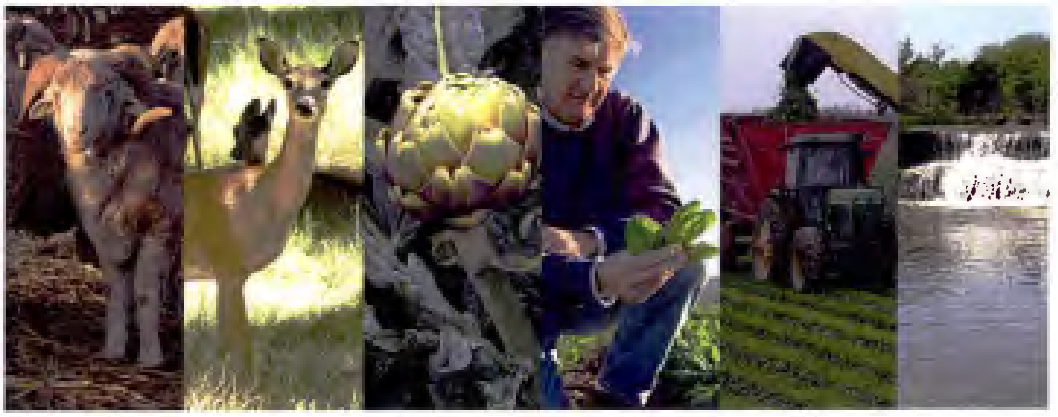

TEXAS A&M AGRILIFE RESEARCH

WINTER GARDEN AND SOUTH CENTRAL REGION

RESEARCH GOALS AND IMPACTS

Texas A&M AgriLife Research and Extension Center at San Angelo
Texas A&M AgriLife Research and Extension Center at Stephenville
Texas A&M AgriLife Research and Extension Center at Uvalde
College of Agriculture and Life Sciences, Texas A&M University

TEXAS A&M AGRILIFE RESEARCH

2015

GOAL

Protect water quality and increase the amount of water available for urban and rural use through new technologies and approaches.

PROGRESS

Protecting watersheds

- Stephenville Center researchers have developed new methods of screening water and soil samples for coliform bacteria that will allow better assessment of efforts to mitigate bacterial contamination of watersheds.

Enhancing irrigation and cropping systems

- Uvalde research on water conservation for leafy greens continues to show impressive results for the recirculating hydroponic system, with more than 90% water savings compared to those grown under field conditions. The hydroponic project reached over 350 people through educational programs and attracted a multimillion-dollar investment in a hydroponic system to be placed in a Central Texas location.
- Deficit irrigation applied with subsurface drip systems is an important strategy for sustaining specialty melon productivity in water-limited regions of Texas. Uvalde Center researchers demonstrated a 36% water savings in Tuscan-type and cantaloupe melons.
- A two-year research project in Uvalde showed that integrating strip tillage into a cropping system increased watermelon yield efficiency (biomass per inch of water applied) by 12%–18%. Integrating deficit-irrigation strategies with specific crop coefficients can improve pepper water-use efficiency up to 25% in water-limited regions of Texas.
- The Uvalde Center's findings on plant growth regulators aimed to alleviate transplant shock and reduce crop losses in stressful environments; this can result in significant savings or more profits for high-value crops such as tomato and pepper.
- Uvalde Center researchers collaborated with corn breeders at the Lubbock Center to test the effect of irrigation timing on corn growth and yield. Delivering water through nighttime drip irrigation appeared to significantly reduce root zone temperature, which translates into a 10% increase in yield.
- Texas land available for green industry activities such as nurseries, greenhouses, landscaping, and urban forestry is estimated at 1.5 million to 2 million acres. These activities use up to 6 million acre-feet of water annually, rapidly approaching the usage by irrigated agriculture in the state. The ornamental plant program at the Uvalde Center is helping green industries improve water-use efficiency by implementing new research publicized in books and journals and at conferences.

Reducing urban water consumption through graywater reuse

- Efforts are under way at the Uvalde Center to launch a statewide initiative on reusing graywater for irrigating home landscapes and ornamental plants in urban areas. Research has shown that many ornamental plants can grow just as well when irrigated/watered with graywater from bleach-free household laundry. Irrigating with graywater could save 400,000 acre-feet of potable water per year within the state, or about 8% of annual potable urban water use.

GOAL

Sustain and support efficient use of land resources and ensure air quality in the production of food and non-food crops.

PROGRESS

- A cropping system project at the Uvalde Center determined that the use of cover crops reduces wind erosion, thereby improving air quality. It also allows for more efficient use of land. In response to regional growers' requests, researchers are expanding this project by adding drought-tolerant crops into the rotation systems. Center researchers are collaborating with Sesaco Co. to test sesame growth and yields with different irrigation regimes in southwestern Texas.
- Uvalde researchers studied the use of starch-based, biodegradable plasticulture mulch and found that these mulches degrade almost 100% after 12 months in the field. Biodegradable plastic mulch requires minimal or no labor costs to remove and dispose of after harvest and can mitigate soil environmental pollution better than polyethylene plastic.
- Uvalde research on screening efficient sources of organic fertilizers (fish meal, chicken manure, plant meal, and blood meal) can potentially enhance soil microbial activities, soil physical and chemical properties, and plant performance. This study will help Texas organic growers maximize their profitability.

GOAL

Conduct basic and translational research to minimize the unfavorable effects of agricultural production and urban communities on the environment.

PROGRESS

Improving environmental sustainability of meat and milk production

- Dairies in North Central Texas have more manure phosphorus than they can safely apply as effluent or compost to their croplands without raising soil phosphorus to levels that threaten surface-water runoff into the Bosque and Leon Rivers. Stephenville Center researchers developed strategies to increase waste-management efficiency by 45% through on-dairy phosphorus recycling using year-round forage cultivation and reduced phosphorus excretion in diets. This saves dairy producers $900 million in land purchase or lease costs and reduces phosphorus pollution.

Researchers at the Stephenville Center found that secondary compounds from plants native to the southern United States could prevent housefly (Musca domestica) larva from developing in dairy cattle manure. This natural control strategy could reduce both the environmental and economic costs of fly control on dairy farms.

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Designing cost-effective, sustainable, pest- and disease-management solutions

- Red imported fire ants are a chronic pest in much of Texas. These ants present medical, animal health, and agricultural issues in both urban and rural areas. Chemical controls are the most consistent method of management in spite of the fact that fire ants are infected by naturally occurring pathogens. Stephenville scientists are studying two of the most common naturally occurring pathogens, microsporidia and viruses. These pathogens have co-evolved with ants, and it may be possible to upset the evolutionary equilibrium through mechanisms of hormonal interaction, allowing the natural pathogens to dominate the population. Sponsored by the Texas Invasive Ants program, field research into hormonal and or biological control of red imported fire ants is under way to safely reduce ant populations in sensitive areas such as schools, parks, or wildlife-management zones. The protocol will provide a non-toxic means of ant management for citizens living in infested areas.

Improving plant nitrogen use to prevent runoff

- The nitrogen-use efficiency (NUE) of plants that are given conventional synthetic fertilizers averages only 50% because of losses that occur when soluble nitrogen fertilizers are applied to soils. The vegetable and soil programs at the Uvalde Center jointly submitted a National Science Foundation proposal to evaluate improvements of NUE through advances in nanotechnology.

Returning farmed exotic animals to native countries

- Uvalde researchers are collaborating with the international conservation community to aid successful repopulation of endangered African ungulates bred on Texas ranches back to their native lands.

GOAL

Conduct basic and translational research into the factors affecting biological diversity and ecosystem structure and functioning, including the role of human activity.

Wildlife is a valuable resource in Texas, bringing in over $6.2 billion annually. Researchers at Uvalde work with private landowners to increase the quantity, quality, and diversity of wildlife in Texas. This wildlife provides healthy outdoor recreational opportunities for 6.3 million people who hunt, fish, or watch wildlife in Texas each year, and in doing so supports many jobs in the wildlife-related service and retail industries.

PROGRESS

- Genetic testing by Uvalde scientists revealed that deer cannot transmit tick fever to cattle. This finding saves the State of Texas $2 million per year by eliminating the requirement to impose quarantine restrictions and fund a costly wildlife-control program.
- Texas A&M AgriLife Research and AgriLife Extension are conducting multiple, diverse studies to help solve the chronic decline in wild quail populations and restore healthy populations of this iconic game bird.
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- Juniper infests over 10 million acres of Texas rangelands, reducing forage production and livestock carrying capacity by 10%–50%. It also increases the potential for wildfire and adversely affects the hydrologic cycle, soil health, and biodiversity. Researchers at the Sonora Research Station, part of the San Angelo Center, have developed innovative management strategies using prescribed fire and goat browsing to reduce the cost of juniper control over sevenfold compared to mechanical methods, for a savings of over $100 per acre for brush control.
    - *Selective breeding was used to develop goats that consume about 15% more juniper than average goats. On the millions of acres of juniper-infested rangeland, that can translate to an increased carrying capacity of about 10%. This could result in an additional net income of $600 for a herd of 100 goats, while increasing the efficiency of goats as a biological control agent for juniper.*
    - *Research has demonstrated that juniper can be used as a roughage source in ruminant diets. If this technology is adopted by one 500,000-head feedlot, it could reduce feed cost about $1.5 million while providing a net profit to the juniper harvester of about $1 million and clearing over 20,000 acres of juniper-infested rangeland at no cost to the landowner.*

GOAL

Improve agricultural production and efficiency through advances in animal and plant breeding, management, and health.

The Uvalde vegetable physiology team assisted a College of Agriculture and Life Sciences plant breeder in the development of a new tomato cultivar 'TAM Hot-Ty', which provides excellent quality, is heat and virus resistant, and produces high yields on a small, compact plant, saving both space and water. This cultivar has attracted the attention of Texas growers and retailers.

PROGRESS

Protecting and improving livestock

- Because of goat breeding cycles, there is typically an excess of fresh goat meat in late summer and early fall, resulting in lower prices. At the San Angelo Center, researchers are selecting goats that ovulate earlier in the spring to enhance the production of year-round goat meat and allow producers to benefit from the approximately 20% higher prices that exist during the low-volume winter months.
- Scientists at Stephenville developed an *in vitro* embryo production and transfer system to improve summer fertility in commercial dairy cows, saving the industry $40 million annually.
- The Texas Beef Improvement project at the Uvalde Center resulted in selection of "efficient" animals that gain the same as their "inefficient" herd mates while consuming 15%–20% less feed. Researchers also found that differences in efficiency are related to differences in digestibility and rumen microbiota.

Developing new cultivars with superior traits

- The Uvalde vegetable physiology team assisted a College of Agriculture and Life Sciences plant breeder in the development of a new tomato cultivar 'TAM Hot-Ty', which provides excellent quality, is heat and virus resistant, and produces high yields on a small, compact plant, saving both space and water. This cultivar has attracted the attention of Texas growers and retailers.
- The Uvalde vegetable team conducted five field trials of 75 elite TAMU pepper hybrids to evaluate yield, fruit quality, and resistance to viruses and bacterial leaf spot. This led to identification of three hybrids for commercial license by a seed company and 10 others for further testing with commercial growers.
- The vegetable team also produced trials of 34 experimental TAMU hybrids, 29 elite inbred lines, and 21 commercial cultivars of specialty cantaloupe melons. This led to identification of 5 candidate hybrids for larger commercial trials; these have high sugars, large fruit, and resistance to powdery mildew.

Using native plant germplasm to restore grassland ecosystems

- Landowners in the Cross Timbers region are more interested in restoring farmland to its original diverse, native vegetation than they are in gaining economic returns from the land. Stephenville researchers are developing native plant germplasm for inclusion in commercial seed mixes for woodlands, prairies, rangeland reseeding, roadside revegetation, wildlife plantings, and cultivated pastures.

- *The researchers collect germplasm from remnant native vegetation sites, evaluate it for potential uses, and then develop it into releases that are made available to commercial seed companies.*
- *Two cultivars have been released through the North Texas Ecotype Project, established at Tarleton State University to facilitate prairie restoration.*

- Stephenville Center researchers collect, evaluate, and release commercial ecotypic germplasm that will replace exotic invasive monocultures of annual ryegrass, bermudagrass, and speargrass. Their work, funded largely by the Texas Department of Transportation and the Texas Parks and Wildlife Department, is providing sustainable alternatives for roadside revegetation and grassland restoration. As a result, TxDOT now requires more native seed in roadside revegetation mixes. The increasing demand for native plant species from Texas seed companies will create millions of dollars of additional income within the state.

Conducting peanut-breeding programs focused on genetic resistance, drought tolerance, or insect and disease tolerance

- Researchers at the Stephenville Center identified and transferred wild peanut genes that control rootknot nematodes and improve drought tolerance and transferred these genes into cultivated varieties, saving producers $30 million annually in pesticide applications and $40 million in irrigation and water-pumping costs.
- Stephenville peanut breeders have released the first nematode-resistant variety in the world with high oleic acid content. This release could increase Texas peanut producers' income by $15 million to $25 million annually while reducing pesticide requirements and maintaining heart-healthy characteristics in peanut products.
- Drought tolerance has become a focal point of the Stephenville Center's wild species introgression program. A wild peanut species native to desert climates in northeast Brazil has been found and recently hybridized in Texas. Transference of drought-resistance genes to commercial peanut varieties could reduce irrigation water requirements by 10%–20% or more. A 10% reduction in water use would be in line with the 2080 projections needed in the High Plains Water District Management Plan.

- The Stephenville Center's greenhouses contain the largest collection of exotic species of South American peanuts of any university in the world. Some of the plants are over 25 years old, and many contain genes that will sustain peanut production in Texas, both economically and environmentally.
- Texas scientists have been working for several years on transferring genes from wild peanut into cultivated varieties. Stephenville researchers found wild species from Brazil that have genes for higher oil content. While domestic peanut varieties contain 48%–51% oil, some wild species contain up to 64% oil. Globally, many countries encompassing an estimated 3.0 billion people grow peanuts for their cooking oil. Stephenville breeding efforts have produced a hybrid that contains 64% oil (equal to that of the wild parent), and this hybrid is cross-compatible with cultivated peanut. Variety releases will soon be available, and these new varieties will greatly enhance international development efforts to feed the hungry.
- Stephenville researchers, with scientists in Lubbock and College Station, released the new peanut variety 'Tamrun OL11'. This new cultivar has a high oleic and low linoleic acid ratio and is resistant to sclerotinia and tomato spotted-wilt virus. It has the potential to increase Texas peanut farmers' annual income by $20 million to $30 million.

GOAL

Add value to raw agricultural products and expand market channels through new product development and enhancements to existing commodities.

Uvalde Center researchers developed integrated crop strategies — from transplanting to harvest — for artichoke, a specialty crop for Texas. Research on improving stand establishment of artichoke showed that using a low level of nitrogen fertilization can improve transplant quality and the plants' ability to withstand drought and heat shock in the field. These results will also improve profitability by reducing fertilizer costs for growers.

PROGRESS

Developing and promoting specialty crops

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- The breeding and physiology pepper programs at the Uvalde Center jointly released 15 disclosures of jalapeño pepper inbred lines and three habanero pepper lines.
- Uvalde research and extension faculty are researching the adaptation of specialty crops for growth in southwest Texas. They are studying stress management, nitrogen fertilization, and irrigation practices (drip, center pivot, hydroponics) on a variety of new crops, such as globe artichokes, diverse melon types, bibb and romaine lettuce, kale and other leafy greens, determinate tomatoes, olives, and grapes.

Improving wool marketing

- The value of wool is determined primarily by mean fiber diameter (MFD) and clean wool yield of greasy wool. In the United States, wool from different growers is often combined into a single lot before being sold to improve marketing efficiency and provide larger, uniform lots of wool. Each bale in these lots must meet American Society for Testing and Materials standards. Because of the large sample size and high price for obtaining results from official methods, marketers use visual appraisal to determine which bales to combine to make a sale lot. Low-cost, rapid near-infrared spectroscopy techniques are being developed at the San Angelo Center that will improve the efficiency of interlotting to assure buyers of a uniform lot and add value to wool for growers.

Studying the economics of high-value crops

- Researchers in the College of Agriculture and Life Sciences, Department of Agricultural Economics, analyzed the economic impacts of agriculture and recreation on the Winter Garden region. Agriculture is vital for the prosperity of southwest Texas and the Winter Garden, with a farm gate value estimated at $564 million for 2013. Researchers expect that within 10 years, a 10% expansion of high-value crops will have an additional economic impact of $84 million.

GOAL

Minimize the impacts of foodborne hazards and biosecurity threat agents.

PROGRESS

Developing procedures to ensure the safety of food and consumer products

- Climate conditions during the past few years have led to the development of mold on crops such as corn. When these molds develop, they produce mycotoxins, which have negative effects on animal production and human health. Aflatoxin is a mycotoxin of special concern because it has been associated with cancer in humans. Milk can contain aflatoxin from feeding contaminated grain to dairy cattle. Scientists at the Stephenville Center determined that an aflatoxin binder was effective at reducing the transfer of the toxin into milk. This helps to ensure production of safe and wholesome milk for consumers.

GOAL

Model and understand the dynamic relationships among biological molecules to genetically improve production, disease resistance, and environmental adaptability of plants and animals used to produce food, fiber, and bioenergy.

PROGRESS

- Researchers at the Stephenville Center have developed the ability to rapidly differentiate small amounts of plant pathogenic bacteria in the bodies of insect vectors through multi-locus melt typing assay. The first of its kind, this technique can determine bacterial subspecies, discover new mutant strains, determine which insects are important to a disease epidemic, and help track the source of alternative wild host plants that may harbor the bacterium.
- Stephenville Center researchers developed and published a rapid genotyping method for identifying strains of the bacterium that causes Pierce's disease in grapevines and other perennial species. This method will help entomologists better understand the impacts of insect vectors on disease epidemiology.
- The Uvalde Agronomy program is using computing tools for physiologists and breeders to collect large amounts of plant and soil data. This will have implications for adoption in both high- and low-input systems.
- Uvalde researchers collaborated with USDA scientists to build a multisensory cart for rapid phenotyping and crop-traits monitoring. This innovative tool will facilitate screening and selection of improved genotypes with drought and heat-stress tolerance and high productivity.

GOAL

Capitalize upon data from high-throughput sequencing, proteomics, metabolomics, metagenomics, and other advanced technologies to develop systems biology tools for improving agricultural productivity.