**NCERA 180 Multistate Hatch Project Annual Meeting**

**August 30, 2023 10:00 am CST**

**Zoom Meeting –** [**https://sdstate.zoom.us/my/muthukumarappan**](https://sdstate.zoom.us/my/muthukumarappan)

1. Introductions: John Evans called the meeting to order and explained about what happened during the Covid period. He welcomed and thanked all the participants for joining today’s meeting
2. Participants:

K. Muthu Muthukumarappan, Dept Head, ABE, South Dakota State University - NCERA 180 - Admin Advisor

Chris Hamilton, NC regional multistate projects coordinator, NIMSS system admin, and NCRA Assistant Director.

Steve Thomson, National Program Leader, USDA-NIFA

John Fulton, Ohio State University

Joby Czarnecki, Assoc. Res. Prof. - Mississippi State University

Rob Proulx, NDSU Extension, Agriculture Technology Systems Specialist

Peter Kovacs, South Dakota State Univ.

Pedro Andrade - University of Arizona

John Evans, Purdue University

Madison Dixon, Associate Director, Agricultural Autonomy Institute, Mississippi State University.

Wesley Porter, University of Georgia Tipton Campus

Amir Haghverdi, Associate Professor, University of California Riverside

Ignacio Ciampitti, Kansas State University

David Mulla, University of Minnesota

Elizabeth Hawkins, Ohio State University

Mary Love Tagert, Mississippi State University Extension

Andre FB Reis, University of Missouri

Alex Thomasson, Mississippi State University

Wes Lowe, Mississippi State University

Manoj Karkee, Professor, Center for Precision and Automated Agricultural Systems

Nicholas Uilk, South Dakota State University

Christina Hamilton introduced herself as the system administrator for the national multi-state project database where all the annual reports, proposals, members, and other items related to multi-state projects are kept. Also introduced was Dr. Muthu, who serves as the administrative advisor, making him the liaison between the group and Christina’s office.

Following introductions, John Evans explained the project outline, including the focus on three objectives. These objectives were (1) to promote multidisciplinary collaboration among researchers and industry and leverage these technologies to improve the environmental and economic sustainability systems; (2) provide insight and direction to industry and funding agencies; and (3) improving stakeholder literacy by sharing educational materials between universities. The group has previously been focusing on variable rate fertilizer application and precision ag data utilization as these are the two areas that were identified and are certainly lacking and have a big impact in our field. Specifically, the group has been helping improve understanding of how precision technologies are going to sustainably increase power production both from new scientific knowledge and then how these practices are applied both in terms of variable rate application. Regarding the second, the group has been working on how farm data can be leveraged to contribute to the improvement of prescriptive agricultural practices again, leading to publication and technology transfer. Ultimately, the group hopes to better inform industry and funding agencies of the critical gaps in the area of precision technologies and practices, and that comes from the sharing of educational materials and datasets with stakeholders.

Dr. Steven Thomson talked about the USDA programs under his purview, and specifically those that favor foundational research in robotics. Although NSF is sunsetting the National Robotics Initiative, USDA plans to continue with that program with approximately the same budget in the range of $4 million. Dr Thomson expressed his observation that although the foundational aspect of the program has scared a few people in the past, computer scientists and mechanical engineers, however, seem to be excited about the possibility of being able to work on some more innovative robotic systems, instead of using what's available (which was more in line with what NRI required). Secondly, Steve discussed the cyber-physical systems program. David Korman and Steve are planning to enhance the robotic section to make it more prominent. Steve believes that with this change, some of the projects which may have previously gone to NRI could now be sent to CPS. In closing, Steve focused on proposal panel progress. The A1551 program had its first panel earlier this year and he felt it was successful. The balance of proposals to that program was a little less than A1521, which is the broad range program. He expressed that the balance was good being the first year for the RFA. Moving forward, he indicated that all disease-management-focused proposals should go to A1551. For A1521, USDA is collecting comments from stakeholders. Updates will be sent in a Dear Colleague letter from NSF regarding this program for which proposals will be due with no deadline.

Before moving into station reports, Pedro Andrade talked about a group that has a lot of overlap with this group, which is W3009. This group has integrated systems, research and development in automation and sensors for sustainability. He encouraged our members to investigate that group.

**Station Reports:**

John Fulton expressed gratitude for John Evan’s leadership in getting the previous report submitted and get the ball rolling. All the members appreciated John Evan’s time and effort in head starting this multistate group back on track. John Fulton encouraged all the members to review Appendix E and asked them to contact other colleagues to comeback and encourage new members to join this dynamic group for fruitful discussion.

**The Ohio State University:**

John Fulton talked about the Digital Ag Extension team conducting on-farm research under the e-fields program, along with organizing county, regional, and state trainings. In Ohio, drainage is a big aspect for profitable crop production, since there since significant acres exist with drainage technology needed. Ohio is not a big irrigation state, but they have quite a bit of livestock production. Therefore, when they look at manure and environmental aspects that they're dealing with in Ohio, Ohio State University has a significant amount of research focused on improving manure management on crop and pasture lands trying to minimize off-site transport of nutrients from farms into waterbodies.

Elizabeth Hawkins continued to describe how the Ohio State University is engaging their farmers in the eFields program and building quite a decent sized database and pushing forward on how this data can be used to answer further questions and bring benefit back to the farmers who have participated. The other big project is focused on solar power, which is creating competition for land use with prime farm ground. Researchers are trying to understand how precision ag can play a role in making those sites dual use rather than removing those acres from production.

**Purdue:** John Evans talked about the activities happening in Purdue University. The primary focus is on the automation around current machines like sub-task automation. They are trying to improve some efficiencies and reduce operator stress. AI has been big around Purdue, and certainly in Industry, in helping them with weed identification and disease. They are also involved in plant measurements and tying that in with some of their ergonomic studies that are going on to produce some high-density data sets and that's another project which automation is developing. Some platforms produce even higher density datasets than we're already getting from current machines and how that's going to impact what they do in the future. They are also doing a lot around connectivity as well, using different types of radios to push data out of unconnected fields and get it onto the cloud and help us make decisions.

Following on to what was mentioned by OSU, regarding irrigation, there is more in Indiana than Ohio. The big thing is getting rid of water in the spring with the help of streaming products here around sequestering water in wetlands, and then holding that back to try to use for irrigation in the fall. The water quality lab at their research facility is performing well. Regarding solar, they have been doing a lot of solar research on putting solar panels 10 feet above the crop to try to get solar to farm. They are able to do more with less resources because they pool resources to be as effective so as they can.

**University of Georgia:**

Wesley Porter described their UGA Integrated Institute of Precision Ag. They have hired 18-20 new faculty/staff and organized the annual national conference on precision ag in May 2023 with national speakers including John Evans from Purdue University. With the new hires they are working on all aspects of precision ag. They currently have a lot of variety in work going on including machine learning, precision ag, irrigation, technology, fertilizer, sprayer control systems, water management, robotics, autonomous systems, specialty crops, etc.

**University of Minnesota:**

David Mulla talked about their first Center for Precision Ag established many years ago. Currently the center employs 15 faculty, and they all work on various aspects of precision ag. One of their focuses is on crop phenotyping, where they are applying machine learning techniques to help construct 3D images of crops and various levels of stress and do detailed evaluations for the characteristics of those plants from the point of view of canopy architecture. They are also applying machine learning for detection on nitrogen in corn and trying to identify this V-shaped yellowing again, using drones and high resolution RGB photography. This allows them to work with the individual leaves and do a lot of detailed machine learning approaches to help determine the level of nitrogen stress. For instance, they can count the individual leaves that are stressed and then relate those to the amount of fertilizer that is needed.

They are also working on more conventional things that involve sensing at various stages and there have been several studies where they are able to show significantly less use of nitrogen fertilizer with no impact on yield and very large benefits for environmental quality. They are also using hyperspectral imagery to try and separate different kinds of stressors such as sulfur, potassium, and nitrogen, which all create yellowing of leaves, but the yellowing happens on different parts of the leaves. They developed a method for identifying when to spray fields for aphids using their drone and satellite remote sensing. And detecting the threshold where spraying is needed using support vector machine classification in 100s commercial fields with accuracy of over 85%. The crop modeling approach gave them the optimal management of water without compromising crop yield. It also helps reduce nitrogen leaching the soil and moisture. They are also using a lot of different scientific techniques to further advance precision ag and to revolutionize the way farmers are actually collecting and analyzing data.

**Mississippi State University:**

Alex Thomasson reported on several of their research and education activities happening at Mississippi State University. Alex Thomasson echoed what Pedro mentioned earlier, indicating that there are several multistate groups (NCERA180, S1069, S1090, W3009, for example) that have overlapped and suggested it would be good if the leadership of overlapping multistate groups would communicate and occasionally co-host meetings. He believed increasing coordination would increase overall attendance. Muthu appreciated Alex for his excellent suggestion and indicated he would be happy to initiate communication with other multistate groups.

Joby Czarnecki mentioned that MSU researchers are working to improve the value of the farm data by working with growers to increase grower capacity for understanding data. They are also trying to build spatial and economic models that can be applied to small plot data to make these results more farm scale relevant.

Madison Dixon described the new Autonomy Institute at MSU and their focus on advancing the adoption of autonomous vehicle systems for agricultural production and processing and for general agricultural research. Mississippi State has an extensive network of expert faculty and principal investigators that are already doing a great deal of research in the precision ag area. He hopes the Institute will promote collaboration not only with faculty and experts at Mississippi State, but also with academia at large across the country, which is well represented in this group here. In summary, the Institute provides opportunities to foster interdisciplinary collaboration for anything and everything at the intersection of agriculture and autonomous systems, this is what they are focused on and are working to get established.

Mary Love Tagert mentioned their establishment of a new extension program in agriculture technology. They are also working on managing site specific soybean diseases and working on several projects related to phenotyping, calibrating several yield monitors, etc.

**Washington State University:**

Manoj Karkee mentioned that their researchers are focusing on developing handheld solutions for monitoring and managing specialty crops, such as phenotyping, crop estimates and tools and lag phase detection tools in vineyards. Manoj’s program focuses on developing robotic solutions for farming in terms saving labor cost and improving input efficiency solutions.

Manoj also presented on the work of Dr. Lav Khot, which focuses on the precision ag side of the overall work, which includes developing novel materials as well as novel technologies for spraying different kinds of pest control materials in certain vineyard crops. They're looking at ozonated water and some other materials that could be effective for controlling different kinds of pests. They're also looking at smarter, more precise application technologies by using and installing a wide range of AI based sensors. They are also in the process of integrating remote location systems and a demo farm into one system for efficient management of operations.

**South Dakota State University:**

Peter Kovacs described their new Raven Precision Ag Center constructed to develop collaborative research activities between Agronomy and Agricultural Systems Technology at South Dakota State University. Their precision ag projects on the agronomy side include the basics of seed placement within field and/or relative to the seed. He also mentioned that carbon is a big hot topic and they are working on how to capture those extra values, whether it's ethanol production or one of the big companies is planning to work or build a plant here. Possible applications could range from sustainable jet fuel production, and with net zero emission production, precision cover cropping effort on research, drone, and machine learning involvement in crop production, etc. Precision livestock management also is of interest within the State, especially in the western part by managing those livestock. They are seeing how they can use remote sensing (including drones) and/or GPS locators to manage those livestock groups for health, or even just to keep track of them – both would help them on the grazing process.

Regarding education, Nic Uilk described their annual precision connect event where the summer interns present their poster to industry reps and other stakeholders. Currently, they have 8 Kubota with Raven monitoring systems and in the process of adding two from John Deeres to elevate hands on experience for their undergraduate students.

**University of California at Riverside:**

Amir Haghverdi described the decision support tools that they have developed using a USDA grant for growers in Southern California desert region. The vision for their work is to move forward with precision water management. Amir described their SAMZ-Desert project on variability in terms of crop growth and health using 3 years of data. They also used all 3 years data from 2018-2020 remote sensing from Landsat to look at the special variability over time. The second project IMT-Desert was also a decision support tool for growers so they could use it easily and this is mainly irrigation based on water production function concept it's basically the relationship between yield, and either irrigating applied water or evapotranspiration. Future work involves investigating local functions for multiple crops, site specific functions by growers, yield predicating capability based on drone data and zoning fields with substantial salinity.

**Kansas State University:**

Ignacio Ciampiti described their focus on the mission of land grant system and their research teaching and outreach components. On the research side, they have different teams working on campus. Ignacio mentioned the International Precision Ag Conference, which will be hosted by KSU in summer 2024 where they are planning to do some workshops on analytics, modeling robotics, and on sensors and field. They are moving to develop a new collaboration in terms of developing a data analytics lab.

About the outreach, they have a few new schools on digital labs, precision ag and they also trying to work on developing a partnership with a few industry partners in developing some summer boot camps.

**North Dakota State University:**

Rob Prolux reported about a group called Grand Farm, which is really trying to establish a national presence in ag tech and bringing together industry, academia and startups entrepreneurs to advance agriculture. Grand Farm has recently acquired 140 acres of land to have an innovation site just west of Fargo and announced at their Autonomous Nation Conference. They've secured the first round of funding to build a 25,000 square foot building to bring industry academia folks together. NDSU in collaboration with Grand Farm, and also with the local Chamber of Commerce and Economic Development Corporation, is one of 16 finalists for an NSF Engines competition which, if successful could bring $160M over 10 years.

**University of Arizona:**

Petro Andrade reported that they are working collaboratively with the College of Engineering on robotics, automation, and machine learning. He described their work on precision planting and application of different inputs to alter the salinity level right next to the seed to allow the seed to germinate in the soil. By doing a mass balance and it is possible to have improvement on germination, emergence, and crop development, even on soils that have a salinity that is problematic. They got into soil sensing for soil quality applications partnering with a soil health expert and developed this sensor to monitor carbon dioxide. They are going to be monitoring a ton of soil carbon in very expensive scientific ways for the next couple years and that will be done on actual farm fields. Several potential collaborations related to this work were identified, including work with Amir and Joby.

**2023 Annual Report:**

Muthu (AA) will prepare the minutes of the meeting with the help of his secretary and distribute them to the group for submission to NIMSS.

**Business Meeting and Elections:**

All members unanimously approved the following slate of executive team members.

Chair – Wesley Porter, University of Georgia Tipton Campus

Vice-Chair – Peter Kovacs, South Dakota State University

Secretary – Joby Czarnecki, Mississippi State University

Meeting Adjourned at 12:35 PM CDT.