the sustainable development of the arable sector**
- **To connect public sector science to the private sector**

To recreate the best of the past

Networks established

- **Wheat (WGIN)**
- **Oilseed rape (OREGIN)**
- **Short rotation coppice (BEGIN)**
- **Pulse crops**
- **Miscanthus**
- **Oats**

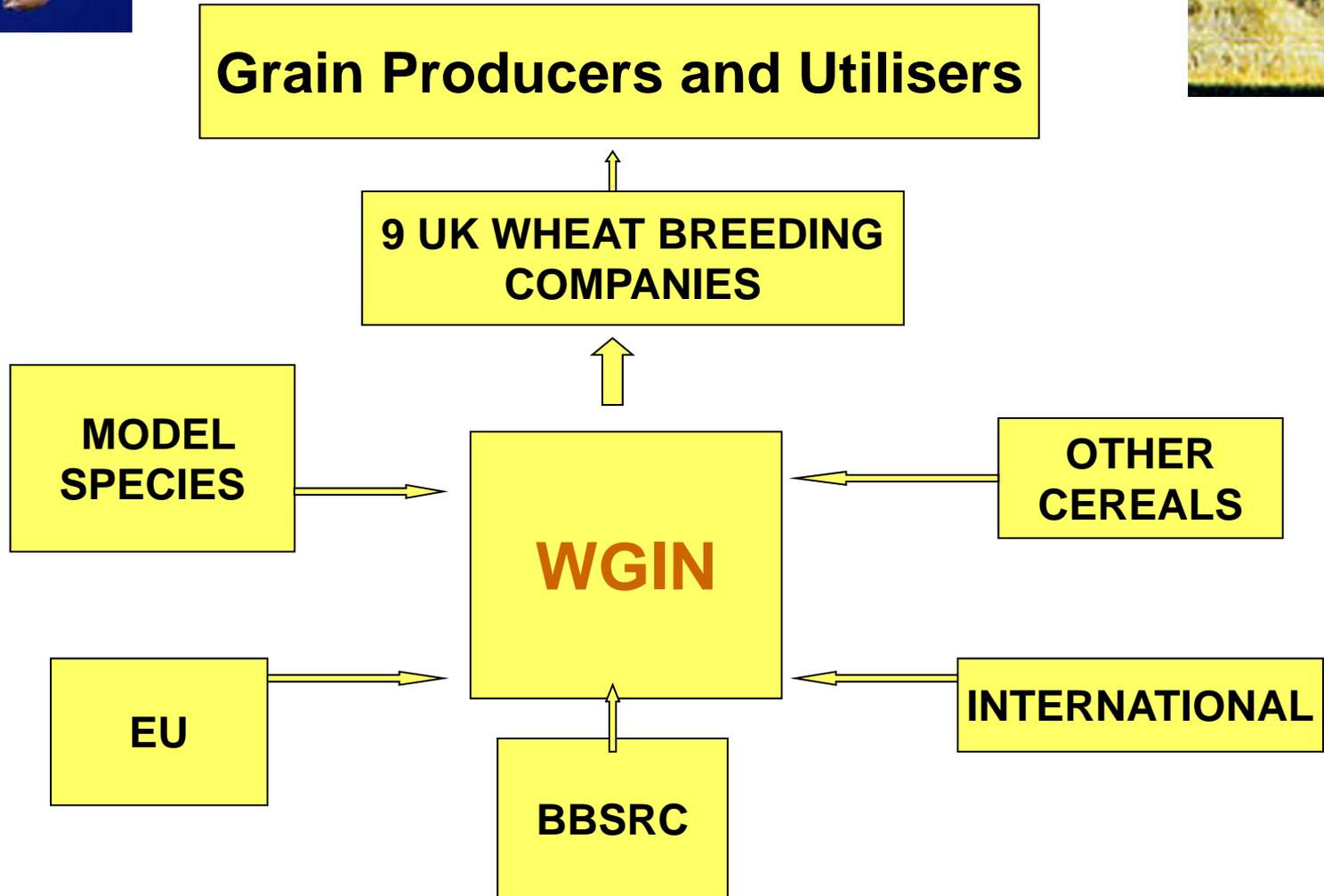


The longer-term vision

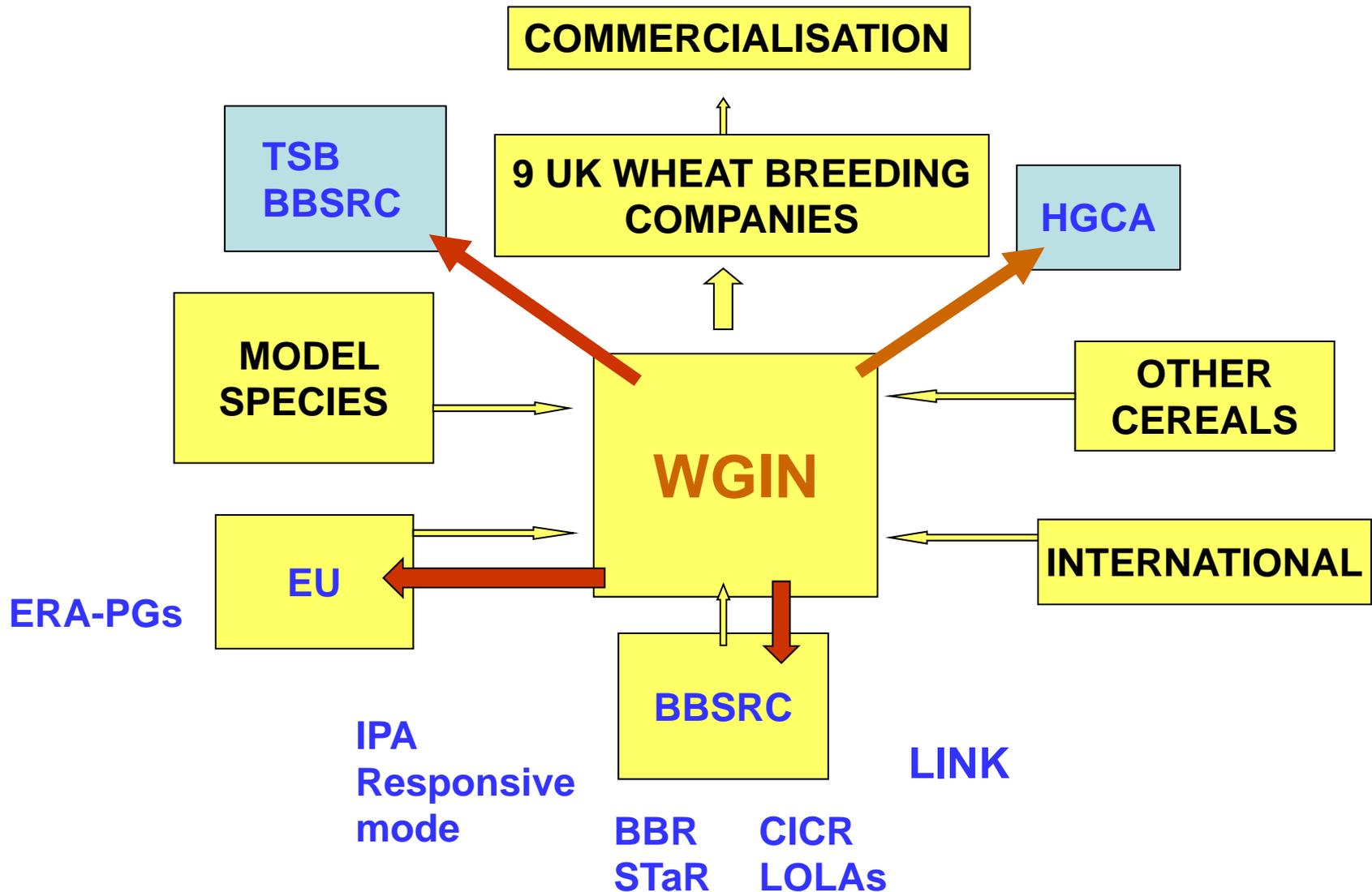
- A strong crop breeding sector deploying the best technologies science can offer
- A strong strategic and applied research base competing effectively for resources
- A strong base for international partnerships
- More resource efficient and productive crops



The Defra WGIN



The modest WGIN funds would attract additional funds to wheat research by other sponsors



Projects of 5 years duration

The WGIN 1 project (2003 – 2008) - £1.80 million

The WGIN 2 project (2008 – 2013) - £1.95 million

WGIN 2 project – funded partners

John Innes Centre

University of Nottingham

Rothamsted Research

Mission statement - WGIN 2008 to 2013

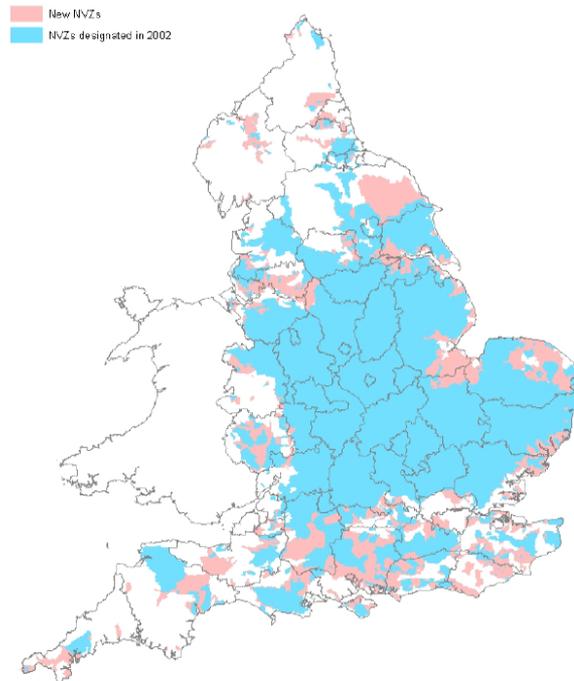
Improving the environmental footprint of farming through crop genetics and targeted traits analysis

Defra's current policy priorities addressed by WGIN

- 1. Support and develop British farming and encourage sustainable food production**

Defra's current policy priorities addressed by WGIN

2. Help to enhance the environment and biodiversity to improve quality of life



Increase in England of Nitrate Vulnerable Zones (NVZ) due to arable activities 2002 (blue) to 2009 (pink)

Defra's current policy priorities addressed by WGIN

3. Support a strong and sustainable green economy, resilient to climate change

Wheat Genetic Improvement Network (WGIN) 2008-2013

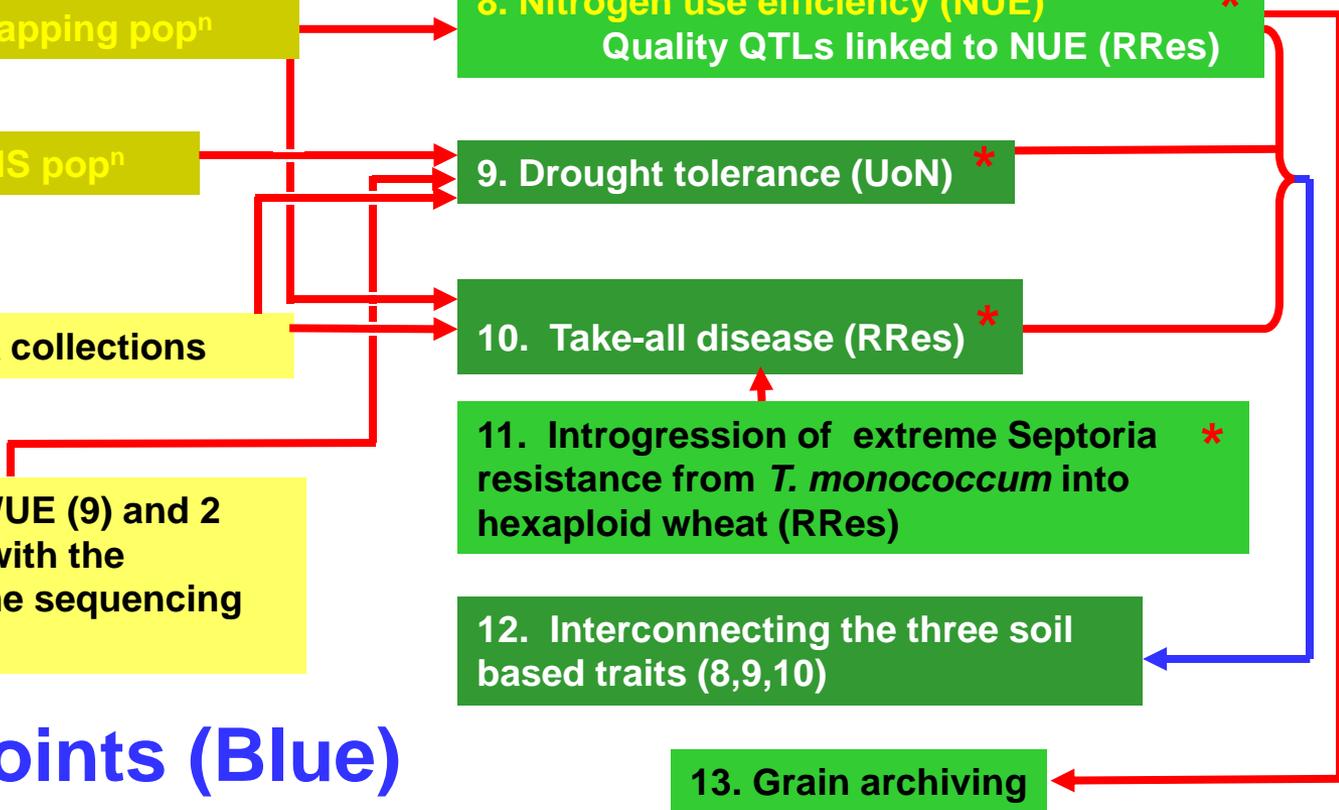
Tools and Resources

- 2. Near Isogenic lines (NILs) *
- 3. The Avalon x Cadenza Mapping popⁿ
- 4. Paragon gamma and EMS popⁿ
- 5. AE Watkins and Gediflux collections
- 6. New mapping popⁿ for WUE (9) and 2 new popⁿ to align WGIN 2 with the international wheat genome sequencing effort

Targeted traits

- 7. Insect resistance (RRes) *
- 8. Nitrogen use efficiency (NUE) *
Quality QTLs linked to NUE (RRes)
- 9. Drought tolerance (UoN) *
- 10. Take-all disease (RRes) *
- 11. Introgression of extreme Septoria resistance from *T. monococcum* into hexaploid wheat (RRes) *
- 12. Interconnecting the three soil based traits (8,9,10)
- 13. Grain archiving

Key control points (Blue)
cross connections (Red)



Characterisation and provision of genetic resources

The **AE Watkins** spring and winter wheat collection
(JIC)

1930s collection from markets in 32 countries

Seed now available for > 1000 'purified' lines

**Represents germplasm never used in
UK wheat breeding programmes**

Simon Griffiths / Simon Orford

Trait identification

1. Improved nitrogen use efficiency (NUE)
2. Grain quality (QTLs) linked to NUE
3. Improved water use efficiency (WUE)

Consecutive years of field trials



Drought Tolerance / Water use efficiency (WUE)

- **Searching for scoreable traits**
- **Identifying genetic markers**
- **Creating a drought specific germplasm collection**
- **Developing a suitable mapping population cv Paragon x Garcia**

John Foulkes

Trait identification – RRes

2. Reducing pest and disease pressure

Aphids



***Septoria* leaf blotch**



Take-all fungus



Annually all crops at high risk

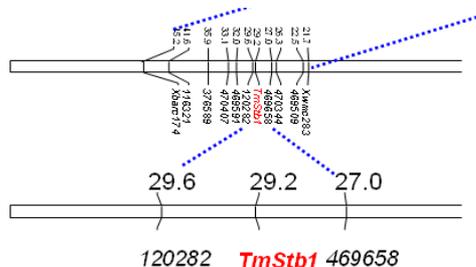
**A major problem
for 2nd / 3rd wheat
crops**

2nd wheat syndrome

Septoria resistance



Field assessment over 5 years

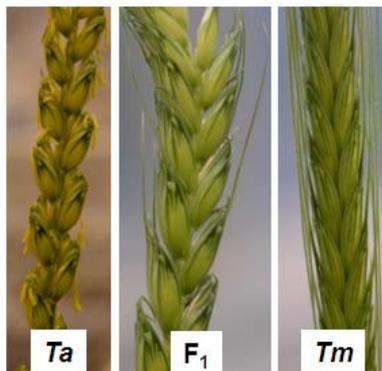


Fine mapped locus to Chr7A

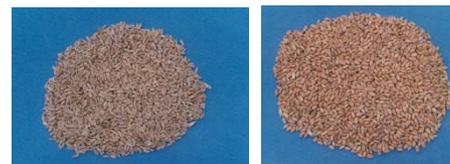
Introgression breeding

Pairing locus mutant *ph1*

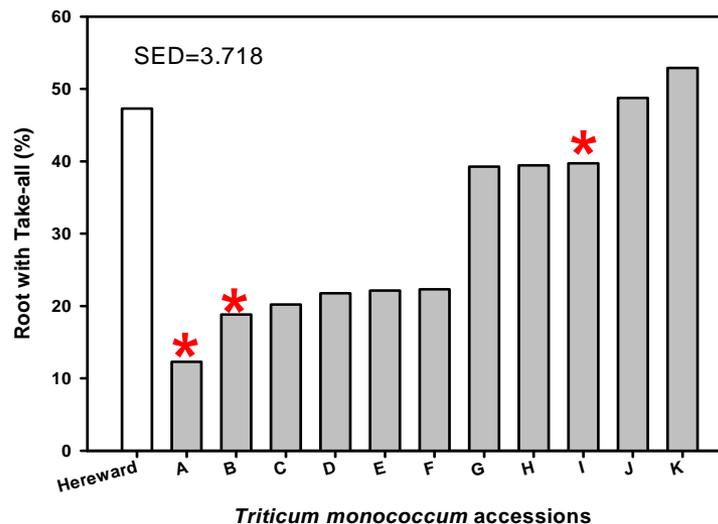
cvs Chinese Spring, Paragon



Take-all resistance in *T. monococcum*



infected roots



Three mapping populations produced and F₆ populations to be screened in 2012

Take-all disease – soil-borne fungus

In 1st wheats - no disease problem



A major problem
for 2nd / 3rd wheat crops

2nd wheat syndrome



Typical take-all patch showing stunting
and premature ripening of the crop

The risk of Take-all is largely dependent on the amount of inoculum in
the soil at the time of sowing

An important WGIN 1 discovery

The genotype of the 1st wheat influence the amount of take-all inoculum build-up in the bulk soil



Plant Pathology (2010)

Doi: 10.1111/j.1365-3059.2010.02375.x

Evidence that wheat cultivars differ in their ability to build up inoculum of the take-all fungus, *Gaeumannomyces graminis* var. *tritici*, under a first wheat crop

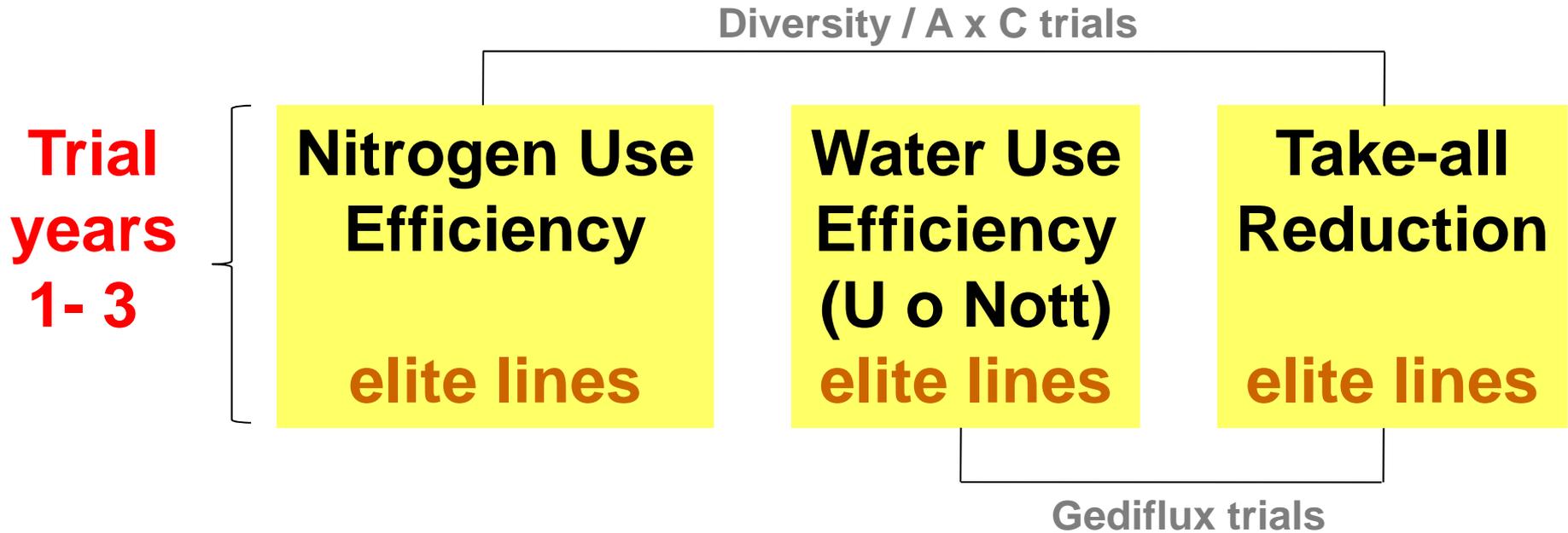
V. E. McMillan, K. E. Hammond-Kosack and R. J. Gutteridge*

Department of Plant Pathology and Microbiology, Rothamsted Research, Harpenden, Hertfordshire AL5 2JQ, UK

This study used the 1st wheat NUE diversity trial

Richard Gutteridge

WGIN 2 Interconnecting the three soil based traits



Aim: To identify the lines with good tolerance to multiple stresses (years 4 – 5)

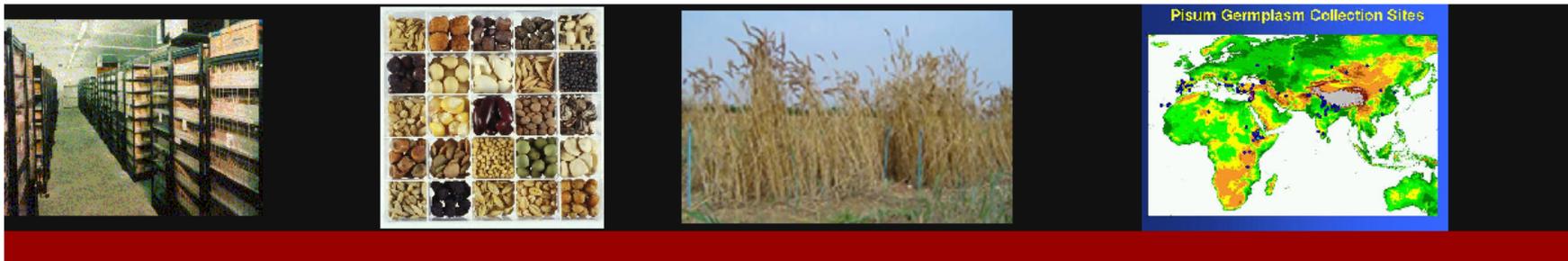
What are the similarities / differences between the three traits ?

Accessing the WGIN germplasm

Two routes:

RRes – by E. mailing directly to WGIN

JIC - Genetic Resources Unit



Collections /
Databases

Genetic Resources Unit

What's New

The Centre is custodian of a number of key germplasm collections which serve academic, industrial and non-industrial groups both within the UK and internationally. They are the subject of research in their own right as well as being involved in a range of collaborative programmes. The collections housed within a purpose built facility maintained at 1.5 °C and 10%RH with some 600m³ of storage capacity.

People

GRU
Publications

Links

Material from the collections is available on request to research, academic and commercial communities subject to availability. A material transfer agreement is required before seed is released. Please email for details of the agreement.

Return to
Genetic
Resources

For further information relating to the collections please contact: Mike Ambrose
John Innes Centre, Norwich Research Park Colney Lane, Norwich, NR4 7UH.
TEL: +01603 450630 EMAIL: JIC.geneticresources@bbsrc.ac.uk

**Accession numbers
over 40,000 for
RRes WGIN
accessions**

Mike Ambrose

Central storage of grain from the field trials

8 years of field trials

The stored samples - 500 g / 1 kg grain at - 20 C

~ 6,000 samples with associated metadata

**Key biological resources for new projects
and / or pilot studies**

The Networking objectives

8 of the 20 activities

The Defra WGIN: Dissemination, Liaison and Communication

Annual “Stakeholders’ Forum” (Nov)

Focussed Workshop – 2009 ‘A x C mapping popⁿ’

2010 – DArT marker analysis

Workshops with overseas partner organisations:

CIMMYT, INRA, 2010 – Serbia / Eastern Europe

2011- Brazil

Web Site (www.WGIN.org.UK)

Six Monthly Electronic Newsletter

Scientific publications

Annual displays at ‘Cereals’

E. mail:wgin.defra@bbsrc.ac.uk



ABOUT

INFORMATION

RESOURCES

STAKEHOLDERS

HOME >

Welcome to WGIN 2nd Phase (2009-2013)

Defra Wheat Genetic Improvement Network - Improving the environmental footprint of farming through crop genetics and targeted traits analysis

Background

The UK government is committed to more sustainable agriculture but this vision is facing an ever expanding range of environmental, energy and climate change challenges. Wheat is grown on a larger area and is more valuable than any other arable crop in the UK. Established in 2003, the Wheat Genetic Improvement Network (WGIN) arose directly from a realisation in the early 2000s that over the preceding two decades there had been a widening disconnection between commercial plant breeding activities and publicly funded plant and crop research. The overall aim of WGIN is to generate pre-breeding material carrying novel traits for the UK breeding companies and to deliver accessible technologies, thereby ensuring the means are available to produce new, improved varieties. An integrated scientific 'core' which combines underpinning work on molecular markers, genetic and genomic research, together with novel trait identification, are being pursued to achieve this goal.



site guide

The site is grouped into the following four sections:

ABOUT - for general information about WGIN, including news items and contacts.

INFORMATION - for more detailed information about WGIN, including reports and information tools.

RESOURCES - for experimental resources and research related tools

STAKEHOLDERS - for information on the Stakeholders Forum

Please use our interactive dropdown menus, the side menus, or the link tracker to navigate the site.

--see [site-map](#) for overview

RECENT UPDATES

OLD Site - [The old site is still available here.](#)

Disclaimer: WGIN is a publicly funded project and the data and resources it generates are freely available to the research community, providing that the use of any WGIN data and resources are acknowledged.

Maintained by
Suzanne Thrussell
Project assistant

Accessible via the
MONOGRAM
website

Economic impact of WGIN

Special focus Newsletter May 2008

- £4.3 M new grants + £2.95 M existing grants

The cost of WGIN 1 was £1.8 M over 5 years

Another WGIN project impact audit just completed

- 20 new projects described in Nov 2011 Newsletter

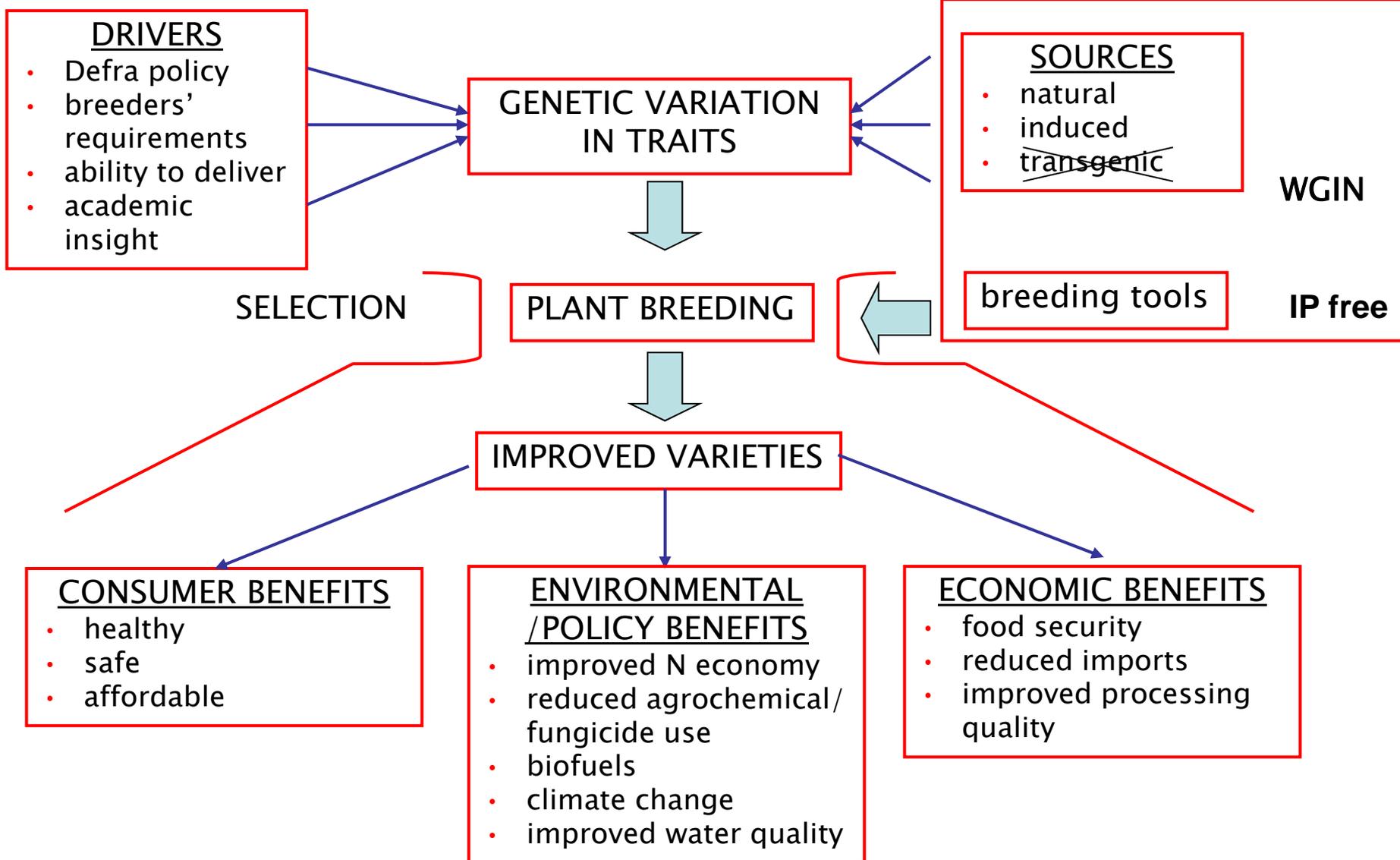
- £15.39 M new grants

14 projects partially industry funded

BBSRC, HGCA, Defra, Technology Strategy Board, Scottish Government, EU Lawes Trust, Rothamsted International, John Oldacre Foundation

The cost of WGIN 2 is £1.95 M over 5 years

WGIN in the wider context



Defra

**Donal Murphy-Bokern, Bruno Viegas, Kath Bainbridge
and Farhana Amin**

WGIN (present)

**RRes - Peter Shewry
Kim Hammond-Kosack
Malcolm Hawkesford
Richard Gutteridge
Kostya Kanyuka
Suzanne Thrussell**

**JIC – Simon Griffiths
Susan Freeman
Cathy Mumford**

**UoN - John Foulkes
Jayalath DeSilva**

WGIN (past)

**RRes – Andy Phillips
Katie Tearall
Peter Barraclough
Hai-Chun Jing
Carlos Bayon
Sam Irving
Lesley Smart
Ruth Gordon-Weeks
Elke Anzinger**

**JIC - John Snape
Robert Koebner
Liz Sayers
Christian Rogers
Pauline Stephenson
Leodie Alibert
Simon Orford
Michelle Leverington**

The farm / trials staff at all the sites used

**The Plant Breeders
The Management team**

www.WGIN.org.UK



 **CIMMYT**
International Maize and Wheat Improvement Center



Wheat Straw Bio-Filled Polypropylene
Industry and World-First Usage in Quarter Trim Bins on 2010 Ford Flex

Extrusion Compounding → Injection Molding

Wheat Straw → Wheat Straw / Polypropylene Resin → Wheat Straw Bio-Filled Polypropylene Quarter Trim Bin

AgriPlas™





The WGIN disclaimer

WGIN is a publicly funded project and the **data and resources it generates are freely available to the research community, providing that the **use** of any WGIN data and resources are **acknowledged**.**

In grant applications as well as final publications

We developed in early 2010 : A generic statement on data and resource use by others

Please use this statement and inform us of all successful activities

Three Defra's current policy priorities addressed by WGIN

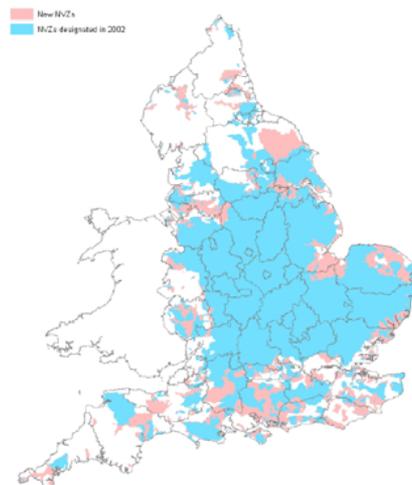
1. Support and develop British farming and encourage sustainable food production

Help to enhance the competitiveness and resilience of the whole food chain, including farms and the fish industry, to help ensure a secure, environmentally sustainable and healthy supply of food with improved standards of animal welfare

Three Defra's current policy priorities addressed by WGIN

2. Help to enhance the environment and biodiversity to improve quality of life

Enhance and protect the natural environment, including biodiversity and the marine environment, by reducing pollution, mitigating greenhouse gas emissions, and preventing habitat loss and degradation



Increase in England of Nitrate Vulnerable Zones (NVZ) due to arable activities 2002 (blue) to 2009 (pink)

Three Defra's current policy priorities addressed by WGIN

3. Support a strong and sustainable green economy, resilient to climate change

Help to create the conditions in which businesses can innovate, invest and grow; encourage businesses, people and communities to manage and use natural resources sustainably and to reduce waste; work to ensure that the UK economy is resilient to climate change; and enhance rural communities