State of Oregon Annual Report for Calendar Year 2013
W-6 Technical Committee

Compiled by 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's requests from 104 users for plant germplasm through GRIN in 2013 make it a major user in the western region, along with California and Washington.

Progress Reports:

1. **Shawn A. Mehlenbacher**, Dept. of Horticulture, Oregon State University, 4017 ALS Bldg., Corvallis, OR 97331

Hazelnut – eastern filbert blight. Brooke Peterschmidt defended her M.S. thesis. She also showed that in crosses with susceptible selections, eastern filbert blight resistance from the Spanish cultivar 'Culpla', Serbian cultivar 'Crvenje' and Russian selection OSU 495.072 segregated 1 resistant : 1 susceptible. She mapped all three resistances to the same location on the map as 'Gasaway' resistance.

All eight of the hazelnut selections resistant to eastern filbert blight (EFB) received as scions from a Forestry Institute near Moscow have been crossed with susceptible selections. Seedlings of Moscow N02 are growing in the field. Seedlings of seven other selections were grown in the greenhouse, inoculated with EFB in 2013, and are now expressing cankers in our EFB nursery. Data on disease response will be collected in December, 2014. High EFB resistance to EFB was detected in two selections from the Republic of Georgia, six from southern Russia, and three from the Crimea (Ukraine). High levels of quantitative EFB resistance were also detected in a dozen selections of diverse origin.

Hazelnut – incompatibility. Limbs were bagged on hazelnuts in the USDA Repository's field collection, and the female flowers were used to identify the incompatibility alleles in interspecific hazelnut hybrids from the New York Agricultural Experiment Station in Geneva, NY. A paper published in the Journal of the American Society for Horticultural Science in March 2014 summarized the results of 17 years of incompatibility testing using fluorescence microscopy, including the discovery of six new alleles and determination of dominance relationships among 105 new pairs of alleles. S-alleles were reported for 284 cultivars, 13 interspecific hybrids and 522 selections of diverse origin. Geographical differences in S-allele frequency were noted.

Hazelnut – simple sequence repeat markers. With Nahla Bassil, we used SSR markers to characterize interspecific hybrid hazelnuts. Brooke Peterschmidt, in her M.S. thesis research, developed 113 new simple sequence repeat (SSR) markers and characterized them using 50 diverse hazelnut accessions. Currently, M.S. student Gehendra Bhattarai is developing new SSR markers from the 'Jefferson' genome sequence (115× coverage), assembled from Illumina reads, which serves as the reference genome sequence for hazelnut. Genomic DNA of seven other cultivars was also sequenced using Illumina. Alignment of reads from these seven cultivars with the 'Jefferson' sequence allowed in silico comparisons and identification of polymorphic SSRs. A search of the 'Jefferson' sequence for four types of SSRs (tri-, tetra-, penta- and hexa-repeats) for repeat lengths >15 bp using the MISA tool identified 17,588 SSR-containing fragments. Short fragments (<400 bp), repeat motifs containing only A's and T's, and repeats at the ends of the fragments were removed. The remaining 2,075 unique fragments were trimmed, retaining 250 bp on either side of

the repeat motif. Paired-end Illumina sequences from the seven accessions were aligned with each trimmed 'Jefferson' sequence using MAQ software. Aligned sequences were inspected using Tablet, and 489 microsatellites that showed variation in number of repeats but conserved flanking regions were identified. Primer pairs were designed for these SSRs and used for PCR amplification of 24 diverse accessions. Electrophoresis on agarose gels confirmed polymorphism of 367 of these. Polymorphic SSRs will be characterized by amplification of 50 accessions with fluorescent primers and sizing with capillary electrophoresis, and assigned to linkage groups based on segregation in one of our mapping populations.

2. James Myers and Kara Young, Department of Horticulture, Oregon State University, 4017 Agriculture & Life Sciences Bldg., Corvallis, Oregon 97331

For the tomato breeding project, M.S. student Kara Young requested 13 *Solanum pimpinellifolium* lines in 2013. They are currently being evaluated for late blight resistance in a field trial at the Lewis-Brown Research Farm. The objective is to find lines that may be useful to breed tomatoes resistant to late blight.

In bean, Dr. Myers has an on-going project to identify novel resistance QTL in scarlet runner bean and transfer them to common bean. The project was initiated in 2000 by screening *Phaseolus coccineus* accessions in the USDA PI collection, with selected lines then crossed to *P. vulgaris* to create three backcross populations (91G/PI255956 BC_2F_8, 91G/PI433251 BC_2F_6, and M0162/PI433251 BC_2F_6) and characterize white mold resistance QTL. Five QTL, some apparently unique from *P. vulgaris* QTL were identified. One significant finding was that as in *P. vulgaris*, white mold resistance in *P. coccineus* is quantitatively inherited and controlled by multiple factors. A second finding was that interspecific lines do not approach homozygosity at the same rate as intraspecific lines when inbred over generations. A third, recently recognized finding is that lines derived from interspecific hybridization show a higher rate of outcrossing than do *P. vulgaris* lines. This last observation, in combination with interspecific incompatibilities, may help explain why approach to homozgyosity with inbreeding is slower than expected.

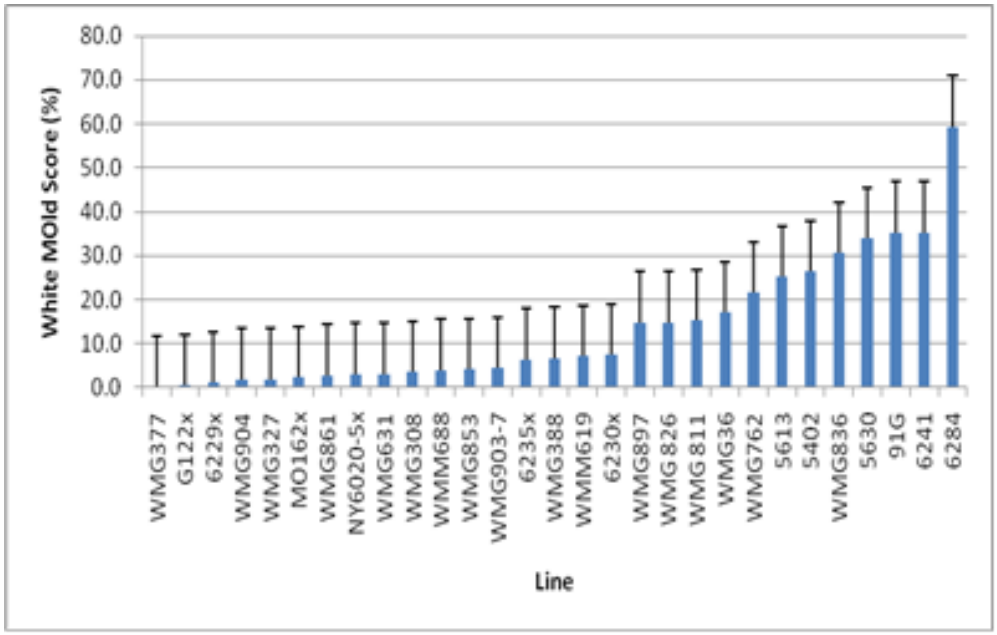

Figure 1. White mold score (geometric mean of incidence and severity) of *P. coccineus* derived lines grown in the field at Corvallis, Oregon in 2012. Entry names followed by "x" are partially resistant checks.

A set of 18 lines derived from these populations was identified as moderately to highly resistant, and have been seasonally tested the past three years. Most lines show stable resistance although a few have reverted back to a susceptible state (see for example WMG836, Figure 1). In general, the ranking of the lines has remained the same. The most resistant lines are on the left in Fig. 1. Crosses were made in Spring 2011 of Spinel great northern and OSU5613 Bush Blue Lake with 13 interspecific lines possessing markers for identified interspecific QTL to produce 55 cross combinations (including crosses to sublines within an interspecific line type). These numbers were reduced by discarding crosses with apparent revertants. In 2012, 24 populations (12 to each susceptible parent) were advanced to the F_3 by single seed descent, one year later than originally proposed due to personnel changes in 2011-12. The populations will be used to fine map and validate the QTL. These populations advanced by single seed descent are in F_5 and now ready for phenotypic and genotypic characterization.

3. Jennifer Lorang, Dept. of Botany and Plant Pathology, Oregon State University, 2082 Cordley Hall, Corvallis, OR 97331.

She graciously received 9 rice (*Oryza sativa*) and 37 barley (*Hordeum vulgare*) accessions in 2013. She screened these lines for sensitivity to fungal toxins produced by several plant pathogens, in hopes of finding lines to map genes conferring disease susceptibility. None of the lines appear to be useful for this type of investigation, but she remarked "The service that the U.S. National Plant Germplasm System provides is crucial for our continued research efforts to fight plant disease".

4. Jeff Leonard, Dept. of Crop and Soil Science, Oregon State University, 107 Crop Science Building, Corvallis, OR 97331

In 2013 he received seeds of two spring wheat lines carrying two stripe rust resistance genes not currently available in PNW germplasm: Yr48 and QYr.ucw-3BS. He incorporated those genes into elite lines through three rounds of backcrossing and will introduce those into the OSU breeding program in the spring of 2015.

He also received seeds of three accessions of *Aegilops markgrafii*, the putative C genome donor to *Aegilops cylindrica* (goatgrass). Goatgrass is a common weed in wheat agriculture and gene flow between wheat and goatgrass occurs. He is developing genome-specific markers for a footrot resistance gene, *Pch1*, and wants to enable detection of *Pch1* introgression to goatgrass. He uses the *Ae. markgrafii* accessions as the basis for determining which marker products are derived from the C or D genome of goatgrass. This project is continuing.

5. Patrick M. Hayes, Dept. of Crop and Soil Science, Oregon State University, Crop Science Building 107, Corvallis, OR 97331

He received two sets of accessions from the National Small Grains Collection in 2011: the World Core (~ 2,000) and the World Core winter subset (~400). Both were assessed as part of OSU's role in the USDA-NIFA Triticeae CAP project. He assessed the World Core in Corvallis for resistance to stripe rust and scald, plant height, and heading date. Barley stripe rust data were collected in 2013 and are being collected again in 2014. He assessed the World Core winter subset

for low temperature tolerance at Pendleton and in cooperation with the University of Minnesota. Both sets of accessions have been genotyped with the 9K Illumina SNP chip under the auspices of the Triticeae CAP. Genome-Wide Association Mapping in both arrays is in progress to detect genes and QTLs determining the target phenotypes. Two manuscripts from this work are in press. At least two more manuscripts (one on stripe rust resistance and one on low temperature tolerance) will be submitted in 2014. It is expected that Genome-Wide Association Mapping will reveal additional resistance QTLs.

6. **Colleen Roseborough**, Dept. of Crop and Soil Science, Oregon State University, 107 Crop Science Bldg., Corvallis, Oregon 97331

109 wheat (*Triticum aestivum*) accessions were requested from the National Small Grains Collection for a study of alpha gliadins, which are associated with celiac disease in humans. The list of accessions represents important US cultivars over the period 1900-2013 and was compiled from three sources: World Wheat Book, Commercial Wheat Varieties of the US, and USDA. The research project has two hypotheses: 1. The concentration of alpha gliadins has not increased in US cultivars significantly over time. 2. Despite selection for low protein and wheat gluten, US soft white wheat cultivars have same level of variability for the alpha gliadins as US hard red wheat cultivars. RNA is currently being isolated for MiSeq and protein will be evaluated using an Agilent Bioanalyzer.

7. **Aymeric Goyer**, Hermiston Agricultural Research & Extension Center, Oregon State University, 2121 S 1st Street, Hermiston, Oregon 97838.

174 accessions representing > 20 potato species were received from NRSP6 in Sturgeon Bay, WI to study folate concentration. Vitamin B9 (a.k.a. folates) deficiency is one of the most widespread nutritional deficiencies worldwide, and is associated with the increased risk of birth defects (e.g., spina bifida, anencephaly), strokes, cardiovascular diseases, anemia, some types of cancers, and impairment of cognitive performance. Most of these deficiencies are due to low folate intake. Vitamin B9-enriched potatoes have the potential to deliver the needed amount of folate to the widest populations. Toward this goal, he has been exploring the natural genetic diversity of folates in various potato germplasm. Our studies focused on over 130 genotypes that included commercial varieties and advanced breeding clones, indigenous cultivars (landraces) (54 accessions from the Groups Phureja, Stenotomum, and Andigena) and wild potato species (Solanum section Petota) (64 accessions) from South and Central America, as well as the Southwestern United States. Overall, we found a huge range of folate concentrations among the accessions, far greater than reported for any other plant. The broadest range of concentrations were found within primitive cultivated and wild potato species while modern potato varieties had a relatively narrow range of folate concentrations, illustrating the narrowing effect of selection. He is currently expanding screening to new segregating individuals (germplasm received in 2013) from the previously-found high-folate species to identify new sources of high folate germplasm. A M.S. student was hired as part of a NIFA-funded grant to work on pre-breeding and breeding for folate enhancement in potato based on preliminary data obtained on germplasm received from NRSP6. The student will evaluate folate in new potato germplasm received in 2013, and in potato hybrids obtained by crossing wild potato germplasm with *Solanum tuberosum*. The materials were received in good condition, although some were infected with PVX.

8. Chad Finn, USDA-ARS NW Center for Small Fruits Research, 3420 NW Orchard Street, Corvallis, OR 97339

Dr. Finn has collected many seeds and plants over the years, and has donated many to the USDA Repository collection. Recent releases from his berry breeding program include 'Sweet Sunrise' and 'Charm' strawberries (2013), 'Columbia Star' blackberry (2013), and 'Baby Blues' blueberry (2014). Applications for U.S. Plant Patents were submitted for all four releases. Breeding and germplasm investigations continue in *Rubus* (red and black raspberry, blackberry), *Fragaria* (strawberry) and *Vaccinium* (blueberry).

Strawberry. For the RosBREED project "Enabling Marker-Assisted Breeding in Rosaceae", over 500 genotypes were asexually propagated by USDA-ARS-HCRL, Michigan State University, Driscoll Strawberry Associates, and the USDA-ARS-NCGR. The NCGR propagated over 120 genotypes from their collection. Crop reference sets that include genotypes and seedling populations representing the breadth of relevant diversity and encompassing founders used in breeding the domestic strawberry were identified and planted in Oregon, Michigan, Florida, New Hampshire and California. Phenotypic traits were identified and used to comprehensively characterize this Crop Reference Set including fruit weight, firmness, skin toughness, soluble solids, titratable acidity, pH, external and internal color, flavor, shape, ease of capping, drip loss after freezing and thawing, and total anthocyanins for fruit quality attributes together with remontancy, crop load, disease resistance and plant architecture. M.S. student Megan Mathey collected the phenotype data in Corvallis and coordinated the collection in the other locations as part of her thesis completed in June 2013.

Rubus (general). Two seed lots (one of *Rubus idaeus* and one *of R. occidentalis*) were obtained in 2012 from the Corvallis Repository for ongoing evaluation of *Rubus* species. The seeds were germinated and the seedlings planted. They are being evaluated in the field in 2014.

9. Chris Poklemba, USDA-ARS National Forage Seed Production Res. Ctr., 3450 SW Campus Way, Corvallis, OR 97331

Accessions of several species were requested for a study of nuclear DNA content using flow cytometry with DAPI stain and an internal standard (*Arabidopsis thaliana*, or *Zea mays* B730. The species were chosen for screening because it was suspected that they might show variation in genome size across their range. Species that show variation in nuclear DNA content will be studied in more detail with additional accessions. So far he has screened: 7 accessions of *Hesperostipa comate*, 2 of *Hesperostipa comata* subsp. *comate*, 10 of *Poa fendleriana*, 54 of *Poa secunda*, 4 of *Sphaeralcea munroana*, 2 of *Sphaeralcea parvifolia*, 10 of *Sporobolus airoides*, 1 of *Eriophyllum confertiflorum*, 4 of *Eriophyllum lanatum* and 1 of *Eriophyllum lanosum*. Of these, 2C DNA content variation has been positively identified in *Eriophyllum*, *Hesperostipa*, and *Sporobolus*, and additional germplasm has been requested for further analysis. Of the remaining accessions and species, further screening is being conducted with alternative internal standards. He plans to share the final data set with GRIN, and to publish the information as a small note on the geographic variability of DNA content variation, and potential association between DNA content variation and climate.

10. Alan M. Kapuler, Peace Seeds/Seeds of Change, 2385 SE Thompson Street, Corvallis, Oregon 97333.

Helianthus accessions were requested for on-going research on sunflower. Having observed during the past 15 years crosses of *Helianthus argophyllus* x *H. annuus* that confer horticulturally and agronomically important traits to common sunflowers, he grew a set of accessions from GRIN of *Helianthus argophyllus*. The accessions included PI 494571, PI 494711, PI 468651, PI 494572, PI 435624, PI 435629, and PI 435633. There was considerable variation in morphology in these accessions of the southern Texan endemic species *H. argophyllus* reflecting the possibility that collections of the species or the growouts for seed increase included hybrids with *H. annuus*. He isolated the plants with distinctive *H. argophyllus* characteristics (early branching, white tomentose leaves, stems and buds, dwarf character, and smooth leaf margins). This year he is growing the isolates, and 10-15% of the plants show interspecific characteristics. Most of the selected lines are homogeneous with traits one would associate with *H. argophyllus* growing in a hot, sandy ecosystem. Thus he is recovering *Helianthus argophyllus* as a species with limited introgression from *H. annuus*. Among the traits conferred by *H. argophyllus* to *H. annuus* are longer flowering season (from 2 months to 4 months), whorled inflorescences with sometimes synchronized flowering times such that a single plant can grow to 10', make 20 or more inflorescences which open at the same time on huge plants, have smaller seeds attractive to birds, have large central eyes in the flowers with color patterns from purple to lemon yellow to orange to red of horticultural and optical beauty.

He wishes to thank GRIN and all those who support the public distribution of plant germplasm for the common good. "Public domain plant breeding is the core of a healthy and sustainable agriculture. It supports the adaptation of important food, fuel, medicinal and ornamental species to changes in climate both at local and global levels".

11. Jerry Hall, Grassland Oregon, Inc., 4455 60th Avenue NE, Salem, Oregon 97305

Grassland Oregon continues to be a major user of plant germplasm, with *Crambe* and *Chenopodium* receiving emphasis in recent years. He reports that they have planted out the *Crambe* twice now. In the Spring of 2013 they planted out lines in a dryland, no-till situation. The plants became established and produced seed, but shattering and birds proved to be problems in seed production. In the Fall of 2013 they planted the trial again. All but a couple of plants were winterkilled. These plants have been isolated and resulting seed will be harvested and planted this coming Fall. The *Chenopodium* was planted the Spring of 2013 on a dryland no-till situation. Plants established well, however it probably should have been planted in mid-April if there was any hope to harvest viable seed. *Chenopodium* could be grown in Western Oregon, but breeding for earlier maturity will be necessary.

12. Virginia G. Lehman, Blue Moon Farm, P.O. Box 2390, 33754 Tennessee Road, Lebanon, Oregon 97355

Seeds of 64 accessions of radish (*Raphanus sativus*) were requested for use in breeding higher seed yielding material for the cover crop market, and she contracted for some nematode work but the research is only preliminary at this point. She is evaluating timothy (*Phleum pretense*) accessions seeking drought resistance for forage yield. Annual ryegrasses (*Lolium multiflorum*)

accessions are being used to look for salinity tolerance. Additional accessions been added to the breeding program and she is still in the research mode.

13. Kenneth and Debra Hignight, NexGen Turf Research LLC, 33725 Columbus St. SE, Albany, Oregon 97322

Cynodon transvaalensis (14 accessions) were received in spring 2013 and are still under evaluation for potential turf quality and combining ability. The germplasm needed to be established in greenhouse mowing trials as well as evaluated for floret fertility. Final evaluation of the accessions will be completed in September 2014.

14. Joseph Wipff, Barenbrug USA, Inc., West Coast Research STaton, 36030 Tennessee Road, Albany, OR 97322

Festuca arundinacea (594 accessions) from Mediterranean countries were requested for use in the turfgrass breeding program.

15. Troy Hake, Outside Pride Inc., 915 North Main Street, Independence, Oregon 97351

Two accessions of *Trifolium repens* was requested to ascertain the height of the plants. They are looking for the most dwarf white clover they can find that has small leaves.

16. David Lawrence, Oregon Olives, 17645 SE Walnut Hill Road, Amity, Oregon 97101

Oregon Olives requested 18 accessions of olive (*Olea europaea*). The company's objective is the introduction of commercial olive cultivation into Oregon, and identification of the best cultivars to do so. Although this is a long term endeavor, there are already several standout cultivars from the clonal germplasm repository, including 'Verdale'. The next phase of the investigation will be the quality of the products (table olives, olive oil) that can be produced from the cultivars. 'Verdale' and other interesting comments are shared on his blog (www.OregonOlives.com).

17. Keith Warren, J. Frank Schmidt & Son Co., 9500 SE 327th Avenue, P.O. Box 189, Boring, Oregon 97009

In February 2012, he obtained scions of six selections of the paperbark tree hazel (*Corylus fargesii*). He grafted ~8 of each, depending on available scion wood. Successful grafts were held in the greenhouse for the 2013 season, then lined out in field plots in Boring, Oregon in May 2014. These will need to grow for at least one year before any evaluation is possible. Also under evaluation as landscape trees are six interspecific hybrid tree hazel selections from OSU (*Corylus colurna* x *C. fargesii*).

In July of 2013, he obtained one plant of *Sorbus torminalis* 'SOR 274.001', which is being held for future evaluation as an ornamental. In August 2013, he obtained budwood of four

additional selections of *Sorbus torminalis*. These were budded onto *Sobus aucuparia* rootstock in field rows. Bud takes varied by clone. They are expected to grow strongly in the field and will be evaluated in the late summer of 2014. Bud numbers and take numbers are as follows:

No. Budded	No. Takes	Accession
15	3	SORBUS TORMINALIS 'SOR 274.001'
15	3	SORBUS TORMINALIS 'SOR 274.005'
15	15	SORBUS TORMINALIS 'SOR 275.010'
15	0	SORBUS TORMINALIS 'SOR 276.008'

18. Larry Stauffer and Vijay Balan, X-Plant Laboratory, Inc., 3535 SW Multnomah Blvd PMB 106, Portland, OR 97219.

X-Plant Laboratory, Inc. is a small plant micropropagation laboratory located in the Multnomah Village area of Portland, Oregon. Xplant has been using plant germplasm obtained from the National Clonal Germplasm Repository in Corvallis, Oregon (NCGRCOR). At the present time, U.S. commercial production of hazelnuts (filberts) is limited to the Pacific Northwest region. In 1970, eastern filbert blight, (EFB) was found in orchards near Vancouver, WA, and has spread southward into the Willamette Valley of Oregon. Initially, the outlook for the Oregon hazelnut industry was bleak, but the hazelnut breeding program at Oregon State University (OSU) created new EFB-resistant cultivars and pollinizers. In vitro cultures are established by Barbara Reed at the USDA National Clonal Germplasm Repository in Corvallis. Cultures from Dr. Reed's lab has enabled X-plant to micropropagate both initiated and non-initiated clean plant material. We have been able to propagate inventories of *Corylus* (18 cultivars) as well as *Humulus* (two cultivars) and *Rubus* (five cultivars) that would otherwise not be available for propagation and subsequent sale to nurseries and the final destination, growers. X-plant has difficulty keeping up with the demand from the agricultural sector. Their current inventory of *Corylus* totals ~6,000 plants, but they have potential buyers for 10,000 plants per month. With bimonthly micropropagation rates of 1.2 to 1.5, they hope to increase their *Corylus* inventory in the coming year to satisfy this demand. Total sales of *Corylus* varieties for 2013 were 5,700 plants. They have no definite buyers for two forms of *Humulus* (Ultra and Fuggle-H) obtained from NCGR-COR, but interest is high. They maintain refrigerated stocks of the *Corylus*, *Humulus*, and *Rubus* plants listed above. Xplant's goal is to maximize growth, multiplication and rooting rates by comparing multiple media modifications, but they currently use recommended media and methods for micropropagation. Although X-plant does not intentionally limit sales just to Oregon nurseries, to date these are the only customers to which they have provided Corylus.

19. Jeanette Uhden, Essex Labs Inc., 5549 Lone Pine Road, Terrebonne, OR 97760

Accessions of mint (*Mentha spicata* and *M*. x *gracilis*) were obtained from the Corvallis Repository. The mint plant selections are currently being maintained in their breeding program and examined for any attributes that can be used to improve oil yield, disease resistance, and unique flavor components. As of this date she had no results to report.

20. Angela Labrum, Carlton Plants Nursery, 16100 SE Unionvale Road, Dayton, Oregon 97114.

In vitro cultures were requested of hazelnut (*Corylus avellana*) and pear (*Pyrus communis*). She is currently growing the selections in tissue culture to test media and growth habit.

21. Dan Armstrong, 2788 Riverview Street, Eugene, Oregon 97403

Two accessions (PI 63499 and PI 614880) of *Chenopodium quinoa* were received from the Ames IA PI Station. Below is his report on is use of the seeds.

GROWING QUINOA IN THE WILLAMETTE VALLEY

Abstract: This experiment seeks to test the earliest date for planting *Chenopodium quinoa* in the Willamette Valley for use as a commercial crop.

Chenopodium quinoa has been grown in the Willamette Valley for more than twenty years, but only for specialty seed production, never as a commercial crop. There are several reasons for this, some related to the commercial market and some related to production problems. This experiment seeks to explore some of the production related problems.

The main production problems for growing commercial quinoa in the Willamette Valley are (1) infestation by lygus bugs (common and prevalent in the Willamette Valley) and (2) the late (mid-September) harvest date. In the case of the lygus bugs, they become most dangerous to quinoa after the grass seed harvest in July, when the lygus bugs migrate from the harvested grass seed fields to other plant varieties - *Chenopodium quinoa* being one possible migration target. The September harvest is problematic because of moisture increases in the air and the higher likelihood of rain, both of which can become problems when allowing the seed to dry in the field.

By finding a shorter-term quinoa and/or one that can be planted earlier and also be harvested earlier could conceivably avoid both the wet weather of September and the July attack of lygus bugs. With these ideas in mind, the experiment was designed.

The experiment was done with six varieties of *Chenopodium quinoa*: one variety that I have been growing for five years, three varieties that came from Philomath Seed breeder Frank Morton (Cherry Vanilla, French Vanilla, Brightest Brilliant Rainbow), and two varieties that came from the Seed Bank at Iowa State (PI 614880, PI 63499).

The experiment model was simple. The six varieties of *Chenopodium quinoa* listed above were planted at or near the middle of October, November, December, January, February, March, April, and May. The experiment was looking for the earliest planting that reached harvest and/or that had the earliest harvest.

Results to Date. While the experiment must continue through the harvest of all maturing plants, as of June 14, 2014, the results are as follows:

1. Though there was germination in every planting, regardless of the weather (which was really cold this winter) or variety, none of the seeds planted in October, November, December, January, or February matured. In fact, none of those that germinated lasted more than two weeks.

2. One variety planted in March survived. That was a single plant from the PI 63499 seed. It is still alive and flourishing.

3. All varieties planted in April produced plants. The germination rate was marginal, but at least one plant of each variety is living and thriving at this time.

4. All varieties planted in May produced plants. The germination rate was significantly greater than April and many plants in all varieties are alive and growing at this time.

5. Lygus bugs are not currently attacking any of the plants. This is likely to change in another month or six weeks.

Comments. As there are survivors from three different planting dates spanning two months, key criterion to watch during the next few months are:
1. Arrival of the lygus bugs.
2. The date when the seed pods fill.
3. The date when the mature quinoa can be harvested.

22. Steve Goffena, Oregon Quinoa Seed Research, P.O. Box 207, Amity, Oregon 97101

Seventeen accessions of *Chenopodium quinoa* were received in April. The seeds were planted in the field in Amity, OR on June 3 in 12 x 12 ft plots in rows 18 inches apart. The plots were irrigated until the plants began to flower. The seeds matured on Sept. 6 and were harvested on Sept. 10. Weeds, especially lambsquarters and redroot pigweed were difficult to control. If he repeats the trial, he will plant earlier (April 15) to reduce the need for irrigation and facilitate weed control. He also feels that a 12-inch spacing would be better for weed control and lead to more upright growth. At the 18-inch spacing, most accessions "looked like Christmas trees with the seed panicles from the ground to the top" of the plants. Most accessions were more than six feet tall and fell over, with seeds from the ground to the top of the plants. Of the accessions in the trial, he rated PI 634919 and PI 614884 as the best for physical form, as they were 4-5 ft tall and had most of their seeds at the top. However, their seeds were quite small. He adds that he has no doubt that Kevin Murphy at WSU will develop varieties that grow well in the Pacific Northwest.

23. Jeff and Cheryl Boden, West Union Gardens, 7775 NW Cornelius Pass Road, Hillsboro, OR 97124

Cuttings of three accessions of *Actinidia arguta* and one of *A. callosa* were requested, but were not established.

24. Joan Rowe, 39560 Modoc Point Road, Chiloquin, OR 97624

She received three cuttings of each of six varieties of pomegranate (*Punica granatum*) in the spring of 2013. As a hobbyist, she wanted to see if any would be hardy in Chiloquin (US zone 5) and also try some in Phoenix, Oregon (US zone 7). She was able to propagate all 6 varieties, planting out one of each variety in fall of 2013, and leaving the other two of each to overwinter in pots in a cool greenhouse. The winter of 2013-14 was particularly harsh. Temperatures in Chiloquin in December dropped to -20F for 1 night, -15F for 1 night, followed by 2 nights below 0F with very little snow cover, and in Phoenix to 4F for 2 nights followed by 10F for 2 nights with no snow cover. Although it is not too late for the Chiloquin plants to leaf out I suspect they did not survive. In Phoenix, all four showed new growth from the roots, though not until June. The six-month old plants 4F in Phoenix Oregon were DPUN 63 Kaj-acik-anor, DPUN 147 'Sumbar', DPUN 151 'Sirenevyi', and DPUN 161 'Sverkhranniy'. However, six- month old plants probably not surviving down to -20F in Chiloquin Oregon were DPUN 73 Kazake and DPUN 99 'DK from Shevlan'. All six varieties survived the winter in a cool greenhouse (down to 24F) in Chiloquin Oregon.

25. John Saltveit, Home Orchard Society, 13305 SW Havencrest Street, Beaverton, OR 97005

He experiments will several types of tree fruits and publishes information in the Home Orchard Society's Pome News. He reports that the azarole hawthorn was grafted successfully onto hawthorn rootstock and is growing well. It has not fruited yet but looks very healthy. The Kuganskaya fresh edible quince took their grafts quite well. He published an article on the use of mycorrhizal fungi in the home orchard, describing his experiments. The results will be published in the June edition of the Pome News from the Home Orchard Society, and have been described in permies.com, the largest permaculture source on earth. He states, "I appreciate what you do to try to make our future food sources more secure".

26. Patrick Murphy, Grange, 51427 Cedar Road, La Pine, Oregon 97739-9599

He received packets of seeds and plant starts two years ago (1 *Rubus idaeus* and 3 *Vaccinium corymbosum*
The seeds and starts were planted as recommended. He had, 2 growing seasons ago, a very poor season for the area and very low food production.

His conclusions on the gene bank seeds:
"1. We had very low germination rate, indicating poor storage conditions for the seeds. A large percentage of the seeds were started in indoor flats.
2. Of the seeds that did germinate, we tried to allow bolting to gather seeds. Very few bolted, and what seed we did harvest would also not germinate when attempted.
3. The plant starts we received did not survive the summer.

As I mentioned, we did have a poor growing season that year and low production from everything we planted. The problems consisted of lower than normal temperatures and vastly reduced sunlight. We attribute the lowered sunlight to the aerial spraying that resulted in dense cloud filled skies for much of the season.

This area is difficult to grow food in at its best and is partially due to mini climates, often separated by only a few miles. It literally can drop below 30 degrees any day of the year making it a necessity to use frost blankets for most of the growing season.

I began the season by keeping careful records of what was planted where and at what time. Unfortunately, we had a fire last April and all of my records were destroyed, as well as our greenhouse. This means that I am unable to supply more details than what I have from memory.

It is too late to try the seed bank seeds again this year. If they are available next year, I would like to try again.

27. Bo Boyajian, Sterling Creek Farms, 2639 Little Applegate Road, Jacksonville, Oregon 97530

Four accessions of grape (Vitis hybrids) and 26 accessions of apple (Malus) were requested. The grape cuttings were potted and rooted in the nursery. The apple scions were successfully grafted to MM.111 rootstocks. The resulting vines and trees will be made available to farmers and gardeners in Jackson and Josephine counties next year.

28. Fritz Skirvin, 6694 Ripling Brook Dr. SE, Salem, Oregon 97317.

He and two friends ordered rooted runners of 'Marshall' strawberry. They arrived with half-inch roots but failed to establish, even in a greenhouse. He questioned if the runners had been collected too early for establishment. He later obtained a few plants from a nursery in Albany.

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Goyer A, Sweek K. 2011. Genetic diversity of thiamine and folate in primitive cultivated and wild potato (*Solanum*) species. Journal of Agricultural and Food Chemistry 59: 13072-13080.

Goyer A, Bamberg J. 2012. Genetic diversity of thiamine and folate in primitive cultivated and wild potato (*Solanum*) species. Annual Meeting of the Potato Association of America. Denver, CO, August 2012.

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Mathey, M.M., S. Mookerjee, K. Gündüz, J.F. Hancock, A.F. Iezzoni, L.L. Mahoney, T.M. Davis, N.V. Bassil, K.E. Hummer, P.J. Stewart, V.M. Whitaker, D.J. Sargent, B. Denoyes, I. Amaya, E. van de Weg, and C.E. Finn. 2013. Large-scale standardized phenotyping of strawberry in RosBREED. J. Amer. Pom. Soc. 67:205-216.

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Muñoz-Amatriaín, M., A. Cuesta-Marcos, J. Endelman, J. Comadran, J.M. Bonman, H. Bockleman, S. Chao, R. Russell, R. Waugh, P. Hayes, and G. Muehlbauer. 2014. The USDA Barley Core Collection: genetic diversity, population structure, and potential for genome-wide association studies. PLOS One. In press.

Njuguna, W., A. Liston, R. Cronn, T.L. Ashman and Nahla Bassil. 2013. Insights into phylogeny, sex function and age of *Fragaria* based on whole chloroplast genome sequencing. Molecular Phylogenetics and Evolution 66:17-29. DOI: 10.1016/j.ympev.2012.08.026

Peterschmidt, B.C. 2013. DNA markers and characterization of novel sources of eastern filbert blight resistance in European hazelnut (*Corylus avellana* L.). M.S. Thesis, Oregon State Univ., Corvallis, OR.

Thomas, A.L., P. Perkins-Veazie, P.L. Byers, C.E. Finn, and J. Lee. 2013. A comparison of fruit characteristics among diverse elderberry genotypes grown in Missouri and Oregon. J. Berry Res. 3:159-168.

Abstracts (note that not all are from 2013):

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Lightle, D. M. Dossett, C. Finn, and J. Lee. 2014. Effects of three novel resistant black raspberries on *Amphorophora agathonica* feeding behavior and performance]. Ent. Soc. Amer. Ann. Meeting, Portland, OR.

Mathey, M.M., C.E. Finn, S. Mookerjee, K. Gündüz., J.F. Hancock, A.F. Iezzoni, L.L. Mahoney, T.M. Davis, N. Salinas, N.V. Bassil, K.E. Hummer. P.J. Stewart, V.M. Whitaker, D.J. Sargent, B. Denoyes, I. Amaya, and E. van de Weg. 2013. A standardized phenotyping protocol for strawberry in RosBREED. Am. Soc. Hort. Sci. annual meeting, Palm Desert, CA.

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Salinas, N., D. Kim, J. Hancock, K. Gündüz, B. Denoyes,, J. Perrote, M. Mathey, D.J. Sargent, A. Iezzoni, C. Peace, C.E. Finn, and N. Bassil. 2014. Validating microsatellite markers linked to remontancy in octoploid strawberry. Am. Soc. Hort. Sci. annual meeting, Orlando, FL.

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