



SID 4

Annual/Interim Project Report for Period 2011

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Project details

1. Defra Project code

IF0146

2. Project title

Defra - Wheat Genetic Improvement Network - WGIN

3. Defra Project Manager

Dr. Katherine Bainbridge

4. Name and address of contractor

Rothamsted Research, Harpenden, Herts

Postcode AL5 2JQ

5. Contractor's Project Manager

Prof Kim E Hammond-Kosack

6. Project: start date

01/12//2008

end date

31/11/2013

Scientific objectives

7. Please list the scientific objectives as set out in the contract. If necessary these can be expressed in an abbreviated form. Indicate where amendments have been agreed with the Defra Project Manager, giving the date of amendment.

01 Project management (RRes); 02 Production of Near Isogenic lines (JIC); 03 The Avalon x Cadenza Mapping population (JIC); 04 Paragon gamma and EMS mutagenised populations (JIC); 05 AE Watkins and Gediflux collections (JIC); 06 New mapping populations to align WGIN 2 with the International wheat genome sequencing (JIC); 07 Insect Resistance (RRes); 08. Nitrogen use efficiency (NUE) and Quality QTLs linked to NUE (RRes); 09 Drought tolerance (University of Nottingham); 10 Take-all disease (RRes); 11 Introgression of extreme resistance to Septoria leaf blotch from Triticum monococcum into hexaploid wheat (RRes); 12 Exploring the Interconnections between the three soil based traits; 13 Grain archiving; 14. Sub-contractor projects (To be determined during the project) 15. Website; 16 Electronic Newsletter; 17 Annual Stakeholders Forum; 18 Focussed workshops; 19 International collaborations; 20 Publicity

Summary of Progress

8. Please summarise, in layperson's terms, scientific progress since the last report/start of the project and how this relates to the objectives. Please provide information on actual results where possible rather than merely a description of activities.

Objective 1. Three management meetings were held during the year. (1) 16th February 2011 at KWS, Thriplow (2) 20th July 2011 at RRes, Harpenden and (3) 11th November 2011 at KWS, Thriplow. Each was well attended by the funded researchers, other non-funded wheat scientists and the commercial wheat breeders.

The progress on the 11 wheat research, **Objectives 2 through 13**, is summarised in an accompanying word document.

Objective 14 Subcontractor projects:

Subcontractor project A: Exploring the use of $\Delta 18O$ and total mineral ash content in wheat as a new tools for phenotyping wheat with respect to water inputs – John Foulkes, University of Nottingham. This 2 year project is closely aligned to the WGIN core research objective 9. This project has proceeded well and a full write up of the year 1 activities is summarised in an accompanying word document at the end of research objective 9.

Subcontractor project B: Non-destructive screening of WGIN Paragon mutants for grain NUE traits - Richard Weightman, ADAS: This work has now completed and the final report and data has been delivered and is available to view on the WGIN website.

Objectives 15, 16 and 17. The WGIN website was kept up-to-date regards meetings reports, the November newsletter and final reports and datasets from year three. A bumper Newsletter was released in November, this included an audit of the impact of the WGIN project (since 2008) on newly funded wheat projects. The Annual stakeholders meeting at RRes was very well attended in Nov with approximately 100 participants and included talks and an eight person panel discussion. All presentations from the stakeholder meeting are available on the website.

Objective 19. Joint Workshops - A joint wheat workshop between UK scientists and Brazil scientists was held in Londrina (Brazil) 2-4 May 2011. This was supported from the UK side by a BBSRC ISIS award and from the Brazil side by EMBRAPA funding. A meeting report and follow up plans for joint grant proposals going forward were prepared and submitted to BBSRC in July.

Objective 20. The scientific outreach activities were numerous, with displays by both JIC and RRes staff on specific WGIN objectives at Cereals 2011, via field demonstrations and talks at the respective sites and engaging the media and the farming press.

Amendments to project

9. Are the current scientific objectives appropriate for the remainder of the project? YES NO
 If **NO**, explain the reasons for any change giving the financial, staff and time implications.

Contractors cannot alter scientific objectives without the agreement of the Defra Project Manager.

There have been no changes to the scientific objectives. However at the John Innes Centre there has been a change of staff funded by WGIN.

Simon Orford is no longer funded and the two new recruits are Cathy Mumford and Susan Freeman.

Progress in relation to targets

10. (a) List the agreed milestones for the year/period under report as set out in the contract or any agreed contract variation.

It is the responsibility of the contractor to **check fully that all milestones have been met** and to provide a detailed explanation when they have not been achieved.

Milestone		Target date	Milestones met	
Number	Title		In full	On time
01	Project management	30/11/2013		✓
02	Production of Near Isogenic Lines	01/03/2013		✓
03	The Avalon x Cadenza mapping population	30/11/2013		✓
04	Paragon gamma and EMS mutagenised populations	01/01/2011	✓	
05	AE Watkins and Gediflux collections	01/07/2011	✓	
06	New mapping populations	01/03/2013		✓

07	Insect Resistance	01/04/2010	✓	
08	Nitrogen use efficiency (NUE) and Quality QTLs linked to NUE	30/11/2013		✓
09	Water use efficiency and drought tolerance	30/11/2011	✓	
10	Take-all disease (introgression part only)	30/11/2013		no
11	Introgression of extreme resistance to Septoria leaf blotch from Triticum monococcum into hexaploid wheat	30/11/2012		no
12	Exploring the Interconnections between the three soil based traits	30/11/2013		✓
13	Grain archiving	30/11/2013		✓
14	Sub-contractor projects	30/11/2013		✓
15	Website	30/11/2013		✓
16	Electronic Newsletter	30/11/2013		✓
17	Annual Stakeholders Forum	30/11/2013		✓
18	Focussed workshops	30/11/2009	✓	
19	International collaborations	30/11/2013		✓
20	Publicity	30/11/2013		✓

(b) Do the remaining milestones look realistic? YES NO
 If you have answered **NO**, please provide an explanation.

The introgression from *T. monococcum* to *T. aestivum* of the Take-all and Septoria resistance traits encountered problems in late 2010 at the back cross one stage with all the F1 failing to produce reproductive tillers. A further period in vernalisation permitted some ears to develop but no viable pollen was produced. Therefore to achieve objectives 10 and 11, we have now embarked on an alternative introgression strategy using the *T. aestivum* spring lines Paragon and Chinese Spring which harbours the *ph1* pairing locus mutation. In the first instance seed of this newly available stock from the JIC was multiplied in the glasshouse during Q2 /Q3. The F1 crossing programme will recommence in 2012.

Publications and other outputs ---

11. (a) Please give details of any outputs, e.g. published papers/presentations, meetings attended during this reporting period.

Peer Reviewed:

*Allen A.M, Barker G.L.A, Berry S.T, Coghill J.A, Gwilliam R, Kirby S, Robinson P, Brenchley R.C, D'Amore R, McKenzie N, Hall A, Bevan M, Hall N and Edwards K.J.(2011) Transcript-specific, single-nucleotide polymorphism discovery and linkage analysis in hexaploid bread wheat (*Triticum aestivum* L.). *Plant Biotechnology Journal* 9, 1086–1099.

*Burt, C., and Nicholson, P. (2011). Exploiting co-linearity among grass species to map the *Aegilops ventricosa*-derived Pch1 eyespot resistance in wheat and establish its relationship to Pch2. *Theoretical and Applied Genetics* 123, 1387-1400.

Griffiths S. et al (2012) Meta-analysis of the genetic control of crop height in elite European winter wheat germplasm. *Mol Breeding* 29: 159-171.

Howard, T., Rejab, N.A., Griffiths, S., Leigh, F., Leverington-Waite, M., Simmonds, J., Uauy, C., and Trafford, K. (2011). Identification of a major QTL controlling the content of B-type starch granules in *Aegilops*. *Journal of Experimental Botany* 62, 2217-2228

McMillan, V. E., Hammond-Kosack, K.E. and Gutteridge, R. J. (2011) Evidence that wheat varieties differ in their ability to build-up inoculum of the take-all fungus, *Gaeumannomyces graminis* var. *tritici*, under a first wheat crop. *Plant Pathology* 60, 200-206

McDonald A. J. and Gutteridge, R. J. (2011) Effects of take-all (*Gaeumannomyces graminis* var. *tritici*) on crop N uptake and residual mineral N in soils at harvest of winter wheat. *Plant and Soil* 350, 253-260.

* Although no WGIN staff are named in these papers they are both major users of WGIN outputs (COS markers and Avalon x Cadenza population)

Non-Peer reviewed:

Conference Poster Wingen L. U., Orford S., Goram R., Leverington-Waite M., Bilham L., Dicks J., Griffiths S. (2011) Mining for Useful Variation in the AE Watkins Wheat Collection European Plant Genetic Resources Conference 2011 – 20th meeting of the EUCARPIA Section Genetic Resources, April 5-7, 2011

Conference Poster Wingen L. U., Dicks J., Griffiths S. (2011) Data Management and QTL Discovery in Wheat Research International Symposium on Integrative Bioinformatics, Wageningen, The Netherlands, March 21-23, 2011

Hawkesford M J (2011) An overview of nutrient use efficiency. In 'The Molecular and Physiological basis of Nutrient Use Efficiency in Crops, Hawkesford MJ and Barraclough P, eds. Wiley Blackwell, Chichester, pp 5-19.

DeKok L J, Stulen I and Hawkesford M J (2011) Sulfur nutrition in crop plants. In 'The Molecular and Physiological basis of Nutrient Use Efficiency in Crops, Hawkesford MJ and Barraclough P, eds. Wiley Blackwell, Chichester, pp 295-309.

McMillan VE, Hammond-Kosack KE, Kanyuka K, Gutteridge RJ (2011) Reducing take-all inoculum build-up during a first wheat crop. *Phytopathology* 101(6): S118

Brown NA, McMillan V, Urban M, Gutteridge R, Kanyuka K, Antoniw J, van de Meene A, and Hammond-Kosack KE (2011) New knowledge on the important wheat diseases, *Fusarium* ear blight (head scab) and take-all. Rothamsted Research Annual Report.

Rothamsted Research Newsletter (April) A new approach to reduce the risk of Take-all disease. Vanessa McMillan, Kim Hammond-Kosack, Kostya Kanyuka and Richard Gutteridge. 2 pages

Conference Poster at Rothamsted Research Day 21st October 2011 Reducing take-all inoculum build-up during a first wheat crop: a genetic approach. Vanessa McMillan, Kim Hammond-Kosack and Richard Gutteridge.

Popular press articles:

Cereals 2011 (June) – Living display and three posters on take-all inoculum build up, root resistance in wheat to Take-all and the agronomic practices which can minimise the risk of Take-all. Prepared and presented by Vanessa McMillan and Richard Gutteridge This display had immediate on line coverage of the take-all story on Farmers Weekly interactive online entitled ‘– Take-all levels linked to first wheat – 13th June 2011’

Oral Scientific Presentations:

Feb 2011 Kim Hammond-Kosack Talk to University of Nottingham MSc students on the whole WGIN project at Rothamsted Research

Feb 2011 Vanessa McMillan, Kim Hammond-Kosack and Richard Gutteridge Investigating take-all inoculum build-up and resistance in wheat. Rothamsted Research Association Diseases workshop at Rothamsted Research.

March 2011 Vanessa McMillan, Kim Hammond-Kosack and Richard Gutteridge Investigating take-all inoculum build-up and resistance in wheat. Rothamsted Research Annual Postgraduate Symposium.

April 2011 Vanessa McMillan, Kim Hammond-Kosack and Richard Gutteridge Identification and characterisation of resistance to the take-all fungus in wheat. HGCA student symposium. Audience- HGCA PhD students and supervisors, HGCA project committee

April 2011 Vanessa McMillan, Kim Hammond-Kosack and Richard Gutteridge Identification and characterisation of resistance to the take-all fungus in wheat. Exeter University, School of Biological Sciences PhD symposium. Audience- PhD students and supervisors.

May 2011 Malcolm Hawkesford: Brazil, joint meeting with Embrapa

May 2011 Kim Hammond-Kosack : Brazil, joint meeting with Embrapa

May 2011 Malcolm Hawkesford: Copenhagen paper at NAC conference

June 2011 Malcolm Hawkesford: VIGS meeting, presentation

Sept 2011 Malcolm Hawkesford: Beijing Global Food Security Conference, talk

Sept 2011 Malcolm Hawkesford: Berlin Botanical Conference, invited Plenary talk

Sept 2011 Malcolm Hawkesford: Congliano, Bionut invited talk

Oct 2011 Malcolm Hawkesford: Mexicali invited plenary talk

Nov 2011 Malcolm Hawkesford: Hinxton Crop Ontology presentation and discussions

Nov 2011 Malcolm Hawkesford: Rothamsted Research Association presentation

Jan 2012 John Foulkes: Seminar on “High throughput phenotyping for drought tolerance traits in wheat” at Teagasc Oak Park Crops Research Centre Carlow Ireland

Scientific Discussions:

May 2011 Malcolm Hawkesford: Martenvasar, Hungary, joint discussions

Nov 2011 Malcolm Hawkesford: Clermont-ferrand, joint discussions with INRA

Scientific Outreach activities / articles:**S Griffiths (JIC)**

Joint RReS/JIC display at Cereals '11 Chromosome shaped plots showing location of genes under study in WGIN

Local Farm Machinery Enthusiasts (Starting handle Club): Presentation May 2011

Annual Cereals Event: Organising, setting up and presence on the stand. June 2011

Home Teachers Visit to JIC: Presentation June 2011

Local Farm Machinery Enthusiasts: (Norfolk Ploughing Society): Presentation Sept 2011

Visit by UEA MSc to glasshouse trials (John Turner) informal presentation – Oct 2011

NIAB Farmers Day: Presentation Nov 2011

NFU AGM North Norfolk: Presentation Jan 2012

M Hawkesford (RRes)

June 2011: Cereals 2011

J Foulkes (UoN)

Interview on Radio Four Farming Today featuring the WGIN drought tolerance research (Objective 9) on 18 June 2011.

Richard Gutteridge (RRes)

Cereals 2011 (June) – Living display and three posters on take-all inoculum build up, root resistance in wheat to Take-all and the agronomic practices which can minimise the risk of Take-all.

Talk and field visit- Frontier agronomists visit to Rothamsted: Rothamsted Research OSR and Wheat Experiments Tuesday 12th April 2011. Talk: Investigating take-all inoculum build-up and resistance in wheat. Field tour of take-all experiments.

Kim Hammond-Kosack (RRes)

Innovate 2011 London (11th October). WGIN and the Take-all project invited to be a part of the Global Food Security stand hosted by the BBBRC at the Technology Strategy Board's Innovate '11 event, Islington, London, U.K,. Attended by Kim Hammond-Kosack, Wing Sham Lee and Vanessa McMillan. Our display included healthy and Take-all infected wheat seedlings, WGIN Newsletters, WGIN postcards and the RRA newsletter which featured the WGIN take-all project.

- (b) Have opportunities for exploiting Intellectual Property arising out of this work been identified? YES NO
If YES, please give details.

This project is entirely IP free.

- (c) Has any other action been taken to initiate Knowledge Transfer?..... YES NO
If YES, please give details.

Objective 10 Take-all research is now part of a 5 year TSB project called ' Low TAB' which involves three of the commercial wheat breeding companies. A separate website called LowTAB is currently under construction and will become available by mid 2012 to publicise this KT activity.

Future work

12. Please comment briefly on any new scientific opportunities which may arise from the project.

In the WGIN Stakeholder Newsletter Nov 2011, a total of 20 new research projects are briefly described. These projects are using either WGIN derived information or WGIN generated resources. In the spread sheet in the Newsletter the exact WGIN resources used by each project have been documented.

In total 21 new wheat projects have been funded since 2008. The total of new funds procured is £15,390,702. These projects have a duration of between 1 and 5 years, with most being either 3 or 4 years long.

The largest project by far is the BBSRC funded wheat Pre-breeding Lola (PI- Graham Moore at JIC) which was well supported by the UK wheat breeding community. This project has received considerable media attention both nationally and internationally.

The other newly funded projects are led by Industry (1 TSB-BBSRC), ADAS (2 projects), SAC (1 project) , NIAB (4 projects), JIC (2 additional projects), RRes(7 projects), Univ Bristol (1 project) and Univ Reading (1 project).

Eleven projects have UK based industry partners and one project is part of an EU consortium with academic and industry partners.

A number of wheat grant applications using WGIN information and resources are currently under consideration = in Phase 2 of the BBSRC Crop Improvement Research Club.

Declaration

13. I declare that the information I have given is correct to the best of my knowledge and belief.

Name	Professor Kim Hammond-Kosack	Date	20th February 2012
Position held	Research Programme Leader		