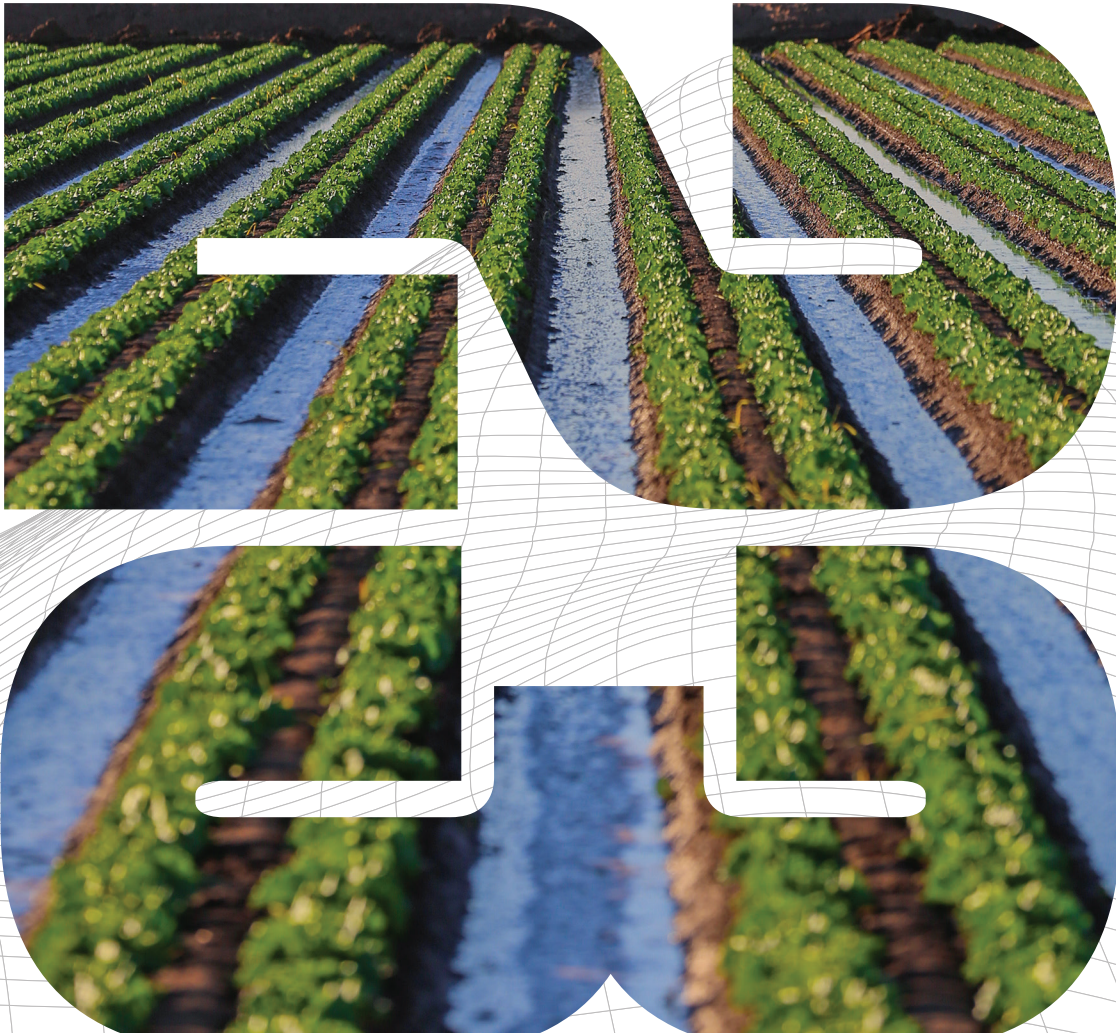


ANNUAL REPORT



THE UNIVERSITY OF ARIZONA

Yuma Center of Excellence
for Desert Agriculture



2023 GROWTH & COLLABORATION

Plant Disease Management

One of the first priorities YCEDA was tasked to address when the center was founded was Fusarium wilt of lettuce. This disease was first identified in California in 1990, and in Arizona in 2001, and it has since become a widespread problem in the Yuma growing region. To advance disease management, YCEDA has been conducting field trials since 2015 to evaluate tolerance of commercial lettuce cultivars to the disease, evaluate breeding lines from public breeding programs, and evaluate plant protection products. This disease could not be addressed by YCEDA alone. Therefore, an additional goal was to find collaborators and build the Fusarium wilt of lettuce research program. To achieve this, we assembled a Fusarium wilt of lettuce working group of plant pathologists and plant breeders from California, Florida, Arizona, Arkansas, and the UK. This group meets monthly to discuss ongoing and future research. Due to their efforts, several projects have been funded, and YCEDA assisted with two field trials in California in 2023. A notable way that this group is assisting the lettuce industry is by focusing on the unusual symptoms being observed in California and more recently in Arizona. New pathogen races are likely present in the USA, and it is vital that we understand how this may affect the lettuce industry. The Fusarium wilt of lettuce working group is striving to address this emerging challenge. We are excited to have initiated this group that is now providing important information to the lettuce growing community.

Arizona Fusarium wilt of lettuce field trials are conducted in collaboration with Robert Masson from Cooperative Extension. In our 2023 field trials, we planted twenty-two commercial iceberg and twenty-three romaine cultivars, breeding lines for lettuce breeders at the USDA-ARS in Salinas, University of Florida, and UC Davis, and pre-commercial cultivars from private breeding companies. The disease severity was relatively low this year, but we collected important data on the performance of cultivars and breeding lines. The Arizona and California field trials were planted with donated seed in commercial fields and managed by our grower cooperators. Our breadth of accomplishments is due to our collaborative community of stakeholders.

Other diseases on our radar include downy mildew of lettuce, impatiens necrotic spot virus (INSV), and whitefly transmitted melon viruses. We are collaborating with Dr. Richard Michelmore at UC Davis on downy mildew trials in 2023 and 2024 to help determine what pathogen races are present in Arizona. Our lab at the Yuma Ag Center is supporting plant virus research in collaboration with Dr. John Palumbo at the University of Arizona, and Dr. Bill Wintermantel at the USDA-ARS in Salinas. This work helps track INSV and melon viruses in insect vectors and weed hosts.

Action-Driven Wastewater-Based Epidemiology



Over the past three years, YCEDA has established a successful wastewater-based epidemiology (WBE) program for the early detection of human pathogens. Our team implemented wastewater testing throughout Yuma County and is the first research group to have evidence for prevention of disease outbreaks in college campuses,

local businesses, and throughout the community. In support of this program, our team has received over \$3.8M in funding to establish a state-of-the-art laboratory and testing facility in Yuma, AZ at the Yuma Ag Center, equipped with digital PCR and next-generation genome sequencing instruments. We also expanded our team with two full-time lab technicians, are supporting two full-time graduate students' WBE research, and have forged partnerships with nationally-recognized public health experts. The Yuma Center of Excellence has broadened the team's vision, capabilities, and expertise! As we move forward with ongoing wastewater testing, our team will be monitoring additional diseases of interest, such as influenza and Candida auris. In collaboration with a WBE steering committee, these results are shared with public health officials and key decision makers to inform disease preparedness and response actions to protect the community. Our team is grateful for all our collaborators throughout Yuma County. The success of this program is due to the amazing support from all of the community stakeholders.

Irrigation Efficiency



Studies were conducted from 2016 to 2023 to track water and salt balance across the significant cropping systems within the irrigation jurisdictions of the Yuma area of the Lower Colorado River Region. Crop evapotranspiration (ETc) was measured in 14 major crops throughout multiple cropping seasons on commercial farming operations using eddy covariance and other methodologies. Weather data from nearby AZMET stations were collected and Penman-Monteith reference evapotranspiration (ETo) values compiled. Satellite imageries were processed for multiple indices as potential aids in tracking growth and water demand. Salinity was monitored by electromagnetic conductance (EM 38) surveys augmented by soil sampling and laboratory analyses.

Measurements of crop evapotranspiration and water applied show that seasonal irrigation application efficiencies are 80-90% for most Yuma-area vegetable cropping systems. These data indicate that in-season leaching fractions are





generally below the leaching fraction of 20% typically required for salt balance with Colorado River water in salt sensitive vegetable cropping systems. Furthermore, most spring and summer crops grown in rotation with the cool season vegetables, such as grains or melons, also resulted in net seasonal salt loading. Overall, these cropping systems are not sustainable without additional leaching to mitigate salt accumulation.

The compiled database of water and salt observations is a robust and validated collection that will be a resource for future cropping and water management decisions. This information is summarized in the “Quantitative Assessments of Water and Salt Balance for Cropping Systems in the Lower Colorado River Region” report, which is available on the YCEDA website. Scan the QR code to read and download a copy.

More technical developments of these data are being published in refereed scientific journal publications. Ongoing work includes data collection for citrus and alfalfa, completion of DesertAgWISE, an irrigation and salinity management APP, compilation of revised crop coefficients and salinity management information into a user-friendly webpage, and revision of the United States Bureau of Reclamation water accounting system for the Lower Colorado River.

Introducing the Desert Agriculture Soil Health Initiative (DASHI)

Desert agriculture produces roughly 90% of the fresh nutritious vegetables in the United States and Canada between October and April, thus enabling food security and human health for roughly 340 million people. Desert croplands are the most productive agricultural systems in the world, but with worsening climate change, desert croplands are first to face harmful effects of extreme heat and water scarcity. However, deserts are also the first place to develop solutions from the ground up to sustain food production as other regions become hotter and drier. Therefore, the desert agricultural industry’s top concern is to improve assessment and management of soil health for increased competitiveness, efficiency, job growth, and sustainable production of nutritious food in the coming decades. Soil health is defined by the US Department of Agriculture as, “the continued capacity of a soil to function as a vital living ecosystem that sustains plant, animals, and humans.”

Soil health science is currently failing to address desert agricultural sustainability in the USA and globally because soil health assessment and management frameworks have been developed by scientists and agricultural stakeholders in wetter climates. Desert croplands have unique soils and environments that require unique solutions. However, science is currently disjointed across many institutions, funding agencies, scientific disciplines, and soil health challenges. Therefore, Dr. Joseph Blankinship, University of Arizona Associate Professor in

the College of Agriculture, Life, and Environmental Sciences, and YCEDA have created the Desert Agriculture Soil Health Initiative (DASHI). Dr. Blankinship will direct the initiative.

DASHI’s mission is to sustain desert agriculture globally for the next 100+ years, thereby supporting food production to improve human health, food security, and economic growth. Foundational values of DASHI are teamwork, inclusion of diverse stakeholders, science-based decision making, financial growth, and responsiveness to evolving industry needs. Participants in DASHI include researchers, cooperative extension, crop producers, the broader agricultural industry (e.g., manufacturers and retailers of field equipment, seeds, fertilizers, and other soil amendments), government, foundations, philanthropists, nongovernmental organizations, and food retailers.

In 2024, DASHI is ramping up through 1) grower and researcher workshops to improve understanding of how to uniquely assess and manage soil health in desert croplands, 2) building interdisciplinary and interagency teams with diverse stakeholders to address the highest-priority research needs, and 3) accelerating outreach at state and federal levels to increase awareness and funding of desert agricultural soil health research. The overarching goal of this initial phase of DASHI is to create a Strategic Plan for Desert Agriculture Soil Health that prescribes a coherent, perpetual, and economically viable path forward for researchers and stakeholders during the next decade. The strategic plan will consist of novel and impactful approaches to address the four most urgent soil health research needs identified by desert agricultural growers and researchers:

- 1) How can we create a standard for assessing soil health in desert croplands?***
- 2) How can we reduce soil salinity using less water?***
- 3) How can we increase soil organic matter while ensuring food safety?***
- 4) How can we optimize fertilizer use, plant nutrition, and crop nutrient density to enhance human health?***

Small Grants Program



One way we implement research in Yuma is through our small grants program. Fourteen projects have been funded since 2019 on soil health, agricultural technologies, plant disease, food safety, irrigation efficiency and water conservation. Scan the QR code to learn more about this program and the projects funded.


2023 YCEDA HIGHLIGHTS


This past year brought change to YCEDA when Governor Katie Hobbs appointed Paul Brierley, our inaugural executive director, to lead the Arizona Department of Agriculture. The structure of YCEDA as a public-private partnership allows the center to respond quickly to emerging challenges and opportunities for desert agriculture, shift resources to projects important to industry stakeholders, and provide timely, usable results. It also enables us to respond adeptly to change. We are working hard to continue the momentum generated by Paul over his tenure.

- YCEDA released the “Quantitative Assessments of Water and Salt Balance for Cropping Systems in the Lower Colorado River Region” report, the culmination of a large multi-institution, cross-disciplinary project.
- YCEDA launched a new project focused on soil health, a priority issue identified by industry stakeholders. The Desert Ag Soil Health Initiative (DASHI), directed by Dr. Joey Blankinship, will build a program for soil health for desert agriculture. A successful workshop was held in November to bring together growers and scientists to discuss current knowledge, challenges, and industry needs to assist with the strategic planning process. We are looking forward to the next stages of DASHI.
- YCEDA received funding from the National Science Foundation to bring end-to-end broadband connectivity to the Yuma Ag Center. Between this and the broadband towers being built throughout Yuma County, Yuma will be an ideal proving ground for new technologies for desert agriculture.

YCEDA continues to grow collaborative networks, initiate projects, and bring important research to Yuma to address the pressing needs of the Desert Ag industry. These efforts would not be possible without the support of our stakeholders. Thank you!


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