

**August 16-17, 2017 – NC7 RTAC Meeting, West Madison Agricultural Research Station,
University of Wisconsin, Madison**

The 2017 NC-007 RTAC meeting was held at West Madison Agricultural Research Station is 8502 Mineral Point Rd., Verona Wisconsin, and hosted by Dr. William Tracy of the UW-Madison Dept of Agronomy.

Attending:

Wendy Wintersteen, NC-007 Academic Advisor, Iowa State University
William Tracy – Univ. of Wisconsin – Madison, and Host
Peter Bretting – USDA-ARS, Office of National Programs
Gary Kinard, USDA/ARS, NGR, Beltsville (via teleconference)
Melanie Caffé, South Dakota State University
Candice Gardner, USDA-ARS, NCRPIS, Ames, IA
Theodore Hymowitz, Retired, Univ. of Illinois
Amy Iezzoni – Michigan State University
Terry Isbell – USDA-ARS, NCAUR, Peoria, IL
Jules Janick – Purdue University, Indiana
Burton Johnson – North Dakota State University
Aaron Lorenz – University of Minnesota
Thomas Lübberstedt – Iowa State University
Erik Sacks – University of Illinois
Michael Stamm – Kansas State University (via teleconference)

Dr. William Tracy welcomed participants and provided information about Univ. of Wisconsin programs and Wisconsin Agriculture. Dairy is a \$54 B /yr business in Wisconsin, and the cheese industry has been transformed. The Dairy Research Institute devotes substantial resources to develop new cheeses with UW researchers. Wisconsin is the #2 state in the US for processing vegetables, and #3 for potatoes, with processing industry located primarily in the central sands area of the state. The state is also a significant producer of tart cherries. The Wisconsin Alumni Research Foundation, WARF, provides significant endowment investment in campus research, and is supported by royalties associated with vitamin research, specifically vitamin D uses, and from patents associated with warfarin.

Tours of UW-Madison research facilities included:

- 1) The Wisconsin Crop Innovation Center (WCIC), hosted by Mike Petersen and Shawn Kaeppler. The history of the center's development and innovation accomplishments was explained, its acquisition by Monsanto and subsequent transfer to the university, and greenhouse and laboratories were explored.
- 2) Julie Dawson of the Urban & Regional Food systems led a tour of variety trails for fresh market growers, and described organic systems production testing, on-farm trials of 12 crops by 70 growers which including heirloom varieties of tomatoes, and chef trials and tasting tests.
- 3) Lucia Guitierrez described her research efforts on quantitative genetics of complex traits of wheat, oats, and barley. Multi-location testing of barley in the US and Canada, the 'fields of flavor' project, is looking at multi-purpose, naked barley with feed and flavor attributes. A wheat panel is being evaluated for adaptation to Wisconsin, of interest to the baking industry for use in developing unique, local-sourced production.
- 4) Charlene Grahn, PhD student, demonstrated carrot research plantings, described the process of vernalization and transplant of carrot stocklings selected from evaluation trials in El Centro, CA.

The Carrot research program focuses on production, disease resistance, and market-sensitive traits, and makes extensive use of domesticated *Daucus carota* and crop wild relatives in its program.

- 5) Bill Tracy and Pat Flannery gave a brief synopsis in the field of the sweet corn research and breeding program. Four endosperm types, multiple genes controlling various aspects of sweetness, conversion of sugar to starch, and 'mouth feel,' are investigated and evaluated. Diverse, tropical sweet corn germplasm is introgressed into high quality elite temperate backgrounds. U WI sweet corn lines are extensively licensed.

Wendy Wintersteen, ISU College of Agriculture and Life Sciences Dean, stressed the value of the NC-7 RTAC participants' information exchanges. She stressed the importance of demonstrating impact and public return on investment in germplasm research and utilization. The NC-007 project revision submission was reviewed and approved, and the NCR AES Directors have approved its budget.

Substantial efforts are being made to improve public understanding of the importance of food and agricultural research, to elevate the importance of investment in agriculture, and to differentiate the mission of agricultural research from those of NSF, NIH, etc. Partnerships between NIFA, ARS, ERS, NASS, and the universities are critical to accomplishing mission. The REE Agencies' budget collectively is just under \$3 B, and federal investment in agriculture research must be doubled to retain global competitiveness. The Supporters of Agricultural Research (SOAR+ website provides insightful information, <http://supportagresearch.org/> . The Foundation for Food and Agriculture (FFAR) was created in 2014 and allocated a one-time investment of \$200 M, <https://foundationfar.org/> . It provides a source of matching funds for research initiatives. Of note, the new Natl. Academy of Science Prize in Food and Agricultural Science was awarded for the first time, to Edward Buckler IV, USDA-ARS Research Geneticist & Group Leader.

Gary Kinard of the Beltsville, MD National Germplasm Resources Laboratory, provided an update via teleconference on the status of the Plant Exchange Office, plant explorations and acquisitions, on the GRIN-Global System's continued development, and on the hiring of taxonomist Melanie Schori. Dr. Schori will have a full year working with taxonomist John Wiersema on GRIN taxonomy, providing continuity for this valuable resource that is used by taxonomists globally.

Peter Bretting, USDA-ARS, provided an update on the status of the National Plant Germplasm System as a whole, its historical funding status and resource needs, and continued global demand for plant genetic resources. From 2011-2015 NPGS genebanks distributed more than 1 M samples, which directly impact reduction of crop vulnerability in multiple ways. From 2005 to 2015, the purchasing power of the NPGS's budget has declined substantially. If funding continues at current or further reduced levels, choices must be made in how resources are devoted with germplasm maintenance the highest priority, and characterization, evaluation and distribution lower priority. Amy Iezzoni illustrated the example of the Davis, CA clonal repository's decision to no longer distribute budwood to homeowners due to resource constraints. The genebank does distribute to a group that has assumed responsibility for further distribution. Peter indicated that acquisitions will continue, but focused on germplasm at risk of loss, Crop Wild Relatives (CWR), and towards unique opportunities to acquire important genetic resources to resolve production challenges. The collections are heavily biased towards diversity at the cultivar level rather than to CWRs. It is crucial to conserve valuable germplasm developed by breeders and other scientists as they retire and institutions no longer will maintain them. NC7 participants were encouraged to let curators know of important collections available for transfer to the NPGS upon retirement of key scientists and developers. An update on the US implementation of the International Treaty for Plant Genetic Resources for Food and Agriculture (ITPGRFA); NPGS germplasm distribution

policy for germplasm associated with the Standard Material Transfer Agreement (SMTA) is being developed.

One-third of the current NPGS genebank personnel positions will become vacant during the next few years; it is critical to develop training for new plant genetic resource (PGR) personnel. A conference is scheduled in 2018 to bring thought leaders together to develop training strategies. An international, distance-learning, modular training program may be needed, as well as multiple training pathways.

Melanie Caffé, incoming RTAC member from South Dakota State University, provided a thorough update on research activities at the SDSU, including alfalfa stress tolerance, improved cold tolerance, and factors that impact alfalfa persistence in grazed rangelands. Other research accomplishments included use of sea wheatgrass as a source of biotic and abiotic stress tolerance; identification of wheat genotypes resistant to tan spot disease or stem rust resistance and sensitivity to pathogen toxins; the development of diverse synthetic hexaploid wheats from wild ancestors; use of rye for wheat improvement; and her own research phenotyping diverse oat accessions and evaluating them for winter hardiness and survival in South Dakota.

Stephanie Greene provided a report detailing the status of collections held at the Natl. Laboratory for Genetic Resources Preservation (NLGRP) in Ft. Collins, CO. A substantial effort has been made to identify tropical maize germplasm that can be transferred to the NCRPIS for active curation and distribution.

Candice Gardner reported changes in NCRPIS staffing during the past year due to retirements, departures, new hires and promotions. Currently three permanent and two term federal positions are vacant, and cannot be filled until Congress determines FY18 funding levels. LED lighting is being installed in NCRPIS greenhouses over time due to both financial constraints and the need to upgrade electrical infrastructure to support them. Staff members have observed improved plant health and seed production using LED lighting as opposed to the old lighting. Individual project details are described in the annual report.

Amy lezzoni reported on sour cherry germplasm research at MSU pertaining to root rot resistance and graft compatibility with various scions progressions. Armillaria root rot forces growers to move to non-infested fields, and there is no effective control for soils contaminated with the fungus. Crop wild relative germplasm is needed for sources of genetic resistance; quarantine regulations make it almost impossible to access these resources. A strong genomics team from Clemson is searching for solutions to Armillaria. Rebecca Grumet's Cucurbita research focuses on disease resistance. New researchers are breeding and utilizing genomic information and bioinformatics in the strawberry and blueberry programs. Potato researchers are collaborating with ARS researcher to turn potato, a polyploid crop, into a diploid crop in order to facilitate crop development. An MSU soybean researcher studied Chinese literature to identify plant genetic resources suitable for pyramiding genes for aphid resistance, and collaborates with a Univ. of Minnesota researcher on this project.

Burton Johnson presented research on screening new crops for adaptation. Although 56 new crops have been evaluated by NDSU faculty, only sunflower and canola have been successfully adopted by growers. One county in ND produces 85% of the canola grown in the US. Permits allowed pilot testing of industrial hemp production on 3,000 acres in ND this year by 35 growers, and producer interest as measured by field day attendance is high. Hemp seed is valuable as dehulled grain and is very profitable; 337 bu/ac corn or 117 bu/ac soybean or 154 bu/ac wheat production would be required to produce the same return per acre. Hemp is a short day plant that can move south. Marketing fiber has

been unsuccessful, and it is burned off in the spring. Germplasm availability is limited. Funding constraints are impacting the number of NDSU breeders and their work.

Theodore (Ted) Hymowitz described how soybean was introduced to North America, the search for germplasm sources that did not have the SP-34 allergen nor a trypsin inhibitor, and progress of research to use this germplasm as a source of animal feed. He utilized library resources to determine how the soybean cyst nematode was introduced unintentionally to the US along with import of soil, the purpose of which was to introduce nitrogen fixing *Rhizobia*.

Erik Sacks reported on *Miscanthus* research, and trials of hybrids between *Miscanthus sinensis* and *M. sacchariflorus* across a gradient of daylength environments in the US. In the north, plants are shorter, and a seed dormancy response is epistatic to flowering. A reference genome will be published in 2018. Quarantine is a significant issue to accessing *Miscanthus* from Asia. Erik has been offering a two credit PGR course at the Univ. of Illinois in plant genetic resources; few students enroll.

Mike Stamm reported (via teleconference) on canola growers' experience in the Southern Plains; production was good in 2017, and acres in TX and KS combined doubled from the year before. Wheat price dictates what growers plant. Since 2010, Kansas State University has released 10 canola varieties which are actively licensed. In 2016, 500,000 acres were planted to these varieties.

Aaron Lorenz described the history of soybean research at the Univ. of Minnesota from the 1940's to present. Variety development targets conventional, tofu, and natto markets. Soybean cyst nematode research focuses on identifying germplasm with alternative genes for resistance; 90% of MN soy acres were planted for 40 years that used a single source of resistance. Eighty five % of soy varieties' ancestry trace to 18 landraces, and primarily a variety called Lincoln. Collaborative high throughput screening investigations focus on identifying biochemical mechanism(s) of resistance, and genomic prediction for complex traits.

Terry Isbell of the USDA-ARS research at Peoria, IL discussed renewable jet fuel feedstock development research supported by NIFA, and the HRJ grant structure which supports genetics, stress trials, processing and conversion, economic and life cycle analyses, systems analyses and product acceptability assessment, and education and outreach. Of all oilseed taxa tested, only camelina survived every winter; if winter camelina yields with canola, it is the best candidate for jet fuel feedstock development. Another consideration in application of oilseed meal is whether the meal contains erucic acid, which is used to plastic manufacturing to keep plastics from sticking together, is toxic in feed and food products, and not an issue for jet fuel. Camelina meal is free of erucic acid, pennycress meal is not.

Thomas Lübberstedt, Iowa State University discussed research on maize viruses and germplasm resources being used to determine genetic basis of resistance. Three lines are showing complete resistance to sugarcane mosaic virus (SCMV), and two major genes are involved. SCMV in association with MCMV has resulted in the maize lethal necrosis (MLN) crisis in African maize production. CIMMYT has been screening tens of thousands of lines and accessions in Africa. Part of the challenge is the rareness of important genes, and their identification. Other research focuses on resequencing of *bm3* gene alleles (maize silage quality) and a reverse genetic approach to examine pleiotrophic effects on grain yield, a forward genetics approach to nitrogen use efficiency (NUE), and genetic prediction studies on root traits.

Jules Janick of Purdue University presented his research associated with the Voynich Codex, described as the most mysterious manuscript in the world, its history, the work of cryptologists to determine and interpret its language and meaning. All plants in the manuscript are MesoAmerican; the cities and volcanoes described are Mexican, and Aztec symbolism is used. The text combines Nahuatl, Taino, Spanish, Arabic and other languages; it is valuable because it was created by a native, and the work was evidently not filtered or censored by government or church authorities. Dr. Janick has served as the NC7's RTAC member from Indiana for xx years. Next year the baton will be passed to Dr. Lori Hoagland.

Resolutions: Burton Johnson and Terry Isbell provided NC7 RTAC resolutions.

i.) Whereas be it resolved that the NC7-RTAC committee extends our deepest appreciation to Bill Tracy for hosting and chairing an excellent meeting in education, entertainment, food, and fellowship and to the faculty and staff who shared their expertise and informed us about their research objectives and progress, facilities, and capacities.

ii.) Whereas be it resolved that the NC7-RTAC committee extends our most heartfelt thanks and admiration to Jules Janick and Ted Hymowitz for attending and enriching our meeting

Future NC7 RTAC meetings: 2018 – Ames, IA, August 14-16; 2019 – IL; 2020 – Minnesota;

The meeting adjourned at 12:00 on August 17th.