**MINUTES OF ANNUAL MEETING**

**W5168 Multi-state Research Project**

**Michigan State University, East Lansing, MI**

**October 03-04, 2024**

The meeting was called to order by the Chair of the group, Héctor Pérez, at 8:30 AM. He welcomed the participants, and the plans and goals for the meeting were discussed. No NIFA representatives were present. Although Dr. Wei Zhang, Interim Chair of the Department of Plant, Soil, and Microbial Sciences at Michigan State University, was scheduled to deliver welcoming remarks during the morning session, he delivered them later in the day due to scheduling conflicts.

The writing committee was thanked for their efforts, and the approval of the new W5168 Project proposal by NIFA was acknowledged. Chair Héctor Pérez provided an overview of the multistate project and the program's logistics. Paul Johnson, the project adviser, highlighted the importance of impact statements. He emphasized the significance of continuing research, connecting it with the average person, and including how W5168 impacts people in their states in the impact statements.

Several opportunities to enhance the project's impact and increase participation in the group were discussed. These included expanding project objectives to invite other seed researchers, allowing more than one scientist to represent a state, and involving seed industry representatives to address industry challenges. Additionally, the proposal to recommend allocating specific USDA funds for seed science research was discussed.

Break

Reports of Research Activities, started at 10:00 AM:

**Héctor Pérez** (Univ. of Florida): Presented research on seed development, production, and quality in *Uniola paniculata* (sea oats) and its importance for coastal dune restoration. To address challenges in seed supply and quality that hinder the progress of dune restoration, collaborations were established with five state agencies to collect seeds from 18 sea oats populations over two years. Biochemical, physiological, and physical traits were studied across a large latitudinal gradient.

Key findings include:

* Higher antioxidant concentrations were common in seeds from extreme environments but did not correlate with better germination.
* Antioxidant spikes after imbibition were associated with poor germination and reduced aging stress survival.
* Traits such as surface-to-volume ratio and stable antioxidant levels during early imbibition strongly predicted extended seed viability under stress.

**Tomokazu Kawashima** (Univ. of Kentucky): Reported a greenhouse study of soybean cultivars with varying seed sizes that revealed a positive correlation between seed weight and the duration of the lag phase during seed development, suggesting a genetic link between early seed development and final seed size. Large-seeded cultivars exhibited more pavement cells on cotyledon surfaces, indicating that a longer lag phase promotes additional cotyledon cell division.

Analysis of RNA-seq data from cotyledon-stage seeds identified transcripts enriched in large- or small-seeded cultivars, with large-seeded varieties showing higher expression of cell division-promoting genes in seed compartments. These findings suggest that seed growth is regulated across compartments, and prolonged early development in large seeds results in more cotyledon cells and increased seed size.

**Sabry Elias** (Oregon State Univ.): Reported efforts to develop a qPCR test to detect annual contamination in perennial ryegrass, create a glyphosate bioassay test for annual ryegrass, and use a thermogradient table to screen cover crops for cold and heat tolerance.

**Imtiyaz Khanday** (Univ. of California- Davis): Presented research on the identification of a gene regulatory module in which male-expressed BABY BOOM (BBM) transcription factors activate expression from the female alleles of *YUCCA* auxin biosynthesis genes in zygotes to initiate embryogenesis. This discovery underscores a crucial male-female genomic interaction during early seed development and opens new possibilities for engineering superior seeds.

In collaboration with international partners, progress made in the synthetic apomixis technology was highlighted, achieving over 95% clonal seed formation in commercial hybrid rice. This breakthrough technology ensures the preservation of hybrid vigor, revolutionizing crop propagation.

Additionally, they investigated abscisic acid (ABA) biosynthesis regulation in tomato seed development, identifying critical genes associated with seed dormancy. Through targeted gene editing, mutants have been developed, producing high-quality seeds with enhanced vigor and climate resilience.

**Xingyou Gu** (South Dakota State U.): Reported on their efforts to improve the germinability of hybrid rice varieties by leveraging mapped seed dormancy genes. They also reported on developing a genetic strategy to reduce transgene flow into weedy rice relatives using a CRISPR/Cas9-based multiplex targeting seed adaptive traits, identifying regulatory mechanisms in the gibberellin signaling pathway related to seed dormancy and germination speed, and evaluating the effects of seed dormancy genes on soil seedbank longevity.

**Krista Isaacs** (Michigan State Univ.): Reported on her efforts focused on improving smallholder farmers' access to quality seeds in Africa and Latin America by integrating crop ecology, plant breeding, and gender studies with participatory, inclusive methods.

**Business Meeting**

Several ideas for recruiting new members were discussed. Pérez will compile a list of U.S. land-grant institutions, query the C4 member list for potential industry and university recruits, and create a new Google Drive folder to store and share all relevant information with group members. All group members will contribute by inviting new seed scientists based on the extracted information from land-grant and C4 institutions.

Regarding the group website previously created by Kawashima and Fleming as a tool for recruiting new members and increasing the visibility of the research conducted by the group, Kawashima and Isaacs will collaborate to enhance and improve its functionality.

It was agreed that Kawashima would serve as Chair, Khanday as Vice-Chair, and Isaacs as Secretary.

2025 Meeting Location: Xingyou Gu has graciously offered to host next year's meeting at South Dakota State University.

The meeting was adjourned at ~5 pm.