

## **Board for International Food and Agricultural Development (BIFAD)**

### *Crossroads: Science, Innovation, Markets, and Policy for Feeding the World*

#### **Public Meeting at Purdue University**

**October 20-21, 2015**

#### **October 21<sup>st</sup>, 2015: Public Meeting (live streamed)**

#### **Welcome and Opening Remarks**

BIFAD Chairman Dr. Brady Deaton opened the meeting. He welcomed the audience both in the room and through the webcast to the BIFAD Public Meeting, held at the Purdue Memorial Union South Ballroom on the Purdue University campus in West Lafayette, Indiana. The BIFAD Board Members were introduced; five of them were in attendance.

- Dr. Brady Deaton- BIFAD Chairman, Chancellor Emeritus of University of Missouri, Columbia, Missouri; Executive Director, Deaton Institute for University Leadership in International Development (In attendance)
- Dr. Gebisa Ejeta- Distinguished Professor, Department of Agronomy, Purdue University, West Lafayette, Indiana; World Food Prize Laureate (In attendance)
- Dr. Waded Cruzado- President, Montana State University, Bozeman, Montana (In attendance)
- Hon. James M. Ash – Partner at the law firm of Husch Blackwell LLP and Chair of the firm’s Food and Agribusiness Unit, Kansas City, Missouri (In attendance)
- Dr. Cary Fowler – Former Executive Director, Global Crop Diversity Trust, Rhinebeck, New York (In attendance)

Chairman Deaton asked for a moment of silence to honor David P. Lambert, a food security advocate and friend in the fight against hunger, who passed away on October 16<sup>th</sup>.

#### **Old and New Business**

Chairman Deaton introduced James Ash and Dr. Cary Fowler; this is their first public meeting since being appointed to the board in June 2015. He thanked Marty McVey for his service to the board during his term.

Chairman Deaton thanked the team of consultants, led by Vic Lechtenberg, Professor at Purdue University, for their work on the BIFAD Report on Human and Institutional Capacity Development (HICD). This report and follow-on e-consultation continue to lead thinking around capacity development as it relates to institutions as well as individuals.

## **BIFAD Member Outreach Reports**

### The Innovative Agricultural Research Initiative (iAGRI) in Tanzania

BIFAD organized a familiarization visit to the USAID/Tanzania funded iAGRI project. The team consisted of BIFAD Chairman Brady Deaton, Susan Owens, BIFAD Executive Director and USAID/BFS Office of Agricultural Research and Policy Acting Office Director, and Tag Demment, Vice President of International Programs at the Association of Public and Land Grant Universities. The delegation visited the Ohio State University-led iAGRI project at Sokoine Agricultural University in Morogoro, Tanzania. This project is funded by the USAID Tanzania Mission under the Feed the Future Initiative. The team spent several days exploring the university-to-university partnership model that is integral to the iAGRI project.

The team was impressed by the approach that Ohio State and US partners have taken in their engagement with Sokoine at all levels. The iAGRI model is a holistic HICD effort with a strong institutional development mandate. iAGRI has incorporated proven strengths from the US land-grant system through interactions with the private sector and investments in human capital – 139 students from SUA and MAFC have entered degree programs. The team recommended a rigorous review to determine whether this model can be integrated into programs in other countries.

During the second portion of the trip, the team went to Ethiopia where they visited with deans of agriculture from multiple Ethiopian colleges and universities and met with Embassy and USAID/Mission contacts. This was an encouraging visit - Ethiopia is committed to developing its tertiary education sector.

### Nutrition Panel at the World Food Prize

At the 2015 World Food Prize BIFAD convened a Nutrition panel to discuss the economic impact of malnutrition and the loss of human capital and productivity. The panelists had a wide range of specialties, which led to an engaging discussion.

### Feed the Future Innovation Labs – Kansas State University (KSU)

BIFAD Board Member Jim Ash met with Innovation Lab directors at KSU – Feed the Future Innovation Lab for Sustainable Intensification, Feed the Future Innovation Lab for Applied Wheat Genomics, Feed the Future Innovation Lab for Sorghum and Millet, and Feed the Future Innovation Lab for Reduction of Post-Harvest Loss – and Dean Floros, the Dean of Agriculture at KSU. Innovation Lab partnerships were discussed along with their efforts to advance collaborative research and HICD. Agriculture programs, like the Innovation Labs, have a direct benefit to the farmers and producers here in the US as well as in developing country partner countries.

## **New Business**

BIFAD received a letter from a group of University administrators regarding concerns over the J1 visa process. BIFAD convened a working group chaired by Jim Ash to review the concerns and requests laid out in the letter. The working group will include two representatives from the university community and one member from APLU. BIFAD is committed to working together to recommend a decisive course of action.

## **Presentation of Awards – BIFAD Award for Scientific Excellence in Research**

Board Member Waded Cruzado presented the two awardees with the BIFAD Award for Scientific Excellence in Research.

Dr. Larry Murdock, Purdue University Professor of Entomology, was recognized for his research on cowpeas/black-eyed peas and the development of the Purdue Improved Crop Storage (PICS) bags. These three-layer hermetically sealed bags prevent post-harvest losses for farmers in Africa.

Dr. Layne Coppock, Dr. Getachew Gebru and their team of researchers were recognized for the Pastoral Risk Management (PARIMA) Project in Ethiopia and Kenya which helped hundreds of pastoralists to diversify their livelihoods.

Drs. Larry Murdock, Layne Coppock and Getachew Gebru gave presentations on their research.

### **PICS Bags – Dr. Larry Murdock**

Dr. Murdock spoke about the demands of feeding a growing population and how improved storage techniques can help meet this challenge. More food can be made available by improving storage techniques and reducing crop losses during storage. Cowpea weevils are devastating to farming families and due to their high reproductive rate 100 weevils can multiply and cause significant damage in a few weeks.

The PICS were developed in partnership with the Bean/Cowpea CRSP (today the Legume Innovation Lab) to find a low cost way to improve the storage of cowpeas to prevent pest infestations in Cameroon. Dr. Murdock led a team to develop three-layer hermetically sealed storage bags which remove oxygen and prevent weevils from multiplying. When used correctly, PICS bags have helped cut weevil damage to cowpeas to virtually zero percent. The average monetary benefits are estimated at \$150 per household, per season, doubling the income of most farmers. Currently, efforts are being made to establish networks of distribution for these technologies in addition to storage for other grains in other countries in Africa and Southeast Asia.

### **Pastoral Risk Management (PARIMA) Project – Dr. Layne Coppock and Dr. Getachew Gebru**

Drs. Layne Coppock and Getachew Gebru spoke about their work on improving risk management and resilience in pastoral groups on East African rangelands. They conducted a needs assessment for pastoral groups in Kenya and Ethiopia, which revealed the clear need for food, water and expanding livelihoods to reduce dependence on livestock. The PARIMA Project brought Ethiopian women on a two week trip to meet a group of Kenyan women for peer-to-peer learning. Kenyans inspired the Ethiopian women. This led to a capacity building model, first to inspire the women, then to build entrepreneurial and microfinance skills and offer other literacy and math classes. PARIMA established 59 groups with 2,300 members (many were women). The groups had a 97% rate for repayment of loans. The project brought about changes in the pastoralist's lifestyles. Many moved from huts to houses and began sleeping on mattresses instead of hides. The increase in

income along with changes in education and gender equity reduced hunger overall. Today, Kenya activities are sustained and expanding while in Ethiopia support for this model has been leveraged by the government. These results show that human capacity building offers great returns to development investment with high risk groups such as pastoral women.

Board Member Waded Cruzado thanked the presenters for their inspiring presentations.

## **PANEL #1: Climate-Smart Agriculture – Closing the Yield Gap in a Changing Climate**

Dr. Jeffrey Dukes, Director, Purdue Climate Change Research Center and Professor of Forestry & Natural Resources and Biological Sciences introduced the moderator and the panelists.

Dr. Thomas Hertel, Distinguished Professor of Agricultural Economics, moderated this panel. Dr. Hertel presented a global yield gap map for maize. He noted that yield gaps remain large, particularly for coarse grains, and that closing these yield gaps must be addressed with changing climates. Dr. Hertel discussed the impacts of climate change, making the point that the adverse consequences of yield impacts greatly outweigh the beneficial impacts. Compared to other climates, the tropics are modeled to be hit the hardest by climate change, yet this is where yield gaps are already the largest.

### **Dr. Lisa Ainsworth, Associate Professor of Plant Biology, University of Illinois**

Dr. Ainsworth spoke to her research on focus crop responses to climate and environmental change. Her lab focuses on improving crop productivity in a warming world by projecting future atmospheric conditions and studying the key mechanisms by which plants respond to particular elements of climate change. She emphasized that precipitation events are occurring with more intensity, with more rain, and larger periods of droughts. The drier areas will become drier and the wet areas wetter. Pollution is now causing problems in agricultural areas. She noted that climate change has already impacted crop yields and cited some of Dr. David Lobell's publications, which examined yield impacts on global changes in precipitation, annual yields of particular crops since the 80s, and the productivity targets that humanity needs to reach compared to the current projection of yields. Areas in Central Africa are showing high probability for crop loss in the future. We must meet the challenges in order to have resilience.

### **Dr. Mitch Tuinstra, Professor of Plant Breeding and Genetics and Wickersham Chair of Excellence, Purdue University**

Dr. Tuinstra spoke about the challenges of adapting crops and agricultural systems to environmental stresses and building resilience to climate change. Agriculture is highly sensitive to environmental stresses. For instance, an entire season of flooding isn't needed to see changes in crops or crop loss. He emphasized that drought and excess water have been the two largest climatic issues limiting yield gaps for the past 20th century, and globally are projected to increase with severity and frequency with the changing climate. There have been successes; plant breeders in North America are making tremendous gains in plant tolerance to environmental stresses. Breeders

are able to take the adaptation genes (submergence tolerance- Sub1A) and add them to improved crop varieties to better withstand seasonal flooding. This has been shown possible in rice and many scientists are working on similar improvements in maize and other crops. He emphasized the importance of data-driven agriculture, particularly genomics and phenomics in order to enable gene discovery and optimize crop use for food, fuel, feed and fiber. Dr. Tuinstra praised the model for Heat Tolerant Maize for Asia (HTMA) which is a public-private partnership for the development and deployment of heat stress-resilient maize varieties. Furthermore, he concluded that continued adaptation of key food crops is crucial for ensuring global food security.

**Dr. Linda Prokopy, Associate Professor of Natural Resource, Social Science, Purdue University**

Dr. Prokopy spoke to her research around the project “Useful to Usable (U2U): Lessons learned about Selling Climate-Smart Agriculture,” whose short-term goal is to transform climate information into usable knowledge for data-driven decision making, with a long-term goal to make agriculture more profitable, sustainable, and resilient. The research team takes models, data, and stakeholder input to create effective, timely, and accessible decision support tools for farmers in the Midwest. She emphasized that one of the key takeaways from her research is that the most influential individuals in farmer decision-making are family, friends, and seed/fertilizer dealers, followed by crop consultants, the least influential being extension agents because of their limited interaction. It is important to know when to approach farmers about decisions, such as when to buy seeds for drought or flood tolerance, so they can make informed decisions regarding their next planting season. Providing farmers the best information allows for improved decision making.

**Panel #1: Question & Answer**

Dr. Hertel thanked the panelist for their presentations.

Dr. Hertel asked Dr. Ainsworth about the contradictory statements of climate change on crop production, particularly the tremendous benefit of increased carbon dioxide on plant production.

Dr. Ainsworth commented that although carbon dioxide improves photosynthesis rates, the increase of carbon dioxide mixed with the other climate impacts such as temperature, variation in precipitation, etc. will not be a general increase in crop production, actually the opposite.

Dr. Hertel asked Dr. Tuinstra about closing the yield gap by introducing different crop varieties and about the difficulties of getting farmers to adapt to high-tolerant varieties, particularly with his experiences with maize and sorghum.

Dr. Tuinstra replied that farmers are savvy and desire the best returns on their investment. They ask questions like ‘how much money am I putting in? How much is risk aversion worth compared with decreases in yield? How much should I invest and how much can I expect as a return?’ These are the questions farmers ask themselves all over the world. In developing countries, farmers don’t have access to the technologies and the seed systems are not as developed. They are more conservative in their decision making due to the risks and costs.

Dr. Hertel followed up by asking about the crop yield growth plateaus and leveling off. Will the yield ceiling occur soon?

Dr. Tuinstra replied that the sky is not the limit for crop yield growth. When we look at historical yield responses, genetic improvements are not taken into consideration. You look at the yield curves, and it does appear that they are plateauing; however, just 10 years ago, developing a new commercial variety took 8-10 years and now we're looking at 3-5 years. Instead of only having a few cycles, the improved lines that are developed now will continue to improve in the future. Genetic engineering opportunities will continue to substantially improve adaptation, especially adaptation to environmental stresses.

Dr. Hertel asked Dr. Prokopy about the possibility of her project benefiting farmers in developing country and furthermore, how the U2U project can be transferable to developing countries.

Dr. Prokopy responded by saying that more rigorous social science methods must be used to find out farmers' needs. Researchers/people shouldn't assume they know what people want, but work with them and engage in a dialogue to improve interactions and availability of decision-making tools. A lot of what these farmers want is the openness to work together.

**Response by Dr. Nora Lapitan, Acting Division Chief, Research Division, Agricultural Research and Policy Office, USAID**

Dr. Lapitan thanked the panel. She defined climate-smart agriculture as using smart agricultural practices which are informed by science. Understanding the impacts of climate on agriculture and the impacts of agriculture on climate are foundational in advancing climate-smart agriculture. This is crucial because the largest yield gaps are in the most food insecure regions of the world. Dr. Lapitan supported Dr. Ainsworth's point regarding a general decrease in crop production despite the benefit of increased carbon dioxide in the atmosphere. For instance, increasing CO<sub>2</sub> increases temperature by 4 degrees centigrade and for maize a one degree increase can decrease crop yields by 7%. Dr. Lapitan also encouraged Dr. Tuinstra's research advancements in plant breeding such as a shortened breeding cycle and improved climate resilience through breeding. These are areas where Feed the Future is aiming to advance as well. Dr. Lapitan highlighted Dr. Prokopy's point on stakeholder engagement: include the stakeholders from the very beginning, examine their practices, what tools do they need, and how they can engage in climate-smart agriculture.

Dr. Lapitan emphasized that climate change and considerations of climate change in agriculture are embedded in Feed the Future: using natural resources efficiently and wisely, implementing enlightened policies, increasing market access, and reducing risk of smallholder farmers. She also emphasized the need for improved data on the impacts of climate change in order to not only plan for significant changes, but to plan for significant actions. The United States has taken the lead for climate-smart agriculture through the launch of the Global Alliance for Climate-smart Agriculture.

Dr. Lapitan stated that climate-smart agriculture will help meet global goals of sustainably and substantially reducing poverty and hunger, with public-private partnerships foundational for helping smallholder farmers. Feed the Future has announced new investments in public-private partnerships which will improve the availability of improved seeds and associated technologies.

## **PANEL #1: Question/Answer/Comment Period by BIFAD Members**

Dr. Cary Fowler responded to Dr. Ainsworth's citation of David Lobell's work and made the point that his study looks at concentrations of the highest number of poor and hungry and the crops that feed these people, especially in South Asia and Sub-Saharan Africa. He was curious about crops that would be most adversely affected by climate change beyond the three major crops of wheat, maize, and rice. Secondly, he pointed out the gaps in many studies of yield impacts on climate change outside of three major crops, with many other crops important for the hungry and poor, including native crops. He asked the panel about priority setting for breeding crops other than the top three grain crops.

Dr. Ainsworth replied by expanding on the criteria of Dr. Lobell's study, stating that the three staple crops have the most consistent and reliable data and research. Dr. Ainsworth agreed that tubers and other grains are incredibly important. Breeding priorities must be sensitive to what people want to grow, and if people don't want certain crops, they will not be produced. As the climate changes, there will be a huge barrier in understanding by farmers of more adaptive crops. If people don't know how to grow a certain crop or don't want to grow it then uptake will be a challenge.

Hon. Ash asked Dr. Prokopy to speak a bit more about the influencers in her U2U project. Dr. Prokopy responded by saying that many of the farmers were large-scale farmers and that the biggest influencer was the private sector.

Dr. Ejeta commented on the premise of panel being the use of the talent pool in US universities and how there are many grand challenges that have questions that need to be addressed with conservation agriculture, biodiversity, building soils, climate resilience, carbon sequestration, sustainable intensification, mitigation of the effects of climate change on agriculture and vice versa, precision agriculture, and diversification of crops and crop resources in farming.

Chairman Deaton echoed Dr. Ejeta's point of strength within US universities and the importance and relevance of investing in scientific research for producing relevant studies and in the end helping farmers in need.

## **PANEL #2: Plant Sciences Research and Education Pipeline**

Dr. Karen Plaut, Senior Associate Dean for Research and Faculty Affairs, Purdue University, moderated this panel. She introduced the topic and the panelists. Dr. Plaut opened the discussion by saying that the world needs plants that are more efficient, tolerate a changing environment, and provide improved yields. She then talked about Purdue's Plant Science Research and Education Pipeline, an initiative to expand capacity in plant biology, transform plants to improve crops, produce large-scale plant analysis, and incorporate entrepreneurship and leadership for students.

**Dr. Jian Kang Zhu, Distinguished Professor of Plant Biology, Purdue University**

Dr. Zhu's research focuses on the signaling pathways in plants that govern their responsibility to environmental stresses such as drought resistance, salinity and other abiotic stresses. He noted that there have been significant contributions to plant epigenetics and that in order to continue great strides in crop production, research in developing gene-editing technologies must continue to advance.

Dr. Plaut asked Dr. Zhu to describe the gene editing technologies now and their role in the future.

Dr. Zhu stated that the cost of sequencing has been decreasing dramatically. The plants can easily be sequenced; the challenging part is determining what each gene does when it comes to addressing abiotic stresses and what gene is best for addressing each specific issue. In newer technologies such as CRISPR-CAS9, any sequence can be targeted. Guide RNA will pair with the gene that you want to find and will guide the CAS9 to any gene that you want in order to make a cut and repair the editing. It is a very powerful technology with a multitude of usages, unlike transgenic GMOs, only multinational companies have access to capital that can commercialize their varieties. With CRISPR-CAS, people in developing countries have access to this technology and do not rely upon capital-intensive commercialization.

#### **Dr. Katy Rainey, Assistant Professor of Agronomy, Purdue University**

Dr. Rainey studies genetic improvement of soybeans using multi-disciplinary approaches and is interested in the commercial sales of soybean cultivars and open software for soybean gene editing. She explained the use of soybeans and how these technologies are being used around the world. Sixty percent of soybeans are used for protein and oil (soybean oil is the main source of vegetable oil) world-wide, 98% of the meal is fed to animals, and 6% of soybeans are consumed by humans predominantly in Asia. Most of the soybean production is used for oil and animal feed. It is an important source of proteins but in the developing world it follows a different model since it isn't necessarily directly consumed.

Once targets are researched for particular soybean genes, the first application would be to deploy new genetic diversity, as soybeans have a very narrow genetic base. In order to have improved yield estimates for soybeans, Dr. Rainey is trying to find imagery to identify covariates that would account for phenotyping on a large scale. These new technologies will improve quality and quantity so that we can improve genetic diversity and yield improvements. A lot of soybean diseases are not quantified or controlled, genetic solutions are not being utilized because farmers are not aware of them.

#### **Dr. Melba Crawford, Associate Dean of Engineering for Research, Purdue University**

Dr. Crawford began her introduction by saying that satellites didn't have the impact that the scientific community thought they would when it comes to in-time data for farming and natural resource management decisions. In the past, the data received by satellites was not adequate for application of small scale farmers. All of the steps in data collecting caused delays which made it untimely for agriculture. Today we have the opportunity to utilize other technologies for data analysis and integration such as airborne methods, UAVs and proximal sensing methods on the



ground. Taking the data and creating information is valuable, but it takes modeling and analysis with a lot of computing power. Society has advanced dramatically in computer capabilities and the quality of data that is available for making decisions.

She discussed moving from passive hyperspectral data to multi-spectral data to hyperspectral data, which allows people to understand chemical changes and certain properties in climate and plant physiology. Drones with sensors are going to be moving rapidly but the sensors are more expensive than the platforms themselves. The scaling down of the size of sensors will be a big improvement that will allow many individuals to utilize this technology.

## **Panel #2: Question & Answer**

Dr. Plaut asked Dr. Zhu for the most significant challenges to overcome plant stress.

Dr. Zhu responded by saying that there are lots of challenges to overcome plant stress. From plant biology, it is the complexity of plant stress and in particular drought stress. There is no standard definition - it is dependent upon severity, locality, and the stages of the plant life cycle. Stress, especially drought stress, comes in many different forms, and the stress mechanisms are different. There is great difficulty in measuring the resistance to drought stress; there is no measurement that is definitive in drought stress, which makes it difficult to study.

Dr. Plaut asked Dr. Rainey about the characteristics of soybeans she is studying and how they are being used in developing countries.

Dr. Rainey said simply put, the three characteristics are throughput, robustness, and ease of use. However, characteristics must be looked at with respect to different climates. Dr. Rainey believes that using sensory and real-time data to help us diagnose problems in real-time in addition to any data that can help to measure architecture and yield is useful, no matter the complexity of it, especially in developing countries. She stressed continuing to incorporate the application of the cellphone model which has leap-frogged many of the other technologies available. For example, a regional operator of a UAV collecting data and linking it to phones for diagnostic data when farmers are having issues.

Dr. Plaut stated that multidisciplinary teams are required and that a lot of different people are needed and then asked how can these people and fields be brought together.

Dr. Crawford stated that one of the things she sees happening, which is powerful, is that people are getting bored in their designated field and then move forward to another field. If you have people with a certain level of knowledge plus the big picture perspective this can will greatly benefit a project. It is important to have a strong team working together to move forward on issues.

Dr. Plaut wanted the panel to describe how they have trained their students to bridge these interdisciplinary approaches.

Dr. Rainey said that she provided them with the data sets to integrate information and to sequence the data. A lot of these innovations are improvements in computational capabilities and statistical

analysis. She also stated that being involved in collecting data in the field is important.

Dr. Zhu agreed with Dr. Rainey that students must understand the statistics and analyze large data sets. Labs and faculty must be open-minded in learning particular techniques and disciplines.

Dr. Crawford said that it takes an interdisciplinary culture and the co-advising of students that are interested in the trans-disciplinary research. Data collection is important in helping students to understand the stakeholders and processes involved.

## **PANEL#2: Question/Answer/Comment Period by BIFAD Members**

Dr. Cruzado asked Dr. Crawford about the future of UAVs and their context in developing countries in applying these potential solutions without suppressing already existing platforms.

Dr. Crawford said that the experience here provides a foundation for us to build on. Every technology is important in gaining this data, one of the most valuable being the human eye. UAVs help fit in with a lot of geo-spatial data being collected and this is just one more layer. With the hopefully appropriate use of these technologies, countries will use our learning curve for regulations that ease the problems and mistakes we have made.

Dr. Fowler asked Dr. Zhu about the sequence of events that would need to take place for cheap biotechnological tools to be used and what kind of impact it would make.

Dr. Zhu stated that the use of CRISPR-CAS could edit any gene. This technology will most likely be used by high-school students in the future.

Dr. Ejeta asked Zhu to elaborate on what the scientific community is doing to prevent the public's misunderstanding of previous technologies (GMOs, etc.), particularly on the ethical and regulatory barriers?

Dr. Zhu stated that similar issues have been raised for CRISPR-CAS as with GMOs. The end product is not transgenic once the transgene is gone after editing. The particular gene is changed, but it is no different than chemical or radiative gene editing. The US has set a good example with in not regulating this technology similarly to GMOs. Ethical issues are not the same in organisms other than plants. Similar to other gene editing technologies, we need to make sure the end product is safe.

## **PANEL#2: Audience Questions:**

Mr. Gary Burniske, Managing Director of the Purdue Center for Global Food Security asked how farmers can provide input to produce more relevant varieties and how to better engage the end-users to ensure the success of the product.

Dr. Rainey replied that data needs to be presented showing that these significant traits are successful.

Dr. Zhu responded that his first priority is to advance the understanding the fundamental processes of these plants.

Dr. Plaut said that extension provides a facet to get information out and receive questions that local farmers have.

Chairman Deaton concluded that it is the role of universities to lead this research and engage farmers and go into the fields to find out the pressing issues that can be addressed globally.

### **AFTERNOON SESSION at the Stewart Center (live streamed)**

Dr. Brady Deaton introduced USAID Acting Administrator, Ambassador Alfonso E. Lenhardt and Dr. Peter McPherson, President, the Association for Public and Land-grant Universities (APLU).

#### **Remarks by Acting Administrator, Ambassador Alfonso E. Lenhardt**

Ambassador Lenhardt thanked to Chairman Deaton and President Mitch Daniels for hosting the meeting; Dean of Agriculture, Jay Akridge, and BIFAD Board Member, Gebisa Ejeta for their planning efforts and congratulated the 2015 winners of the BIFAD Award for Scientific Excellence.

Ambassador Lenhardt stated that BIFAD has been a strong partner in USAID's work to eradicate extreme poverty and helping to feed the hungry. Their advice and council has been valuable in shaping USAID's engagement with universities under the Feed the Future Initiative. Feed the Future has shown great successes- 7 million farmers have gained access to new tools or technologies, more than 12 million children have been reached with nutrition interventions leading them to a brighter future. Taken together, all of the Feed the Future efforts are empowering farmers and families to flourish for the generations to come. The population is growing which requires at least a 60% increase in agriculture production alone. Climate change is already affecting crop yields. These are not challenges USAID can solve alone. Partnerships are strategic for solving these issues. The 24 Feed the Future Innovation Labs are on the cutting edge of efforts to research, develop, and take to scale of technologies to address food security.

Ambassador Lenhardt commended Purdue University for its work in helping to address the issues of post-harvest storage and supporting the U.S. Borlaug Fellows Programs which funds US students pursuing an advanced degree to conduct global food security research.

#### **Remarks by Dr. Peter McPherson, President, APLU**

Dr. McPherson stated that there is a small cluster of work that is critical for growth and human progress: human resources, building institutions, creating technology, and government that works. He stated that if there is one way to make the world stronger, it would be to have better educated people, particularly higher education. Second of all, people need a stable government with sound

economic policies that fosters growth and businesses. Purdue has a role in every one of these points. USAID funding to universities shows a deep commitment to research. Dr. McPherson acknowledged Woods Thomas, the first Executive Director of BIFAD, as the man that exposed him to agriculture in the developing world. He thanked BIFAD for its continued contributions.

### **Panel #3: State, Industry, and University Partnership and Roles in Feeding a Growing World**

Dr. Jay Akridge, Glenn W. Sample Dean of Agriculture, moderated this panel. Dean Akridge opened the panel by setting the stage and introducing the panelists. He thanked Acting Administrator Lenhardt and Dr. McPherson for their kind words. Dean Akridge said that there are many challenges that require various types of organizations to work together.

#### **Jim Moseley, Farmer and Former USDA Undersecretary of Natural Resources**

Dean Akridge asked Mr. Moseley what he thinks are some of the biggest barriers that you see in addressing food security and why they are so.

Mr. Moseley replied that markets and policy individually are very important, but that science, innovation, and markets are at the forefront. Resource issues with water prove to be a challenge, just look at the drought in California this past year. This is an issue that will become more prevalent across the world. Significant improvements in soil health need to be made because of the massive degradation of soil. The trend has not changed since 1990; there is still a decline in soil productivity as related to soil health. Genetics can help feed the population of 9 billion, but it will not do it alone, soil health must be taken seriously. Mr. Moseley then raised the issue of food loss and waste. In the developed world, the major source of food waste is caused by the retailer and the consumer, while in developing countries the problem is far earlier in the food supply chain, at the initial producer and the storage and transportation of the food once it has left the farm. He emphasized that more attention must be given to agricultural research; the US did very well in the earlier part of the last century, but has lost that intensity of agricultural research since then. Mr. Moseley concluded by saying that no individual, organization, institution, or government is able to tackle the issues that we're talking about by themselves. Expertise will come from many different sectors and these experts need to come together in order to create beneficial partnerships.

#### **Ted McKinney, Director, Indiana State Department of Agriculture**

Dean Akridge asked Mr. McKinney about the role of Indiana's government in feeding the world.

Mr. McKinney stated that Indiana agriculture works well with universities and the private sector, and we need to continue to pursue this cooperation. He wants to minimize the burden of government, create a favorable business climate, promote the acceptance and adoption of technology and work for the highest of ethics.

#### **Dr. Scott Hutchins, Global R&D Leader, Dow AgroSciences**

Dean Akridge asked Dr. Hutchins about the role Dow AgroSciences plays in feeding the developing world.

Dr. Hutchins said that discovery development, and commercialization of technology (machinery, chemical, fertilizer, seed, and genetics) has been running parallel with food security. This technology and others will continue to help feed the world. He said that public policy is very important, particularly science and technology are incredibly important when evaluating systems and technology when producing legislation.

Dr. Hutchins said that institutions must address the paradigms out there: the local farmers are just not in the position to utilize new technology and they are not able to afford it. It takes time to work with local markets to successfully introduce and keep a product in certain areas. The private sector aim is to release products which have a positive impact.

**Dr. Betty Bugusu, Managing Director, International Food Technology Center and the (FPL Project)**

Dean Akridge asked Dr. Bugusu to talk about the Feed the Future Innovation Lab for Food Processing and Post-harvest Handling and what the partnerships are like.

Dr. Bugusu states the four major components when looking at post-harvest loss reduction: drying, storage, nutrition, food processing and value addition. Work being done by the Feed the Future Innovation Lab for Food Processing and Post-harvest Handling focuses on development of affordable and efficient drying technologies. For instance, exposing food to rain when set out to dry causes diseases (mycotoxins) which are harmful. The Food Processing Lab wants to help farmers by looking at ways for farmers to test for moisture in their dried products. Subjective measurements used by farmers to determine if their grain is dried don't always provide accurate answers. Dr. Bugusu advocated for capacity building for both humans and institutions. She also acknowledged the importance of public-private partnerships to give key logistic knowledge to those in the private sector.

The goal of the International Food Technology Center is to increase access nutritious food and opening market opportunities for smallholder farmers, based in Kenya and Senegal. They have partners in both countries and outside of the US: North Carolina A&T State University, University of Pretoria in South Africa, Institute of Food Technology in Senegal, University of Eldoret in Kenya, and CIMMYT. CIMMYT is a very strong partner in the socio-economic aspect of their work.

Dr. Bugusu believes that a market-driven approach is necessary. The important factors are the demand and where it will make a profit for smallholder farmers. They are looking at the whole value chain, particularly effective ways to disseminate the technologies and how they can engage key stakeholders. Dr. Bugusu also addressed the importance of gender integration, as women do most of the post-harvest work in Sub-Saharan Africa.

**Dr. Dieudonné Baributsa, Research Assistant Professor (Purdue Improved Crop Storage – PICS2)**

Dr. Baributsa explained that much of the growing population will be in developing countries and his work is looking at how to reach smallholder farmers to reduce post-harvest losses. Farmers who use PICS bags can sell their grain when they want for a high market price and have improved food security. The Bill and Melinda Gates Foundation, Feed the Future, and USAID are currently promoting the program in more than 20 countries in Africa and Asia. Working with government extension services, local and international NGOs, farmer organizations, and women organizations, he highlighted that many of these countries and partnerships have been necessary. The difficulties lie in building the markets and moving technologies to the farms. Farmers like the technology, they want the technology, but they have a hard time finding the product. To date 5 million PICS bags have been sold. Although they have tried the private sector is not able to move fast enough to get this technology to smallholders.

In some situations, it is difficult to get the government to commit or expand the technologies to different areas. They need to learn the proper use of the technology, afford the technology, and get the technology. It is very expensive to promote these technologies. They have been able to get innovations to smallholder farmers and there are opportunities to work on this same platform that PICS has worked on along with the private sector.

**Gary Burniske, Managing Director, Center for Global Food Security (Borlaug Fellows Program)**

Dean Akridge asked Mr. Burniske to comment on the Borlaug Fellows program and the impact it has.

Mr. Burniske responded by saying that the US Borlaug Fellows Program in Global Food Security is designed to increase the numbers of outstanding US food security professionals equipped with the scientific knowledge to effectively manage global landscapes to support sustainable food systems. The program provides exceptional graduate students in a range of disciplines relevant to food security with the support to conduct research in developing countries in collaboration with an international agricultural research institution such as those within the CGIAR system, or a national agricultural research organization or university. Students work with a scientist mentor from the host research institution and spend between 6 months and 2 years in residence, conducting field trials or collecting information that contribute towards their thesis or dissertation, and leading to Masters or Doctoral degrees. To date, the program has fielded 110 graduate students from 45 universities across the States at 43 research centers in 38 developing countries with most students clustered in Feed the Future countries. We anticipate supporting an additional 60 students over the upcoming year.

In addition to research abroad, the Borlaug program also hosts a Summer Institute - which is an intensive two-week introduction to Global Food Security oriented to graduate students, domestic and international - studying at US universities. The Summer Institute has lectures, practicums, panels, field trips, individual and group projects. Over the course of two weeks, interdisciplinary teams are formed and charged with developing proposals for tackling pressing food security issues in a Feed the Future country. They present their proposals during the final day of the institute, providing an excellent team building opportunity. To date, the program has hosted 135 students

during the first four Summer Institutes from 52 universities of which 64% have been domestic students and 36% have been international students from 25 countries.

### **PANEL #3: Question/Answer and Comment Period by BIFAD Members and Public comment period**

Hon. Ash asked Dr. Baributsa and Dr. Bugusu if government plays only one role, as a facilitator, how they can play a role in helping the agriculture and food sector.

Dr. Bugusu said that many governments have minimal investments in agriculture and infrastructure that is needed to disseminate the technologies that they are working on. Governments need to do more than just facilitate, they need to provide loans to many of these stakeholders so that business ventures must be conducted. Roads, electricity, and other infrastructure are needed for effective business environments.

Dr. Baributsa responded that government should try to create a dialogue and try to give well-balanced incentives to the private sector.

Dr. Ejeta asked Mr. Moseley about the decline on public spending on the intersection of science, technology, and policy and how we get the governments to become involved in agricultural research for the future of our countries.

Mr. Moseley responded by saying that land-grant universities are very important in this dialogue. It is a matter of perspective, first there is a large amount accomplished from the early 1900's. People came off of the land and the country grew, and it has done well economically. The land-grant system should reflect upon its current role. It has done well, but funding continues to be a challenge. The world is becoming, in our lifetime, perhaps a more dangerous place. Agriculture is directly linked to national security. Thirty to forty years from now, the world will be around at most 10 billion and there are still people who are hungry now. A government choosing to feed other people leads towards stabilization and peace.

Chairman Deaton stated that the private sector has discovered that there are strategies that can be taken to address the changing climate issues. He asked Dr. Baributsa and Mr. Burniske what needs to be done to harmonize sectors in the bigger picture and how can a business force be created attuned to these needs.

Dr. Baributsa said developing countries must be incorporated in these programs as there is a lack in human capacity.

Mr. Burniske said that the US Borlaug Fellows program has had lasting research impacts on individuals conducting food security research that will and has inspired careers. Sparking interest in this sector for emerging leaders is an important priority.

Dean Akridge asked how to take full advantage of the land-grant system and how to utilize the

three departments of education, extension, and research.

Dr. McPherson said that land-grant universities have played a large part in the development and dissemination of technology, and partnering with a lot of the private sector.

Dr. Ejeta provided some concluding statements, stressing the importance of the BIFAD board meeting at Purdue University and other BIFAD meetings at other universities, highlighting the opportunity to interact with faculty as being very significant. This is an important partnership that needs to be developed and the board was made to serve as a partner to the US government. Bringing the board to universities is an important initiative.

Chairman Deaton thanked the panelists and the Purdue University students and faculty. He adjourned the meeting at 4:00 p.m. EDT.