

Minutes from the OREGIN Stakeholder Forum 2016: Breeding oilseed rape for resistance to pests and diseases - approaches and advances

31st October 2016

Rothamsted Research, Harpenden, Hertfordshire AL5 2JQ., Fowden Conference Hall

Organized by Sam Cook (Rothamsted Research) & Bruce Fitt (University of Herts)

The meeting started at 11:00 and was attended by 54 people representing a range of stakeholders. Presentations marked* are available as PDFs on the OREGIN website <http://www.herts.ac.uk/oregin/about-oregin>

Draft Minutes

Welcome to Rothamsted - Prof. Achim Dobermann (Rothamsted Research)

Prof. Dobermann talked about the new Rothamsted Strategic Themes (1 April 2017 onwards).

1. Tailoring Crop Performance
2. Future Agri-Food Systems
3. Animals and Crops
4. Novel projects for bio-economy

He pointed out the importance of having strategic partners within the UK and worldwide

Session 1: Introduction to Pests and Diseases of OSR. Chair - Sam Cook (Rothamsted Research)

1. Pest problems in OSR - Caroline Nicholls (AHDB)*

Caroline presented a summary of the most damaging pests in OSR

Emphasis was given to:

- Cabbage Stem Flea Beetle
Pyrethroid resistance and ban on neonicotinoid seed treatments = loss of control.
2014/15 Impact: damage to 31,000 ha (5% of oilseed rape lost) in England of which 9,000 ha were replanted (1.5%); Total lost 22,000 ha (3.5%). Loss valued at £23M. 62% of losses occurred in East of England (£13M)
- Slugs
Impact: 59% total area; yield losses 4% (54,354 tonnes) without pesticides. Losses £18M/year
- Rape winter stem weevil
The main problem is the larvae
- Peach potato aphid/ spread virus (TuYV)
There are some control options with pesticides and cultivars (e.g. Amalie which is resistant to TuYV) but it is an important problem in mild winters.
Impact: 60% crops with TuYV; yield losses 15%; Loss £67M/year; ~9% total crop value
- Pollen beetle
Pyrethroid resistance problems and insecticide damage to beneficial insects
- Cabbage seed weevil & brassica pod midge

2. Pathogen problems in OSR - Julie Smith (ADAS, Crop Monitor)*

Julie presented a summary of the key diseases of OSR.

Emphasis was given to:

Phoma, which has been a problem over the past years

Light leaf spot (LLS), which has an increasing importance, including the South of England

Clubroot, which has an increasing importance. Found in 52% soils examined in 2006-08

The Defra funded Pesticide Usage Survey highlighted a mismatch between grower fungicide focus and economic yield losses caused by the diseases requiring control, which may partly explain why certain diseases are becoming more prevalent .

Many OSR crops are now treated with fungicides 4-5 times per year in contrast to recent past (~2 treatments per year) which is likely to lead to problems with insensitivity to azole fungicides.

The five most popular OSR cultivars in the UK are susceptible to LLS and there is an increasing need for more integrated disease control strategies.

Julie presented a current project on managing resistance to clubroot pathogen *Plasmodiophora brassicae*.

She also discussed issues of yield penalty in resistant cultivars, disease resistance, disease escape and disease tolerance.

Session 2: OREGIN - History, Current resources and research & Future importance. Chair – Vasilis Gegas (OREGIN Stakeholder Forum Chair; Limagrains UK Ltd.)

3. OREGIN: Defra's perspective - David Cooper and Luke Spadavecchia (Defra)*

David Cooper pointed out the importance of Crop Genetic Improvement Networks with emphasis that they act as catalysts for collaborative breeding projects, promote researcher/agri-food industry engagement, accelerate innovation, minimise the translational gap between fundamental and applied research and are a "conveyor belt" for genetic resources, expertise and data. They also provide stimulation for PhD projects and train future crop scientists.

Defra has long history of funding translational (strategic applied) research and David presented Defra's funding of the GINs over the past years.

David also discussed what the GINs set out to do and what they have achieved. He also stressed the importance of continued funding for the GINs.

Luke explained that Defra is working towards considering options of GINs continuing. He also mentioned that they have identified a future funding model to take them forward. He mentioned that there will be an extension plans for 2017 which will help stakeholders in reporting and give time for Defra to plan for future.

Luke replied that there are informal partnerships between the governmental agencies that would benefit if they were formal.

4. OREGIN update on plant resources - Graham Teakle (Warwick)*

Graham presented the available Diversity Sets

BnaDFFS (OREGIN, Warwick); ASSYST (Rod Snowdon, Giessen); BoIDFFS (VeGIN, Warwick); BcgDFFS (VeGIN, Warwick).

BnaDFFS: currently 173 fixed lines with good seed stocks.

Functional genotypes for expanded diversity panel; mRNA seq-100bp single end reads- Earlham Institute, Norwich

RIPR Diversity panel of 383 *B. napus* accessions (355,563 transcriptome SNPs)

BoIDFFS: 376 founder accessions, >100 fixed lines (mostly DH) as part of RIPR

BcgDFFS: 244 DH lines

He presented new mapping populations available.

Seed distribution: Warwick for TNDH & TVSL OREGIN mapping populations; for the rest by Charlotte Allander at National Vegetable Genbank. A charge is made to cover costs of replacing the material.

Can supply only small number of seeds; need to allow time to bulk them up before experimental work can start.

5. OREGIN update on Pathogens - Yong-Ju Huang (University of Herts)*

Yong-Ju presented data on severity of phoma stem canker and light leaf spot from field experiments with a set of 100 accessions from the OREGIN *B. napus* Diversity Fixed Foundation Set (BnaDFFS). She also discussed the pathogen (*Leptosphaeria maculans*, *Leptosphaeria biglobosa* and *Pyrenopeziza brassicae*) collection available at the University of Hertfordshire. She finally presented the OREGIN website hosted in the University of Hertfordshire.

6. OREGIN update on Pests - Sam Cook (Rothamsted)*

Sam presented several potential traits to confer avoidance of pollen beetle and data on screening the OREGIN BnaDFFS in field trials for resistance/tolerance/avoidance for pollen beetle in 2009/10 and CSFB in 2015/16. She highlighted difficulties in using field trials for pest screening; field and lab data for CSFB feeding were not consistent. She suggested more targeted approaches were first needed in the lab, then scale-up in field trials. Mentioned the importance of pollen beetle and the possibility of using *B. rapa* as a trap crop because of the early flowering.

POSTER SESSION – 15 posters were displayed and discussed over lunch

Session 3: Research advances in breeding OSR for pest and disease resistance. Chair – Vasilis Gegas (OREGIN Stakeholder Forum Chair; Limagrain UK Ltd.)

7. Pest & pathogen problems: A breeders' perspective - Mark Nightingale (Elsoms)*

Mark pointed out the importance of developing commercially available cultivars that are “farmer friendly”. Long term breeding targets were: Resistance to pests; Adding value to the crop; Improving long term viability

Major problems:

- Cabbage stem flea beetle

- Slugs

- Diseases: LLS-the most important disease of OSR over the past 6-7 years

Canker-not a serious threat for the UK. *Leptosphaeria biglobosa* has increasing importance

Verticillium wilt- cultivars tolerant, several pathogen-races in the same field

Clubroot- up to 70% yield loss

Sclerotinia stem rot- no available genetic resistance

Importance of added value to the crop: e.g. reduced fungicide reliance, increased yields, reduced herbicide reliance and elevated oil content

He also stressed the need for AHDB to support & promote UK agriculture.

There is a need for the projects to be driven by industry and have partnerships between institutes/universities.

8. Advances in understanding resistance to *Leptosphaeria maculans* (canker) - Henrik Stotz (University of Herts)

Mentioned current control strategies for phoma stem canker in the UK, including breeding for qualitative and quantitative resistance. Reported on sensitivity of *L. maculans* and *L. biglobosa* to currently used azole, SDHI and QoI fungicides. Pointed out problems with breakdown of *R* gene-mediated resistance and current research on temperature-sensitivity of this type of resistance.

Introduced modelling of direct protein interactions between *R* gene products and corresponding pathogen effectors. Also introduced the concept of searching for resistance genes using genomic information to support breeding for resistance.

9. Advances in understanding resistance to *Pyrenopeziza brassicae* (light leaf spot) - Chinthani Karandeni Dewage (University of Herts)

Discussed the importance of light leaf spot disease on oilseed rape as well as on vegetable brassicas highlighting the need for better resistant crop cultivars. Also mentioned the evidence of pathogen population variations present in the UK. She presented the recent advancements in brassica genetic information and opportunities for making rapid progress with identification of resistance against the light leaf spot pathogen *P. brassicae*.

10. Advances in understanding resistance to pests: A horticulture perspective- Rosemary Collier (University of Warwick)

Rosemary mentioned that 49 insect species are potential problems for Brassica plants. She described losses because of pests on horticultural brassicas. Main problems: Cabbage root fly, Aphids, Diamond-back moth, Small white butterfly, Cabbage white butterfly. From those, Cabbage root fly, Diamond-back moth, and Cabbage white fly are examined within VeGIN with some interesting and exciting advances. Discussed advantages and disadvantages for resistance vs tolerance in terms of sustainability of the approach over time.

11. Advances in understanding resistance to pests: An OSR perspective - Rachel Wells (JIC)

Rachel mentioned that 20% of the world's crop yield losses are due to pests. She referred to grey field slug (*Deroceras reticulatum*); Impact: 59% of total OSR, £43.5M losses on OSR & wheat. She described laboratory bioassays using the OREGIN BnaDFFS lines in controlled environment experiments for phenotyping (slug palatability and cabbage stem flea beetle)

Posters

Kevin Carolan	Methods to preserve genetic resistance against the evolution of virulence
Sam Cook	Push-Pull strategies to reduce insecticide input to OSR: potential of low alkenyl glucosinolate varieties (push) and turnip rape trap crops (pull)
Sam Cook	Responses of pollen beetles to petal colour: Potential for control strategies based on manipulation of visual signals used in host-plant location
Duncan Coston	OSR pest control, pollination and productivity: Implications of the neonicotinoid restrictions
Fryni Drizou	The effect of aphid infestation at OSR susceptibility to <i>R.solani</i>
Neil Graham	1. Identifying genes controlling nutrient uptake and use in Oilseed rape 2. Improving nitrogen-use efficiency in Oilseed rape (<i>Brassica napus</i>)
Yong-Ju Huang	Identification of pest and disease resistance in the UK OREGIN Brassica biodiversity collection
Georgia Mitrouisia	Coexistence of <i>Leptosphaeria</i> spp. on oilseed rape in the UK
Susanne Schreiter	Roots of decline? Assembly and function of the rhizosphere microbiome in relation to crop yield
József Vuts	New research into the pheromone biology of the cabbage stem flea beetle (<i>Psylliodes chrysocephala</i>)
Sacha White	Investigating tolerance of oilseed rape to pollen beetle damage

Minutes taken by: Dr Georgia Mitrousia (Herts)

Minutes checked by: Prof. Bruce Fitt (Herts), Dr Sam Cook (RR) & the presenters of the presentations listed above