

Oilseed RapE Genetic Improvement Network



(OREGIN)



Ian Bancroft 22 February, 2016

OREGIN pioneered the Defra-funded crop genetic improvement networks (in 2003), has adapted to recent agricultural changes and continues to be relevant to challenges the industry faces



UK oilseed rape markets

Seed harvested (farmers, 700 kHa in UK) £600M pa

Seed for sowing (breeders) £48M pa

Fertilizer

Agrochemicals (fungicides, insecticides & herbicides)

Oil processors

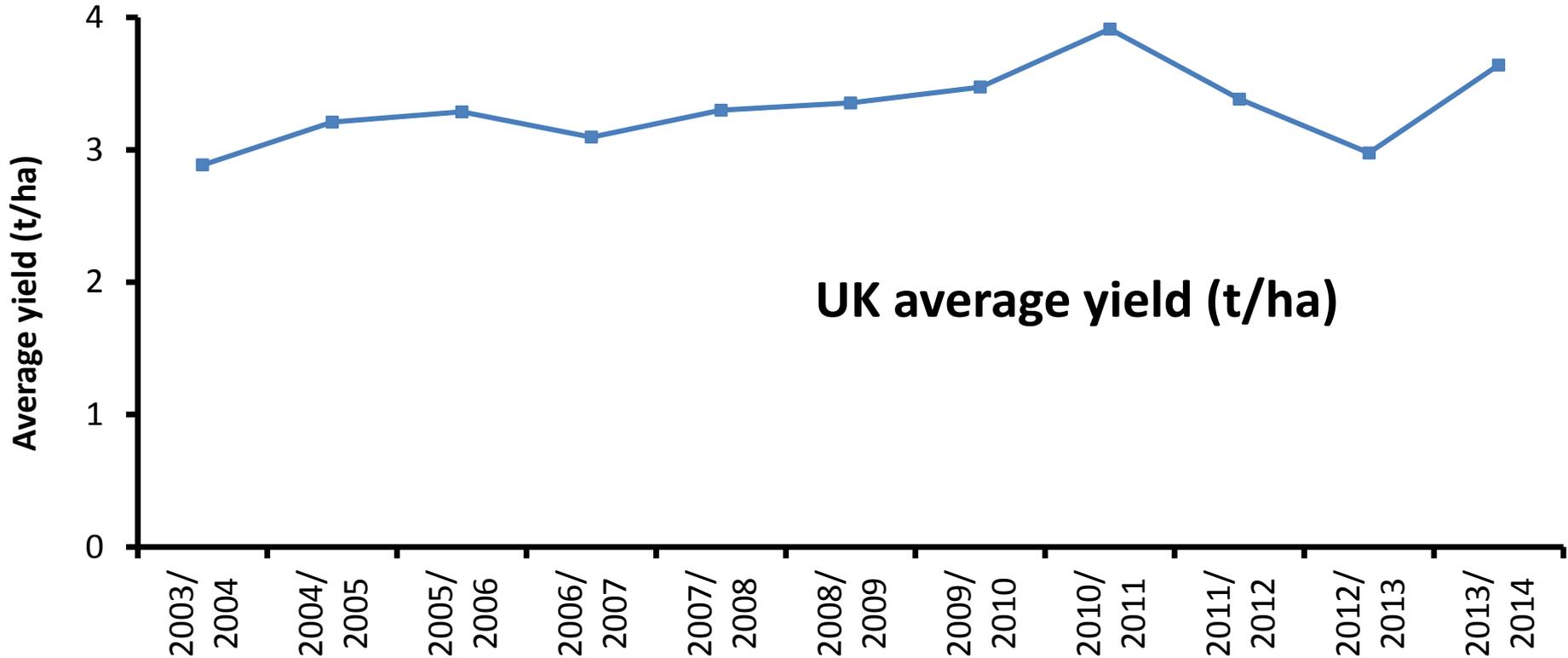
Food processors

Industrial products

**OSR is a key partner to wheat in crop rotations,
allowing control of grass weeds**

Challenges

UK oilseed rape yield plateau on farms



Challenges

Pests & diseases



Flea beetle



Light leaf spot



Phoma stem canker



Challenges

Factor	Breeding	chemistry	Engineering	Systems/IT
Radiation use efficiency	✓	✓		
Water use efficiency	✓	✓ Anti-transpirants		
Deeper rooting	✓	✓	✓	✓
N use efficiency	✓	✓ New formulations	✓ Precision F	✓ Rotation
Adapt to warming climate	✓			✓
Disease: Light leaf spot	✓	✓		
TYMV, Verticillium, rotational frequency	✓	✓		✓

Opportunities

- **Genome sequences now available**
- **Extensive genetic diversity available in related species**
- **Edible *and* industrial types grown (depends on oil composition)**
- **Market for co-products (add value to crop)**



Aims of OREGIN

To underpin genetic improvement of UK oilseed rape crop by:

1. Providing genetic resources for oilseed rape breeding
2. Providing information resources for oilseed rape breeding
3. Maintaining/expanding interactions between industry stakeholders & academics

UK oilseed rape genetic resources: plants

Genetic diversity panel

Diversity Fixed Foundation Sets of *Brassica napus* developed, maintained in genebank at University of Warwick & distributed. Now 169 lines publicly available



THE UNIVERSITY OF
WARWICK


John Innes Centre
Unlocking Nature's Diversity

 The University of
Nottingham

Mapping populations

5 new oilseed rape mapping populations now publicly available

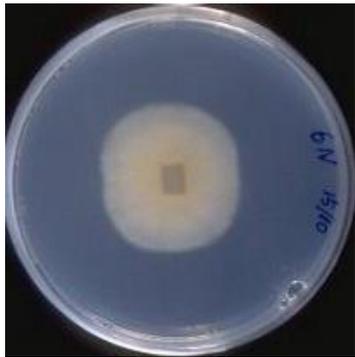


Elsoms 

UK oilseed rape genetic resources: pathogens

Pathogen	No. isolates
Phoma stem canker pathogens	100
Light leaf spot pathogen	100

Important isolates to characterize breeding material for resistance against these pathogens



Leptosphaeria spp.



Pyrenopeziza brassicae

Isolate collection to be housed in UH new science building (2016)



<https://www.herts.ac.uk/oregin>

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1. Providing genetic resources for oilseed rape breeding
- 2. Providing information resources for oilseed rape breeding**
Website received >10,000 hits from 120 countries, 2010-2014
Now moved to University of Hertfordshire: <https://www.herts.ac.uk/oregin>
3. Maintaining/expanding interactions between industry stakeholders & academics

UK oilseed rape information resources: trait data



About OREGIN

Information

Stakeholders

Linkage map

Trait data

Contact OREGIN

Home > Trait data

Trait data

Data Area	Specifics	Lines / Populations	Project	Contact	Data Available	Data Curated	Priority
Published QTL	From papers associated to curated maps	Many	Many	Ian Bancroft (University of York)	yes	-	-
Diversity screens	---	BnaDFFS	OREGIN	Ian Bancroft (UoY) Graham Teakle Rachel Wells (JIC)	2010 - 2011	-	HIGH
Diversity screens	Variety level scores, replicated	---	EU-RESGEN	web	yes	-	Medium

<https://www.herts.ac.uk/oregin>

UK oilseed rape information resources: molecular data

Linkage maps

High resolution transcriptome SNP map for TNDH population 



Bancroft et al. Nature Biotechnology 29:762-6, 2011

High resolution genome SNP maps for 4 OREGIN populations 

<http://www.yorkknowledgebase.info/>

Diversity panels

Functional genotypes and associative transcriptomics in expanded ASSYST panel (includes DFFS lines) 



Harper et al. Nature Biotechnology 30:798-802, 2012

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3. **Maintaining/expanding interactions between industry stakeholders & academics**

UK oilseed rape community

Broad range of academic research groups in the UK (Universities and BBSRC Institutes) with interest in “translational biology” from *Arabidopsis* into brassicas

Small academic community focussed on rapeseed (*Brassica napus*) as a research system

UK-based breeders (providing the opportunity to breed rapeseed for UK conditions)

Broader stakeholder community interested in rapeseed genetic improvement (agronomists, farmers, equipment manufacturers, processors)

UK oilseed rape community

Community-building activities supported by OREGIN

- Management meetings with stakeholder participation (2 per year)
- Stakeholder Forum meetings (annual)
- UK-BRC meetings (annual; currently OREGIN sponsors the catering)

OREGIN: UK oilseed rape community

Community winter oilseed rape field trials

- Disease susceptibility of OREGIN cultivars/lines
 - Trials currently growing at several sites screened for range of diseases
- Nitrogen use efficiency of OREGIN cultivars/lines
 - ~200 scientists visited OSR field trials at Rothamsted Research (3 years)



OREGIN outputs

- **Exploitation of resources and knowledge by breeders and other parts of the industry**
- **Stronger UK community**
- **Presentations at industry-facing meetings (e.g. Cereals)**
- **New 'spin-off' projects (e.g. £3.1M BBSRC sLoLa RIPR 2014-2018, Innovate UK project MAQBAT 2015-2018)**
- **~30 refereed publications (to 2014)**

Relevance of OREGIN to Defra's 5 & 25 year plans

Purpose

Unleashing the potential of food and farming, nature and the countryside, championing the environment and protecting us all from natural threats and hazards.

Objectives



A cleaner, healthier environment which benefits people and the economy

Genetic improvement of fertilizer use efficiency reduces N run-off and improves carbon footprint

Genetic bases for pest and disease tolerance reduces pesticide and fungicide use

An organisation continually striving to be the best, focused on outcomes and constantly challenging itself

Themes

- Boosting UK productivity
- Data availability and utilisation
- Better domestic regulation
- Delivering our priorities internationally (including EU reform, US and China)

Relevance of OREGIN to Defra's 5 & 25 year plans

