**June 3-4 2015 - NC7 RTAC Meeting, North Central Regional Plant Introduction Station**

**1305 State Ave, Ames, IA**

Participants:

Wendy Wintersteen, AA;

RTAC members: Thomas Lübberstedt, Terry Isbell, Burton Johnson, Michael Stamm, Erik Sacks, James Orf, Dipak Santra, and Jules Janick

Other participants: Manjit Misra, Kendall Lamkey, Marty Spalding, Maria Salas, Catherine Bonin, Matt Liebman, Peter Bretting, Gary Kinard, Stephanie Greene, Jessica Barb

NCRPIS staff: Candice Gardner, Mark Millard, Kathy Reitsma, David Brenner, Dan Barney, Jeff Carstens, Laura Marek, Larry Lockhart

Wednesday, June 3

*Manjit Misra, Dir. of ISU Seed Science Center & BigMap*, Chair of the NPGCC; Presidential Initiative (Global Food) welcomed the group. Dr. Misra provided an update on the status of food production in Sub-Saharan Africa, and ongoing projects to address development of National Seed Health Systems in Africa. Twenty four African countries are food-insecure; 80-90% of African farmers do not use quality seed, essential for food security. A Gates-funded project in Nairobi (SEMI) uses the ISU Seed Science Center as their model, and provided online M.S. training in Seed Technology and Business.

The Global Food Security Center (GFSC) has six research platforms, and integrates plant and animal science. Projects include Ag Trafo in Ghana, designed to strengthen the private seed sector, build government capacity, provide training in ‘knowledge management’, and develop seed programs and seed labs. Training of key faculty is important to Africa, as well as tailoring programs to meet African needs. Iowa State University is a signatory member of ‘PUSH’, or Presidents United to Solve Hunger, via the United Nations.

Dr. Misra chairs the U.S. NGRAC, or National Genetic Resources Advisory Council, which advises the Secretary of Agriculture and the National Genetic Resources Council on matters including market needs, quality seeds, ongoing evaluation of commercially available non-GM and organic seed varieties, and the value of genetic resources. Many issues could arise in the next 50 years that will require diverse genetic resources; currently genetic resource management and research is underfunded.

*Wendy Wintersteen, NC7 Academic Advisor, ISU Dean College of Agri. & Life Sciences*

The NC7 Project is one of the few examples where the Agricultural Experiment Stations contributes funding to support multi-state programs. The Chair of the Association of Public Land Grant Universities spoke with the Secretary of Agriculture on January 20th about the importance and state of genetic resources management and utilization.

The Plant Introduction Station and Iowa State University have very close and positive interactions, with the integration of personnel, facilities, and joint training of students.

The Agricultural Experiment Station Directors have streamlined the midterm review process for MultiState Projects, reducing bureaucracy. It is very important to have NC7 impact statements in NIMSS, and for participants to report for colleagues, not only themselves. NC7’s project midterm is in 2015.

Issues of high importance include germplasm conservation and utilization, protection of pollinators, and increased general funding to agricultural research to address critical issues. All federal funding directed to agriculture research totals approximately $2 B; NASA is funded at $7 B, and NIH at $30 B.

Iowa State University is the largest undergraduate location in the Land-grant University system after Texas A&M and UC-Davis. Growth in the student population is positive, but comes with challenges.

*Gary Kinard, USDA-ARS, Nat. Genetic Resources Laboratory (NGRL) Research Leader*, Database Management Unit and Quarantine Research Update (via phone), addressed Plant Exchange Office personnel changes. There has been no reduction in funding, and a modest amount of funding is still available for explorations. Most of the recent explorations have targeted domestic germplasm acquisition. Foreign explorations are fewer in number due to denial of U.S. access for a variety of reasons, including lack of ratification by the U.S. of the ITPGRFA, or unacceptable terms for access.

International distributions generally require phytosanitary inspection certificates, which are obtained via USDA-APHIS, or through state agricultural inspection services (in Iowa, it is IDALS) for a fee basis. Distributions come from the NPGS sites to APHIS in Beltsville for inspection, and each inspection costs $61 (will increase to more than $80 soon), and the shipments together with their import permits and phytosanitary inspection certificates are send via U.S postal mail internationally. ARS does not have authority to recoup these fees, the NPGS sites have contributed part of the expense some years, and Agency funds have also been requested to enable shipments to continue.

Many countries’ postal services fail to ever deliver the shipments. UPS and FedEx are prohibitively expensive for the NPGS to use for international shipments until a requestor provides an account.

The NGRL continues to have multiple personnel vacancies and will recruit an additional developer soon.

The GRIN-Global System, designed to replace the legacy GRIN System, is undergoing security audits, a new requirement for federal software systems, which has further delayed release. It is not possible to predict when the requirements will be met and implementation can occur. Internationally, The Czech Republic’s GRIN-Global system is now ‘live’, four other genebanks have implemented, and several of the CGIAR centers are close. CIMMYT was the first genebank to go into production with a live public interface. Dan Barney and Mark Millard commented on how GRIN-Global facilitates and accelerates their curatorial information management tasks and workflows.

*Peter Bretting, USDA-ARS, Office of National Programs* – NP301 Update (via phone). Dr. Bretting’s report was circulated and discussed. The Plant Zone Hardiness Map has received wide acceptance and the website receives heavy use. More than 500,000 accessions are held in the NPGS collections. Germplasm distributions increase each year. NPGS funding remains at essentially 2008 levels. The seed-based stock centers are better supported than the vegetative (clonally propagated) stock centers, which are severely challenged. Management of genetic and genomic stocks is challenging, and the number of accessions has exploded as a result of research funding, but collection management funding has not followed. Management of genetically engineered stocks and ensuring freedom from adventitious presence are costly, and sites are analyzing best practices and methods to achieve objectives while minimizing costs.

Genebank efforts must be prioritized due to resource constraints, and those priorities are Maintenance, Documentation, Acquisition, and Distribution, followed by research and breeding.

DivSeek Iniitative: 58 international partners are partnering to characterize genetic diversity and facilitate utilization. DivSeek aims to bridge the gap between the information requirements of genebank curators, plant breeders, and biological researchers, to support applied germplasm curation, forward-looking breeding programs and strategic research. This is important to address food security challenges in the face of climate change.

ARS’ Big Data Initiative is a high priority. Objectives have been established for the 2015-2019 period. ISU is a key partner in this initiative. The private sector has invested substantially in this area, and the public sector is trying to develop necessary capacity to support investigations using enormous, complex and diverse datasets.

*Candice Gardner, USDA-ARS, NCRPIS, and NC7 Coordinator* – budget presentation and NCRPIS highlights

The annual report of the North Central Regional Plant Introduction Station was distributed, and highlights discussed. The collections now number more than 52,000 accessions and about 42,000 are available for distribution. More than 40,000 packets are distributed annually, and more than 25% of the unique accessions are distributed annually. Handling of non-research requests continues to command time and resources to communicate and cancel, a challenge we have not been able to resolve. More than 700 new accessions were acquired during the year, largely of *Helianthus*, *Fraxinus*, wild *Daucus* and other Apiaceae.

Highlights included the publication of the results of phenotyping and genotyping 2500+ maize inbred accessions (Romay et. al., 2011), and the lessons learned about diversity of temperate private and public sector maize lines versus those originating from the tropics. The maize curator discussed the IBS (Identity by Sequence) tool he developed that allows a user to query based on relationships between lines or contrast lines, available via MaizeGDB, at <http://alpha.maizegdb.org/TYPSimSelector> . The 300 diverse maize lines that were used in the Nested Association Mapping Panel.

A sunflower association mapping panel of 288 lines was phenotyped, genotyped, and is available.

The funding sources that support NCRPIS activities include $523 K Hatch MultiState, $2.3 M USDA Plant Introduction CRIS, $1.2 M USDA Germplasm Enhancement of Maize CRIS, ISU’s Agri. Experiment Station provides benefits for all ISU staff at the station and more than $400 K as in-kind support.

There were seven vacancies at the time or printing of the annual report. There is a backlog of positions in ARS, and hiring process is slow. The Agency is hiring contractors to attempt to make progress on the backlog. More retirements are anticipated in FY2016.

Facilities – The NCRPIS is a designated mission-critical site due to the importance of the germplasm collections. Homeland Security requirements (HSPD 12) necessitate the replacement of the station’s access security system with a Lenel System, which will tie the NCRPIS facility’s security system with USDA headquarters. The original system was installed in 2003 at a cost of about $300,000, following 911 and security requirements at the time. Funding will be provided by ARS HQ.

Funding was provided by the MidWest Area and ARS Headquarters for a backup generator system for the station; a Statement of Work was developed and the project was submitted for bidding. Three diesel powered backup generators are to be installed to provide power for the station.

During the 2015 summer, the NCRPIS headquarters building and the GEM cold seed storage building’s roofs will be coated with a polymer product to extend the lifetime of the roofs and fix leakage problems. ARS CRIS project funds ($25 K) support this work.

*Stephanie Greene, USDA-ARS Curator, Natl. Center for Genetic Resource Preservation,* via phone provided a report that was distributed and discussed. It enumerated various personnel changes at Ft. Collins, which like many sites is undergoing turnover due to retirements. Backup status: 82% of the NPGS seed collections are backed up at the NCGRP, while 15% of clonal accessions are backed up. A number of clonal species are backed up via cryopreservation methods, and methods are being developed for other species. In 2015, about 19,300 accessions were shipped to Svalbard (Global Seed Vault) for backup. About 38% of these came from the NCRPIS. Ft. Collins monitors germination of the backup holdings; currently they have capacity to conduct about 3,000 tests per year, which is much less than needed.

*Marty Spalding, Iowa State University Assoc. Dean, Liberal Arts & Sciences* – Presidential Initiative on Genome Editing. Dr. Spalding presented information on ISU’s Crop Bioengineering Consortium (CBC), the CRISPR/Cas genome editing technology, and ISU research initiatives to advance capacity to use CRISPR/Cas for research and crop improvement. CRISPR/Cas is a novel technology that can produce bioengineered crops that contain no transgenes. The CBC focuses on four key crops, maize, soybean, sorghum and rice, and capitalizes on ISU’s core strengths in genome editing, crop transformation, crop genetics and genomics. The CBC also explores regulatory, economic and societal implications of new breeding technologies.

*Robin Pruisner, IDALS, & Charlie Block, USDA-ARS and NCRPIS* – Phytosanitary issues update

Dr. Block gave the presentation on behalf of Dr. Pruisner, who could not attend. Pathogen assay demand is increasing. Cucumber green mottle mosaic virus in California has emerged as a new production threat. This disease is also a problem in Australia. Phytosanitary certification demand has also increased; the Iowa Department of Agriculture and Land Stewardship (IDALS) is the authority that inspects and issues these in the state of Iowa.

At the NCRPIS, phytosanitary activities include field inspections, seed health testing; fungicide seed treatment; and disease management programs. The most important phytosanitary maize disease is Stewart’s wilt. Field inspections or ELISA testing of seed lots is required for export, depending on the destination country. All imported squash seed is tested for squash mosaic virus, and all plants grown for seed increase are tested; positive plants are eradicated.

All seed health test results are documented in the GRIN database; pathology data is referenced for those seed requests that required ‘declarations’, and used to track occurrence in regeneration lineages. In 2015, the lab provided data for 120 declarations for international shipments.

*Ursula Frei & Thomas Lübberstedt, Iowa State University Doubled Haploid (DH) Facility*

Thomas Lübberstedt provided information on the background of the facility, its service and research functions, and operations. Because all chromosome pairs are identical in a diploid doubled haploid organism, there is no heterozygosity. DH lines are highly desirable for genetic and genomic research for this reason; the DH Facility was created in response to need demand for infrastructure to support research objectives. A research community has developed to understand the phenomena of haploid induction and doubling, and to enable development of DH technology for other crops. Drs. Frei and Lübbersted have developed new haploid induction lines which are licensed by ISU.

*Maria Salas, ISU Agronomy faculty*, provided a description of the sorghum breeding program, germplasm materials, traits of interest, and the current status of research and line development programs.

**Field tours:**

NCRPIS field tour: Laura Marek, Oilseeds Curator & Jessica Barb, ISU Agronomy faculty

Agronomy Farm: Matt Liebman, ISU Agronomy faculty – diversified cropping systems

Catherine Bonin, Postdoctoral Researcher – bioenergy crops

*Norman Cloud, Kemin Industries*, ([https://www.kemin.com/en](https://www.kemin.com/en%20%20) )pprovided a presentation that informed the RTAC of Kemin Industries’ unique research and alternative crop products for animal nutrition and health, dietary ingredients and much more. There are many challenges associated with new crop development, product development, and quality assurance, and their use of plant genetic resources to address these challenges was of high interest.

**RTAC Member and Curator presentations:**

*Dipak Santra, Univ. of Nebraska*, via speakerphone, presented the Proso millet breeding program, which aims to release improved millet varieties for a wheat-millet-fallow cropping system. Trait targets include yield, maturity, uniformity, seed quality, and non-shattering. It is used as bird feed, and for human consumption (beer). In 2014, the variety ‘Plateau’ was released, a waxy Proso millet. Marker develop and mapping studies are under way, and a diversity analysis of 90 accessions from the NCRPIS collection is underway. QTL mapping has identified 19 individual QTLs for various traits.

*Mark Millard, USDA-ARS and NCRPIS Maize Curator,* presented information on maize curatorial efforts and collection status. Mark has devoted 35 years to curation. The collection comprises nearly 40% of the genebank’s accessions. Populations comprise 83% of the maize collections and about half are tropical and half are temperate. Inbreds account for 12%, expired PVP inbreds 2%, GEM releases 1%, and teosinte 2%. Inbred lines account for 78% of distributions. 62% of the collection is available. Mark enters citations in GRIN related to utilization of the collection’s germplasm.

*Kathy Reitsma, Iowa State University, NCRPIS Curator, Vegetables,* updated the RTAC on the condition and utilization of the vegetable germplasm collections. Vegetable distribution requests continue to increase annually. All or significant portions of the NCRPIS cucurbit collections were requested, and appear to be driven in part by the anticipated implementation of the Nagoya Protocol; in 2015, distributions were 45-60% higher for *Cucumis* and *Cucurbita* compared to 2013. All available *Daucus* accessions were sent to Pakistan for diversity evaluation. A USDA-ARS researcher in Wisconsin is collaborating with breeders in Pakistan and Bangladesh on a multi-year evaluation of some of the more recently collected *Daucus* germplasm for heat and drought tolerance. The Ocimum (basil) collection has also been highly requested primarily for evaluation for downy mildew resistance, genotyping and oil analysis. More than 570 non-research requests (home gardeners) were received in 2014 for vegetables alone, which cannot be honored.

Recent efforts focus on *Daucus*, *Cichorium* and cucurbits regeneration, *Daucus* taxonomy, handling collections made in Turkey by Phil Simon and David Spooner, and the project to evaluate and molecularly characterize *Daucus* and allied Apiaceae for taxonomic revision. Phytosanitary issues are critically important to the quality of the vegetable germplasm; accessions are routinely tested for squash mosaic virus and bacterial fruit blotch, seed-borne diseases. 2014 Regeneration efforts focused on Cichorium (chicory) due to aging seed lots (1988 and older) with declining viability, new Daucus acquisitions, and aging stocks of cucurbits or hard-to-handle accessions (greenhouse).

*Dan Barney, USDA-ARS and NCRPIS Herbaceous Ornamentals Curator*, (joint presentation with Jeff Carstens, USDA-ARS Woody Ornamentals Curators) described the NC7 ornamentals collection as comprised of 500 medicinal, 200 mints,1000 herbaceous ornamentals, and 1800 woody landscape accessions. These germplasm are used by research institutions and breeding companies in the US and internationally, botanic gardens, and producers. They are requested for use in crop development and production, insect protection, extension outreach, development of alternative crops, morphological and biochemical characterization, gene discovery, education, evolutionary studies, archaeology, anthropology, art, regulatory activities, botanical gardens, environmental restoration, and to support pollinator populations.

*David Brenner, Iowa State University, NCRPIS Amaranth, Quinoa & other crops Curator*, described the diversity of the many species of *Amaranthus* (3000 accessions), grasses, legumes, umbel, and quinoa. Many seed lots are old and regeneration is needed. Contamination by weed pollen is a problem when regenerating *Amaranthus* in the field, necessitating use of greenhouse resources. Research on breaking of seed dormancy led David to use medical oxygen concentrators to break seed dormancy with some success. The quinoa collection has been in high demand, particularly for research aimed at temperate environment production, perhaps as a late season or as a winter crop in the south when temperatures modulate. David continues to work on lodging resistance and reduced plant stature in *Amaranthus*, and identifying sources of male sterility resistance, a common germplasm request.

*Thomas Lübberstedt, Iowa State University* - presented information on the urgency of identifying germplasm resistant to MLN, or Maize Lethal Necrosis, a devastating viral disease in Africa. There is an urgent need for identification of MLN resistant donors, and CIMMYT is conducting extensive screening efforts in Kenya. A systems approach is needed, incorporating pathology, breeding, agronomic management. Complicating disease control are ever-present vectors and ever-present sources of inoculum. One research foci of the Lübberstedt lab is on sugarcane mosaic virus, and fine-mapping of Scmv1/Scmv2 genotypes, identification of useful QTLs and haplotypes. Collaborative research efforts on the issue include CIMMYT, USDA-ARS, ISU, the Univ. of Hohenheim, Univ. of Halle, Technical Univ. of Munich, Univ. or Arhus, multiple international breeding companies, and West African researchers, particularly those of Kenya and Tanzania. (It was suggested that Mexican Dent be checked out as a potential additional virus resistance source.)

*Bill Tracy, Univ. of Wisconsin – Madison* described the importance of the sweet corn to the agricultural industry in Wisconsin. Used fresh and for processing, the most common endosperm types include supersweet (for shipping and processing), sugary enhancer (fresh market), and sugary. Other valuable genes include brittle, and shrunken-2. Evidence suggested that sugary1 was domesticated as many as five times. New types of sweet corn use the Su2-I allele, or by interaction of su1 with another gene (dose dependence). UW-Madison has established a diversity panel of sweet corn lines. Of increasing interest is marketing of ‘culinary corns’ to chefs interested in developing offerings utilizing the flavors

*Burton Johnson, North Dakota State University*, Plant germplasm importance to agricultural sustainability. The North Dakota Agricultural Experiment Station and North Dakota State University are devoted to serving the producers, agricultural community and citizens of North Dakota to enhance agricultural sustainability. In the College of Agriculture, Food Systems, and Natural Resources the Dept. of Plant Sciences has 14 crop breeding programs focused on developing new and improved germplasm, including some crops with multiple market classes. Improved germplasm has improved resistance to abiotic and biotic stresses. The improved germplasm also has improved end use quality that is desired by those who use and process the harvested seed in many value-added businesses in North Dakota.

*Jules Janick, Purdue University* provided information about Horticultural Reviews and the history of Plant Breeding Reviews, both major scientific journals he has been responsible for as editor for many years.

*Eric Sacks, University of Illinois*, discussed new crop development at his institution. Eric’s research is devoted to collection of *Miscanthus* genetic resources and characterization of their genetic diversity, and trait association analyses. There are about 200 accessions of *M. sinsensis* and 850 of *M. sacchariflorus*. *Miscanthus* is useful for biomass for energy production, animal bedding and feed, and fibers. Other genetic resource utilization research at the U of Illinois include woody biomass (G. Kling, black locust, or *Robinia*); soybean cyst nematode and aphid resistance from PI accessions (B. Diers); and use of the maize Nested Association Mapping panel, ex-Plant Variety Protected lines, and the Illinois long term selection populations (S. Moose).

*Terry Isbell, USDA-ARS-NCAUR, Peoria, IL* summarized the focus of research operations in his laboratory. The number of sample fatty acid composition analyses have been decreased due to decreased CRIS support for these activities, and reduced allocation of support staff (from 1.0 to 0.5 person-years). In the past year, they support analyses of 4900 soybean, 400 *Brassica*, and 100 *Thlaspi* samples. Breeding efforts with *Thlaspi* focus on selection of non-dormancy, in order to reduce improve stand establishment and reduce weediness in subsequent seasons.

*Jim Orf, University of Minnesota,* described his program utilizing diverse soybean germplasm. Current commercial varieties trace back to few germplasm sources. Glycine soja and Glycine max crosses are utilized to introgress novel alleles. All USDA collection accessions have been genotyped with a 50k SNP chip, and most accession have phenotype data. The question is how to use the information. Early maturity groups have been under-investigated; most acreage expansion opportunity is in states like ND. This is partly due to changing climate, milder seasonal weather in northern areas and more precipitation. NIR is used to look at various quality traits. He is interacting with companies for exotic material evaluations and to introgress yield QTL. PI accessions are useful for special purpose and food grade breeding (export to China). It is challenging to know what germplasm contributes to commercial varieties as companies report yield data, but not whether materials is used in their breeding programs.

*Mike Stamm, Kansas State University,* reported on status of winter canola production and research efforts. Winter canola acres steadily increased to 300k until 2013/14, then decreased due to drought in 2014/15. Kansas production acreage is stable, but the 2015 harvest will be affected by early winter kill which occurred too early in November (there was no acclimation period and no snow cover). Further south extended rains were problematic for harvest. There has been an increase in winter canola hybrids in the national winter canola variety trials, with open pollinated variety numbers less than 50%. Kansas State has collaborative agreements with a variety of partners on canola development. Roundup ready varieties are released and licensed to companies such as Monsanto. Research and service agreements with Monsanto, INRA (cms germplasm), NDSU, Haplotech, and USDA enable progress on many fronts, including herbicide resistance, development of male sterile germplasm, and others.. A collaboration with Oklahoma is focused on blackleg resistance. Other traits under selection include for low growing point near the soil surface and semi-dwarf habit. Quality traits will be pursued in the future. 12:00 – 12:30 New Business, Resolutions, Nominations

**New Business:**

*Discussion on sites of future meetings:* The group recommended that the 2016 meeting be held at the University of Wisconsin-Madison, WI, the 2017 meeting at the University of Minnesota, and the 2018 meeting in Ames, IA>

*Resolutions Committee (Jules Janick and William Tracy):*

\* The RTAC is concerned that there ARS has no authorized means to recover costs associated with the issue of phytosanitary inspection certificates, seed shipments, and adventitious presence testing for genetically engineered crop accessions. Be it resolved that ARS devote attention to developing a method of recovering costs for these concerns and the authority to do so.

\*Five crops have potential for acquisition of accessions that may have transgenes (as their intellectual property protection expires), maize, soybean, sugar beet, canola and cotton. The RTAC believes that providers of these accessions need to provide documentation concerning the transgenes.

\*The RTAC is concerned about insufficient back-up generator protection at the NCRPIS, and encourages completion of this project as soon as possible.

\*Thanks to Dean Wendy Wintersteen who hosted the June 3 evening dinner and guest speaker.

\*Thanks to Thomas Lübberstedt, Candice Gardner, and the NCRPIS staff for their efforts in organizing and hosting the NC7 RTAC meeting.

\*Sincere thanks to the guest speakers for their excellent, informative presentations.