

PROTECTING OUR GROWTH INDUSTRIES: Q&A WITH DR. ARGELIA LORENCE, ASU

By AMP Staff

A rice field in the Arkansas Delta.

Dr. Argelia Lorence and
ARA's Jerry Adams

More than 40 percent of the nation's rice production is attributed to Arkansas rice farmers. In fact, no other state in the nation produces more rice than Arkansas, which contributes more than \$6 billion to the state's economy. Enhancing this industry through the application of cutting-edge science is crucial to the Arkansas economy.

Member and professor of metabolic engineering at Arkansas State University, has devoted her life to equipping farmers with the latest tools and technologies to maximize their yields and adapt to changing growing conditions.

AMP: Much of your recent work centers around heat stress-levels on rice. How are the changing climate and extreme weather conditions affecting Arkansas' No. 1 crop?

Dr. Lorence: Unfortunately, climate change is raising nighttime temperatures. We call this high night air temperature stress, or HNT stress, and it has two main effects in rice. First, it causes the yield to drop significantly. Second, it increases chalkiness, decreasing the quality and value of rice grains.

Globally, nights are becoming hotter at a higher rate than days are, and there is a 10 percent yield penalty for every 10C increase in night temperature. Arkansas' nighttime temperature

has increased by 0.50C, a 5 percent yield penalty that costs our state millions in revenue. Accelerating strategies to develop rice varieties able to thrive under more frequent hotter conditions is key.

AMP: You advocate for more weather stations near agricultural farms to reliably track temperature patterns in the rice growing regions. Specifically, what is required to meet that need?

Dr. Lorence: In a paper we published in 2021, one of the Ph.D. students on our team discovered that during the last four decades, night temperature has significantly increased in several of the U.S. rice-growing states. We also found that California is the state with the best weather station infrastructure. They have between three to five times more weather stations than other rice-growing states. (Arkansas, which more than doubles California's rice output, currently maintains five stations.) This allows California to have more detail (a.k.a. higher granularity) and enhanced ability to model and predict how changing climate conditions may affect their crops.

AMP: You serve as director for the Arkansas State University phenomics facility. How does this facility serve Arkansas, especially in its relationship to our state's agricultural community?

Dr. Lorence: Arkansas State was an early adopter of high-throughput plant phenotyping, or phenomics, in the United States. Because of this, we have optimized protocols to characterize the responses of plants growing under normal and stressful conditions. We acquired key instrumentation in 2011, and we've not only maintained it, but we've also been able to upgrade. This facility serves both academic users and industrial clients.

In addition, we can do a wide range of assays, from testing the effects of soil types, application of various biological products, germination assays, vigor assessment, growth measurements, plant health indicators and yield tests. The species we have the most experience with are crops such as rice, corn, soybean, tomato, and tobacco and model plants such as arabidopsis and marchantia. We can analyze seeds, plant tissue cultures, small plants and the vegetative growth of crops. We serve users from our region (Arkansas, Missouri and Texas) in addition to many other parts of the U.S.

AMP: Food security is a global concern, and the U.S. is a global leader in food production. What steps can the country take to safeguard the nation's food supply?

Dr. Lorence: I spent two full days recently in a workshop — Feeding the Planet Sustainably — talking with 120 other scientists helping the National Science Foundation identify steps that the U.S. can take during the next two, five and 10-plus years to fund research to safeguard food security of the United States and the world.

I had three big takeaways from the workshop. First, better integration between agronomy, breeding, biotechnology and computational and modelling approaches is needed to find solutions. Arkansas has these research capabilities and is working to grow and leverage them to find solutions.

A second big point is the need for regional investments and strategies, as different regions may be affected by a changing climate in various ways. The third is improved training of a diverse next-generation of students. I'll slide in a fourth in that our collective research requires better integration with international counterparts.

AMP: Your work is important not just for Arkansas, but for the entire world's food supply. What if funding weren't an issue?

Dr. Lorence: I'd develop our phenomics capabilities at the greenhouse and field levels in Arkansas. This could serve different groups, including plant researchers, rice growers, soybean growers, cotton growers, corn and sorghum growers and people involved in the forestry industry. I would also promote developing a center to improve the resiliency of crops of importance to the Mississippi Delta region to heat, drought and diseases with emphasis in bringing to this region more experts in key areas such as genome editing, artificial intelligence and computational and modelling expertise.

AMP: What do you want the Arkansas business community and public officials to know about your research and how it's making a difference?

Dr. Lorence: I would like the Arkansas business community to know that we have good ideas and promising results, and that additional investment would go a long way to help us make further progress in discovering novel markers to develop rice varieties that are more nutritious and resilient.

I would like public officials to know that we need their help in removing barriers to attract the best talent. Interdisciplinary and multi-cultural teams are needed to address the challenging problems we are facing. We welcome talent from anywhere and everywhere.

The ARA Academy of Scholars and Fellow is a community of strategic research leaders who strive to maximize the value of discovery and progress in the state. Learn more at ARAlliance.org.