

State of Oregon Annual Report for Calendar Year 2022

W-6 Technical Committee

Shawn A. Mehlenbacher

Oregonians continue to use the PI system extensively. Users include state and federal researchers as well as private seed companies and private individuals. Oregon is a major user in the western region, along with California and Washington. Also, Oregon's state representative S. Mehlenbacher has a W-6 companion project and research progress is reported here.

Progress Report:

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High level eastern filbert blight (EFB) resistance assigned to a linkage group (LG). In cooperation with Tom Molnar at Rutgers University, we have identified more than 100 sources of resistance. Over several years, resistant accessions were crossed with susceptible selections, and the resulting seedlings exposed to EFB under a structure topped with diseased branches. In progenies that segregate 1:1 (resistant : susceptible), resistance was assigned to a LG based on correlation with mapped simple sequence repeat (SSR) markers, with the initial focus on regions where resistance was previously mapped (LGs 6, 2 and 7). In August, 2022, a summary report was presented at the International Horticultural Congress in Angers, listing 30 sources that had been assigned to a LG: 17 on LG6, 5 on LG2, and 8 on LG7. Additional assignments in the past year include four Turkish selections to LG2, three (*C. americana* 'Winkler' and OSU 366.060 and hybrid OSU 401.014) to LG1 and Dickum hybrid OSU 1044.086 to LG4, the latter two being new LGs with major genes for EFB resistance. Graduate students are developing new SSRs and conducting fine mapping: Brianna Heilsnis in the LG2 resistance region and Rion Mooneyham in the LG7 resistance region. Resistance from 12 sources has not yet been assigned to a LG but crosses have been made and seedlings exposed to EFB.

Quantitative EFB resistance. Quantitative resistance is expressed as fewer and smaller cankers, exemplified by 'Sacajawea' and 'Tonda di Giffoni', which serve as check cultivars. Resistance is quantified by exposing a dozen potted trees per selection under a structure topped with diseased branches, and then counting and measuring cankers 18 months later. The OSU hazelnut breeding program identified a diverse set of 78 selections with a high level of quantitative resistance. The list includes 17 selections of Turkish origin and 19 from eastern Europe/Caucasus, all of which are from imported seed lots shared by OSU and Rutgers. Testing is being repeated to better document the resistance. To investigate genetic control of quantitative resistance, selections have been crossed in pairs and the seedlings planted in NJ and MO along with the parents. A multi-species SNP array now under development will allow GWAS analysis and identification of QTL for quantitative EFB resistance. Justin Lombardoni's PhD research at Rutgers University identified three important QTL for quantitative resistance from 'Tonda di Giffoni'.

Hybrid hazelnuts. Selection OSU 541.147 was released and trees will be sold under the name "The Beast". Its pedigree is 75% European and 25% American, with resistance conferred by a dominant allele on LG7 from *C. americana* 'Rush'. F₁ selections (72) from crosses of the American hazel (*Corylus americana*) and the European hazel (*C. avellana*) have been exposed to EFB under the structure. Of the selections recently tested at OSU, about half have more disease

than the check 'Sacajawea', one third have less disease than 'Sacajawea', and others have no cankers. It appears that the American hazel transmits quantitative as well as major gene resistance. Selections from the F₁ generation and seedlings of the F₂ generation (from pairwise crosses of unrelated F₁ selections) are being shared with partners at Rutgers Univ., Univ. of Nebraska-Lincoln, and the Univ. of Missouri). Early results from NJ show that most of the F₁ selections express moderate to severe EFB, and interestingly, disease scores at Rutgers on the same clones differ from OSU scores. Segregation in the F₂ followed a distribution curve expected for quantitatively controlled traits; tolerance and resistance were recovered in the offspring. Transgressive segregation was common with several individual seedlings having less EFB than either parent.

Pollen-stigma incompatibility. Incompatibility in hazelnut is sporophytic and controlled by a single locus. Each year we identify the S-alleles of about 60 selections. This year's tests included interspecific selections from Ontario, Canada and *C. avellana* selections from Rutgers University. The Ontario and New Jersey selections had been in post-entry quarantine to prevent the introduction of new isolates of EFB.

Table 1. Incompatibility alleles in selections from Courtland, Ontario and Rutgers University.

Selection	Sa	Sb	Comments
Chelsea	1	20	confirmed
Norfolk	12	25	confirmed
ONT 1K	2	10	done
ONT 2C	4	25	confirmed
ONT 3K	17	23	done
ONT 3L	17	25	done
ONT 3-13	20	23	done
ONT 4B	11	14	31, 32, 33 not yet tested
ONT 5C	17	25	confirmed
ONT 8G	17	25	done
Rutgers 123.014	2	20	done
Rutgers 126.077	10	33	done
Rutgers 126.138	10	22	done
Rutgers 130.205	2	12	done
Rutgers 420.088	6	32	done
Rutgers 421.005	2	6	done
Rutgers 427.028	4	17	done
Rutgers 503.011	2	3	done
Rutgers 504.028	10	20	done
Rutgers 504.116	4	10	done
Rutgers 506.002	4	4	S4 pollen
Rutgers 514.034	4	30	done
Rutgers 519.021	2	18	done

2. Michael Qian, Dept. of Food Science and Technology, Oregon State University, Corvallis, OR 97331

Allium accessions (101) requested in 2019 were used in research to determine diallyl disulfide content (DADS analysis). These are sulfur-based biostimulants for the germination of *Sclerotium cepivorum* sclerotia. One article was published in the Journal of Agricultural and Food Chemistry.

3. Ryan Graebner, OSU Columbia Basin Ag Research Center, Adams, OR 97810.

14 vetch accessions were requested and evaluated in the 2022 growing season under dryland conditions near Pendleton, Oregon to determine whether they would be suitable in a cover crop mixture. He did not find that any of the vetch accessions tested were vigorous under these conditions, similar to an earlier evaluation of a single commercially available but unspecified vetch variety. He concluded that vetch is not suitable in cover crop mixtures for dryland growing conditions in Eastern Oregon and will shift his focus to other more promising legumes.

4. Loreene Mae Evans-Marks and Ryan Hayes. USDA ARS Forage Seeds and Cereal Research Unit, Corvallis, OR 97331.

From 2016-2021 they conducted some G by E field trials with 20 individuals from each of 10 GRIN ecotypes. There were 3 susceptible lines from GRIN and two (PRG Jet and Morning Star) that were used as controls for stem rust QTL mapping. Experimental lines (28) previously tested in the greenhouse for stem rust were included in these trials. Nine of the GRIN lines used had shown some stem rust resistance. Trials were grown in 6 different locations: 5 in the Willamette Valley and one at the Hermiston Field Station. In the five years of trials, they only had one year of good stem rust infection and never had any infection in Hermiston. South Valley locations, both in Harrisburg, were especially weedy and soggy trials. The mid-valley sites (Hyslop Farm and Crabtree) and the North Willamette Research and Extension Center in Aurora had good infections. They were looking to see if plants that showed resistance in a controlled environment showed similar resistance in a field setting. They also collected single pustule isolates to see if stem rust was genetically unique based on location. They are developing a stem rust resistant perennial ryegrass forage variety. These resistant materials will be crossed to known rust resistant germplasm for association mapping.

The accessions requested in 2019 were used in a GWAS breeding program. From 2020 to 2022 5 individuals of 17 ecotypes from the core collection of PRG were crossed with a stem rust resistant PRG forage Kingston R2 parent. Seed from ~90 crosses was harvested and put into cold storage. Ecotypes that headed without cold treatment were eliminated (ecotype 14 from Cyprus). The ecotypes from Finland, Prince Edward Island, the most northern ecotypes as well as the most southern types from Chile, New Zealand and Australia did not produce heads the first year. In 2021, these ecotypes were given a chilling treatment (5 C) for 12 weeks instead of 8 and had much better head development and seed set. The stem rust resistant plant material that was used in both studies was generated by Dr. Bill Pfender at the USDA who developed a PRG stem rust QTL mapping population.

5. Quinn Gillespie, RST Quality Manager, Universal Seed Co., Independence, OR.

A diverse array of seeds (67 accessions, a 2019 shipment) was requested and used as a seed identification reference herbarium and for training future analysts in seed identification. He has an analyst in his lab who was studying for the RST exam and the seeds were used to study for the exam. The species requested are from the updated RST study guide list. Proficiency testing in seed identification is a continuing education requirement of the Society of Commercial Seed Technologists.

6. Brian Roth, Orson's Greenhouses, Inc., Tangent, OR 97389.

He would like to thank the staff of ARS GRIN for allowing him the opportunity to work with this material. He received the seeds of *Phaseolus vulgaris* 'Ruby Dwarf Horticultural' in late 2022. Plants are now (2023) growing in the field for seed increase to build up stock to a

level that will allow our operation to further evaluate and possibly reintroduce this bean to the local gardening community. This accession was grown and sold by Gill Brothers Seed of Portland, OR between the 1920s and 1950s but does not appear to be currently available to the gardening public. The company that bought out Gill Bros. dropped many of their locally adapted varieties. We grow and sell garden starts at our Albany and Roseburg, OR seasonal retail outlets. I would like to grow these out and evaluate them for possible reintroduction to the Western Oregon garden trade.

7. Tim Ford, Pineview Farms, Lebanon, OR 97355.

‘Shamrock’ Kentucky bluegrass (KBG, *Poa pratensis*) was requested and used in greenhouse crosses with other high seed yielding KBGs. The objective is to develop an ultra-high seed yielding KBG variety with acceptable turf quality. The few true hybrids were evaluated in Lebanon, Oregon and the best 23 were planted in seed yield tests near Madras and Imbler, OR. The best hybrids (2-3) will be harvested this week and evaluated for panicle production and floret fertility. The 23 were also entered into turf testing at Rutgers University.

8. Virginia Lehman, Blue Moon Farms LLC, Lebanon, OR 97355.

Accessions of timothy (*Phleum pratense*), vetch (*Vicia villosa*) and Kentucky bluegrass (*Poa pratensis*) were requested and used in research. She is very appreciative of the material for research. “The maintenance of this material is critical to future genetic research.” Three accessions of timothy were compared to their breeding material for maturity. Comparison trials generated data for certification agencies. The same approach was used for the ‘Voronezskaja’ vetch.

The Kentucky bluegrasses ‘Park’ and ‘Kenblue’ were used as standards in comparison to newly developed germplasm for the plant descriptor data for certification. Kentucky bluegrass A-34 was used to make hybrids, or attempted hybrids, and we are still testing the few materials we think might be hybrids.

9. Robin Lamp, Forage Breeder, Barenbrug USA, Albany, OR 97322.

Two accessions of *Bromus sitchensis* were requested. Seeds will be planted this summer for the fall nursery. Selections will be made based on maturity, disease, forage potential, and seed yield potential. Then in subsequent years the best plants will be used to make synthetics with other *B. sitchensis* varieties.

The Agropyron hybrid (PI 469213) is the original cross made by the USDA for the variety now called Hamann, which Barenbrug USA licenses from the USDA. Dr. Bryan Kindiger (USDA retired) recommended to Barenbrug by to obtain a sample and keep as a backup in cold storage in case any issues arose with the variety in the future.

Six PIs of teff (*Eragrostis tef*) were requested but the seeds have not yet been sown. Due to COVID and staff shortages, we had to prioritize and postpone some of our planting projects over the past few years, and the teff nursery was one of them. As of now, this project has a planned start date of 4/1/24. Our intention is to evaluate each line, and work towards hybridization efforts with other various teff varieties.

10. Barbara Hinds-Cook, DLF Pickseed Inc., Philomath, OR 97370.

She ordered ‘Linn’ perennial ryegrass for inclusion as a standard cultivar in a plant variety protection nursery. However, because the seed had only 22% germination, she unable to include it in the PVP nursery. Instead, she took those 22 plants, planted them in the field in isolation, and hopes to increase the seed. “This probably isn’t the kind of information you want,

but it is important for the U.S. National Plant Germplasm System to know they are sending out **low germinating seeds.**”

Publications:

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Qian, Y.L., Hua, G.K.H., Scott, J.C., Dung, J.K.S., and **Qian, M.C.** 2022. Evaluation of sulfur-based biostimulants for the germination of *Sclerotium cepivorum* sclerotia and their interaction with soil. *J. Agric. Food Chem.* 70:15038–15045.