STRATEGIC PLAN

Texas A&M AgriLife Research and Extension Center at Lubbock

TEXAS A&M AGRILIFE RESEARCH

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STRATEGIC PLAN: TEXAS A&M AGRILIFE RESEARCH AND EXTENSION CENTER AT LUBBOCK (LREC)

The Texas A&M AgriLife Research and Extension Center at Lubbock, LREC, is committed to promoting continuous economic and environmental sustainability improvement in Texas Southern High Plains agriculture production systems through innovative research and education programs.

Mission

- Be responsive to LREC stakeholder, commodity organizations and partner- evolving challenges to provide integrated crop production solutions.
- Align LREC research and education activities synergistically with Texas A&M AgriLife strategic priorities.
- Be a safe, productive, and supportive environment to foster employee, student, and allied community professional and personal development.

Goal

Focus on core competencies in crop production, plant breeding, and water use practices; continuous stakeholder, commodity group engagement; close ties with regional USDA-ARS, Texas Tech and West Texas A&M universities; and collaboration with other government entities, international institutes, and allied industry to lead agriculture's contribution to economically strong and healthy communities in the Southern High Plains, and associated state, national, and global impact of a vital agriculture sector.

STRATEGIC PRIORITIES AND LREC ACTIVITES

Synergistic Interactions Between Priorities

These four research priority areas interact synergistically to deliver healthy living to Texans (Figure 2). Innovative research is the foundation of this strategy, which empowers the nexus between agriculture and human health by cultivating science-based solutions to develop sustainable, profitable, and resilient agriculture that provides affordable, high-quality, nutritious food.

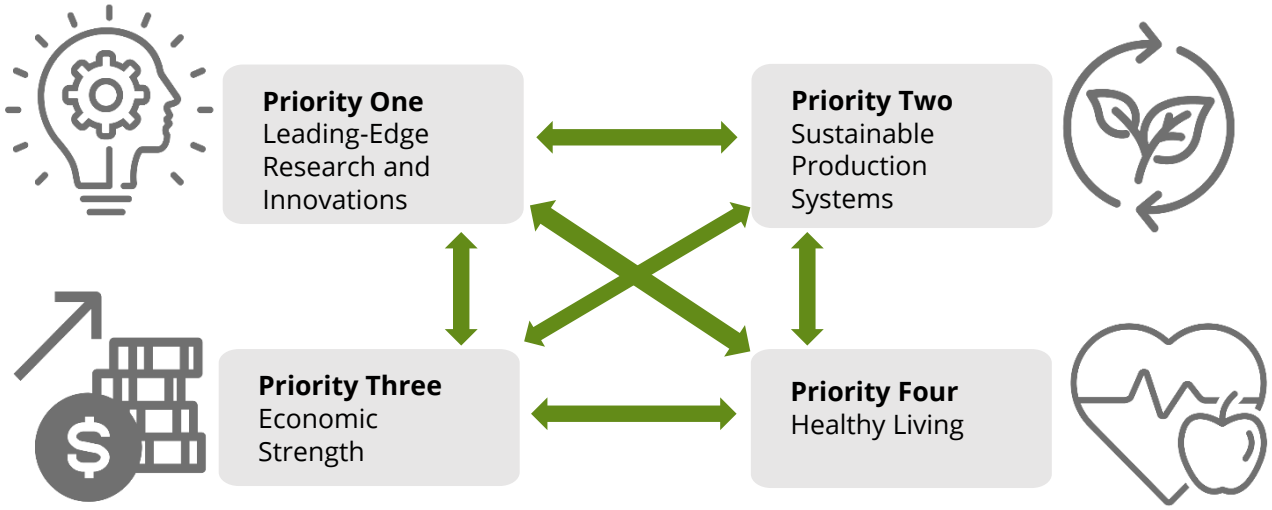


Figure 2. Synergistic interactions among our four research priority areas

STRATEGIC PRIORITY ONE – LEADING EDGE RESEARCH AND INNOVATIONS

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

Goals and Milestones

LREC work with other Texas A&M AgriLife units and its federal, state, and international collaborators to strengthen its research capabilities in the following areas:

- Sensor and digital imaging-based data for specific crop variety-soil-water interactions
- Existing and emerging weed, insect, and disease threats
- Advanced plant breeding capabilities
- Value-added crops for industrial uses

LREC plans to strengthen its research capacity and infrastructure:

Invest in technology to strengthen innovation in key LREC capacities for soil health and water management research.

Conduct irrigation experiments for specific crop varieties and hybrids using combinations of soil, plant, UAV, and environmental based sensors for development of irrigation management tools.

Maintain land use agreements and biosafety greenhouse infrastructure to develop and deploy identification and early detection technology and strategies to monitor, contain, and alleviate impact from spread of Fov4 infection into major Texas upland cotton production regions.

Identify and exploit the genetic basis for resistance to disease and pests, incorporating germplasm from cultivated and wild species collections (corn, cotton, grain sorghum, peanuts, potatoes).

Develop genetic resources necessary to advance genomic-based breeding strategies in key crops and build collaborations with system units and other institutions with advanced genomic capabilities.

Develop stress-tolerant and mycotoxin-resistant short-season corn germplasm for new crops and livestock production systems.

Develop crop varieties with improved nutritional and quality characteristics (e.g., HiA™ corn and high oleic peanuts) exploring targeted resequencing to reduce genotyping costs.
Utilize existing system infrastructure or invest in enhanced phenotyping for field, greenhouse, and/or rainout shelter research to strengthen plant breeding and crop evaluation capabilities.

Provide science-based information to facilitate new industrial crop use such as guar for food additives, fiber from hemp, and biofuel from peanuts.

STRATEGIC PRIORITY TWO – SUSTAINABLE PRODUCTION SYSTEMS

Provide the translational research necessary to develop high-quality, safe, and sustainable food and fiber systems with local, national, and global impacts.

Goals and Milestones

LREC will work with other Texas A&M AgriLife units and its federal, state, and international collaborators to strengthen research in the following areas:

- Soil health and soil-plant resiliency
- Carbon sequestration promotion/quantification methodology
- Increasing nutrient use efficiency in crop production systems
- Optimizing the use of water in crop production

LREC plans to strengthen its research capacity and infrastructure:

Conduct research to determine improved management practices (nitrogen fertilizer application, conservation tillage, crop rotation, and cover cropping) that will maintain or enhance the value and health of soils, increase water capture and storage, reduce greenhouse gas emissions, and optimize cotton production efficiency.

Invest in best available chemical, physical, and biological soil analyses to determine the effects of conservation tillage, crop rotation, and cover crop use on soil health.

Use both traditional and investigate new, innovative approaches to evaluate nutrient cycling and water capture and storage.

Use available advanced technology (e.g., FTIR) to measure greenhouse gas emissions in real-time to determine the best nitrogen fertilizer management strategies when using conservation practices.

Quantify the effect of soil applied and residual nitrogen on cotton compensatory potential with respect to insect management and develop insect-pest management strategies for water-deficit cotton production systems.

Improve water use efficiency for sustainable crop production and rural economic development through development of high-yielding and drought/heat/salt tolerant and disease-resistant corn, cotton, grain sorghum, and peanut germplasm.

Provide optimum strategies for transitioning from irrigated to rainfed row-crop agricultural production while providing scientific guidance on most effective use of limited irrigation water.

Develop / modify software tools and applications to collect, analyze, and output actionable irrigation information to end users.

Seek and implement strategies to improve productivity, yield, and fruit quality for grape growers in the Texas High Plains AVA.

Upgrade equipment for field research and on-farm experimentation, developing new, higher-throughput equipment suitable for breeding (and extension) programs.

Install water-conserving irrigation systems at Lubbock.

STRATEGIC PRIORITY THREE – ECONOMIC STRENGTH

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

Goals and Milestones

LREC will work with other Texas A&M AgriLife units and its federal, state, and international collaborators to strengthen research in the following areas:

- Optimizing production systems from agriculture to consumer use
- Economic and cost benefit analysis on new and emerging production technology issues
- Carbon Credit strategies for producers
- Production issues affecting water policy, availability, and potential alternate sources.

LREC plans to strengthen its research capacity and infrastructure

Short term, perform economic analyses on the impact of Verticillium wilt and pest infestations on producer profitability; mid-term, analyze the economic cost and payback periods of various field level technologies such as drip irrigation and determine optimal crop mixes for growers with varying well capacities; longer-term, assess the economic viability of alternative crops such as guar and hemp.
Continue to develop economic and effective weed management systems for Texas agriculture incorporating new and emerging technologies.

Identify, monitor, and develop strategies for managing herbicide resistant weeds and emerging *heliothis* insect resistance to existing biotechnology-based products.

Develop seed varieties specific for economic opportunity alternative and emerging production systems underserved by commercial industry, such as certified or transitioning organic.

Strengthen testing capacity with new technology available at regional institutions to develop cotton germplasm with fiber profiles that enhance utilization and economic value.

Evaluate economic feasibility of novel production methods and strategies for High Plains grape growers.

For the first time, determine the greenhouse gas emissions associated with cotton production and conservation management in the Rolling Plains and High Plains of Texas.

In cooperation with appropriate partners (public and commercial), improve/develop next generation of irrigation management tools for Texas High Plains crops, corn/cotton/grain sorghum/peanuts.

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

LREC will work with other Texas A&M AgriLife units and its federal, state, and international collaborators to strengthen research in the following areas:

- Nutritional optimization of foods in the marketplace
- Dissemination, including implementation of science and policy-related initiatives.

LREC plans to strengthen its research capacity and infrastructure:

Work with seed partners and system experts to commercialize specialty corn for high-value healthy and health food and animal feed, and corn Hi-A™ inbred lines and hybrids with high anthocyanins and antioxidants.

Invest in seed storage and appropriate land for planting seed production to deploy high oleic peanut varieties developed at LREC.
Continue to support the North Region of Better Living for Texans with infrastructure office space at LREC.

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.

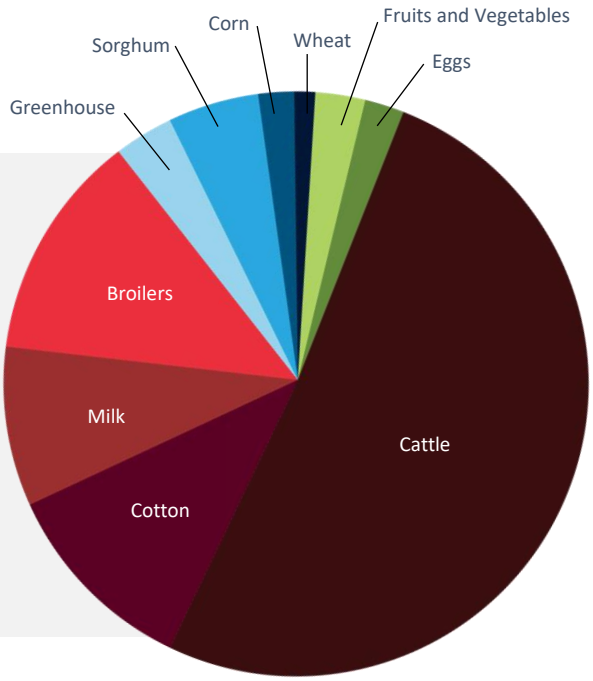
Rapid agricultural productivity increases, relative to gains in other food sectors of the U.S. economy, have translated into falling real prices of food consumed at home. For example, in 1948-2018, the share of U.S. household income spent on food at home declined from 22.3% to 6.4%, while total food 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.

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

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



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.

Figure 3. Texas top 10 commodities in terms of market value

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 grazingland, 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 and is 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 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 to apply the power of fundamental

life sciences to solve real-world issues. Discoveries in genetics, crop and animal management systems, and links between poor human nutrition and chronic diseases are accelerating our impacts on sustainable food and fiber supply chains. Our approach integrates basic and applied research to create, as stated in our vision, "healthy lives and livelihoods improved through abundant, affordable, and high-quality food and agricultural products in Texas and the world."