

# IOWA SEED & BIOSAFETY NEWS

VOL. 32 NO. 1 | FALL 2016



THE NEWSLETTER OF THE SEED SCIENCE CENTER AND THE BIOSAFETY INSTITUTE FOR GENETICALLY MODIFIED AGRICULTURAL PRODUCTS

## New Scholarship Honors Global Food Security Advocate David Lambert

Seed Science Center Distinguished Fellow David Lambert dedicated his career to developing strategies to mitigate world hunger.

The first recipients of a new endowed scholarship for undergraduate students at Iowa State University (ISU) are scheduled to be announced Thursday, October 13, during a luncheon held in conjunction with the World Food Prize's 2016 Borlaug Dialogue.

Established in memory of global food security advocate David Lambert, the David Lambert Hunger Fighter Memorial Scholarship was created to honor the strides that Lambert made in addressing food security and malnutrition during his lifetime.

Funded by contributions from Lambert's family and friends, the \$1,000 scholarship will be awarded to an Iowa State University sophomore or junior each year with a demonstrated interest in seed science, global food security, and/or childhood nutrition. Recipients will be selected on the basis of academic excellence, leadership skills, and interpersonal skills.

"Everyone who knew David knew what a kind and generous man he was," said Seed Science Center Director Manjit Misra. "David was a Distinguished Fellow for our center, an avid supporter of the World Food Prize, and my friend. He truly believed that no child, whether he or she resides in the U.S. or around the world, should ever go to bed hungry. And, he tirelessly committed himself to developing policy to fight hunger and malnutrition to make that goal a reality."

David's close friend Dan Silverstein agrees. "David inspired many to embark on careers of service to others. He spoke truth to power, advocating forcefully for the moral obligation of ending world hunger. He inspired audiences to see hunger at personal level, and do something about it."

(See page 2 for more information about David Lambert.)

**"David inspired many to embark on careers of service to others. He spoke truth to power, advocating forcefully for the moral obligation of ending world hunger.**

**He inspired audiences to see hunger at a personal level, and do something about it."**

**—Dan Silverstein**



TO FEED THE FUTURE  
WE MUST FIRST *SEED* THE FUTURE

SEED SCIENCE CENTER AND  
BIOSAFETY INSTITUTE FOR  
GENETICALLY MODIFIED  
AGRICULTURAL PRODUCTS

AMES, IOWA, 50011-1050

Phone (515) 294-6821

Fax (515) 294-2014

Email [seedsci@iastate.edu](mailto:seedsci@iastate.edu)

SSC Website

[www.seeds.iastate.edu](http://www.seeds.iastate.edu)

Seed Lab Website

[www.seedlab.iastate.edu](http://www.seedlab.iastate.edu)

BIGMAP Website

[www.bigmap.iastate.edu](http://www.bigmap.iastate.edu)

Director

Manjit Misra

#### PROGRAM LEADERS

Center Business Manager

Lisa Shen

Communications

Regina Hendrickson

Computer Technology

Yuh-Yuan Shyy

DNA Laboratory

Nancy Gonzalez

Global Food Security Consortium

Cassie Welch

Global Programs

Dileepkumar Guntuku

Risk Assessment

Jeff Wolt

Seed Conditioning

Alan Gaul

Seed Health

Charlie Block, Tracy Bruns

Seed Pathology

Gary Munkvold

Seed Physiology

Susana Goggi

Seed Technology & Business  
Curriculum

Gary Munkvold, Lori Youngberg

Seed Testing

Mike Stahr



## About David Lambert

David Patterson Lambert was an internationally recognized advocate for global food and nutrition security. An avid supporter of the World Food Prize, Lambert was passionate in his fight against world hunger.

The principal of Lambert Associates, a Washington-based public affairs consulting firm, Lambert provided strategic policy advice on issues including food safety, biotechnology, child nutrition, and global food security.

During his career, Lambert served as Senior Vice President to the New York Stock Exchange, and Legislative Assistant to U.S. Senator J. William Fulbright of Arkansas, Chairman of the Senate's Foreign Relations Committee. Former President Clinton appointed Lambert Permanent Alternate Representative and Foreign Agricultural Service Counselor to the U.S. Mission to U.N. Agencies, and he served as a member of the U.S. Delegation to the U.N.'s Codex Food Safety Commission in Rome and Geneva. Lambert also accompanied Ambassador George McGovern on humanitarian missions throughout Asia and Africa.

Lambert held the position of Distinguished Fellow for the Iowa State University (ISU) Seed Science Center from 2009 to 2015 and lectured at the Catholic University of America, teaching graduate courses on global food security and hunger issues.

Lambert passed away October 16, 2015, at the age of 75.

## IN THIS ISSUE

- |   |  |    |  |
|---|--|----|--|
| 3 | Vilsack, Cuban Delegation Visit Seed Science Center                    | 9  | Symposium Poster Competition Winners Named                           |
| 3 | Haryana Minister of Agriculture Discusses Ag Practices                 | 10 | STB Holds First Lunch and Learn                                      |
| 4 | Seed Health Testing Staff Make Commitment to Excellence                | 11 | Commentary: Weighing in on Cover Crops, Palmer amaranth              |
| 5 | Advancements in Seed Counting Technologies Prompt Rule Change Proposal | 12 | Guntuku Works with USAID ATT Program in Ghana                        |
| 6 | Research Highlights  | 12 | Telangana Ag Minister Visits ISU                                     |
| 7 | Awards, Recognitions, Activities                                       | 12 | Memorial Clock Dedicated to Lisa Shepherd Jenkins                    |
| 7 | Summers Named Misra Scholar  | 13 | Wolt Committed to Biotech Capacity Building in Korea                 |
| 8 | Symposium Highlights "REAL Sustainability"                             | 13 | Blake Installs Testing Equipment in Ghana, Trains Seed Entrepreneurs |
| 8 | ISU Signs MOU with Zamorano Agricultural School                        | 14 | Seed Science Center Profiles   |
| 9 | Outstanding Achievement Awards Honor Shepherd Jenkins, Lambert         | 15 | Center Shortcourse, Workshop Update                                  |

**Cover:** (From left) David Lambert speaks on world hunger issues at Iowa State University, talks to attendees of the Wallace-Carver Washington Leadership Symposium, and stands in a soybean field.

*Iowa State University does not discriminate on the basis of race, color, age, ethnicity, religion, national origin, pregnancy, sexual orientation, gender identity, genetic information, sex, marital status, disability, or status as a U.S. veteran. Inquiries regarding non-discrimination policies may be directed to Office of Equal Opportunity, 3350 Beardshear Hall, 515 Morrill Road, Ames, Iowa 50011, Tel. 515 294-7612, Hotline: 515-294-1222, email [eooffice@iastate.edu](mailto:eooffice@iastate.edu).*



Left: Agronomy Associate Professor Susana Goggi explains seed testing methods to U.S. Agriculture Secretary Thomas Vilsack and Cuban Minister of Agriculture Gustavo Rodriguez Rollero. Right: Vilsack spoke on the importance of Iowa State's land-grant mission in promoting agricultural sustainability.

## U.S. Agriculture Secretary Thomas Vilsack and Cuban Delegation Visit Seed Science Center

U.S. Agriculture Secretary Thomas Vilsack and a nine-member Cuban delegation, including Cuban Minister of Agriculture Gustavo Rodriguez Rollero, visited the Seed Science Center on June 3.

After Seed Science Center Director Manjit Misra welcomed the delegation, Vilsack commented on the importance of Iowa State University's land-grant mission given global food security challenges. "I want to welcome you to one of the truly great land-grant universities," said Vilsack. "The land-grant system was started by President Abraham Lincoln in the midst of our own Civil War. He understood then, as we understand today, that knowledge is key. That development of knowledge occurs in labs across universities. And it is important that we transfer that knowledge. Agriculture faces many challenges, the least of which is to be more sustainable."

Rollero then commented on the role of seed in agricultural development. "I am sure that after our tour of the labs here [at the Seed Science Center], I will reaffirm my belief that there cannot be any type of projection for development for agriculture anywhere in the world unless the first thing that is resolved and projected for research are the seeds and the phytogetic resources."

Following a tour of the Seed Science Center provided by Agronomy Associate Professor Susana Goggi, the delegation was joined by a number of key Iowa agricultural stakeholders in a roundtable session. The group discussed opportunities for collaboration including agricultural trade with Cuba.

"I am sure that after our tour of the labs here [at the Seed Science Center], I will reaffirm my belief that there cannot be any type of projection for development for agriculture anywhere in the world unless the first thing that is resolved and projected for research are the seeds and the phytogetic resources."

—Cuban Minister of Agriculture Gustavo Rodriguez Rollero

## Haryana Minister of Agriculture Discusses Agricultural Practices and Opportunities

Iowa State University College of Agriculture and Life Sciences Endowed Dean Wendy Wintersteen and Seed Science Center Director Manjit Misra welcomed Om Prakash Dhankar, Cabinet Minister of Agriculture, Animal Husbandry and Dairying, Fisheries, Irrigation, and Development and a delegation from Haryana, India, to the Seed Science Center on August 9th.

Dhankar and his delegation toured the center, after which they discussed Iowa agriculture and possibilities for future collaborations.

Prior to arriving in Ames, Dhankar met with Iowa Agriculture Secretary Bill Northey at the Capitol, where the two signed a Memorandum of Cooperation.

The purpose of the group's visit was to learn more about Iowa's agricultural production and technologies. Haryana, a state in northwest India, is a leading contributor of the country's food grain and milk production.



From left: Varinder Singh Kundu, Additional Chief Secretary to Government, Haryana Agriculture Department; ISU College of Agriculture and Life Sciences Endowed Dean Wendy Wintersteen; Haryana Minister of Agriculture Om Prakash Dhankar; and Seed Science Center Director Manjit Misra discuss agricultural production practices at the Seed Science Center.



Left: Jessica Blake, Charles Block, Tracy Bruns, and Kaitlin Metzger are pictured in the new Seed Health Testing Lab expansion. Right: Charles Block and Tracy Bruns work together to evaluate seed health samples.

*“Lisa Shepherd Jenkins created a seed testing program with a reputation for trustworthiness and excellence. We hope to build upon and to strengthen that reputation as we move forward.”—Charles Block*

## Seed Health Testing Lab Staff Make Commitment to Excellence a Priority

The sudden illness and passing of Iowa State University (ISU) Seed Health Testing Coordinator Lisa Shepherd Jenkins in the summer of 2015 necessitated an immediate and extraordinary effort be put forth by Seed Science Center faculty and staff. Seed Health Testing Lab staff and others quickly stepped in to volunteer their services and expertise, not only to keep Shepherd Jenkins’ lab running smoothly, but to ensure that it maintained its high level of quality service.

### Staff Welcomes New Coordinator, Moves into Expanded Space

Today some new, but familiar faces make up the Seed Health Testing Lab staff. And, in addition to moving into an expanded lab space, they are making it their priority to continue Shepherd Jenkins’ commitment to excellence in seed health testing.

Former USDA Plant Pathologist and ISU Plant Pathology and Microbiology Assistant Professor Charles Block assumed the position of Seed Health Testing Coordinator in July of 2016. Block, who brings with him nearly 40 years of experience working with seed-borne pathogens, and National Seed Health System (NSHS) Accreditation Coordinator Tracy Bruns head up the Seed Health Testing Lab staff which includes Lab Manager Kaitlin Metzger and Seed

Analyst Jessica Blake. As Seed Health Testing Coordinator, Block will work closely with Bruns. He will oversee the daily operations of the lab, and he and Bruns will participate on national panels, boards, and committees that involve seed-borne diseases, testing methods, and phytosanitary regulations. They will conduct research in seed pathology and will evaluate and improve existing seed-testing protocols and provide instruction and training for seed industry personnel, scientists, and regulatory officials.

Because the ISU Seed Science Center is the Administrative Unit for the NSHS, as Co-director of the NSHS Administrative Unit, Block will standardize laboratory and field inspection methods across the U.S. He will carry out technical reviews of laboratory seed health testing methods and will work with national and international contacts to keep abreast of new and emerging diseases. Block, Bruns, and NSHS Co-director Gary Munkvold, will also act as liaisons with the USDA-Animal and Plant Health Inspection Service’s Plant Protection and Quarantine program, the Iowa Department of Agriculture and Land Stewardship, and the American Seed Trade Association on international seed trade issues.

Plant pathologist Bruns served as Accreditation Coordinator and played an integral role as Interim Seed Health Testing Coordinator during the year

following Shepherd Jenkins’ death. She will assist Block in performing scientific evaluations of seed samples. She will also oversee NSHS applications for accreditation and accreditation renewals, will evaluate accreditation materials, and will act as liaison for the Cucumber Green Mottle Mosaic Virus (CGMMV) pilot program.

Kaitlin Metzger and Jessica Blake will manage and conduct day-to-day sample setup and processing of seed health samples, respectively.

Block is enthusiastic about his new position and co-workers. “The staff is fantastic,” he said. “Everyone is good to work with and helpful. I thought I knew what to expect when I came here, but truthfully, things are going *better* than I expected. I am pleased for the opportunity to blend my expertise with these individuals to address the challenges ahead. Lisa Shepherd Jenkins created a seed testing program with a reputation for trustworthiness and excellence. We hope to build upon and to strengthen that reputation as we move forward.”

The Seed Health Testing Laboratory at Iowa State is one of the most active phytosanitary seed testing programs in the country. It tests a large percentage of the seed lots exported from the U.S. and certifies other labs through the National Seed Health System (NSHS). The lab conducts sample diagnostics, pathogen identification, and interpretation of test results for more than 350 pathogens.



## About Charles Block

Charles Block previously served as a plant pathologist for the United States Department

of Agriculture - Agricultural Research Service (USDA-ARS) North Central Regional Plant Introduction Station and as an Assistant Plant Pathology Professor at Iowa State. He holds a B.S. in chemistry from Briar Cliff University and a master's and Ph.D. degree in plant pathology from Iowa State.

During his 37-year career at the Plant Introduction Station, Block coordinated the seed health testing program, handled phytosanitary issues, and provided support to curators on plant disease-related issues.

## Seed Health Testing Lab Expansion

An increase in the workload being experienced by Iowa State's Seed Health Testing Lab resulted in the need for additional space to process ELISA and other tests. A 324-square-foot expansion was completed this fall, and move-in is currently underway.



A progression of seed counting technologies: Trip board, mechanical seed counter, and electronic seed counter.

## Advancements in Seed Counting Technologies Prompt Committee to Pursue Rule Change Proposal

Seed Lab Manager and Association of Official Seed Analysts (AOSA) Vice President Mike Stahr is currently serving on an ad hoc committee that is developing an AOSA Rule change proposal. The proposal seeks to include electronic seed counters in Volume 1 of the *AOSA Rules for Testing Seed* that currently governs the use of mechanical seed counters.

Stahr says that although some aspects of seed testing haven't changed greatly in the last 100 years, the emergence of biotech traits, on-line seed herbariums, cameras that measure the rate of seedling growth, and the increased use of electronic seed counters have brought about significant changes in the seed testing industry.

"Years ago, the alternative to counting seeds by hand was to use a trip board, which typically has a capacity for 100 seeds," says Stahr. "A big leap from that method was the invention of the vibratory mechanical seed counter, which walks (by vibrating) seeds up a type of spiral staircase until they drop one by one past a photo eye." By using this method, Stahr says a 500-gram sample of soybean seed might take five minutes to be counted.

Today another major advancement in seed counting is the use of electronic seed counters that can accurately count some species of seed at the rate of hundreds of seeds per second. These electronic seed counters not only have the ability to count very small and irregularly shaped seeds, but can also provide information about seed surface area and color.

To better understand how widespread the use of electronic seed counters is, Stahr's committee sent a survey to AOSA labs and Society of Commercial Seed Technologists (SCST) members inviting them to share information regarding their use of mechanical vs. electronic seed counters. "One of the findings has been that nearly 50% of the respondents are using electronic seed counters," he said.

A Rule change proposal will be submitted in October. To support the proposal, Stahr's committee is conducting a referee comparing the use of mechanical and electronic seed counters.

AOSA Rules are added each year, and existing rules are modified in recognition of advances in seed testing or changes in the use of seeds. Submission of AOSA Rule proposals are due by mid-October each year and cover a wide range of topics in seed testing. Individuals attending the American Seed Trade Association (ASTA) conference in Chicago each December have the opportunity to preview the submitted proposals. Proposals that meet AOSA requirements (those that have supporting evidence, or are submitted in cooperation with other labs, etc.) are posted on the AOSA and SCST website ([www.analyzeseeds.com](http://www.analyzeseeds.com)) in February and are announced in a webinar in early May. Proposals are then discussed and voted on at the AOSA/SCST Annual Meeting each June. Successful Rule proposals are incorporated into the *AOSA Rules for Testing Seeds* and are released the following October.

## Research Highlights—

### Soybean Proteins GmTic110 and GmPsbP are Crucial for Chloroplast Development and Function

D. Sandhu, T. Atkinson, A. Noll, C. Johnson, K. Espinosa, J. Boelter, S. Abel, B.K. Dhatt, T. Barta, E. Singasaas, S. Sepsenwol, A.S. Goggi, and R. Palmer

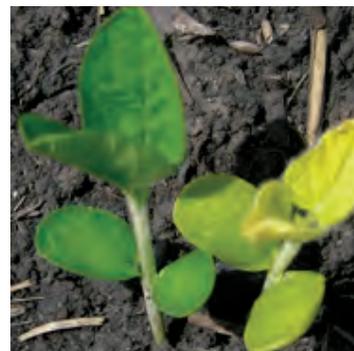
Genome fluidity, the capacity of the genome to reorganize, has been documented for many plants. These changes are usually the result of biotic or abiotic environmental stress. Associate Professor of Agronomy and Seed Science Susana Goggi and her students investigated the effects of environmental stress on seed. Goggi collaborated with United States Department of Agriculture - Agricultural Research Service (USDA-ARS) Research Geneticist and former University of Wisconsin Professor Devinder Sandhu, and the late USDA-ARS Research Geneticist and Iowa State University (ISU) Agronomy Affiliate Professor Reid Palmer, to evaluate descendants from single soybean plants grown in an ultra-low-density planting design. The team investigated chlorophyll metabolism in yellow-viable mutant soybean seedlings and their yellow-lethal mutant counterparts. This article, for the first time, explains why some chlorophyll deficient plants can survive, while others die. Understanding these genetic, cytological, and physiological processes in mutants, helps us understand the normal function of a healthy plant. This research was partially funded by the American Seed Research Foundation, the Iowa Crop Improvement Association, and the ISU Department of Agronomy (Baker Funds).

To access the full article visit: *Plant Science* 252 (2016): 76–87. <http://www.sciencedirect.com/science/article/pii/S0168945216301893>.

### The Effects of GA<sub>3</sub> and Psyllium Husk on Switchgrass Germination and Establishment

J.N. Butters, K.J. Moore, A.W. Lenssen, A.S. Goggi, and C.A. Bartel

Iowa State University (ISU) CenUSA Bioenergy intern Jessica Butters from Central College in Pella conducted research at the Seed Science Center this summer. She investigated ways to improve switchgrass emergence and establishment, one of the serious production limitations for this biomass-producing warm season perennial grass that is native to Iowa prairies. In an effort to increase yield and efficiency, Butters investigated the two main causes of poor switchgrass establishment, which include dormancy and seed desiccation, through laboratory and field studies. Butters was hosted by Agronomy Professors Ken Moore and Andy Lenssen, and Associate Professor of Agronomy and Seed Science Susana Goggi. She used growth promoters KNO<sub>3</sub>, or GA<sub>3</sub> to break seed dormancy and psyllium husk to improve water retention. Butters worked under the direct supervision of ISU Seed Laboratory Trait Coordinator Tyler Tuning and Seed Analysts Nancy Heideman, Kim North, and Usha Arora. While GA<sub>3</sub> increased germination rates over KNO<sub>3</sub> and H<sub>2</sub>O, final germination percentage was unchanged. Adding psyllium husk, with or without growth promoters, did not improve total germination. Results from this research were presented at a poster session for ISU CenUSA Interns.



Top: Yellow-lethal mutant (right) and normal soybean seedlings. Bottom: Normal, yellow-lethal mutant and yellow-viable mutants growing at the ISU Bruner Farm in Ames.



Seed treated with psyllium husk forms a gelatinous mass when placed on a moistened blotter.

# Awards, Recognitions, Activities

## Goggi Named CSSA Fellow

The Crop Science Society of America (CSSA) announced in July that Susana Goggi will be named a 2016 Fellow at an awards ceremony to be held during their Annual Meeting November 6-9 in Phoenix. Fellow is the highest recognition given by the CSSA. Members of the Society nominate worthy colleagues based on their professional achievements and meritorious service. Up to 0.3 percent of the Society's active and emeritus members may be elected to Fellow.



Susana Goggi

## Stahr Elected AOSA Vice President

Seed Lab Manager Mike Stahr was elected Vice President of the Association of Official Seed Analysts (AOSA) in May and installed at their annual meeting with the Society of Commercial Seed Technologists (SCST) in Portland, Oregon, in June. Stahr will serve two years as VP and two years as President. Stahr also serves as Co-Chair of the AOSA Rules Committee and as Chair of the AOSA Vigor Committee.



Mike Stahr

## Munkvold To Serve as APS Councilor-at-Large

The American Phytopathological Society (APS) has elected Plant Pathology and Microbiology Professor Gary Munkvold to serve as Councilor-at-Large for a three-year term. As Councilor-at-Large, Munkvold will serve as a liaison between APS members and the leadership council.



Gary Munkvold

## Newlin Earns Lifetime Achievement Award

The American Seed Trade Association (ASTA) honored seed-industry veteran Owen J. Newlin with its inaugural Lifetime Industry Achievement Award at their June meeting in Portland, Oregon. The award recognizes exceptional professionals whose career contributions to the seed industry span more than 50 years. Newlin, an ISU alumnus, has served the seed industry for more than 60 years. For more information visit: [www.betterseed.org/about-asta/seed-industry-honors/](http://www.betterseed.org/about-asta/seed-industry-honors/)



Owen J. Newlin

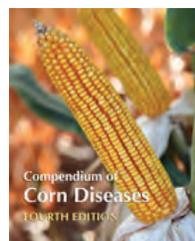
## Block is Co-Editor of *Compendium of Sunflower Diseases and Pests*

Seed Health Testing Coordinator Charles Block is co-editor of the first edition of *Compendium of Sunflower Diseases and Pests* recently released by the American Phytopathological Society. The publication is available at: [www.apsnet.org/apsstore/shopapspress/Pages/45072.aspx](http://www.apsnet.org/apsstore/shopapspress/Pages/45072.aspx).



## Munkvold Co-Edits *Corn Disease Compendium*

Plant Pathology and Microbiology Professor Gary Munkvold, co-edited the fourth edition of the *Compendium of Corn Disease*, recently released by the American Phytopathological Society. Visit: [www.apsnet.org/apsstore/shopapspress/Pages/44921.aspx](http://www.apsnet.org/apsstore/shopapspress/Pages/44921.aspx) for more info.



## Summers Named Misra Scholar

Haleigh Summers of Urbana, Illinois, was named the 2016 Manjit Misra Outstanding Senior Scholar. The announcement was made at the Iowa Seed Association (ISA) Scholarship Recognition Luncheon held during the Agribusiness Showcase and Conference in Des Moines on February 10, 2016.

Summers, who received \$500 in addition to a \$1,000 ISA scholarship, is an Iowa State senior double-majoring in agronomy and seed science. A participant in the ISU Honors program, she hopes to pursue a master's degree in plant breeding or seed production and a PhD degree.

Nine Iowa State students were awarded \$1,000 ISA scholarships at the event. They include Catherine Leafstedt, who was awarded the \$1,000 American Seed Trade Association scholarship, and Kathryn Hoemann, recipient of the first \$1,000 Bill Latham Scholarship.

Other students receiving scholarships included Anthony Moellers, Lucas Roberts, Rebekah Arnold, Sarah Striegel, Kelsey Baumhover, and Jamie Pokorny.

This is the tenth year that the Misra Scholarship has been awarded to Iowa State students. Bruce and Kathy Maunder provide funding for the scholarship that is awarded on the basis of academic excellence and leadership, along with a demonstrated interest in a career in seed science or the seed industry.

Pictured above from left are: ISU Associate Professor Susana Goggi, Rebekah Arnold, Kelsey Baumhover, Anthony Moellers, Jamie Pokorny, Sarah Striegel, Lucas Roberts, Haleigh Summers, Catherine Leafstedt, Kathryn Hoemann, and ISU Seed Science Center Director Manjit Misra.



President of the InangLupa Movement William Dar and USAID Senior Advisor for International Education Christie Vilsack were keynote speakers at the 2016 annual symposium.

## 2016 Symposium Provides Dialogue on “REAL Sustainability”

More than 250 individuals gathered in Ames April 13-14 to attend the Global Food Security Consortium (GFSC) and Leroy & Barbara Everson Seed and Biosafety Symposium titled “REAL Sustainability.”

Hosted by the Seed Science Center and held in the Scheman Building at the Iowa State Center, the symposium discussed key elements necessary for agricultural sustainability. It offered three sessions that explored the topics of “Developing Research Platforms for Sustainable Food Systems,” “Educating the Workforce for a Dynamic Industry,” and “Building Capacity through Public-Private Partnerships.”

“By providing this important dialogue about sustainability today, I believe we have planted a vital seed,” said Seed Science Center Director Manjit Misra. “A seed that will resonate with the scientists, the policymakers, and the students—the innovators of tomorrow. That we must begin now to look at sustainable, science-based ways to feed our growing population.”

Former Director General of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and President of the InangLupa Movement William Dar, and U.S. Agency for International Development (USAID) Senior Advisor for International

Education Christie Vilsack, were keynote speakers at this year’s symposium.

“Solving the problem of hunger is best achieved by understanding the poor,” Dar said in his presentation titled “Community Watersheds: Platform for Outreach and Creation of Impact.” Dar added that the biggest challenge for developing countries is the looming ‘perfect storm’ made up of the combination of several factors that include climate change, land degradation, loss of biodiversity, the population explosion, and the food and energy crisis.

In her luncheon address, Christie Vilsack spoke about literacy and the importance of teaching children from around the world to read. “Today 250 million children around the world don’t know how to read,” she said. “What I have discovered in every country that I have traveled to on behalf of USAID is empty bookshelves. If there is a school library the shelves are filled with books that nobody wants. And in most of the countries I have visited there are no public libraries,” she said.

Vilsack added that providing low cost, easy to read books written in local languages, digital libraries, and developing programs to train teachers are a few of the answers to the literacy problems around the world.

“If a woman learns to read in a country like Malawi, she will be a healthier woman,” said Vilsack. “She will have



## ISU Signs Memorandum of Understanding with Zamorano Pan-American Agricultural School

Iowa State University (ISU) Senior Vice President and Provost Jonathan Wickert (left) and President of the Zamorano Pan-American Agricultural School Jeffrey Lansdale (right) signed an agreement during the 2016 Global Food Security Consortium and Leroy & Barbara Everson Symposium to collaborate on future international development projects. The projects were identified in a concept note prepared earlier by the Seed Science Center and Zamorano University.

**To view a video of the signing, visit: [vimeo.com/163719961](https://vimeo.com/163719961).**

fewer children, and they will live past the age of five. She will be a community leader. And for every year of education that she receives, her income will go up 10 percent. The GNP of her country will also go up....These are *all* our children. And we owe it to them to make sure they get the very best education and the very best start at life that we can give them.”

### Other Symposium Speakers

Other speakers at the 2016 symposium included: Adebola Adesogan, Director, Feed the Future Livestock Systems Innovation Lab, University of Florida; Vara Prasad, Director, Feed the Future Sustainable Intensification Innovation Lab, Kansas State University; Cory Forbes, Coordinator, Science Literacy Initiative, University of Nebraska-Lincoln; Michelle Benjamin Calhoun, Acting Assistant Deputy Administrator, USDA-Foreign Agricultural Service (FAS); Todd Hall, Executive Vice President, Cargill, Inc.; Moses Osiru, Deputy Executive Secretary, Regional Universities Forum for Capacity Building in Agriculture (RUFORUM); Jeff Dykstra, Co-founder and CEO, Partners in Food Solutions; and Patricia Sheikh, Director of Agribusiness, Corporate Council on Africa.

**Videos of symposium presentations can be found online at: [vimeo.com/channels/1059006](https://vimeo.com/channels/1059006).**

## Outstanding Achievement Awards Honor Lisa Shepherd Jenkins, David Lambert

The Outstanding Achievement in Seed Science and Technology Award is presented each year by the Iowa State University (ISU) Seed Science Center during its annual symposium. The award recognizes individuals for exemplary leadership, commitment to excellence, and outstanding service to the Seed Science Center. This year ISU College of Agriculture and Life Sciences Endowed Dean Wendy Wintersteen and U.S. Agency for International Development (USAID) Senior Advisor for International Education Christie Vilsack presented two Outstanding Achievement awards during the 2016 symposium luncheon. The awards were presented to the families of two individuals whose efforts over the years have made an extraordinary and lasting impact on the Seed Science Center—Lisa Shepherd Jenkins and David Lambert.

**Below left:** Wendy Wintersteen and Christie Vilsack present the Outstanding Achievement in Seed Science and Technology Award posthumously to Andy Jenkins on behalf of his wife, Lisa Shepherd Jenkins. Jenkins served as Seed Health Testing Coordinator for the Seed Science Center and was employed at Iowa State for 23 years.

**Below right:** Wendy Wintersteen and Christie Vilsack present the Outstanding Achievement in Seed Science and Technology Award posthumously to Walker and Taylor Lambert on behalf of their father, David Lambert. Lambert served as a Distinguished Fellow for the Seed Science Center from 2009-2015.



### Symposium Hosts First Poster Competition

Three individuals earned cash prizes in a poster competition held during the 2016 Global Food Security Consortium and Leroy & Barbara Everson Seed and Biosafety Symposium. This is the first time that a poster competition has been held in conjunction with the event.

First place in the competition, and a cash prize of \$250 was awarded to Alejandro Morales from Kansas State University (KSU). Sam Cook, (KSU), and Mackenzie Dickson, Iowa State University (ISU), both tied for second place. They each earned \$175.

From left: Iowa State Agricultural and Biosystems Engineering Associate Professor Thomas Brumm, Sam Cook (KSU), Mackenzie Dickson (ISU), Alejandro Morales (KSU), and Iowa State Vice President for Research Sarah Nusser are pictured during the symposium poster awards ceremony.



STB instructors met in April to review student feedback and brainstorm on online teaching strategies.

## Graduate Program in Seed Technology and Business Holds First Lunch and Learn Session

The growing popularity of the center's online Graduate Program in Seed Technology and Business (STB) has paved the way for enhanced learning opportunities.

In addition to the recruitment of talented and knowledgeable teaching faculty in 2016, Program Coordinator Lori Youngberg focused her attention on exploring ways to enrich students' online learning experiences.

### Lunch and Learn Session Focuses on Best Practices

New this spring was the first STB Lunch and Learn session designed by Youngberg and aimed at engaging STB faculty teaching students online. During the session, STB instructors analyzed feedback from current and past students and discussed techniques they could implement to enhance their online courses. "The session not only helped to create a sense of community among our faculty members," said Youngberg, "but it gave participants an opportunity to learn about the best practices involved in teaching courses online."

Youngberg says that teaching online can present challenges, so opportunities that allow instructors to exchange ideas with their counterparts can often be

beneficial. "Everyone seemed to feel it was a worthwhile exercise, so we hope to continue offering Lunch and Learn sessions that touch on a variety of online learning topics in the future."

### New Seed Science Center Program Assistant

STB Program Coordinator Lori Youngberg and Program Chair Gary Munkvold hired a new program assistant in June. Cindy Robertson will work with Youngberg and Munkvold to market and expand the STB program. She will also assist with administration of the National Seed Health System.

Robertson comes to the Seed Science Center with a unique set of skills in conference/workshop planning and graphic design.



Cindy Robertson

follow us!



Now it's easier than ever to keep abreast of ISU Seed Science Center and Seed Laboratory events and activities!

Visit our new websites at:

[www.seeds.iastate.edu](http://www.seeds.iastate.edu)

[www.seedlab.iastate.edu](http://www.seedlab.iastate.edu)

And our new social media pages at:



[twitter.com/ISUSeedSci](https://twitter.com/ISUSeedSci)



[facebook.com/ISUSeedSci](https://facebook.com/ISUSeedSci)

For the latest updates on the ISU Graduate Program in Seed Technology and Business visit:



[twitter.com/ISUSeedGrad](https://twitter.com/ISUSeedGrad)



[facebook.com/ISUSeedGrad](https://facebook.com/ISUSeedGrad)



**seed grad**  
[seedgrad@iastate.edu](mailto:seedgrad@iastate.edu)



## Commentary: Weighing in on Cover Crops, Palmer Amaranth

by Iowa State Seed Laboratory Manager Mike Stahr

Two new programs have been established to benefit producers and the environment, the cover crop program and the Natural Resources Conservation Service's (NRCS) pollinator program. These programs support ecosystems health and enhance crop production and management. However, the discovery of Palmer amaranth in some fields has raised concern because its source has yet to be identified. This weed can seriously affect soybean producers who have been dealing with common pigweed for years. Until the source of Palmer amaranth is identified, farmers can protect themselves, to some degree, by being cautious when selecting their seed sources.

### NRCS requirements for testing cover crop seed

Farmers have discovered that it can be a profitable option to participate in the cover crop program. Consequently, the Iowa State University (ISU) Seed Lab has seen a marked increase in rye seed testing from farmers who save their own seed or sell seed to other producers.

In Iowa, the NRCS requires farmers using home-grown seed to conduct warm (standard) germination tests and purity tests to determine percent Pure Live Seeds (PLS). For those intending to sell seed to others, a noxious weed exam must also be performed before seed commercialization. This test determines and quantifies the presence/absence of noxious weeds deemed noxious in the state before seed can be sold.

For more information on requirements for selling agricultural seed in Iowa, consult the Iowa Department of Agriculture and Land Stewardship's *Selling Agricultural Seed in Iowa: Selling Direct From the Farm Permit & Labeling Requirements*. It is available on the ISU Seedlab Website at: [www.seedlab.iastate.edu/files/IDALS2014\\_1.pdf](http://www.seedlab.iastate.edu/files/IDALS2014_1.pdf), or write (Robin. Pruisner@iowaagriculture.gov).

If you have a cover crop seed lot that needs to be tested, feel free to send it to the ISU Seed Lab for evaluation.

### What can producers do to protect themselves against Palmer amaranth and other undesirable seeds coming into their fields via planting?

An especially frustrating characteristic of Palmer amaranth seed is that it can't be easily distinguished from common pigweed seeds by visual examination.

Producers can choose one of two options to correctly identify Palmer amaranth seed. They can grow the seeds, because Palmer amaranth plants are easily distinguishable from common pigweed. Or, soon they will be able to differentiate the seed through DNA tests currently being developed in California.

A noxious weed exam requires the visual examination of a seed lot. When primary noxious weed seeds (such as Canada Thistle and quack grass) are found, the seed lot can't be sold until the primary noxious weed seed is removed. When secondary noxious

weeds are found in a seed sample, the seed lot can be sold only if the secondary noxious weed species are listed on the label. Pigweed is a common weed, so it won't be listed on a bag label (tag), but the percentage weed seeds will be listed.

This situation will continue to evolve, however the following practices can aid individuals that need to ensure they possess weed-free seed for planting. 1) Take extra care to buy weed-free seed; 2) Ask your seed supplier to share information from your test analysis report (this option is especially effective, because all species of weed seeds found in the tested sample are listed in the sample analysis report); and, 3) remove the weed seed through the process of seed conditioning. Seed conditioning can effectively remove the undesirable Palmer amaranth seed, leaving the seed lot weed-free to use for the planting of future cover crops.





Global Program Leader Dileepkumar Guntuku traveled to Ghana in February and June as part of a project to enhance the Savanna Agricultural Research Institute.



## Minister of Agriculture from Telangana, India, Visits ISU

Seed Science Center Director Manjit Misra, and Associate Dean of Extension Programs and Outreach John Lawrence, welcomed Telangana Minister of Agriculture Pocharam Srinivas Reddy (third from left) to the Seed Science Center in August.

Reddy brought with him a delegation of seven individuals from the Government of Telangana, India. The group toured the Seed Science Center and shared information and insights about agriculture technology in India.

Before leaving Iowa, Reddy visited Iowa Agriculture Secretary Bill Northey.

## Guntuku Works with USAID ATT Program to Build Capacity at Ghana's Savanna Agricultural Research Institute

In 2016, as part of an agreement with the U.S. Agency for International Development (USAID) Ghana—Feed the Future Agriculture Technology Transfer (ATT) Project, Iowa State agreed to assess the capacity needs of the Savanna Agricultural Research Institute (SARI).

The SARI is one of 13 research institutes that falls under the umbrella of the Council of Scientific and Industrial Research (CSIR). Located in Nyankpala, Ghana, its mission is to conduct agricultural research in the Northern Ghana region to develop improved technologies to enhance overall farm productivity for improved livelihoods.

As part of the project, Seed Science Center Global Program Leader Dileepkumar Guntuku traveled to Ghana in February to conduct a needs assessment for the SARI. Following the report, a Core of Excellence

team made up of experts in maize, soy, and rice seed value chains, business, and communications was established.

Guntuku traveled to Ghana again in June with University of Illinois Urbana-Champaign Associate Professor Lulu Rodriguez and Consultant David Benson. The team took part in a Core of Excellence planning meeting on the SARI campus. During the meeting, attendees discussed ways to improve seed research and supply, and improve information, education, and communication at the Institute. They also shared ideas for upgrading SARI infrastructure and research facilities.

In January 2017 the SARI Core of Excellence staff is scheduled to travel to the U.S. "They will take part in training at Iowa State, at the Soybean Innovation Lab at the University of Illinois in Urbana-Champaign and other Institutions,"

said Guntuku. "This will allow them to observe modern research facilities, and will expose them to innovative science and institutional strategies. When they return to Ghana they will have the tools to enhance the SARI as well as the livelihoods of smallholders in the area."

## Memorial Clock Dedicated to Lisa Shepherd Jenkins

An open house and unveiling ceremony was held Tuesday April 12, 2016, to honor former Seed Science Center Seed Health Testing Coordinator Lisa Shepherd Jenkins. Family members of Shepherd Jenkins, along with center faculty, staff, advisory council members, and others attended the event.

Presentations were given, and the gift of a clock produced by Sticks Gallery in Des Moines was dedicated in Shepherd Jenkins' memory. The clock, which will hang in the Seed Science Center lobby, was a gift from Seed Science Center faculty, staff, students, and friends. Andy Jenkins, Charlie Block, Connie Sandve, Cherie Hill, Kaitlin Metzger, and Regina Hendrickson collaborated on the clock's design.



From left: Andy Jenkins, Ed Bartels, Rachel Bartels, Marianne Shepherd, and Kim Bartels pose by the clock that was dedicated in memory of Lisa Shepherd Jenkins.

## Wolt Continues Decade-Long Commitment to Biotech Capacity Building in Korea

The U.S. is Korea's top supplier for a wide variety of agricultural products. As one of the world's top importers of commodity grain, Korea stands as a critical export market for Iowa corn and soybeans. Because Korea sources commodity grains from the U.S. and other regions of the world where biotechnology crops dominate, Korean regulators are constantly challenged in dealing with the evaluation and approval of new biotechnology traits and trait combinations in grain or feed and food products that may contain biotechnology traits. In addition, Korean agricultural businesses, regulators, and scientists have been working diligently to gain introduction of biotechnology crops for cultivation in Korea where very conservative and precautionary attitudes are common.

Jeff Wolt, Iowa State professor of agronomy and biosafety risk analyst within the Seed Science Center's Biosafety Institute for Genetically Modified Agricultural Products (BIGMAP), has been working with Korean scientists, regulators, and agricultural businesses for more than 10 years to develop capacity for biosafety assessment of biotechnology crops. Wolt first visited Korea in 2006 to conduct a seminar on evaluation of biotechnology crops using principles of Ecological Risk Assessment (ERA) at the National Institute of Agricultural Biotechnology, Suwon.

### 2016 Biotech Activities in Seoul, Jeonju

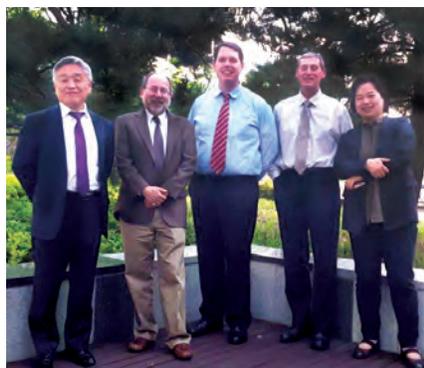
In early 2016, Wolt evaluated progress in biosafety capacity development in Korea by participating in an industry roundtable on risk analysis for GMOs hosted in Seoul by International Life Sciences Institute (ILSI) Asia. In addition, Wolt presented a seminar on problem formulation in ERA, for members of the Korean Rural

Development Administration (RDA) at Chonbuk National University, Jeonju. Despite a well-trained staff of regulators within the RDA supported by academic experts on the Korean national biosafety committee, Korea has been cautious in the implementation of standards for commercial use of biotechnology crops. They continue to find challenges regarding their obligations as signatories to the Cartagena Protocol.

### Korea Biosafety Evaluation Team, Free Trade Delegation Visit ISU

Wolt had the opportunity for further interactions in 2016 when a Korean Biosafety Evaluation Team, which included members of the Korean national biosafety committee, visited Ames in July hosted by the U.S. Grains Council. Wolt gave a presentation on "BIGMAP and Biosafety" and spent the day working through extensive lists of questions prepared by the group in advance of their visit. Wolt's presentation and discussion helped to clarify for the delegation the various players and activities critical to international biosafety harmonization.

In August, a Korean Free Trade Agreement Delegation comprised of experts from the Korean Customs Service visited Ames with sponsorship from the U.S. Department of State. Wolt and the group discussed biosafety in relation to grain and processed product imports to Korea. The group expressed gratitude that the discussion was directed towards the broader needs and activities centered on biotech crop regulation in Korea.



Jessica Blake discusses seed testing methods with seed analysts and entrepreneurs in Tamale, Ghana.

## Blake Installs Seed Testing Equipment, Trains Seed Entrepreneurs in Ghana

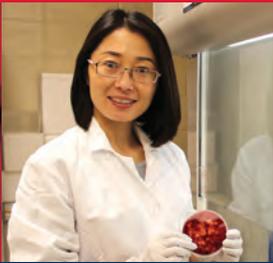
In December 2015, Iowa State Seed Analyst Jessica Blake supervised the installation of new seed testing equipment in three recently constructed Ghana Seed Inspection Unit (GSIU) seed testing labs. The labs, located in northern Ghana in the towns of Bolgatanga, Wa, and Tamale, were designed by Seed Lab Manager Mike Stahr as part of the USAID Ghana—Feed the Future Agriculture Technology Transfer (ATT) project.

During her visit Blake supervised the assembly, installation, testing, and calibration of the new seed testing equipment and assessed future equipment needs.

All three labs were equipped with an identical set of equipment, with the exception of the Tamale Lab, which included an accelerated aging chamber and a free-standing germinator.

Blake later conducted two days of training in Tamale for private seed company owners and seed analysts intending to work in the labs. She gave lectures on general seed testing procedures, proper use of the equipment, and discussed International Seed Testing Association (ISTA) rules. Finally, Blake led participants in hands-on exercises involving equipment use and seedling examination.

Left: Organizers and presenters of an Ecological Risk Assessment Workshop held at Chonbuk National University in Jeonju, Korea, included (from left) Haksoo Kim, Country Director U.S. Grains Council; Jeff Wolt, Iowa State; Andrew Roberts, ILSI-CERA; Michael Dornbusch, Australian Office of the Gene Technology Regulator; and Se-Young Kim, Dow AgroSciences.



## Visiting Scholar Yan Meng

Originally from Jinchang, China, visiting scholar Yan Meng came to the Seed Science Center in November 2015 as part of an exchange program with China Agricultural University in Beijing. Meng, who is working towards a PhD in seed pathology, conducts research with Plant Pathology and Microbiology Professor Gary Munkvold.

Prior to coming to Iowa State, Meng earned a master's degree from Gansu Agricultural University and was employed for six years in the Agriculture and Biotechnology Department of Hexi University, located in China's Hexi Corridor. Because the Hexi Corridor is the biggest maize seed production area in China, Meng came to Iowa State with experience in conducting seed health testing for Chinese seed companies.

Meng's research with Munkvold involves studying the effects of mycotoxins on maize seedling roots. "Maize seedling blight (MSB) reduces yields around the world," says Meng. "In China, MSB has increased in all regions of maize production in the last 25 years. *Fusarium graminearum* is a pathogen of MSB, occurring not only in the Hexi Corridor, but around the world. It produces type B trichothecenes that promote the disease."

The chemotypes of *Fusarium graminearum* and the effects of two different mycotoxins (DON and 15-ADON) on maize root seedlings are Meng's main research focus. She is analyzing the roles the mycotoxins play in *Fusarium graminearum* infection.

Meng believes that her research can be of value to China's producers and others

after she leaves Iowa State. "Understanding chemotype populations can help to determine which fungicides to use, predict which toxins might be produced, and evaluate the risks posed by contaminated food or feed," she said.

Meng says that she hopes her time at Iowa State will lead to future collaborations. "The seed testing technologies that I have learned here at the Seed Science Center can also be used in my country," she says. "I hope that my research and time spent here will promote collaboration between our two centers—the ISU Seed Science Center and the Chinese Agricultural University Seed Health Center. In that way we will be able to supply better services for Chinese seed companies in the future."

Meng, who plans to graduate in July 2017, says that she has enjoyed living in Iowa. "Ames is very different from Beijing, which is a big city with a very fast-paced lifestyle. At ISU it is quiet and peaceful, and people enjoy their life."



Yan Meng and Seed Pathology Lab Manager Derrick Mayfield examine radial growth of *Fusarium graminearum*.



## Graduate Student Josh Knight

Josh Knight joined the Seed Science Center in August of 2015. A native of Parker, Colorado, Knight conducts research with Agronomy and Seed Science Center Associate Professor Susana Goggi and teaches an Agronomy 212 undergraduate lab.

Although Knight was not raised in an agricultural environment, he says that his interest in agriculture and seed science began at a young age. "My passion for plants began when I decided to grow a few pea plants," he said. "I was amazed at how a beautiful plant could form from a small, simple thing like a seed, and then reproduce more seeds that could then be eaten. From that time on, my love for plants and seeds only grew."

Knight's college career did not begin at Iowa State. After attending junior college in Colorado for two years, he made the decision to finish his bachelor's degree in Ames after attending an Iowa State career fair. "I decided to come to Iowa State because of its great agriculture program; specifically its agronomy program," said Knight. "I have family here so that was also a plus, but after attending that event, I began to realize all the great opportunities that Iowa State has to offer."

Once at Iowa State, Knight had an opportunity to conduct soybean breeding research with the late Dr. Reid Palmer. Later he was introduced to Goggi. "I ended up working in Dr. Goggi's lab running peroxidase tests of soybean seed coats and paper towel germination tests as an undergraduate," said Knight.

Knight's current research with Goggi focuses on the soybean pest *Fusarium virguliforme* commonly known as sudden death syndrome, or SDS. His research

(Continued on page 15.)



Scenes from the 2016 Seed Science Center Seed Treatment Workshop.

## 2016 Summer Shortcourse, Workshop Update

Seed Conditioning Specialist Alan Gaul and Seed Lab Manager Mike Stahr facilitate Seed Science Center shortcourses and workshops for seed industry professionals around the world each year from April through August. This year a total of 13 workshops and shortcourses covered topics from seed testing and cleaning, to gravity separation, color sorting, and seed treatment.

According to Gaul, one highlight of this summer's workshop series was the Seed Treatment Workshop in mid-July. "We had an opportunity to hold the workshop in the Hansen Agriculture Student Learning Center for the first time," said Gaul. "Because there was

basically no limitation on the amount or size of the machinery that we used for demonstrations, that workshop was an extremely effective and enjoyable one. We hope to be able to use that venue again in the future."

The Seed Science Center at Iowa State has provided training for seed industry professionals for more than 42 years. In 2016, 160 individuals traveled from 17 states in the U.S. and 8 countries including Australia, Canada, China, Germany, Mexico, Turkey, the U.S., and Zambia to attend seed conditioning and quality workshops at Iowa State.

For more information about Seed Science Center training opportunities, visit [www.seedlab.iastate.edu/training](http://www.seedlab.iastate.edu/training).

Josh Knight (Continued from page 14)

focuses on quantifying the change in seed quality with increasing SDS severity. "Seed quality is very important for seed producers, and knowing how much seed quality decreases with a specific field severity of SDS will definitely be beneficial to them," said Knight. "My work can help them estimate the amount of seeds lost as a result of a certain pest pressure."

In his spare time, Knight makes use of his agronomy skills by breeding pepper plants. "I find the variation in peppers—their size, shape, color, and taste—extremely unique," he said. "I am working on breeding for larger, spicier peppers."

Knight's graduate assistantship is partially funded by the Leroy & Barbara Everson Fellowship in Seed Science. The Fellowship is awarded to one graduate student each year who conducts research on a seed-related topic and exemplifies Everson's commitment to the seed industry.

If you would like to receive your copy of the *Iowa Seed & Biosafety News* electronically, remove your name from the mailing list, or change the way that your copy of the newsletter is addressed, please send an email to [seedsci@iastate.edu](mailto:seedsci@iastate.edu).



### Ramachandran Seminar Focuses on Seed Treatment

Ravi Ramachandran discussed "The Science

and Technology of Modern Seed Treatment" at the Seed Science Center on March 24, 2016.

During his presentation, Ramachandran, head of Syngenta's North American Seedcare Institute, discussed a wide range of seed treatment formulation and performance issues. He also toured the Seed Science Center and discussed seed treatment research with Iowa State University (ISU) faculty and students.

Ramachandran leads a team of seedcare application platform technology and seed biology specialists who provide technical service support to Syngenta's seed care customers in the U.S.



### Smith Discusses Ways to Improve Maize Productivity

Stephen Smith, ISU agronomy affiliate professor and Seed Science

Center visiting scientist, presented a seminar titled "Continuing the Improved Productivity of Maize: Genetic Gain or Genetic Pain?" at the Seed Science Center in April.

A former Research Fellow with DuPont Pioneer, Smith conducts research on germplasm access and benefit sharing, variety identification, genetic gain, sustainable use of genetic diversity, and intellectual property protection.

IOWA STATE UNIVERSITY

Seed Science Center  
2115 Osborn Drive  
Ames, Iowa 50011-1050

*Begin your online*

**ADVENTURE**

**APPLY NOW FOR SPRING 2017**



**seed grad**  
[seedgrad.iastate.edu](http://seedgrad.iastate.edu)

**IOWA STATE UNIVERSITY**  
**Graduate Program in Seed Technology & Business**