

2014 NC7 RTAC Meeting, Four Points by Sheraton Hotel, West Lafayette, IN, Aug. 11-12, 2014

Notes taken by P. Jourdan

Participants: Wendy Wintersteen, Jessica Barb, Candice Gardner, Terry Isbell, Jules Janick (host), Burton Johnson, Pablo Jourdan, Larry Lockhart, Laura Marek, Erik Sacks; via teleconference, Peter Bretting, Gary Kinard and Stephanie Greene

Monday, August 11

Host & Chair Jules Janick introduced **Purdue University's new Horticulture Dept Head, Hazel Wetzstein**, who provided information on her extensive background and her perspectives on genetic resources and their relevance for agriculture, nutrition, economic development and societal welfare. Purdue is investing in a Plant Science Initiative, hiring 10 new faculty members, and will develop plant transformation facilities.

Wendy Wintersteen, NC7 Academic Advisor and ISU Dean College of Agri. & Life Sciences, provided an update on NC7's budget. 'Holding our own' is generally good news. She noted that the Board on Agriculture (deans and directors of Exp. Stations & Extension) hired a lobbying firm to keep the message of the importance of agriculture up front and to emphasize the need to keep supporting research, interacting with Congressional members and their staff who influence funding decisions. Federal funding of AFRI research of \$2 billion contrasts sharply with NIH & NSF funding of \$30 billion. A new Foundation for Agriculture and Food Research has been authorized by Congress at \$200 million, to be matched 1:1 by the private sector. Science and public policy are critical, as is communicating need for agricultural research priorities. We need to move forward with information. Research publications need to acknowledge plant genetic resource use.

Partnerships such as those between the Land Grant Institutions and ARS are being reviewed across the nation; everything is under the microscope due to financial pressures and few options. The Dean urged RTAC members to continue their advocacy of the NC7 Multistate Project to Exp. Station Directors, emphasizing the critical importance of genetic resources. Amy Iezzoni recommended that we take impact statements as these are crucial for marketing and communication of relevance and importance.

Candice Gardner, NC7 Coordinator reported on the NC7 and NCRPIS budget and NCRPIS highlights.

There was general discussion on genetic resources, challenges, issues (much related to funding). It was explained that upon expiration of Plant Variety Protection (PVP), these materials by law must be made publically available, regardless of other regulatory restrictions and intellectual property rights. A disclaimer is provided to recipients indicating other intellectual property rights may be applicable. There is very high demand for expired PVP genetic resources: since 1994, Pioneer's ex-PVPs have been requested 16,500 times.

Germplasm continues to be distributed free of charge; USDA views these as contributions to a multilateral world for food security. ARS policy is to distribute germplasm for research and educational purposes. Expense: on average, we estimate that it costs about \$600/seed lot to regenerate a heterozygous, outcrossing germplasm accession such as those conserved by the NCRPIS. Costs are considerably lower for self-pollinated species.

In response to a question about whether there are GMO's in NC7's collection and how they are handled, currently there are none. When PVP certificates expire for GMO germplasm they will be accepted, segregated and handled according to protocols developed for the purpose of maintaining genetic purity of all accessions.

Budget & Collection Stats: NC7 funding for FY2014 remained steady at \$522,980, thanks is expressed to the AES Director for their continued support. ARS funding for both the germplasm and GEM CRIS projects increased by about \$160 K, with instructions to increase support for maize curation and information management. The total ARS funding is now approximately equal to FY2010 levels. Availability of collections overall is 76%, ranging from 47% to 87% by crop curator, and 80% of holdings are backed up at the NCGRP. Attempted regenerations in FY2014 have been substantially increased, reflecting capacity to hire the temporary student labor needed for these efforts.

The development of the GRIN-Global System continues to progress, and NPGS implementation is anticipated in the first quarter of 2015. CIMMYT has already implemented GRIN-Global, as has the Australian national grasslands genebank, and Canada is not far behind. Other entities are testing.

NCRPIS Staff changes: Congratulations to Jeff Carstens, who was promoted to a CAT III Horticulturist. GEM Coordinator and maize geneticist Michael Blanco retired in June, and this position is vacant. There are five vacant ARS technical positions at NC7, and more than 400 scientific vacancies in the ARS agency.

Stephanie Greene, Curator, Natl. Center for Genetic Resource Preservation (NCGRP), USDA-ARS.

Stephanie introduced herself as new seed curator at NCGRP (vice Dave Ellis position); excited for new opportunity and seeking to keep the tradition of excellent service from NCGRP. She reported that 1321 unique accessions are held at NCGRP of NC7 taxa that are not yet in the Ames genebank. NCGRP now holds backup inventory for ICRASAT and also for CPC (Center for Plant Conservation) network germplasm. Backup across all germplasm sites in the NPGS averages 82% but there is a large range in the amount of material in safety backup between sites. More than 100,000 accessions are now backed up at Svalbard also. Christina Walter's group focuses on research that will support conservation practices, including predictive viability assays, population sampling, and cryopreservation of germplasm that cannot be maintained as seeds.

Laura Marek, ISU Oilseeds Curator at the NCRPIS provided an update on oilseeds work (see report) Note: *Vernonia* is now exclusively North American; genus revision placed the African species to another genera. Laura has done extensive collecting across the southern tier of the U.S., and the mountain west to expand the genetic and geographic representation of *Helianthus* taxa. She works closely with the sunflower research community, and with Dr. Jessica Barb of ISU as a close collaborator.

Gebisa Ejeta, Purdue Distinguished Prof. and 2009 World Food Prize Laureate provided a wonderful overview of his work as a breeder and much inspiration.

Some notes:

“Plant Breeders are God's People”

Appreciate the power of genetic variation

Work on germplasm enhancement programs

Germplasm: source of genetic variation; raw materials; tools for breeding

There is great power in characterized germplasm

Key attributes being sought: ecological adaptation; productivity and yield; emphasis on biological efficiency.

“Natural variation is crucial for gene discovery” – especially natural variation for discovery of phenomena.

Genetic resources conservation: lack of functional in-situ conservation, especially in old world where critical crops originated.

Poor ex-situ conservation in most developing countries; lack of emphasis in research and resources

Paradigm for research has changed: lack of respect for genetic resources?

Need to develop foundational populations of plants for future problems (breeding populations).

Need to train more plant breeders, especially in developing countries. Example of great success in breeding for disease resistance.

Dr. Ejeta stated that the U.S. plant genetic resource collection is the only germplasm resource that can be accessed worldwide. He has also joined the Board of the Global Crop Diversity Trust.

Jay Akridge, Purdue University Dean College of Agriculture discussed the extensive efforts being made at Purdue to grow their agricultural research enterprise. Mitch Daniels, former Gov of Indiana, is now Purdue University’s president. He announced expanded capacity in plant biological sciences and committed \$20 million towards new faculty that will work on transforming plants to improve crops.

The Center for Molecular Agriculture: Directed by Bob Pruet; 10 new faculty; include undergraduate research; plant biotechnology curriculum development includes a Molecular Agriculture Summer Institute. Facility upgrades: to include automated large-scale plant analysis; the 1100 acre agronomy farm becomes one large phenotyping lab; enhanced facilities; seed storage. Promote student entrepreneurship (sensors, drones, etc). Commercialization of products will be important.

Purdue University’s Soybean Center has about 40 faculty who ‘touch’ soybean in some way

Meeting note: Burton leads the Resolutions subcommittee; Amy the nominations subcommittee.

An outstanding tour was provided by Jules Janick and Purdue staff of the Purdue Agricultural Experiment Station tour of the Agronomy Farm, Daniels Turf Center, Meiggs Horticulture Farm, and new greenhouses. State of the art greenhouse technology was described and research associated with plant growth and productivity. Huge energy cost savings have been made with conversion to LED lighting with wavelengths favorable for plant growth and development. Gebisa Ejeta educated us on the development of the sorghum breeding and genetics program in collaboration with researchers in Ethiopia and other African countries. Varieties in the demonstration plot illustrated the steps taken in adaptation, reduction of photoperiod sensitivity, etc.

Jules Janick presented an evening lecture – ‘Unicorns – Tapestries, Mysteries, History and Horticulture’ Another peerless presentation by Jules Janick on Unicorns and the painter of the tapestries! Masterful research and detective work linking art, history, and botanical knowledge that increases our understanding of plants available to different segments of society throughout history.

Tuesday, August 12

Peter Bretting, USDA-ARS, Office of National Programs – NP301 Update (via phone). Twenty NPGS genebanks are spread across growing environments and Land Grant Universities. The NPGS is highly dependent on Land Grant resources for lands, facilities, students, collaborations and personnel are

closely affiliated to these schools. Use of institutional resources is being challenged everywhere. One site, Miami, FL is located on land coveted for development, but is secure for now because an endangered plant is found on site. As collections become more mature, the increase in numbers of new accessions is slowing. Demand for germplasm is steady to increasing, but demand for information is much increased.

Gary Kinard, USDA-ARS, Nat. Genetic Resources Laboratory Research Leader, Database Management Unit and Quarantine Research Update (via phone). Gary reported on specific progress made in GRIN-Global System development and encouraged NC7 RTAC users of the GRIN system to test the public GRIN-Global interface and provide feedback to the Dev Team. Due to deaths and retirements in the Unit, they are very short-staffed and hope to recruit two positions in FY14 and 15. A generational transition is occurring in staffing. Costs of phytosanitary inspection fees for foreign distributions have increased dramatically; inspections now cost \$61 and are increasing. Many thousands of inspections are required each year. Ned Garvey, who managed the inspection program, has now retired. In 2014, \$80,000 was available for plant exploration and germplasm acquisition; formerly, about \$130,000 was available each year.

Thomas Lübberstedt, Iowa State University, provided information on his research on doubled haploid (DH) technology in maize and other crops. He directs ISU's DH facility, which provides induction and doubling services for a fee. Most major maize breeding companies now have extensive work on breeding using DH lines generated from specific crosses and inbreds. A color marker (R gene) and a color sorter are used to enrich populations. Other detection methods are utilized or under development, including embryo oil content, root markers, etc. There is significant genetic variation among inbred lines for haploid induction and/or doubling rates; two inbred lines exhibit a 50% spontaneous doubling rate, eliminating the need for use of colchicine to induce doubling.

Amy Iezzoni, Michigan State Univ. Dept. of Horticulture. In lieu of a research report, Amy led a discussion of what constitutes effective impact statements. Emphasis must be placed on threats to crop production. The last report on genetic vulnerability of crops was by the National Research Council in 1991. Impact statements must address why is xx important, who care, what was, done, and the impact. We recommend that we ask the NRC to go back to '91 report and take a new look at what are the current issues with crop genetic resources.

There is much important that work be done on crop vulnerability statements so they reflect current threats to production and the resources that can be deployed to address them. We need to look 10 years back on use of different germplasm in order to assess impact, and need germplasm stories in the popular press.

Burton Johnson, North Dakota State University, described work on sunflower as an alternative crop and new crop for North Dakota. NDSU's Plant Science has a big program and especially in plant breeding in particular. There are 80 undergraduates in Crop & Weed Science and about 250 in the Dept. of Plant Sciences. There are 11 agronomic crops, one vegetable crop, and one fruit crop addressed by plant breeding programs. In three out of 11 trials, winter canola yielded very close to soybeans.

From 1907-1960, ND developed various Experiment Stations which cover an elevation range of 900-3300' and two drainage basins. Camelina, pennycress, canola, sunflowers, dry beans, pulse crops, winter spelt, and guar are all being grown commercially or being evaluated. Permit is pending to allow

industrial hemp production in northern ND; the Farm Bill allowed states with a developed process for industrial hemp to proceed; safety locked storage is required for all seeds.

Eric Sacks, University of Illinois. Eric summarized his work on *Miscanthus* as a biofuel crop. *M. sinensis* was introduced from Japan as an ornamental in the 1870's; all ornamental miscanthus originate from southern Japan. Eric described population structure analysis of germplasm in Japan and China, which shows outgroup and subgroups. Identity of a group originating from a glacial refuge environment from Taiwan to Hong Kong is very specific and unique. The NPGS funded exploration in 2012 to collect 161 *Miscanthus* clones in Russia; these are now going through quarantine and most will be maintained by Pullman, WA (W6). The Univ. of Illinois acquired about 500 each from China, Japan and Korea of *M. sinensis* and *M. sacchariflorus*, supported by DOE Feedstock Genomics grant funds.

Terry Isbell, USDA-ARS-NCAUR, Peoria, IL. Terry described results of Brassicaceae species research over the past two years, supported by NIFA's Biomass R&D initiative award. Camelina was the only crop of those tested that demonstrated good overwintering survival. He provided data that contrasted yield of oil/acre (pounds) from *B. carinata*, *B. napus*, and *C. sativa*. Burton suggested that winter canola and summer soybeans would be a successful combination for cropping systems in southern U.S. climates.

Jessica Barb, Iowa State University. Jessica described a new sunflower trait discovery and ornamental breeding research program that she initiated in 2013. Sunflower is the world's fourth leading agronomic crop with 1.5 M acres and \$727 M in production in the U.S. The U.S. accounts for 2% of global sunflower production, with 72% utilized in the U.S. and 28% exported. The project's goals are to increase yield and stress tolerance, provide for food security. Ornamental breeding enables public outreach, education, and creates enthusiasm for genetics!

Trait discovery efforts focus on self-autonomous pollination, pollination biology under stress, seed germination and vigor under cold stress, root morphology, and phenolic composition (nutrition). A sunflower association mapping population of 271 lines representing 90% of the allelic variation in sunflowers is being used.

Self-autonomous pollination is 'self-compatible' pollination that occurs without wind or insect activity. Sunflower is a self-compatible, open-pollinated crop; pollination is improved by presence of pollinators, and reduction in yield in large fields can be due to the absence of pollinators. Improving self-autonomous pollination in a crop with a four week pollination window can improve yield. Nutritional research aspects focus on reducing polyphenolics such as chlorogenic acid, an anti-nutritional, to increase protein absorption in humans. Another strategy would be to increase polyphenolics for extraction and use as anti-oxidants in processed foods.

Pablo Jourdan, Director, Ornamental Plant Germplasm Center, The Ohio State Univ. Pablo stressed relevance of their efforts to the ornamental industry. The Center maintains over 4300 accessions of 220 genera and more than 1200 species. *Begonia*, *Coreopsis*, *Lilium*, *Phlox*, *Rudbeckia* are of primary focus. 2015 will be the Year of the Lily in the ornamental industry. Challenges include propagation issues; light is required for germination of orthodox seeds types originating in the tropics. Some must be hydrated and in the dark for a year prior to germination. Some species' seeds must be gloated to germination.

Begonia grandis is the only cold hardy *Begonia* species, of more than 2000. OPGC staff has collected naturalized *Begonia* in Florida, progenitors to the wax begonia. *Phlox* has variation in polyploidy levels; polyploids are found in the serpentine barrens where chromium was mined. It is pollinated by

butterflies. Color scanning is used to predict crosses that would produce unique colors. Interspecific hybrids are frequent. *Rudbeckia* has a large genome, lots of stepwise changes, and little dormancy is observed for most species, but *R. fulgida* is highly dormant. Responses to Ga treatment vary.

New Business, Resolutions, Nominations: Any lezzoni chaired the nominations committee. Nominations accepted and endorsed by the committee: 2015: President, Thomas Lübberstedt; Secretary, Terry Isbell.

Burton Johnson chaired the resolutions committee: Resolutions by the NC7 RTAC committee: Be it resolved

- i) The NC7 RTAC Extends its greatest appreciation to: Dr. Jules and Shirley Janick and Anna Whipkey for hosting and planning a superb meeting program; to the speakers, Jay T. Akridge, Hazel Wetstein, and Gabisa Ejeta; and to the Purdue faculty, staff and students for their excellent presentations and tours - Kyle M Daniel (NC7 ornamentals), Bruce P Bordelon (grapes, pawpaw), Robert T Eddy (greenhouse tour), Gebisa Ejeta (sorghum germplasm), Aaron Patton (turf), Ben Hall (phenotyping) and Tristan Tucker (Horticulture farm and sprayer).
- ii) Suggests that a concerted effort be made to track the impact of plant genetic resources on the U.S. agricultural system.
- iii) Encourages Crop Germplasm Committees to address crop vulnerability statements.