Press Release

17 October 2017

Feed the Future Legume Innovation Lab Bean breeders Juan Carlos Rosas (l.) and James Beaver (rt.) examine a test field of improved bean lines.

Dr. James Beaver (right), of the University of Puerto Rico, and Dr. Juan Carlos Rosas (left), of the Zamorano Panamerican Agricultural University in Honduras, have been selected as winners of the Board for International Food and Agricultural Development (BIFAD) Award for Scientific Excellence in a Feed the Future Innovation Lab.

They are recognized for their contributions to breeding disease-resistant and drought/heat-tolerant varieties of common bean of diverse market classes under the Feed the Future Innovation Lab for Collaborative Research on Grain Legumes, led by Michigan State University.

The team is responsible for the breeding and release of more than 60 cultivars with increased yield, quality, and stability throughout Central America and the Caribbean. They developed more than 23 bean lines and germplasm resistant to Bean Golden Yellow Mosaic Virus, Bean Common Mosaic Virus, and Bean Common Mosaic Necrosis Virus—three highly destructive bean diseases that affect vulnerable, smallholder farmers throughout Central America.

Drs. Beaver and Rosas are also recognized for combining other important traits into the virus-resistant bean cultivars, including resistance traits to fungal diseases, such as web blight and angular leaf spot, and to bean weevil, a serious postharvest grain pest during household storage, plus higher symbiotic nitrogen fixation capacity. Additional research achievements have been genetic improvements in heat and drought tolerance in common bean, which has enabled production in the lowland tropics. This work has been augmented by recent support from the Feed the Future Innovation Lab for Climate-Resilient Beans, led by the Pennsylvania State University. Their research collaboration spans more than 30 years and has contributed directly to improved incomes and increased food security among smallholder farmers in a neglected region of the world.

Drs. Beaver and Rosas have provided innovative leadership in developing and promoting local seed multiplication systems to ensure that smallholders have access to quality bean seed of improved varieties. Using participatory plant breeding approaches, they include smallholder farmers' input in making varietal selections—an approach now used worldwide.

Always focused on the future of bean research, Beaver and Rosas are committed teachers and have trained and mentored a large cadre of students who are now working in leadership positions at universities, national/international agricultural research organizations and the private sector around the world.

The Board for International Food and Agricultural Development (BIFAD) is a presidentially appointed federal advisory committee established in 1975 under Title XII of the Foreign Assistance Act, as amended. Recognizing the critical role of US land-grant institutions in agricultural development, domestically and abroad, and the importance of their engagement in USAID development programs, the BIFAD's main purpose is to advise USAID on agriculture and higher education issues pertinent to global food security in developing countries. For questions, please contact the Designated Federal Officer for BIFAD, Dr. Clara Cohen, at **ccohen@usaid.gov** or 202-712-0119.

Photo credit: I. Widders, Michigan State University

United States Department of Agriculture
Research, Education, and Economics
Agricultural Research Service

Wednesday, September 6, 2017

Nomination: BIFAD Award for Scientific Excellence in an Innovation Lab

To Whom it May Concern,

It is a privilege to have the opportunity to nominate Dr. James Beaver and Dr. Juan Carlos Rosas for the eminent BIFAD Award for Scientific Excellence in an Innovation Lab. Both scientists are exemplary common bean breeders whose individual contributions to common bean improvement merit significant recognition. However, their outstanding, long-term collaboration, encompassing research over 30 years, has resulted in synergistic advances in pyramiding disease, abiotic and insect resistance in cultivars spanning Central America and the Caribbean, and has resulted in substantial gains in training and institutional development. This collaboration will be the focus of this nomination as it has profoundly changed the lot of both subsistence and commercial farmers in the region, and led to substantial development of rural communities and national institutions. Their research has been partially funded by the Bean/Cowpea (1982-2006), the Dry Grain Pulses Collaborative Research Support Programs (2007-2012), the Feed the Future Innovation Lab for Collaborative Research on Grain Legumes (2012-2017), and the Climate Resilient Bean Project (2013-2018), which are funded by the Bureau for Food Security of the United States Agency for International Development (USAID). The achievements reported here cover the period of 2007 to 2017.

I am a Research Geneticist with the USDA-ARS at the Tropical Agriculture Research Station in Mayaguez, Puerto Rico. I have had the pleasure of working with Dr. Beaver and Dr. Rosas in collaborative research spanning 6 years during my tenure as a Ph.D. student at Cornell University and during the last 14 years at the USDA-ARS. I feel uniquely positioned to recommend both of these eminent scientists since I have worked closely with them as both a young scientist during my research on heat tolerance in common bean in both Honduras and Puerto Rico, and since as a close collaborator who has been a recipient of their generous and effective collaborative approach to research.

Although Drs. Beaver and Rosas have had collaborative projects together since 1988, advances during the last two periods of funding, from 2007 to 2017, have resulted in significant achievements in innovation that merit recognition. They have lead significant advances in the characterization of agriculturally important diseases in the region and in the development of disease and abiotic stress resistant cultivars and germplasm. Their methodical approach to pyramiding resistance genes using both conventional screening techniques and marker assisted selection has resulted in multiple disease resistant cultivars that have brought increased food security to the region.

Tropical Agriculture Research Station
2200 P. A. Campos Avenue, Ste. 201
Mayaguez, Puerto Rico 00680-5470
Phone: (787)831-3435 Fax: (787)831-3386

Nature and scientific significance of their innovations:

Bean golden yellow mosaic virus (BGYMV), a critical constraint to common bean production in the Caribbean and Central America, has been a central component of their breeding objectives. They played crucial roles to the early characterization and development of BGYMV resistant cultivars and germplasm in collaboration with CIAT-Guatemala and the U. of Wisconsin in the 1980s and 1990s. This early progress has allowed for the current broad implementation of BYGMV resistance in common bean cultivars developed for the Caribbean and the Central American region. They have implemented an elevated standard for release of multiple virus resistant cultivars, through the pyramiding of BGYMV, BCMV, and BCMNV resistance. These recent efforts have resulted in releases of high yielding cultivars that combine general abiotic and biotic resistance in addition to this multiple virus resistance and include: 'Sankara', 'Bella', 'MEN 2201-64 ML', 'Aifi-Wuriti', 'Beniquez', 'PR0737-1' and 'PR0806-80'. During the last period of this collaborative effort they have released over 23 cultivars and germplasms that will impact thousands of subsistence and commercial farmers throughout the region and many more consumers.

Web blight, a wide-spread and intractable disease in common bean, has been a focus of their collaborations during the last 10 years. To combine sources of resistance to web blight, they have completed four cycles of recurrent selection for web blight in Honduras and discovered possible independent control of seed quality and foliar response in common bean. These collaborative efforts have resulted in recent advanced breeding lines with high levels of resistance to web blight combined with bacterial blight resistance and resistance to BYGMV, BCMV, and BCMNV. This pyramiding of resistance to individually complex disease resistance traits is an extraordinary achievement. In addition they have identified current cultivars and germplasm with good levels of resistance to web blight including Amadeus 77, PR 1147-1, and TARS-MST1.

Instead of focusing solely on the genetic diversity available within common bean, Dr. Beaver and Dr. Rosas pursued the use of other Phaseolus species as sources for bruchid (or grain weevil) and heat/drought tolerance, specifically from tepary bean (*P. acutifolius*). This seminal work on bruchid (*Acanthoscelides obtectus* Say) resistance is a game changing post-harvest achievement as it alleviates rapid degradation of seed and grain quality in the tropics and subtropics, particularly affecting poor farmers. The germplasm developed from these efforts represent the first broad implementation of bruchid resistance in the development of cultivars of Andean and Mesoamerican seed classes. The recent release of the red mottled 'AO-1012-29-3-3A', that combines BCMV and BCMNV resistance with bruchid resistance, is a milestone in this effort. This valuable genetic material was painstakingly selected from crosses with interspecific lines between common and tepary beans that were originally developed between Oregon State University and Sokoine University in Tanzania. During the last 10 years Dr. Beaver and Dr. Rosas have developed local methods for screening with the bruchid insect, moved this resistance into multiple seed classes, evaluated the genetics of bruchid response in common bean, tested these lines with different bruchid biotypes and species, are collaborating on developing breeder friendly markers, and are now testing these improved lines in multiple countries.

Their early recognition of the potential detrimental effects of climate change on common bean production worldwide resulted in early breeding efforts focused on improving both drought and heat tolerance and in improving yield stability in current common bean production systems in Central America and the Caribbean. Through the establishment of new low-land tropical selection environments in locations like Nacaome, Honduras, summer season testing in Isabela and Juana Diaz, Puerto Rico, and in collaborative testing sites in other countries such as El

Salvador and Guatemala, they have achieved significant advances in heat and drought tolerance. The recently collaborative release of the 'CENTA EAC' cultivar in El Salvador, with higher yield potential under high temperatures and drought, follows the earlier release of the heat tolerant cultivar 'Amadeus 77', the most broadly grown common bean cultivar in Central America. In addition, the recent release of 'Don Rey' in Honduras and of 'MEN2201-64ML' in Haiti promise to improve common bean yields under increasing temperatures and drought, while also combining critical disease resistance traits. Additional traits requiring improvement under abiotic stress in the humid tropics including biological nitrogen fixation, resistance to ashy stem blight disease, and resistance to the leaf hopper insect pest also have also been focal areas of their efforts where significant advances have been made.

The use of tepary bean, a highly abiotic-stress tolerant sister species, as a source of abiotic and biotic stress tolerance, promises to continue to provide a significance increase in the resilience of common bean. In addition, this project has been one of the only efforts worldwide focused on improving disease resistance in tepary bean. For marginal environments, too dry or hot for common bean production, tepary bean can been implemented as an alternative legume crop. In 2013, TARS-Tep22, the first improved tepary bean germplasm to be improved using modern plant breeding methods, with rust, bruchid, and bacterial blight resistance, was formally released and has been distributed to the US, Central America, Haiti, and to countries in Sub-Saharan Africa. Recent work has resulted in the selection of the first tepary bean breeding lines with tolerance to BGYMV, the identification of wild tepary with BCMNV and BCMV resistance, and the discovery of three QTL controlling the response to web blight in a tepary RIL population.

Role of innovations in improving the livelihood of the poor:

In addition to the development of scientific innovations that have had broad impact in the common bean sector, Drs. Beaver and Rosas have provided innovative leadership for scaling-up and disseminating these innovations through technology transfer. One key application has been the development and promotion of local seed multiplication systems in Haiti and Central America to ensure that smallholder farmers have access to quality seed of varieties with improved genetics. Dr. Rosas is specifically recognized for his leadership in and advocacy of participatory plant breeding approaches. As a result, these methods are utilized worldwide by grain legume breeders because of the value of farmer input in trait selection and of improved adoption of farmer-researcher collaborative cultivar selections. The widespread demand in Honduras for the newly released cultivar 'Parasito Mejorado 2- Don Rey', a small-red seda seed type with excellent adaptation to the agro-ecologies of the region, is an example of the effectiveness of the participatory breeding approach. The integration of cultivar development and seed production and dissemination at Zamorano and at the University of Puerto Rico has resulted in the improvement of the livelihood of poor subsistence farmers. These efforts have resulted in broad adoption of their improved cultivars in Central America and Puerto Rico resulting in the majority of bean production in both regions using these cultivars and benefiting from their increased yields and seed quality.

Dr. Beaver and Dr. Rosas have worked closely with the National Seed Service of Haiti in the development and release of 'Sankara', a multiple virus resistant black bean cultivar adapted to

multiple agro-climatological zones of Haiti. Considering the susceptibility of the seed sector to natural disasters, they collaborated with USDA-ARS in the implementation of a high quality and reliable Idaho-based seed production and dissemination system for Haiti that resulted in seed dissemination following Hurricane Matthew in 2016, thus contributing directly to food security of the poor and disadvantaged in Haiti. This effort resulted in the production of an estimated 190,000 kg on 190 hectares and the incorporation of the seed in the existing seed Haitian seed distribution systems, likely reaching 1,000s of farmers. These effort will have long-term impact on the economic growth in Central America and the Caribbean through increasing the productivity of common bean through increased yield and seed quality.

The impact of their scholarship has extended internationally resulting in publications of over 35 referred journal papers during this 10 year period. In addition, their regional approach to breeding, collaboration, and training has resulted in long-term, substantial, and broad impact in the knowledge-base in the Caribbean and Central America, and more recently in Sub-Saharan Africa. They have organized multiple workshops focused on critical research constraints such as research methods (Angola, 2008; Honduras, 2009; 2015), biological nitrogen fixation (Mozambique, 2012, Puerto Rico, 2014; Haiti, 2015), seed production (Honduras, 2015), abiotic stress tolerance (Puerto Rico, 2016), and future constraints and objectives (Honduras, 2017). Their dedicated training efforts have resulted in numerous undergraduate theses on important common bean production constraints, including training of Masters students from Angola, Ecuador, Guatemala, Haiti, Honduras and Nicaragua who are now successful researchers in universities, national agriculture research organizations, International Agriculture Research Centers and in the private sector around the world. The combined effects of this committed effort to training has resulted in the development of institutional and research capacity in each of the collaborating countries. Instead of being largely dependent on external sources of breeding materials, programs such as Guatemala, for example, are generating their own genetic material, have long-term objectives and have made significant progress in the development of their breeding programs. Broader collaboration with additional institutions, including CIAT, US Universities and the USDA-ARS have led to the incorporation of several cutting-edge technologies. The inclusion of North Dakota State University and new ARS collaborators in the project during the last cycle of funding has allowed for an additional focus of accelerating the improvement of biotic/abiotic stress tolerance in common bean through implementation promising novel genomics tools such as GBS and genetic GWAS analyses and phenomics technologies using proximal sensing carts and drones.

The widespread contributions of Dr. Beaver and Dr. Rosas to common bean improvement has resulted in numerous awards. Noteworthy awards received by Dr. Juan Carlos Rosas include the Bean/Cowpea and Dry Grain Pulses CRSP Award for Meritorious Achievement, the Bean Improvement Cooperative's Meritorious and Distinguished Achievement Awards, and the Gamma Sigma Delta Honor Society of Agriculture Distinguished Achievement in Agriculture, the highest award given by the Society in recognition of exceptional achievements in agriculture. In 2016, he received the distinction of having a teaching auditorium named after him at the Escuela Agricola Panamericana. Among his many awards, Dr. Beaver received the 2015 Certificate of Recognition from the House of Representatives of the Commonwealth of Puerto Rico for Bean Research Contributions, the 2007 Arturo Roche Award for Excellence in Research presented by the Dean and Director of the College of Agricultural Sciences of the University of Puerto Rico, and the Bean Improvement Cooperative's Meritorious and Distinguished Achievement Awards. He was also named a Fellow of the Crop Science Society of America in 2011.

In conclusion, I strongly recommend Dr. James Beaver and Dr. Juan Carlos Rosas for the BIFAD Award for Scientific Excellence in an Innovation Lab. Their contributions as a collaborative team to the common bean research community, and more importantly to farmers worldwide, have been outstanding and will continue to be felt long into the future.

Sincerely,

Timothy Porch, PhD
Research Geneticist
USDA-ARS Tropical Agriculture Research Station,
Mayaguez, Puerto Rico 00680

Tropical Agriculture Research Station
2200 P. A. Campos Avenue, Ste. 201
Mayaguez, Puerto Rico 00680-5470
Phone: (787)831-3435 Fax: (787)831-3386