STRATEGIC PLAN

Texas A&M
AgriLife Research
and Extension
Center at Uvalde

TEXAS A&M AGRILIFE RESEARCH

CONTENTS

STRATEGIC PLAN, TEXAS A&M AGRILIFE RESEARCH AND EXTENSION CENTER AT UVALDE

About

The Texas A&M AgriLife Research and Extension Center at Uvalde is in the heart of the Wintergarden, a dynamic region characterized by a stable and diverse agricultural economy dominated by irrigated high-value specialty crops, rotational systems with field and vegetable crops, as well as ranching and wildlife enterprises. The center is strategically positioned at the crossroads between urban and rural communities, located 75 miles east of the Texas-Mexico border and 95 miles west of San Antonio, the most rapidly growing metropolitan area in the U.S. The Uvalde Center is located within a 6-county transect with a population of 786,000 people (68% of Hispanic descent) and is near recreational opportunities in the hill country. The major economic activities are farming, ranching, wildlife recreation, hunting, tourism, oil, and gas. The center, established in 1972 with the support of local farmers and community leaders, is recognized as the trustworthy source of scientific education, agricultural, and wildlife information, providing significant economic development and environmental benefits to the citizens and regional producers in southwest Texas. Many diverse educational and scientific programs are held at the center annually, including multi-county programs, field days, growers' groups, commodity and water associations, schools, and college science fairs.

Mission

Our mission at the Texas A&M AgriLife Research and Extension Center at Uvalde is to promote human health and wellness at the nexus of agriculture, environmental sustainability, and animal health through innovative research and science-based solutions. We strive to develop and apply cutting-edge technologies that enhance the well-being of communities in southwest Texas. The Center will develop sustainable solutions to current and emerging problems in Uvalde and the rural communities of the area by building an infrastructure with a strong foundation in basic and applied research and community-centric educational activities.

The Center at Uvalde, led by Research and Extension faculty and staff, serves as a community education HUB for applied research and outreach activities on agricultural crops and wildlife for the Uvalde and the southwest Texas community. Thriving collaborations with The Texas A&M University System, government agencies, international

organizations, and private enterprises allow us to drive progress and bring solutions to stakeholders, empowering our dedication to providing sustainable solutions to the challenge of food and nutritional insecurities now and in the future.
We support and promote the personal and professional growth of all employees across our center and strive to promote understanding and inclusion while fostering an environment of respect and opportunity.

Goal

To enrich the lives and communities across the south and southwest Texas by connecting and engaging people with food, agriculture, wildlife, and environmental health.

STRATEGIC PRIORITIES AND UVALDE ACTIVITIES

The Texas A&M AgriLife Research and Extension Center at Uvalde's research activities align with the strategic priorities of Texas A&M AgriLife Research, addressing the needs of Texas citizens by providing technologies and solutions in urban and rural settings aimed at increasing affordable food access and availability, improving human health, fulfilling consumer expectations, and ultimately strengthening the economy, the environment, and human, wildlife, and livestock health.

Synergistic Interactions Between Priorities

These four research priority areas interact synergistically to deliver healthy living to Texans (Figure 1). Innovative research is the foundation of this strategy, which operates at the nexus of agriculture, environmental and human health by cultivating science-based solutions to develop sustainable, profitable, and resilient agriculture and horticultural systems that provide affordable, high-quality, and nutritious food.

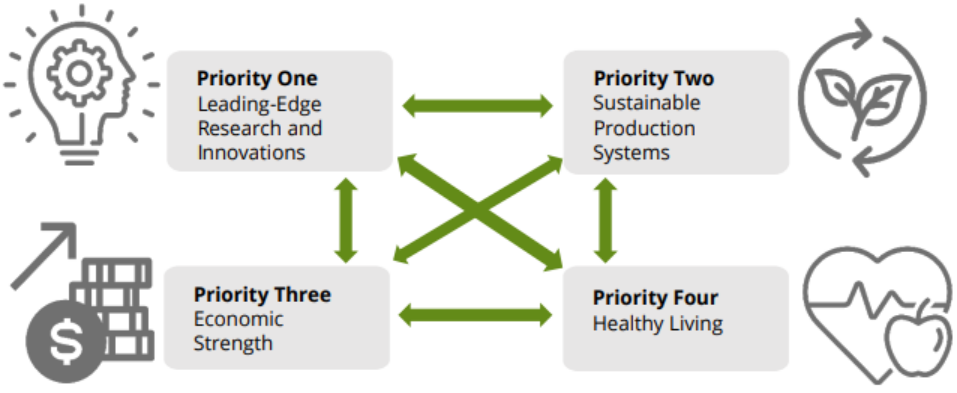

Figure 1. Synergistic interactions among our four strategic priority areas.

Strategic Priority One – Leading-Edge Research and Innovations

Discover innovations, technologies, and science-based solutions to enhance agricultural and ecological systems and the life sciences.

Goals and Milestones

The Center at Uvalde will work with other Texas A&M AgriLife units, Texas A&M System partners, and its federal, state, and international collaborators to strengthen its research capabilities in the following areas:

Plant improvement using the latest technologies, including molecular and other modern breeding tools

- Conduct marker-assisted selection for hybrid testing in onions and disease resistance in watermelon
- Incorporate doubled haploid technique to enhance onion germplasm
- Use of chemical mutagens to develop tetraploid germplasm in watermelon
- Use of cutting-edge tools in transcriptomics and metabolomics
- Use of affordable grafting technologies with advanced rootstock in solanaceous crops

Characterizing natural and induced plant diversity more comprehensively and in new dimensions

- Evaluate natural diversity for machine harvest traits in onions
- Screen vegetable germplasm for biotic and abiotic tolerance
- Analyze natural diversity for metabolites in vegetable crops

Plant genetics — improving productivity, disease resistance, and nutritional value

- Identify and develop regionally adapted germplasm to mitigate production and environmental challenges such as heat and cold stress, drought, pests, and diseases
- Determine environmental and genetic factors underlying seed and transplant quality
- Increase productivity and quality through controlled environment, hydroponics and protected horticultural systems
- Identify genes and mechanisms of nitrogen use efficiency
- Enhance the nutritional value through biofortification
- Breeding vegetable (e.g., onion, watermelon, melon, spinach, tomato, pepper) cultivars for high yield, disease and pest tolerance, better quality, and environmental stress adaptation

Plant health, microbiomes, endophytes, and beneficial interactions

- Enhance resource use efficiency, soil health, and yield through biostimulants and humic acids
- Understand plant-enteric (food safety) pathogen interactions
- Characterize microbiomes in onions via field surveys

Animal diseases (endemic, zoonotic, emerging, re-emerging, and foreign) — detect, mitigate, control, or eradicate

- Screen anti-tick vaccine candidate antigens in white-tailed deer with implications for tick control to benefit wildlife, livestock, and human health
- Enhance the sustainability of the nation's cattle herd by investigating alternative control methods for treatment of cattle fever tick infestations
- Define the role of exotic ungulates in the bovine babesiosis transmission cycle
- Define the role of white-tailed deer in SARS CoV-2 transmission and maintenance cycles
- Identify alternative acaricides for the treatment of tick infestations, thus mitigating the propensity for the development of acaracide resistance
- Develop and test emerging technologies for environmental pathogen detection
    - Expand a newly formed collaboration between TAMUSA and AgriLife Research

Existing and emerging plant diseases and pathogens — detection, identification, control, prevention, and/or treatment

- Develop and utilize qPCR assays to detect and identify diseases in onions
- Evaluate cultural and chemical methods to manage bacterial diseases in onions

Utilize and develop new value-added bioproducts and processes for industrial use

- Characterize morpho-physiological traits of new crops for drought (jatropha, jojoba) and freeze (carinata) tolerance in the Wintergarden region
- Test and develop suitable agronomic practices for growing guayule as an alternative rubber plant in the Wintergarden region
- Characterize morpho-physiological traits of hemp genotypes for cannabidiol (CBD) production while maintaining the psychoactive delta-9-tetrahydrocannabinol (THC) within legal level

Strengthening research infrastructure

The center will strengthen its research infrastructure as follows:

- New research and community center building that includes labs, offices, and a large auditorium

- Renovation of existing laboratories for new high throughput equipment (LC-MS-TOF, GC)
- Establishment of four state-of-the-art greenhouses, environmental controlled growth chambers
- Addition of three high-tunnels
- Assessment and renovation/replacement of animal facilities
- Expand the capabilities for ABSL-2 animal research facilities through infrastructure improvement
- Strategic hires in Plant Sciences and Wildlife Disease Ecology:
    - Crop and Ecosystems Soil Biologist
    - Urban Wildlife and Vector-borne Disease Ecologist
    - Extension/Research Crop Economist
    - Extension/Research Entomologist
    - Agricultural and Water Engineer

Strengthening faculty and staff capabilities

The center will strengthen the capabilities of its faculty and support staff by encouraging the following:

- Increasing active staff recruitment efforts and student support opportunities, to include fellowships to attract and retain top-tier graduate students
- Participation in inter- and multidisciplinary collaborative research project proposal writing workshops
- Participation in project implementation, management, and reporting workshops
- Engagement with The Texas A&M University System Sponsored Research Services procedures, AgriLife Administrative Services, Intellectual Property and Commercialization Office, and the Office of Corporate Engagement and Research Support

Strategic Priority Two – Sustainable Production Systems

Provide the translational research necessary to develop and produce high-quality, safe, and sustainable horticultural and agronomically important regional crops.

Goals and Milestones

The Uvalde Center will work with other Texas A&M AgriLife units, Texas A&M System partners and its federal, state, and international collaborators to strengthen its research capabilities in the following areas:
Soil health — reducing loss and degradation; enhancing regeneration and sustainability

- Improve soil productivity and quality (physical, chemical, and biological) through:
  - reduced tillage
  - optimized irrigation volume/timing
  - use of crop rotation (cover crops, weedy fallow, etc.)
  - application of soil amendments and plant biostimulants

Optimizing the use of water in crop production

- Quantify root water uptake of current cotton varieties and update cotton crop coefficients for the Wintergarden region
- Determine seasonal water use of sesame cultivars in southwest Texas
- Utilize high-throughput data from the ground-based sensing system to characterize drought tolerance in cotton, wheat, corn, and sorghum genotypes in the Wintergarden region
- Monitor soil water status in onion to improve water use efficiency and reduce root disease

Increasing nutrient use efficiency in crop production systems

- Identify genes and mechanisms of nitrogen use efficiency using cutting-edge tools in transcriptomics and metabolomics
- Increase iron availability in hydroponic leafy green vegetables.
- Quantify the effect of winter cover crops for simultaneously improving crop water and nitrogen use efficiency

Using systems approach for digital in-season crop management systems

- Expanding the knowledge of soil and plant-associated microbiomes to mitigate the regional challenges in crop production and soil health
- Integrate soil/plant sensors and cropping system models to deliver actionable information for in-season crop irrigation management

Role of pathogens in food, food safety, and security

- Investigating the role of non-native porcine species to the risk of African Swine Fever virus (ASFV) spread in Texas
  - Define interactions between introduced warthogs and native soft ticks which have been shown to be competent vectors of ASFV

- Understand the role of plant metabolic and genetic backgrounds against food-borne pathogens and manage the production strategies to mitigate outbreaks
    - Quantify the effects of crop management practices (tillage, irrigation, cover crops, etc.) for improving root-zone nitrogen retention and minimizing nitrogen loss to deep drainage

Strategic Priority Three – Economic Strength

Enhance the efficiency, profitability, and resiliency of agriculture, natural resources, and food systems in the state of Texas and the world.

Goals and Milestones

The Center at Uvalde will work with other Texas A&M AgriLife units, Texas A&M System partners, and its federal, state, and international collaborators to strengthen its research capabilities in the following areas:

Developing food processing and safety procedures to enhance agricultural product diversity

- Diversifying regional agricultural production and local business opportunities through new crop introductions (like Brussels sprouts, artichokes, strawberry, moringa, guayule, energy crops)

Carbon Credit strategies for producers

- Improve long-term carbon storage by maintaining a balanced soil carbon and nitrogen ratio through crop management

Maintaining the resiliency of the national cattle herd

- Develop new screening and surveillance options for detection of cattle fever ticks.
- Implement innovative solutions for treating wildlife for tick infestations

Strategic Priority Four – Healthy Living

Discover, disseminate, and facilitate the adoption of scientific evidence at the intersection of nutrition, human health, and agriculture

Goals and Milestones

The Uvalde Center will work with other Texas A&M AgriLife units, Texas A&M System partners, and its federal, state, and international collaborators to strengthen its research capabilities in the following areas:

Discovering evidence relating nutrients in food and human disease prevention

- Enhance the nutritional value of leafy greens through biofortification and nutrient management

Community-engaged intervention, development, and testing

- Expand the 2022 Uvalde County 4-H STEM program
  - Increase student reach (currently 40-50 students grade 3 through 11)
  - Propose institutional REU through NSF funding
- Expand community participation through the hydroponics program

Facilitating the translation of effective interventions with relevant systems and partners (AgriLife Extension, health care, public health, community-based organizations)

- Engagement of extension faculty and the Department of State Health Services to educate the public about the risks of ticks and tick-borne diseases
- Engagement of 4-H extension specialists to educate and train students and teachers in hydroponics and healthy food systems

APPENDIX: TEXAS AGRICULTURE, NATURAL RESOURCES, THE FUTURE

Agriculture

By 2050, the U.S. and world population are expected to increase by 30%, and global real incomes per capita are expected to double. Population and income growth translate into higher demand for both staple products and high-valued foods, such as more animal and plant proteins, fruits, and vegetables. Higher real incomes also mean a growing demand for livestock and feed for livestock. As a result, agricultural productivity has increased dramatically over the years. Today's farmers produce 262% more food with 2% fewer inputs than in 1950. A major component of this increase in agricultural productivity is due to investments in public agricultural research with a benefit-cost ratio of 32, which means that every dollar spent on public agricultural research and extension returns 32 dollars to society. Therefore, large benefits exist for investments in U.S. public agricultural research.

Rapid agricultural productivity increases, relative to gains in other food sectors of the U.S. economy, have translated into falling real prices of food consumed at home. For example, in 1948-2018, the share of U.S. household income spent on food at home declined from 22.3% to 6.4%, while total food consumption increased. With Americans spending 6.4% of their income on food, the other 93.6% is available for spending on a wide range of other goods and services, including recreation, housing, transportation, education, and health care. Therefore, the long-term rise of civilization and living standards worldwide largely tells a story about increasing agricultural productivity. The U.S. is the largest exporter of agricultural products. Since 95% of the world's population lives outside the U.S., the possibilities and opportunities to continue feeding the world are endless.

Cattle	$12.3 billion
Broilers	$2.9 billion
Cotton	$2.6 billion
Milk	$2.1 billion
Corn	$1.1 billion
Greenhouse	$840 million
Fruits and Vegetables	$629 million
Eggs	$500 million
Sorghum	$490 million
Wheat	$276 million

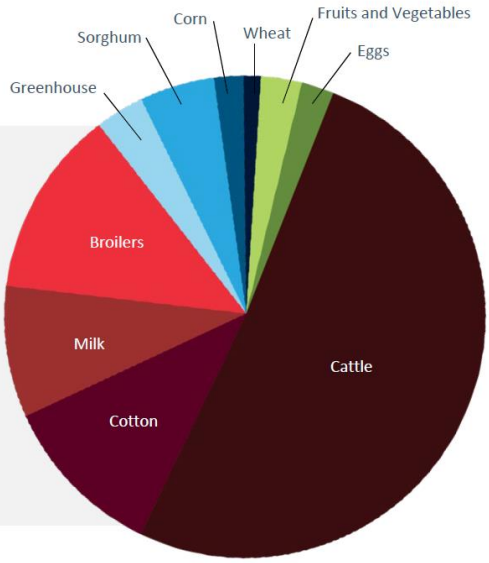

Figure 2. Texas top 10 commodities in terms of market value.

Agriculture has long been a mainstay of the Texas economy, and the success of Texas agriculture has paved the way for the development of new industries and sustained the diversification of our economy.

The food and fiber systems' contribution to the Texas gross domestic product (GDP) was valued at $145.8 billion in 2017. This represented 9.1% of the state's total economic activity. The top ten commodities in market value are cattle, cotton, milk, broilers, greenhouse, sorghum, wheat, fruits, vegetables, and eggs (Figure 3). Additionally, agriculture-related activities such as hunting, fishing, and recreation, among others, are worth over $2 billion.

Texas is the top state in the nation for producing crude oil, natural gas, and wind-based energy, which provide significant competitive advantages. In 2020, Texas accounted for 43% of the nation's crude oil production and 26% of its marketed natural gas production. Texas also has abundant renewable energy resources. It is first in the nation in wind-generated electricity and a leader in biomass-based renewable energy. With many sunny days across vast distances, Texas is also a leader in solar energy potential. Ranking second in the nation in both population and economy, Texas consumes a large share of the nation's energy. Therefore, as U.S. and world economies grow, two main variables sustain such growth — energy and food — and Texas is a key player in both. Integrating and taking advantage of the synergies of both industries will contribute greatly to the continued growth of the Texas and U.S. economies.

Natural Resources

Texas's natural resources are expansive, with nearly 172 million acres of landmass. The state is home to more than 142 mammal species as well as 615 bird species, of which half are migratory.

Freshwater lakes, ponds, and reservoirs cover about 1.2 million Texas acres. This includes nearly 185,000 miles of river, more than 350 miles of coast along the Gulf of Mexico, and 1,254 miles along the Rio Grande bordering Mexico. Texas waters house more than 250 freshwater fish species and 1,500 saltwater species.

Within this natural ecosystem, 141 million acres — more than 80% of the state's total acreage — consist of privately owned working lands and more than 60,000 working landowners. Texas working lands are privately owned farms, ranches, and forests producing agricultural products. This includes 25.8 million acres of cropland, 105.8 million acres of grazing land, 8 million acres of timber, 5.3 million acres of wildlife management, and more than 780,000 acres of other working lands.

At the same time, from 1997 to 2017, Texas lost approximately 2.2 million acres of working lands converted for nonagricultural uses. Of those acres, 1.2 million were converted in the last five years.

The Future

Texas is becoming an urban state, home to four of the top 10 most populous cities in the country (Houston, San Antonio, Dallas, and Austin) and 69 of the top 780 cities. The Census Bureau estimates that Texas has three of the ten fastest-growing counties in the country (Hays, Comal and Kendall) and almost a quarter of the top 100 fastest-growing counties. Although Texas has a large rural population, almost 4.5 million, it only accounts for about 15% of the total, which means that around 25 million people live in urban areas.

The COVID-19 global pandemic pushed the world into several years prematurely into cyberspace and wreaked havoc on the global food supply chain, causing tremendous decreases in food security. Texas was no exception. COVID-19 exposed Texans' poor health status regarding obesity, hypertension, diabetes, heart diseases, and other chronic diseases related to diet and nutrition. COVID-19 also revealed the need to examine food

production and distribution systems, uncovering the need for a more agile food supply system that provides nutritious, affordable, and accessible food to consumers while financially supporting our farmers, ranchers, and agricultural workers, even when there are multifactored disruptions at one time throughout the supply chain.

We are keenly aware that hunger, specifically undernutrition, is one of our most important global issues. Both a cause and a symptom of poverty, it can ultimately lead to conflict, mass migrations, and the rise of terrorism, all of which can impact Texans. We believe that we can help alleviate human suffering associated with hunger and poverty through agricultural science and, in that way, help prevent these outcomes while building a better world for present and future generations. With proper investment today, AgriLife Research will set the foundations of the infrastructure necessary to ensure food security for future generations.

Over-nourishment presents a double-burden paradox that affects nutrition and increases the risk of chronic diseases. Texas agriculture and AgriLife Research are uniquely positioned to partner to improve public nutrition and health by providing a healthier, more nutritious, and abundant food supply.

As Texas agriculture grows, it has a positive multiplier effect throughout the economy. For every dollar of agricultural production in Texas, another $2.19 is generated by other industries in the state to support this additional output. The interconnected nature of Texas agriculture to other sectors of the economy — and the everchanging relationships across these sectors — make it imperative that AgriLife Research is positioned to anticipate and respond to critical needs and emerging challenges.

AgriLife Research's roots are firmly embedded in production agriculture and natural resources. We seek to expand the agency's focus applying the power of fundamental life sciences to solve real-world issues.