RosBREED

Combining Disease Resistance with Horticultural Quality in New Rosaceous Cultivars

V8.3 JULY 2018

East Lansing Participants Meeting

Jim McFerson, Extension Team Leader, Washington State University



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Fig. 2. Thirty-nine of the 59 team members that attended the East Lansing meeting.



Fig. 3. The Extension Team gets down to work.

Nearly 60 RosBREED team members participated in a range of activities in East Lansing MI from 4-8 Mar 2018, including two full-day workshops on Flex QTL (Eric van de Weg) and BIMS (Dorrie Main and Sook Jung), followed by two and one-half of 37 individual work sessions and whole group review and planning led by Project Director Amy Iezzoni. In between, team members enjoyed group meals and a fun meet-and-eat poster session.

Featured AP Member

Susan Gardiner

Jim McFerson, Extension Team Leader, Washington State University

What is your Job description?

I am a Principal Scientist in the New Cultivar Innovation Portfolio at The New Zealand Institute for Plant & Food Research Ltd (PFR). I founded the Mapping & Markers Team since in the early 1990's and have recently stepped down to a three days a week position. My work focuses on developing genetic markers for pest and disease resistances in apple and kiwifruit, using genomics tools. These days I focus on supervision, coaching and



Fig. 4. Cameron entertains at the Meet & Eat session.



Fig. 5. Dr. Susan Gardiner in her laboratory at the New Zealand Institute for Plant & Food Research Ltd.

mentoring, with particular focus on assisting younger colleagues in developing scientific writing skills.

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Why are you involved in RosBREED?

I have been involved in collaborations with US colleagues in the Rosaceae community for the past 26 years and I assisted the community in developing first the RosBREED1 program and then RosBREED2. I am passionate about the application of marker technologies in breeding and wanted to 'spread the word' about what we have been achieving in the New Zealand apple breeding program.

How do you feel you can contribute to RosBREED?

I have nearly 30 years research experience in both developing and applying genetic markers in breeding programs at PFR. I derive my greatest satisfaction from seeing my work in application!

Where Are the RosBREEDlings Now?

Matt Clark (University of Minnesota)

Where are you now and what are you doing?

I'm an assistant professor at the University of Minnesota in the Dept. of Horticultural Science. I have three graduate students in my lab studying different aspects of grape genetics. My position oversees the grape breeding and enology projects. We have about 11 acres of grapevines as part of the breeding program as well as the vines for genetic studies. We make about 75-100 micro-vinifications of wine each year to support the breeding program. We also make wines from our key varieties to help winemakers make decisions for yeast selection, handling, etc. My position is research, teaching, and extension.

How were you involved with RosBREED? Did it prepare you for your current position?

I was a PhD student when I was in RosBREED. I benefited greatly by participating in the annual meetings. It gave me an opportunity to meet with



Fig. 6. Former RosBREEDLING Matt Clark is now an Assistant Professor at the University of Minnesota.

students and faculty from all over the country (and world). The activities included learning new software (Pedimap and FlexQTL) that I still use today. I learned how to engage with other scientists. I also learned about different ways that PIs communicate with their students and their peers. It was good training on how to participate as a scientist, as a mentor, etc. Additionally, I was involved in some of the hard skills, like setting up experiments, developing experimental methods, collecting data, processing genotypic and phenotypic data, QTL mapping, writing, and presenting research. I wish that more students had an opportunity to participate in this community (or one like it). I think the RosBREED family is very supportive of one another and has a way to create opportunity and collaboration. I currently collaborate on a few projects with Jonathan Fresnedo (formerly UC Davis) on grape projects now, thanks to our relationship developed during RB1.

What was your most memorable experience(s) with RosBREED?

On the FUN side, we had a lot of great "RosBreedlings" after hours meetings during our annual retreats to East Lansing. This were powerful in establishing a cohort of scientists. A great way to "check out" what is happening in other institutions.

I made a lot of great friends, across all levels of the RB1 project. Connections that I think were useful for my success as a grad student (Amy welcomed us for a week to learn JoinMap; Nahla hosted us for a week to re-do DNA extractions in Oregon). This is not typical in other projects but meant that we could be successful.

Any advice for RosBREED's current participants?

Take advantage of any opportunity to meet with your grad student colleagues and faculty who participate in the project. Go to the meetings and workshops! Email them and call them when you have success to share or are facing some sort of hardship or question. This is a really bright group of people who have answers to (or pathways to) solving many problems be it genetics, graduate school preparation, writing, documenting, data base management, job hunting, genomics, etc.

Rosaceae Nemesis Apple Scab

Kathleen Rhoades, Extension Team Member, Michigan State University; Ksenija Gasic, Clemson University

Apple scab is a common disease of apples that occurs worldwide and is responsible for more crop losses than any other apple disease. It is caused by the fungal pathogen *Venturia inaequalis*, which thrives best in areas with cool, wet weather. Apple scab causes characteristic dark green to brown "scabby" lesions on leaves, fruit, flowers, and young shoots. Severely infected leaves will be curled or twisted and may drop off the tree altogether. Any part of the fruit is susceptible to infection, and severe infections on the stem end of the fruit result in fruit drop.

The fungus that causes apple scab overwinters on leaf litter on the ground of orchards and in the spring begins producing massive numbers of spores, which are released during wet weather over a period of four to six weeks and travel through air currents to apple tree

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Fig. 7. Severe apple scab symptoms. Photo credit: Jerzy Opiola.

or fruit tissue. Once plant tissue has been infected, a lesion will form and produce more spores, which spread through splashing water drops to other areas of the tree and throughout the orchard.

Preventative fungicide sprays applied regularly throughout the growing season are a common management practice. Since infections originate in the leaf litter, clearing leaf litter or adding chemicals to hasten the breakdown of leaf litter in the fall and winter can help to prevent infection, although this is not always a feasible strategy for large orchards. Scab resistant cultivars are available to growers, although the cultivars that consumers want are not always those with good scab resistance. For example, Gala, McIntosh, and Cortland apples are all well-known and liked by consumers, but are susceptible to scab.

Researchers with RosBREED have identified several genetic factors responsible for conferring resistance to apple scab and are in the process of developing DNA tests to allow apple breeders to rapidly and efficiently evaluate their parental selection trees for scab resistance. One DNA test for apple scab resistance is already in use by apple breeders around the country, and DNA tests for two more genetic resistance factors are currently in development. Genetic factors for scab resistance have been identified by RosBREED scientists in Honeycrisp as well as another University of Minnesota apple cultivar named Wildung, and DNA test development for those factors is in progress. RosBREED scientists are also developing a DNA test for two previously-identified scab resistance genes present in apples that share a common ancestor in R12740-7A, a U.S. apple that was grown from seed collected in Leningrad, Soviet Union in 1937.

Breeders will be able to use these DNA tests to rapidly and efficiently evaluate possible parent trees for scab resistance. The resistant trees can then be crossed with trees that carry desirable fruit quality traits to create the next generation of apple cultivars with delicious flavor, great texture, and resistance to apple scab.

Reference

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Featured Team DNA Testing

Kathleen Rhoades, Extension Team Member, Michigan State University

Nahla Bassil, research geneticist at the USDA in Corvallis, OR, is RosBREED's most skilled negotiator. As head of the RosBREED DNA Testing Team she acts as the liaison between RosBREED investigators and companies that are on the cutting edge of DNA extraction and genotyping technologies, ensuring that RosBREED and Rosaceae researchers have access to the latest technologies at rockbottom prices.

Bassil works with the other members of the DNA Testing Team—Amy Iezzoni, Ksenija Gasic, Chris Saski, and Cameron Peaceto evaluate how RosBREED can take advantage of the latest DNA extraction and genotyping technologies and work with companies to optimize these technologies for Rosaceous crops. As team leader, Bassil works with each of the team members to evaluate their crop group's genotyping needs for the upcoming year and determine which upcoming technologies might be a good fit for RosBREED projects and goals. Team leaders will also provide tissue samples to private DNA testing companies to help them optimize their DNA extraction and testing techniques for rosaceous crops.

The DNA Testing Team has been extremely productive, which Bassil attributes to good communication, great collaboration, and excellent post-docs. The team has been involved in the development of new DNA tests for several disease resistance traits, introducing the KASP assay to allow plant breeders to evaluate two genetic loci at once, and working with Life Technologies to test their OpenArray technology in apple and pear. This technique resulted in 78 validated markers for apple to use in marker-assisted breeding.

Bassil has also worked with Life Technology and RosBREED's international collaborators to update the strawberry SNP array and with Illumina to expand the SNP arrays for peach and cherry. The second-generation strawberry SNP array

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Fig. 8. Members of the DNA Testing Team: Team Leader Nahla Bassil, Ksenija Gasic, Cameron Peace, Amy lezzoni, and Chris Saski.

includes useful SNPs evaluated submitted by scientists from around the world, compiled by crop post-doc Sujeet Verma. The same strategy applies for the secondgeneration peach and cherry arrays.

In RosBREED year four, the team will be working with each of the crop breeding teams to deliver genome scan data of disease-phenotyped families, working with the berry fruit breeding team to develop candidate loci for sweetness in blackberry, which can be used to develop a DNA test, working with the pear team to develop DNA tests for fire blight resistance, and with the rose team to develop DNA tests for black spot resistance.

The team is also working with LGC on a new, more cost-effective technique for SNP detection in peach and strawberry, and a customized extraction protocol of high quality DNA for RosBREED crops. This technique will also be tested for efficient extraction of high quality DNA from mature leaves.

Bassil is confident that the DNA Testing Team will complete their goals by the end of the RosBREED grant, although the next year is going to be a busy one for her and crop post-doc Jason Zurn. The rose, blackberry, and strawberry sub-projects that the DNA Testing Team is working on are all shaping up to finish at around the same time, which means a very busy period is rapidly approaching.

"We're communicating, that's the number one thing," Bassil said, adding, "I really believe in [RosBREED]. I love this project."

Successfully Mastered

Wanfang Fu (Clemson University)

Kathleen Rhoades, Extension Team Member, Michigan State University

Congratulations to Wanfang Fu who has successfully defended her master thesis at Clemson University entitled "Enabling marker-assisted selection (MAS) for brown rot (*Monilia spp.*) tolerance in peach." Her advisor is RosBREED's Stone Fruit Breeding Team Leader Ksneija Gasic.

Wanfang took only a few brief moments off to attend her graduation before getting back to work – she will continue work on enabling marker-assisted selection for disease resistance and modeling the predictive ability of the inheritance of brown rot in seedlings from a susceptible and resistant cross with the goal of obtaining a PhD.



Fig. 9. Wanfang Fu and her thesis advisor Ksenija Gasic.

Community Events

ASHS Annual Conference 31 July-3 August 2018 Washington, DC www.ashs.org/page/GeneralConference

National Association of Plant Breeders Annual Conference 7-10 Aug Guelph, Ontario Canada

> 10th Rosaceae Genomics Conference 2020 Barcelona, Spain Details coming soon!

RosBREED by the Numbers

1000

Number of tart cherry seedlings & cultivars evaluated for bloom date at MSU-Clarksville to develop late blooming cultivars.

177

Number of blackberry cultivars analyzed with the improved DNA fingerprinting set.

71

Number of peach, plum, and cherry seedlings and cultivars under evaluation to determine resistance to three races of Armillaria – a devastating root fungus which affects many Prunus species.

40

Number of blackberry samples submitted to Arbor Biosciences for sequencing to identify SSC (sugars) related genes.

245

Number of pear seedlings inoculaed for fire blight resistance at WSU-Wenatchee

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- Rosaceae Nemesis & Solution
- Community Breeder's Page
- ASHS 2018 Washington, D.C. Report
- Report on Science Communication Workshop

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