76th ANNUAL MEETING

Subtropical Agriculture and Environments Society

CONFERENCE ABSTRACTS

February 11, 2022

Hybrid Format

Invited Speaker Abstracts

Genetic and biotechnology strategies to control insect-vectored diseases

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Endemic and invasive insect-vectored pathogens pose immense threats to agriculture and cause billions of dollars of economic losses. Many of these pathogens have peculiar lifestyles and often are fastidious (unculturable). Few examples include pathogens associated with citrus greening, potato zebra chip and Pierces disease of grapes. Unfortunately, studies of such pathogens are hindered due to their recalcitrance to standard laboratory culturing techniques and a lack of high-throughput antimicrobial evaluation tools. We have undertaken an integrative approach combining the latest genomics, bioinformatics, genetics, and biotechnology tools to develop a novel high-throughput antimicrobial discovery and testing pipeline. Our efforts resulted in identification of multiple antimicrobial peptides, immune genes, CRISPR targets, as well as new chemistries that are effective in killing these pathogens (Nature Communications, 2020, 11, 5802). One or more of these strategies could be further developed into an improved genetic-based plant disease resistance trait to control insect-vectored diseases.

Beef cattle research in the tropics – Experiences from the University of Puerto Rico with the Senepol breed

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Beef cattle in Puerto Rico need disease and heat tolerance to adapt to exclusive grazing systems under continuous heat stress and minimally invasive production styles. Unfortunately, selection pressure for robust cattle can negate desirable meat quality attributes. As a means to mend this gap, the *Finca Montaña* beef cattle improvement center from the University of Puerto Rico-Mayagüez has been evaluating and further developing the Senepol breed; a heat-tolerant *Bos taurus* breed originated in the neighboring Caribbean island of St. Croix. Our research has focused on a naturally occurring mutation in the prolactin gene known as the "slick-hair gene." This particular phenotype is a dominant trait that produces a very short hair coat, increasing thermal stability and comfort under harsh heat. We have also identified the presence of larger sweat glands in Senepol's relative to Holstein's in the island (including slick- haired Holstein's), also facilitating heat dissipation. Both characteristics favor this breed for the tropics with the added benefit of potentially improving meat quality traits relative to *Bos indicus* breeds currently used for beef production. More current research is evaluating alternate production and supplementation techniques. Though a collaboration with Texas A&M College Station, a

feeding trial is currently supplementing Senepol pasture fed bulls with post-extracted algae residue (PEAR) as a protein dense feedstuff that may be locally sourced. Simultaneously, the beef cattle improvement center has begun evaluating a Senepol x Red Angus cross with promising initial results. Though there is plenty of work ahead, we are confident that our investment in the Senepol breed has been a wise one and it will continue to lead us in the right direction for beef production in the tropics.

Wildlife and Vector Ecology: Past, Present & Future

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Understanding the fundamental and ecological basis of disease has long been recognized to be of paramount importance in establishing programs with a goal of disease prevention and/or eradication. One of the earliest and most influential studies leading to the understanding of disease, resulted in the development of Koch's postulates and since then disease control operations have evolved to include evaluations of complex ecological systems. These systems may by simplified by using the paradigm of the epidemiological triangle and focusing on one, two, or all aspects of the triangle and their interactions. Here I touch on past research focused on various aspects of the epidemiological triangle, including surveillance for fleas, ticks and the potential pathogens they may carry. Additionally, I will touch on the ecological relationships and their influence on complex disease systems utilizing Lyme disease and Sylvatic Plague as model systems. I will demonstrate how the information provided through vector ecology can illuminate the path to the future, allowing us to identify and target variables and relationships between parasites, hosts and pathogens, and allowing us to target specific areas, times or hosts. Additionally, I will discuss how I plan to transition my past experiences to benefit the Cattle Fever Tick eradication and to generate future research ideas.

Quantifying species diversity, carbon sequestration, and drought tolerance in regenerating Tamaulipan thorn forests

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The decades-long initiative (since early 1960s) to reforest abandoned old fields in the LRGV began as direct-seeding with a handful of species and at present represents a large-scale operation involving hundreds of thousands of individuals representing ~70 species transplanted annually.

This initiative has met with varying degrees of success, with key bottlenecks related to the high susceptibility of seedlings to drought and heat stress, herbivory, and competition with invasive grasses. Here I report on our field and laboratory efforts to quantify key ecosystem services (biodiversity and carbon sequestration), species performance (growth and survival), and drought tolerance of species in these regenerating forests. Our results show that while reforestation does have a pronounced impact on the carbon fixed relative to abandoned self-regenerating forests, increases in biodiversity with time are severely limited by the presence of invasive grasses. Moreover, the majority of species surviving to maturity in these forests are mostly deep-rooted, nitrogen-fixing species. The use of tree shelters and supplemental moisture has detectable positive impacts on survival in the short term (1 year) but these may not persist into the long term, except for more drought-sensitive species. These results highlight how coupling of field-based quantification of differential species success with detailed ecophysiological knowledge of plant traits can be used to enhance reforestation and restoration of biodiversity within the LRGV.

Technical Talks Abstracts

Applications of Bioreactors to Plant Breeding

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Declining favorable environment, due to climate change, has poised a challenging situation for crop production. The negative impact of high temperatures results in yield reduction and quality deterioration in many crops. High temperatures are common in Texas and several recent years were among the hottest on record. One of the major food crops, potato, has expanded worldwide to areas where extreme high temperatures are frequent. Texas is well positioned to conduct research related to high temperature stress in crops. Our findings could be extrapolated to other states in the US, where heat stress is a major production constraint. Breeding for tolerance to heat stress could be one of the best strategies to ensure continuous production of high-quality specialty crops that meet the increasing food demands. Aiming at the identification of abiotic stress tolerance traits, we use *in vitro* screening methodologies (conventional and bioreactors) of potato, industrial hemp and citrus. These procedures can be applied to other Specialty Crops, because of its multiple advantages of being fast, allowing the screening of many genotypes at once, in reduced space, under controlled environmental conditions, allowing the screening of other abiotic stresses, such as cold and salinity. The technique may allow the identification and characterization of major genes involved in abiotic stress tolerance, opening the possibility of future research on the expression of these genes, thus facilitating the development of abiotic stress tolerant varieties, with desired market attributes for Texas, the USA, and worldwide.

Visualization of *Phytophthora nicotianae* Colonization of Sour Orange Roots

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Phytophthora nicotianae is an important soil borne pathogen that causes citrus root and foot rot. Although resistant citrus rootstocks are available, in the Rio Grande Valley (RGV) of South Texas, such rootstocks are not well adapted to the soil and environmental conditions in the area. Sour orange (*Citrus aurantium*), the most widely used rootstock in the RGV, is tolerant to *Phytophthora* spp. induced diseases. Several studies have been conducted on the interaction between *P. nicotianae* with resistant and susceptible rootstocks. However, limited information is available on the interaction of *P. nicotianae* on tolerant rootstocks, such as sour orange. This study aims to characterize the interaction of *P. nicotianae* on sour orange rootstock growing *in-vitro*, to understand the infection process by visualizing root colonization using microscopy. Live monitoring of *P. nicotianae* zoospores revealed that spore attachment to sour orange root tissue occurs within 2 hours after inoculation. Microscopy imagery of a time course infection

assay showed that *P. nicotianae* colonization of sour orange roots starts within four hours after inoculation and that by 24 hours the mycelium is clearly visible within the root tissues as compared to the un-inoculated control ($p \leq 0.05$). After 48 hours post inoculation, haustoria is visible and root cells begin to collapse in inoculated roots, while un-inoculated tissues remain intact ($p \leq 0.05$). This work provides a better understanding of the interaction between *P. nicotianae* and sour orange rootstock which will aid the elucidation of tolerance mechanisms in citrus to *Phytophthora* diseases.

ASSOCIATION OF NON-SYNONYMOUS SNPs IN CANDIDATE GENES WITH INFLUENCE ON BOVINE TEMPERAMENT

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Bovine temperament is considered an economically relevant trait, which has been associated with weight gain, milk production, and reproductive success. One strategy has been the study of single nucleotide polymorphism (SNP) markers in candidate genes, identifying genes with functions in dopaminergic and serotonergic pathways, as well as in neuronal development and activity. Currently, non-synonymous SNPs have been identified, which due to their changes in residues can influence the structure of the coding protein. In this work, was evaluated the effect of non-synonymous SNPs on temperament in the genes: dopamine receptor 5 (DRD5), Huntington's homologous gene (HTT), serotonin receptor 1B (HTR1B), proopiomelanocortin (POMC), and type vesicular transporter 2 (SLC18A2), in a population of 138 animals (64 males and 74 females) of the Brahman breed, born in the years 2002 to 2017 with phenotypic records of temperament by exit velocity (EV) tests, pen score (PS) and temperament score (TS) [TS = (EV + PS) / 2], from the AgriLife Research Center at Texas A&M University, Overton, Texas. The results had a significant association ($p = 0.0144$) for the marker rs209984404 in the HTR1B gene to the pen score. Genotyping showed only homozygous CC and heterozygous CA genotypes. The genotype CC showed the highest mean of 3.03 ± 0.22 of PS compared to the CA genotype with a mean of 1.86 ± 0.48. This is interesting since the gene belongs to a group of serotonin receptors, which is a neurotransmitter with important activity in animal behavior. Finally, the in silico model with the change of residue (Alanine / Serine) favors a change in the global structure of the protein model.

Poster Abstracts

Environmental Science and Ecology

ENV1

Does species water use strategy predict phenological response to drought in thornscrub seedlings?

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Over the last 3+ decades, reforestation efforts in the Rio Grande Valley have replanted 6,485 hectares of Tamaulipan thornscrub. However, species differences in mortality rates for newly planted tree seedlings is often large. Within six months of planting, hot dry summers subject seedlings to large water deficits. Ecological analysis classifies plants along a spectrum of fast-growing, high-water use plants to slow growing, low-water use plants. The aim of this study is to determine where tree species lie in this water use spectrum, while determining if species which use more water are prone to wilt faster and have higher mortality rates. We selected five native tree species commonly used in reforestation: *Celtis ehrenbergiana, Forestiera angustifolia, Sideroxylon celastrina, Phaulothalmnus spinescens*, and *Zanthoxylum fagara.* We subjected 15 individual seedlings from each species to a 13-day drought and recorded daily total mass change and the status of n = 10 leaves per individual, to quantify water use and phenological stage, respectively. Contrary to our expectation, preliminary data suggest that seedlings with lower water use rates wilt faster than seedlings with high water use rates. We hypothesize that water use may be an indicator of internal water storage within plant tissues and may be an important trait for screening plant species for reforestation.

ENV2

Deforestations and its Probable Impacts on the Rise of Various Environmental Instabilities Including Wildfires

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Since the beginning of civilization, humans have been using forest resources for their livelihoods. In recent decades, exponential population growth has created further demands for additional land and timber for human settlements, and this has led to an unhinged global deforestation. Forests are extremely important to the environment as they hold tons of carbon emissions made by anthropogenic activities. Thus, deforestation affects the environment negatively by releasing the carbon stored in the trees, which leads to an increase in the environmental greenhouse gases and contributes to global warming and changing climate patterns. Change in global temperature could also be caused by natural phenomenon such as solar radiation, but many scientists now

believe that since the 1800s, the industrial revolution and related anthropogenic activities may be the main driver behind global warming and climate change. Environmental scientists also believe that shifting climate might be contributing to hotter temperatures, increased droughts, frequent and severe storms, rising oceans, severe wildfires, population displacements, and loss of plant and animal species. In recent times, the earth is experiencing unprecedented rise in temperature, increased droughts, loss of glaciers, intense storms, recurring floods, and massive and sustained wildfires. The summer of 2021 was recorded as the hottest summer in recent history which may be a key element behind unusually high wildfire activities across the globe. This study focuses on the probable effects of deforestations on such recent climatic disturbances, especially wildfires.

ENV3

Evaluating the dynamics of plant available water (PAW) under cover cropping system

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Cover cropping is a method of improving soil fertility, sequestering carbon, reducing erosion, promoting infiltration, and limiting weed and insect outbreaks by growing non-cash crops. Many farmers, however, are hesitant to embrace this approach due to concerns about root zone soil moisture (plant available water). Plant available water (PAW) is soil moisture present in the root zone of plants. While some studies show that cover crops can increase the PAW, others show considerable decreases, implying that a variety of factors; including climate, soil structure, and cover crop identity play a role. In August 2021, we initiated a 4-year participatory research trial across four farms totaling 325 hectares along a sand-to-clay soil texture gradient in South Texas to better understand the role of soil texture and on-farm practice on the direction of cover crop effect on PAW. At each farm, we quantified PAW by measuring soil moisture at three root zone depths (7, 15, and 25 cm) with 6 replicates both within (root zone) and outside (control) cover cropped areas. While cover cropped regions had lower PAW than control plots at a 7 cm depth, the effect reduced with depth on some farms, which we hypothesize is related to the decline of rooting density along the same profile. In comparison to clay soils, sandy soils showed fewer cover crop-induced soil moisture losses, which was also coincident with a lower aboveground cover crop biomass. Future research will analyze PAW dynamics during the winter inter-cropping and subsequent spring and summer cash crop phases. Our study will inform large-scale adoption of cover crops in semi-arid areas globally.

ENV4

Impacts of Wildfires on Ecology and Human Health

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Wildfires are a natural phenomenon of the forests' ecosystems. For hundreds of millions of years, wildfires have been burning the forestlands throughout the globe under diverse environmental conditions. The discovery of 440-million-year-old fossils of charred remains of plants from England suggests that the wildfires even existed during the Silurian period. Seasonal low intensity wildfires are beneficial to forestlands, as they play an important role in the renewal of some ecosystems and revitalizing the life cycles of some plant species such as some conifer plants. On the other hand, larger, intense, and lingering wildfires may negatively impact environment and human health. Studies indicate that wildfire smoke containing various gases and particulate matter may produce short to long-term human health consequences, including death. In the U.S., most wildfires are instigated by anthropogenic activities, while only about 15% of the wildfires occur naturally such as from lightning strikes. In recent times, wildfires have become more frequent and sustained with accelerated force of destruction. Furthermore, overall global atmospheric temperature has increased. The summer of 2021 was recorded as the hottest summer in recent history and associated with unusually high wildfire activities across the globe. This study focuses on the impacts of wildfires on ecology and human health, and if expanding anthropogenic activities and climate variabilities may have induced the recent extreme wildfire occurrences.

ENV5

Incorporating Native Plants in Insectary Strips to Promote Insect Diversity and Belowground Beneficial Microbes

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Insectary strips have demonstrated the ability to biologically control pests by attracting natural enemies enabling farmers to reduce dependence on chemicals. Native wildflowers have the potential to not only increase the above ground insect diversity, but to also promote soil biodiversity. While there is an increasing number of studies on the role of native flowers on insect diversity, there is limited information on their impact on soil microbes. To address this informational gap, we conducted a 2-year study at an organic farm in Edinburg, Texas. We determined the impact of native flowering plants and sunn hemp, a common hedgerow species, on below-ground and above-ground diversity and their impact on the cash crop yield. We collected soil samples from different locations in the insectary strips and the cash crop (*Brassica oleracea* var. *italica* and *Capsicum annuum* var. *annuum*) and analyzed them for chemical

properties and soil microbial biomass. Our preliminary results show a significant difference in fungal biomass among the different treatments (P=0.04) and at different locations (P=0.0002). Control had significantly higher eukaryotes compared to the other treatments (p=0.0041). Arbuscular mycorrhizal fungi, a beneficial soil microbe, were highest in native annuals (P=0.036) while there was no significant difference between control and sunn hemp. Similarly, our preliminary results on insect diversity indicate a significant difference in insect community composition among the different treatments and different sampling periods. However, we did not find any significant difference in the cash crop yield and pest damage.

ENV6

Can moisture content accurately predict interspecific differences in seedling drought tolerance? Implications for enhancing drought-resilience in restoration

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Climate change projections indicate prolonged heat and water stress for many vegetative communities across the globe, causing more frequent and intense droughts that can lead to large-scale mortality events. Within the Lower Rio Grande Valley National Wildlife Refuge (LRGV-NWR), recently revegetated lands are subjected to periods of extreme heat and water stress. Previous work has documented large interspecific differences in mortality rates for many native species used in these revegetation efforts, spanning 6 – 43 % mortality within the first year. To discern the extent to which differences in underlying drought physiology may be the root cause, we subjected five commonly used reforestation species (*Celtis ehrenbergiana, Forestiera angustifolia, Sideroxylon celastrina, Phaulothalmnus spinescens, and Zanthoxylum fagara*) to a point-of-no-return drought experiment and measured water status (water potential, moisture content), gas exchange (photosynthesis, stomatal conductance) and plant structural attributes for the purpose of identifying interspecific differences in plant functional traits that underlie drought response and to identify incipient mortality risks. Preliminary data suggests that differences in tissue moisture content (leaf, stem, root) may play an influential role in survivorship among the species with stem moisture content exhibiting the most consistency in regard to the identification of incipient mortality thresholds when compared to root and leaf moisture content, both of which exhibited greater variation in incipient mortality thresholds. Additionally, differences in root structural attributes correspond with interspecific differences in drought tolerance. The implications of this research points towards species-specific approaches to moisture management as a means of decreasing *in-situ* seedling mortality in revegetated plots.

ENV7

Cover Crops May Exacerbate Moisture Limitations on South Texas Dryland Farms

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Cover crops are a sustainable management tool for mediating weed pressure, reducing soil erosion, and enhancing soil organic carbon and nitrogen levels. Yet, adoption rates across water-limited farms in Texas remain low, especially among rain-fed producers, due to concerns that cover crop use of soil moisture will negatively impact subsequent cash crop yields. This 3-year cover crop trial in a rain-fed sorghum farm in Lyford, Texas trialed different cover crop mixes and seeding rates and confirmed that cover cropping leads to significant soil moisture deficits and cash crop failure when rainfall is low between cover crop termination and cash crop planting (<30 mm). In seasons one and three, moisture deficits contributed to significantly lower germination of post-cover crop sorghum compared to fallow control plots. Season one controls had 2.3 sorghum seedlings/m compared to 1.1 seedlings/m in cover crops ($t(73) = 6.11$, $p < 0.001$) and season three controls had 6.7 seedlings/m with 3.0 seedlings/m in cover crops ($t(73) = 4.52$, $p < 0.001$). In season two, increased precipitation during a longer moisture recharge period between cover crop termination and cash crop planting helped avoid sorghum germination and yield drops ($t(73) = 0.14$, $p = 0.89$). Length of recharge period, amount of rainfall, species selection, planting density, and termination method are determinants of subsequent cash crop outcomes. Careful management can minimize some risks to soil moisture, but without reliable rainfall at key points in the cropping cycle, cover cropping remains risky for farmers without irrigation access.

ENV8

Agro-ecosystem Modelling for Developing Crop Resilience Strategies to Climate Change Events

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This work aims to identify key baseline crop parameters for use in the process-based agro-ecosystem model Cycles (Kemanian et al., Cycles, 2020; URL https://plantscience.psu.edu/research/labs/kemanian/models-and-tools/cycles) to produce simulated Maize yield outputs for U.S. counties from 1980 to 2016. In development, an index of agreement of 0.77 with the United States Department of Agriculture's yield report values has been achieved for a subset of seven counties. Potential

adaptation pathways were considered and implemented within Cycles. Experimental results to be presented demonstrate in a subset of counties that increasing the Transpiration Use Efficiency, biomass growth per unit mass of water transpired, or decreasing Kc, the ratio of water transpired by the crop to evaporated from the topsoil, results in significant increased grain yield for both water-stressed and non-water stressed scenarios. These results will demonstrate the potential for agro-ecosystem models to be used to tailor crops to their environment and aid in developing a more resilient agricultural system. This work has been supported by Planet Texas 2050, a research grand challenge at the University of Texas at Austin.

ENV9

Understanding the distribution and natural history of *Asclepias prostrata* for conservation in South Texas

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Asclepias prostata is an endemic rare species of milkweed distributed within the transboundary region of South Texas and northern Mexico. In Texas, *A. prostrata* has occurrences in Starr and Zapata County within the South Texas Plains ecoregion. This rare plant species is currently under review to be considered an endangered species by the U.S. Fish and Wildlife Service (FWS) in the near future. To contribute to conservation efforts, our objectives are to (1) document *A. prostrata* current distribution, (2) identify the soil types present in the area, (3) identify potential pollinators, and (4) create a map for potential suitable habitat on FWS property. Some of our field observations include pressures that *A. prostrata* faces such as the U.S.-Mexico border wall, as well as competition with the taller invasive buffelgrass (*Pennisetum ciliare*). This specific competition has shown shade avoidance syndrome expressed by *A. prostrata*. Preliminary results include identifying the soil types found at different *A. prostrata* populations. We have also documented potential pollinators of the species to help understand the role of this plant species within the ecosystem. Lastly, we have also created a map containing our GPS occurrences with designated potential suitable habitat in the Lower Rio Grande Valley National Wildlife Refuge within Starr County. Our findings from this continued effort will document the distribution of *Asclepias prostrata* in South Texas to potentially aid in species distribution modeling, provide insight on why the species may be showing population isolation, and to identify potential suitable habitat for conservation plans.

ENV10

Monitoring the potential expansion of the destructive invasive species *Cactoblastis cactorum* in the Lower Rio Grande Valley

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Species of the genus *Opuntia*, popularly known as the prickly pear cactus or "nopal", is a native plant found in the Rio Grande Valley (LRGV). The *Opuntia* spp. have a great ecological, medicinal and cultural importance for the region. *Cactoblastis cactorum*, or commonly known as the Cactus moth, an invasive species that can destroy prickle pears have been reported in northeast Texas. Thus, it is imperative to detect the expansion of this species in the LRGV. We have been monitoring 100 different areas in Hidalgo and Cameron counties since 2019 and very recently set 10 traps in Willacy and Starr counties. Up to this day, there has not been any evidence that supports the presence of the cactus moth in the Lower Rio Grande Valley. However, since it is not easy to prevent the expansion of this species, to prevent ecological, medical and cultural damage, we must continue monitoring this species. We expect to incorporate community engaged activities to this surveillance program.

ENV11

Model Development for Geohelminth Prevalence in Soil

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Geohelminth Infections are caused by nematodes present in soils in tropical and sub-tropical regions of the world. These infections are neglected tropical diseases, which strongly affect people in developing countries. Contact with geohelminths in soil is a mechanism for transmission. The geographical distribution of these pathogens may be impacted by changes in climate and human lifestyles that together may actively enhance the prevalence of geohelminth infections. The Random Forest Machine Learning Method has been adopted to study how climate change influences the infection of geohelminths using data provided by the ESPEN database for the years 2014, 2015, 2016, 2017 and 2019 in Madagascar. Both climate and socio-economic factors are considered in this study, including soil temperature, soil content, monthly precipitation, night light, local population to yield maps that predict geohelminth prevalence. This methodology can be adapted for predicting geohelminth prevalence in other tropical and sub-tropical regions of the world and provide additional information to assist in mitigation and treatment of this class of infections. This work has been supported by Planet Texas 2050, a research grand challenge at the University of Texas at Austin.

ENV12

Soil Suitability for Supporting *Burkholderia pseudomallei* in Texas

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Burkholderia pseudomallei is a soil- and water-borne bacterial pathogen that is the etiological agent of the disease melioidosis. Melioidosis is prevalent in the tropics and agricultural workers are amongst those at risk because of the potential of their work to contact contaminated soils. In addition, disease occurrence is increasingly being reported in regions north and south of the tropics and in 2019 Texas was declared endemic for melioidosis by the CDC. In this project we are using GIS software to process, analyze, and map data pertaining to melioidosis occurrence and factors such as climate and soil conditions that permit survival of the organism in different environmental niches. Keys aims of our research are to identify geographical regions where *B. pseudomallei* may be present in the environment but not yet detected, and to predict where the organism might be able to spread and become established in the future. The automation of the research workflow through the use of Python using scripted processes allows these maps to be updated as new data become available such as reports of disease occurrence. This work has been supported by Planet Texas 2050, a research grand challenge at the University of Texas at Austin.

ENV13

Geological Sensor Deployment in the Austin Metropolitan Area and the Rio Grande Valley

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The accurate collection, processing, and presentation of environmental data around the globe drives the decision-making of policymakers, public safety officials, and industry leaders. From anticipating a flood, to capitalizing on a rich mineral deposit, leaders in society rely on the credibility of information about events within and above the Earth's lithosphere to set directives in motion that affect millions of lives and billions of dollars. This project's goal consists of the development and deployment of a multi-functional sensors to monitor environmental conditions in areas of Austin and the Lower Rio Grande Valley of ecological interest. Here, we describe strategy for deployment and the methodology for capturing and storing large datasets acquired by these sensors. This research has long-term implications on the ability in how we can use these data

to accurately predict and adapt to changes in the environment that affect agriculture, ecology, health and disaster management in Texas and elsewhere. This work has been supported by Planet Texas 2050, a research grand challenge at the University of Texas at Austin and the EFAS-REEU at the University of Texas Rio Grande Valley.

ENV14

Exploring User Collected Data and Its Ability to Predict Flooding

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User collected data is a relatively untouched source of data that is collected by scraping reports from citizens of an area in many forms that can, for example, include social media posts and the 3-1-1 telephone number, a call service available in many communities that provides access to non-emergency services. In Texas, the 3-1-1 service is available in a few cities including Austin, Dallas, El Paso, Houston, Laredo and San Antonio (https://en.wikipedia.org/wiki/3-1-1#United_States). By tracking 311 calls in Austin, we have begun to see patterns in the areas that suffer the most flooding damage. However, in many areas of Texas that are flood-prone, such as the Rio Grande Valley, there is no 3-1-1 service. We are therefore exploring how to compare and contrast the ways that an area with a uniform emergency flood reporting system and an area without one is able to be prepared for flooding damages that affect the population and the local impacts of flooding including the management of agricultural activities. This work has been supported by Planet Texas 2050, a research grand challenge at the University of Texas at Austin and the EFAS-REEU at the University of Texas Rio Grande Valley.

ENV 15

Effect of cover crops and tillage on a cotton-grain sorghum rotation in a semi-arid region

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Conservation agriculture has not been as widely adopted in semi-arid regions such as South Texas to the extent of other areas of the United States that receive greater amounts of annual precipitation. The lack of research in this area to show the possible benefits of these practices on cropping systems can be attributed as one of the reasons for the low implementation of these management tactics. A cotton-grain sorghum dryland rotation will be used on a Orelia fine sandy loam field that has been under no-till management for over 30 years at the Texas AgriLife

Research and Extension Center at Corpus Christi. Tillage replicates and cover crops were initiated in fall of 2020 to make a randomized split-split plot design with 4 blocks. No-till and tillage are the two main plots (twelve 38-inch rows wide and 38 feet long) with three different cover crops treatments; no cover crops, a mix of 3 cover crop species, and a mix of 6 cover crop species as subplots. Gravimetric soil water content, soil compaction, cover crop canopy cover and herbage mass, and crop yield will be measured throughout the duration of the 2-year study. A basic economic analysis of each coupling of different practices will be conducted as well to look into the feasibility of farmers adopting one or more management techniques into their operations.

Entomology

ENT1

Biological Control of the Asian Citrus Psyllid, *Diaphorina citri*, in the Lower Rio Grande Valley of Texas Using the Ectoparasitoid, *Tamarixia radiata*

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Tamarixia radiata Waterston (Hymenoptera: Eulophidae) is a biological control agent of the Asian citrus psyllid (ACP), *Diaphorina citri* Kuwayama (Hemiptera: Liviidae), vector of the citrus pathogen, "*Candidatus* Liberibacter spp." *T. radiata* are beingreleased in urban environments of citrus growing areas in Texas to reduce ACP populations. The USDA APHIS PPQ S&T Insect Management & Molecular Diagnostics Laboratory developed methods to produce, release, and track large numbers of the beneficial insects for the biological control of *D. citri*. Releases of the beneficial insects were made to assess parasitism and populations rates. Since 2010, *T. radiata* reared by the laboratory were released in urban settings of the Lower Rio Grande Valley of Texas where Huanglongbing (HLB)-positive trees are located.. Prior to *T. radiata* releases, a mean of 43.11 nymphs per flush in residential citrus were detected in 2010. Since biological control releases began, *T. radiata* releases have resulted in a decrease of over 89%, with nymph populations detected at rates of 4.73 nymphs per flush in 2021.

ENT2

Assessment of two novel host-derived *Beauveria bassiana* isolates against the citrus pest, *Diaphorina citri*

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The Asian citrus psyllid (ACP), *Diaphorina citri* Kuwayama (Hemiptera: Liviidae), vectors '*Candidatus* Liberibacter spp.', the causative agent of Citrus Greening Disease (CGD) or Huanglongbing (HLB). Managing populations of psyllids in the Lower Rio Grande Valley (LRGV) of South Texas is imperative given a continuous increase in HLB-positive trees. A component of integrated pest management (IPM) program is the use of strains of entomopathogenic fungi for the biological control of *D. citri*. In an attempt to find endemic strains of entomopathogenic fungi that grow favorably under LRGV environmental conditions and naturally infect *D. citri*, psyllids were collected from local residential areas, surface sterilized, and plated on a semi-selective agar medium. Collection of over 9,300 samples from 278 sites throughout the LRGV led to the positive identification of two *Beauveria bassiana* (Balsamo-Crivellii) Vuillemin (Hypocreales: Cordycipitaceae) isolates, ACP18001 and ACP18002. Chi-square analysis of primary and secondary acquisition bioassays revealed that both field isolated strains outperformed *Cordyceps* (*Isaria*) *fumosorosea* (Wize) (Hypocreales: Cordycipitaceae) Apopka97 under both primary (direct spray) and secondary acquisition (adult exposure to sprayed foliage) bioassays with ACP18002 marginally outperforming ACP18001 under secondary acquisition. Slopes of the dose response regression lines for the three fungi were not significantly different. In addition, the thermal profiles for vegetative growth of each isolate indicated that the field isolates grew at higher rates than the standard at higher temperatures. The new isolates may prove to be good candidates for the management of *D. citri* populations in the LRGV.

ENT3

Bi-National Partnership for the Biological Control of the Asian Citrus Psyllid Along the Mexico Border

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The beneficial parasitoid, *Tamarixia radiata* Waterson (Hymenoptera: Eulophidae) is mass produced at the USDA S&T Insect Management & Molecular Diagnostics Laboratory (IMMDL) to help mitigate the spread of *Diaphorina citri* Kuwayama (Hemiptera: Liviidae) in Tamaulipas and Baja California, Mexico. The insects were produced and collected from greenhouses and transferred in 32 oz. large-mouth vials. The *T. radiata* were then stored in a chiller room at 13ºC (~55ºF) with a 12:12 photoperiod before being shipped to their corresponding location the following week in ice chests and insulated shipping kits. Tamaulipas and Baja California began open releases in 2013 and 2014 respectively. This past fiscal year, the IMMD Laboratory had

provided 2.8 million parasitoids for release in Tamaulipas and 3.1 million were released in Tijuana. From 2013 to 2015 mean *D. citri* nymphs per flush observed in Tamaulipas decreased by 53%, however, from 2016 to 2021 that number has significantly increased. In contrast, Tijuana *D. citri* nymph populations decreased 50.9% from 2014 to 2020.

ENT4

POLYPHENOLIC CONTENT OF NON-POLAR EXTRACT OF *Pithecellobium dulce*

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Mexico is one of the countries with the greatest diversity of flora as it is home of around 26,000 species. One of these plants is the Guamuchil (*Pithecellobium dulce*) which is a common tree in Latin America and some places in Africa y Asia. In the northeast of Mexico, specifically in the north of Tamaulipas, this fruit is occasionally consumed. There is no information available on the phytochemical composition of its seed. The objective of this work was evaluating the phenolic and flavonoid content of non-polar extract of Guamuchil seeds. Phenolic compounds and flavonoids are plant secondary metabolites with significant antioxidant activities offering human health benefits. In this study, a hexanoic extract was isolated from seeds of Guamuchil using the Soxhlet apparatus. The extract was concentrated and dried using rotary evaporation and subsequently collected from the flask. The Folin-Ciocalteau and flavonoid content analysis was made. The results showed that concentration of total phenols was 7.96 ($\pm$0.66) mg of gallic acid equivalents and flavonoids was 15.13 ($\pm$2.02) mg of catechin equivalents for mg of sample; respectively. These results demonstrated the presence of polyphenolic phytochemicals in Guamuchil seeds.

ENT5

Examining the roles of different cover-cash crop rotations on arthropod community dynamics in Lower Rio Grande Valley

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Recent studies have shown that shifting to ecologically based farming improves not only the sustainability but also the resilience of the agroecosystem. The management of the habitat surrounding agricultural systems can provide a suitable environment that aids in propagating

beneficial arthropod communities such as natural enemies, including predators, parasitoids, and pollinators. Cover crops provide a potentially cost-effective method of improving habitats to increase the populations of beneficial arthropods and thus reduce pest incidence. However, the impact of cover crops on the arthropod community dynamics in the management of pest populations is poorly understood. To address this, we have designed a four-year field experiment in the Lower Rio Grande Valley to evaluate the impact of cover crops such as cowpea, sorghum sudangrass, sunn hemp, and radish during the summer seasons, followed by cash crops in the winter. The objective of this study is to examine the role of cover-cash crop rotations on arthropod community dynamics. We hypothesized that cover crop treatments would attract beneficial insects like parasitoids, pollinators, and natural enemies leading to the reduction or repulsion of herbivores, thereby benefitting the subsequent cash crop. Initial arthropod community has been evaluated in four fields in the LRGV a few days after planting cover crops using pitfall traps, sticky traps (blue and yellow), and vane traps installed in both the cover crops and control field plots. A total of 6.615 arthropods were collected and classified to their order. Our preliminary results show that there is a significant difference in the population of arthropods across the four fields and also between cover crop and no cover crop treatment based on their feeding guild and taxonomic order, suggesting that cover crops mediate insect-plant interactions with possible consequences for agroecosystem sustainability and resilience- areas we will continue to explore.

ENT6

(BPS) Mexican Fruit Fly Egg Bubbling Time Study

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Mexican Fruit Fly (*Anastrepha ludens*) is a significant economic pest to the citrus industry of the Lower Rio Grande Valley. Currently, the USDA leads a sterile fly release program aimed at controlling the pest to prevent citrus damage and quarantines. In this study, *A. ludens* eggs from the Guatemalan Black Pupal Strain (BPS) were bubbled for 24 to 48 hours longer than current bubbling times to determine if there would be a beneficial effect on final egg hatches, larval and pupal masses, adult flight abilities, and stress tests of this alternate strain. All eggs were put into bubbling chambers with 2000 ml of RO water, 24 ml of Hydrogen Peroxide, and 2 ml of a 1% Oxalinic Acid solution. BPS eggs that were bubbled for an additional 48 hours prior to infestation on artificial diet produced more larvae and pupae per kg of diet than BPS eggs bubbled for an additional 24 hours, though their pupal mass was smaller. Overall, testing

indicated that bubbling BPS eggs for 48 hours longer produced slightly higher quality control parameters and production of flies for future studies and mass rearing.

ENT7

The Validation of Rapid Diagnostic Tools Used in the Identification of *Anthonomus grandis grandis* Boheman

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The boll weevil, *Anthonomus grandis grandis*, is a serious pest of commercial cotton causing fruit loss and boll damage. Since first being discovered in South Texas in 1892, this pest has caused billions of dollars in losses to U.S. cotton. An eradication program established in 1978 eliminated the pest from many areas in the U.S. While the boll weevil has been eradicated from many areas in United States and portions of northern Mexico, many areas continue to be actively monitored for recent introductions. Occasional captures in weevil-free areas recovered from trapping programs include closely-related species such as *A. g. thurberieae*, the thurberia weevil. This subspecies feeds mainly on wild cotton, and has a geographic range that includes northwestern Mexico and the southwest U.S. These two weevil subspecies are behaviorally different and are difficult to distinguish using morphology alone. The USDA currently uses molecular techniques that rely on sequencing the cytochrome oxidase I (COI) to distinguish boll weevil from those closely-related weevil species. However, while effective at identifying the boll weevil, conventional sequencing can be time consuming. Fast and accurate methods are needed in order to reduce the reaction time to infestations and provide accurate determinations. In this study, we performed the validation of a Single Nucleotide Polymorphism (SNP) assays to provide rapid and accurate identifications for the boll weevil and the thurberia weevil. The results show the assay is a reliable identification method to distinguish boll weevil from thurberia weevil. The work presented here describes those tests conducted to validate the performance of these SNP assays. We provide the results of these tests across three laboratories and evaluate the performance of the assays.

ENT8

Packaging and Shipments of Irradiated Mexican Fruit Fly (Diptera: Tephritidae) Infested Grapefruits for Canine Training Packaging and Shipments

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The United States Department of Agriculture's National Detector Dog Training Center (NDDTC) mission is to train canines to find prohibited agricultural items entering the country. Detector dogs can locate and help prevent the spread of invasive insects, including the Mexican Fruit fly, *Anastrepha ludens* (Loew) (Diptera: Tephritidae), which infest fruit and are detrimental to the citrus industry. Training detector dogs with an insect species that is not endemic or naturalized to the region where the canine training occurs at NDDTC poses a problem. Science and Technology Insect Management and Molecular Diagnostics Laboratory (IMMDL) located in Edinburg, Texas maintains laboratory colonies of *A. ludens* in biocontainment facilities and has developed methods to ship sterilized flies to the NDDTC in Newnan, Georgia for detector dog training. At the IMMDL *A. ludens* larvae are collected and placed with forceps into grapefruit using 20 2nd instar larvae per fruit. Two to three days post inoculation, the infested fruit are irradiated at ~140 Gy dose rate for safeguarding and to ensure the larvae are sterile. The fruit are packaged in specially designed sealed PVC cannisters to prevent larvae from escaping during transportation. To compare shipping container performance, two types of shipping containers, a Styrofoam box and ice chest, were compared for the survivorship of live larvae during transportation. Shipments of infested fruit began in July 2020. A total of thirty shipments containing training aids have been accomplished. The Styrofoam box had a survivorship rate of 81.5% while the ice chest had an increased survivorship of 92.3%. The ice chest increased survivability and overall fitness of the larvae during transit.

ENT9

Examining the role of trap color on pollinator attraction: A test using yellow and colorless vane traps

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Pollinator density and identity estimation is crucial for pollinator conservation and agroecosystem health diagnosis. Although a variety of traps are routinely used for such purposes, whether trap color has a significant impact on pollinator attraction is less understood. Even more critically, it's unclear whether variation in trap color differentially attracts pollinators beyond the target area's ambient pollinator community. To test this, we conducted a field experiment with two types of traps: yellow and colorless vane traps. In three field sites in the Rio Grande Valley, we set up

twelve traps at each site, six colorless and six were yellow, placed equidistant from each other, and the experiment was replicated twice during the cropping season. The insects collected in the traps were identified to order, families and were then separated based on their feeding guilds. In total, we collected 1620 insects, out of which 1228 were pollinators. Generalized Linear Regression analyses shows that yellow- colored traps consistently attracted significantly more total insects ($P<0.0001$) and pollinators ($P<0.0001$)., but these were also field ($P<0.0001$) and season dependent ($P<0.0001$). Furthermore, we noticed that Hymenoptera followed by Coleoptera were the most prevalent orders found in the traps. More specifically, hymenopterans of families Megachilidae, Xylocopidae, Vespidae and Halictidae were more common than others, and the coleopterans of families Meloidae and Melyridae were also found. Our results suggest that trap color is important and should be factored into experiments that estimate pollinator density in field.

ENT10

Testing an Alternative Acid for Rearing Mexican Fruit Fly on Artificial Diet

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Citric acid is a necessary ingredient utilized in the production of artificial diet for the mass rearing of the Mexican fruit fly (*Anastrepha ludens*). There is currently a global shortage of citric acid and an alternative pH lowering ingredient is needed. The Mexican fruit fly is an agricultural pest that damages citrus crops in south Texas. The United States Department of Agriculture has developed the Sterile Insect Technique (SIT), a program used to control the wild population of Mexican fruit flies by mass producing, irradiating and releasing sterile flies. The optimum pH range of artificial Mexican fruit fly diet is 3.75± 2.5. Diets with pH values outside this range result in lower production levels. We conducted tests to identify pH reducers to replace citric acid in Mexican fruit fly mass rearing diets. Experiments were conducted using apple cider vinegar, white vinegar, malic acid, and a sodium bisulfate. Apple cider vinegar, white vinegar, and malic acid diets produced flies meeting accepted quality control measures for Mexican fruit flies in SIT programs. However, apple cider vinegar and white vinegar diets' pH were well above the recommended pH of 4.0, which could lead to microbial problems in larval diets. Sodium bisulfate was not recommended due to high mortality in the diets and poor-quality control values for pupal weights, emergence and flight ability. Malic acid was ultimately recommended as a suitable alternative for citric acid in the production of artificial diets for the rearing of Mexican fruit fly at the USDA facility in Texas.

ENT11

Evaluation of *Steinernema riobrave* entomopathogenic nematodes for treatment of cattle fever tick-infested pastures

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Cattle fever ticks (CFT) *Rhipicephalus microplus* and *R. annulatus* are invasive livestock pests, endemic to Mexico and invasive along the Texas – Mexico border. Acaricide resistance, alternate wildlife hosts and pathogenic landscape forming weeds present challenges for sustainable eradication of this pest in the U.S. CFT are the vector for bovine babesiosis, a lethal disease-causing high mortality in cattle. Efforts to eradicate CFT from the United States have been successful; however, there has been an increase in CFT infestations outside of the Permanent Quarantine Zone in Texas. The entomopathogenic nematodes, *Steinernema riobrave*, which is native to South Texas has been shown to be effective against CFT nymphs and adults. In this study, we evaluated *S. riobrave*, Nemasys-R® (BASF Inc.) for potential use in the eradication of questing CFT larvae in pastures. Potted buffelgrass plants were each infested with three thousand CFT larvae. Over a period of six weeks, three groups of tick-infested potted buffelgrass received weekly spray applications of Nemasys-R®, water, with an untreated control. Each treatment was replicated ten times. Two days following treatments, a white flannel sheet (10 X 20 cm) was pulled across the top of each plant to collect questing CFT larvae. We collected significantly fewer larvae on the Nemasys-R® treated plants ($\bar{x}$ = 38.7) compared to the untreated control($\bar{x}$ = 101.0) results from ANOVA were ($p < 0.05$). Initial results demonstrate the potential for use of entomopathogenic nematodes for control and eradication of CFT larvae in pastures. Our results also demonstrate the need for further research on the efficacy of entomopathogenic nematodes against CFT larvae in pasture trials and ultimately for use in the USDA-APHIS Cattle Fever Tick Eradication Program in South Texas.

ENT12

Examination of the host range of north American lacebug (*Gargaphia arizonica* Drake & Carvallo*)* as potential biocontrol agents for silverleaf nightshade (*Solanum eleagnifolium* Cav.)

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Silverleaf nightshade (*Solanum elaeagnifolium* Cav.; SLN) is an herbaceous perennial weed native to south Texas, but invasive worldwide, especially in Australia. Traditional control methods have little success in controlling this weed, and more recently, exploring biocontrol methods have been of interest. In a collaborative effort with scientists in Australia, the aim of this study was to investigate whether North American lacebug (*Gargaphia arizonica*) has the potential to be a biological control agent for SLN and to determine, whether non-traget Solanaceous crops are also susceptible to this herbivore. Using a combination of field and lab based trials, choice assays and plant traits measurement, we tested the effectiveness of *G.arizonica* in the Lower Rio Grande Valley in south Texas. Periodic observations were made to determine feeding potential of *G.arizonica* on SLN, potato and egg plants in a reverse interspersion approach. Throughout the observation period, both nymphs and adults of *G. arizonica* were observed only on SLN. The field trial was followed by no-choice caged experiments and 30-minute observations for feeding behavior of *G.arizonica* for each pairs at 48 hrs, 96 hrs and 144 hrs a week after placement of lacebugs. Data on Leaf damage, number of alive nymphs, mortality and number of adults were also collected. Generalized regression analyses of the data sets collectively shows that regardless of the trials and assays *G.arizonica* infested SLN more than egg plants, and had more adults and less mortality on SLN. Taken together, our data shows the possibility of using *G.arizonica* as a potential biocontrol agent against SLN.

ENT13

House hunting: harvester ant (*Pogonomyrmex barbatus*) colonies in an urban gradient

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Harvester ants are granivorous insects that reside in arid to semi-arid climates and are prone to establish themselves in rural to semi-urban regions. Though efforts have been made to remove their presence in agricultural settings, no published research has documented their preferences for colony establishment in South Texas urban areas. Harvester ants are considered pests in the U.S. due to their painful stings and removal of vegetation around colony entrances. This behavior jeopardizes the aesthetic of the traditional American lawn, leading to increased use of insecticides to remove established colonies. Data for the study consisted of National Agriculture Imagery Program (NAIP) images, digital elevation models (DEMs), and collection of soil moisture levels within our colonies of interest. NAIP and DEMs were downloaded from the Texas Natural Resources Information Systems website. Soil moisture data (n = 22) was collected from the UTRGV (University of Texas Rio Grande Valley) Intramural fields (26°18'35.5"N 98°10'47.4"W), and values were inputted to ArcMap 10.2.2 for interpolation of soil moisture within the area using

kriging, a form of statistical analysis. Given harvester ants are known to administer painful stings, determining the specific conditions ants establish themselves could help citizens take proper measures to reduce the likelihood of colony establishment on their property. From the data collected, we observed that 47% of the colonies in the intramural fields were found to be established in soil moisture levels of 28-28.5% volumetric moisture content. 48% were situated within 10m of a road, and at the 5m radius around the colonies 47% had an area of pervious material above 80%. Finally, 90% of the colonies were located at an elevation range of 28.5-30m.

ENT14

Texas Persimmons as a possible food source and suitable host for Mexican Fruit Fly (Diptera: Tephritidae)

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The Mexican fruit fly, *Anastepha ludens* (Lowe) is a highly polyphagous pest with a multitude of hosts. Understanding this pest's host range provides valuable information for pest management. Wild Texas persimmons (*Diospyros texana* Scheele) grow in an area that overlaps part of the citrus growing region in TX. To better determine the Mexfly host range, study was conducted to determine if Texas persimmon can serve as host for Mexflies. Thirty laboratory reared adult Mexican fruit fly (Mexfly) were subjected to a no-choice feeding study using wild Texas persimmons fruits to determine if wild Texas persimmons are a suitable food source for adult Mexfly. An oviposition and development trial was conducted with fertile laboratory reared adult Mexflies. The adult Mexflies were able to feed exclusively on persimmons for up to 36 days. No Mexfly larvae emerged from the wild Texas persimmons subjected to fertile Mexfly adults. Based on this test, wild Texas persimmons are not considered a suitable host for Mexfly development.

Pathology

PATH1

Screening commercial entomopathogenic fungi for the management of *Diaphorina citri* populations in the Lower Rio Grande Valley, Texas, USA

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Ten strains of entomopathogenic ascomycete fungi, sourced from commercial formulations of blastopore or conidiospore formulations, were tested in 14 different formulations in a primary acquisition/direct spray bioassay against adult Asian citrus psyllid (*Diaphorina citr*i Kuwayama (Hemiptera: Liviidae)). The *Cordyceps* (*Isaria) javanica* Apopka 97-C (conidia) strain was used as the standard. A statistical ranking system was established in which top performing pathogenic strains were selected for further screening and eventual field trials. Modified Potter-type spray towers were utilized to deliver a range of doses of viable spores to adult *D. citri* in an aqueous spray consistent with the rate of spores per hectare as often used in real-world spray applications. Mortality was assessed after a seven-day incubation period under controlled climate conditions reflecting those in the Lower Rio Grande Valley (LRGV) of Texas, USA. Of the 14 preparations, the strains *Metarhizium anisopliae* E9, *C. fumosorosea* Ifr9901, *Beauveria bassiana* ATCC 74040 and ANT-03, *M. anisopliae* ESALQ1037, and *M. robertsii* DWR2009, showed greater levels of mortality than the standard, Apopka 97-C, in the laboratory setting. Of those six, two (Ifr9901 and ANT-03) were selected for further evaluation based on efficacy, commercial availability, geographical registration, and market outlook on production.

PATH2

Evaluation of Citrus Rootstocks for Tolerance to Virus and Viroid Infections

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Virus and viroid infections are graft-transmissible and their infections affect growth and production of citrus trees. Citrus is predominantly grown on sour orange rootstock in the Lower Rio Grande Valley (LRGV) of Texas. Citrus exocortis viroid (CEVd), Hop stunt viroid (HSVd), Citrus tatter leaf virus (CTLV), and Citrus tristeza virus (CTV) were reported in the LRGV citrus. Moreover, several CTV strains were recently reported in the Upper Gulf Coast area. Although the insect vector, the brown citrus aphid, has not been reported, CTV-positive trees were occasionally found in the LRGV. Citrus grown on sour orange rootstock is highly susceptible to CTV. There is a need for alternate rootstocks that are tolerant to infection from these pathogens. Seedlings were raised from Sour Orange (*Citrus aurantium*), Trifoliate Orange

(*Poncirus trifoliata*), and US-942 (*Citrus reticulata* x *Poncirus trifoliata*) rootstocks and kept under greenhouse conditions. Rootstock US-942 showed better growth compared to the other rootstocks. The evaluation of citrus rootstocks for susceptibility or tolerance to viroids and viruses is important to assess their suitability for use in commercial citrus production in the LRGV. This study will evaluate the response of rootstocks that have been graft-inoculated with CEVd, HSVd, CTLV, and CTV. Measurement of growth parameters of the graft-inoculated rootstock and rating of manifested symptoms will show the response of the rootstock to viroid and virus infections. The detection of pathogens will be performed by extraction of RNA and qPCR with pathogen specific primers. This research will allow for determining the potential tolerant rootstock to be introduced for better citrus production in the LRGV.

PATH3

Effects of temperature stress on growth and sclerotia production of *Sclerotium rolfsii*

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Southern blight is caused by the soil borne fungal pathogen *Sclerotium rolfsii* and affects many hosts. Sclerotia of the pathogen can lay dormant in soils for extended periods of time, leading to devastating and persistent problems in affected fields. Previous studies suggest that the pathogen grows well in warm and moist conditions, however little is known about the growth habits of the isolates found in the Rio Grande Valley. With global temperatures on the rise, it is important to understand how *S. rolfsii* will react to future temperature changes. We designed a study to assess hyphal growth rate and sclerotia production of *S. rolfsii* under temperature conditions. We exposed cultures of an isolate collected from a local tomato field to constant temperatures of 10, 15, 20, 25, 30, 35, 40, and 45C and monitored for hyphal growth and sporulation at 1, 3, 5, and 7 days post inoculation. We compared growth and sporulation using Tukey's range test, and we found that the pathogen grew significantly more quickly at 25, 30, and 35C, and that sclerotia production was significantly higher at 30 and 35C. These results are similar to studies of isolates from other regions. Understanding how this pathogen is affected by temperatures is critical as the effects of climate change take hold, threatening global food security.

PATH4

Studies to Find the Causal Agent for Confusing Foliar Lesions in Citrus

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Lesions similar in characteristic of Citrus Leprosis Virus (CiLV) were observed in leaves from field and greenhouse grown citrus trees. These samples tested negative for the virus in the quantitative polymerase chain reaction (qPCR) based diagnostic assays, leaving the cause of the lesions unknown. It is possible cause of the lesions is by fungal infection, insecticide/herbicide spray damage, or a combination. Leaves were collected from the field and greenhouse. Lesions were excised and surface disinfected for isolation of fungi on Potato Dextrose Agar (PDA). Only those samples collected from the field presented fungal growth, while the samples from the greenhouse presented no growth. Healthy Rio Red grapefruit and Marrs sweet orange leaves were surface disinfected, kept in Petri dishes with moist filter paper, and treated with sterile water, insecticide mixture, fungal spore suspension or combination, and incubated at 28°C. Fungal growth observed on leaves inoculated with the fungus was the only visible damage on the leaves. It was suspected that the temperature difference from the incubator and the field/greenhouse is a factor. Rio Red grapefruit leaves were surface disinfected and treated with three insecticide treatments, optimal concentration, half strength concentration, and double concentration. Half of the leaves were incubated at 28°C and the other half were placed in the greenhouse. All leaves kept in the greenhouse had visible damage after three days. The leaves placed in the incubator had less visible damage. The damage is suspected to come from the insecticides used and the fungus being a secondary infection. Further research and testing will be done to identify the cause of the lesions. Identification of the fungal isolates is in progress.

PATH5

Measuring Microbial Activity of Sweet Potato Crop in the Lower Rio Grande Valley

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The Lower Rio Grande Valley (LRGV) is a sub-tropical region with scarcity of specialty crops. Now more than ever with recent plat virus outbreaks, we have experienced a decline of our once thriving onion and citrus crops. To remedy the pressing issue the Lower Rio Grande Valley is facing, we are testing an alternative crop's feasibility known as sweet potato. *Ipomoea batatas* (Sweet Potato) is a vegetable known to grow optimally in sandy loam soils and in a hot climate, which the LRGV possesses. In this study we sought to determine the optimal fertilization type to grow sweet potatoes and promote soil microbial activity, which is an indicator of soil health. The crop was grown in a semi-arid climate with mild precipitation on hyperthermic calciustoll soil with 63% sand, 19% silt, and 18% clay. We tested and collected soil samples before and after planting the crop. Experiments to quantify the ammonium and nitrate concentration in the soil were measured to assess available concentrations of each compound. Fluorescein Diacetate Analysis was also conducted to measure the microbial activity present. The results of this study suggest that there was not much deviation in the microbial activity between our samples collected (before and after planting) and the control. This could likely be due to the sweet potato's own plant growth rather

than the fertilizer treatment. Further studies will be administered to underlie potential mechanisms affecting sweet potato soil health.

Plant Science

PLSC1

Evaluation of Micropropagation Methodologies and the Use of Temporary Immersion Bioreactors in Hemp

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Hemp (Cannabis sativa) is an important crop valued for both its fiber content and medicinal properties. It is utilized for pharmaceuticals, textiles, paper, rope, oil and biofuels. We established a micropropagation system for hemp that included the use of temporary immersion bioreactors (TIB), that could be applied for mass propagation of elite or commercial genotypes, and to perform physiological stress studies in vitro. Explants were collected from 5 hemp varieties: Carmagnola selezionata, AV1, Eletta campana, Fibranova, and one experimental Chinese clone. Cultures were initiated either from seeds or from excised leaf nodes disinfected by subsequent washes with 5 % commercial bleach and 70 % ethanol. Initially, cultures presented healthy growth using standard MS media; but after few transfers, tissues developed severe chlorosis and died. For all the varieties, tissues cultured on MS media supplemented with mesos and ammonium nitrate (Lubell-Brand et al. 2021) presented continuous healthy growth, multiplication, rooting, and flower induction. Hemp explants grew better in semisolid media than in liquid media where they developed vitrification. Hemp explants cultured in TIB developed well into large plantlets. However, despite the overall good response of hemp in tissue culture, more experiments are needed to optimize and standardize the methodology, since great variation on the degree and amount of growth was observed within the clones.

PLSC2

Investigating the Spatial and Temporal Variations in Soil Properties within Farms of the Lower Rio Grande Valley

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The Lower Rio Grande Valley (LRGV) provides year-round agricultural production opportunities because of its subtropical climate and mineral rich alluvial soils. However, due to intensive agricultural practices soil health has been greatly impacted. To restore soil health, farmers in this region have begun to adopt sustainable agricultural practices, such as cover cropping, low till, and organic farming. While these practices have proven to improve soil health in temperate regions, minimal information is available on the impact of these practices in semi-arid regions. This study aims to explore the spatial and temporal variability of soil characteristics across four farms in the LRGV as influenced by cover crops. We collected soil samples from four different farms with three different soil types, fine sandy loam, sandy clay loam, and clay loam. Soil samples were collected from two different depths, 0-10 cm and 10-20 cm in each farm, and analyzed for moisture, organic matter, pH, salinity, texture, aggregate stability, carbon/nitrogen content, and soil microbial biomass. Our preliminary results show that there is a strong correlation between soil organic matter and soil moisture within the two depths. While there was no significant difference in organic matter between the two depths among the different soil types, soil moisture was different in the two depths of sandy clay loams, with higher moisture in 10-20 cm depth. It is apparent that soil texture influences the soil moisture and organic matter content, soil texture affects moisture content at different depths.

PLSC3

Biochemical Makeup of Sorghum and their Role on Aphid Growth and Reproduction

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Sorghum (*Sorghum bicolor*) is a widely used cereal crop that is commonly used as livestock feed and is typically preyed on by aphids. While previous studies have focused on the impact of individual aphid species' feeding on sorghum, we examined the effects of sequential herbivory by aphids on sorghum to gain a further understanding of the differential defense responses in sorghum following sugarcane (*Melanaphis sacchari*) aphid and greenbug (*Schizaphis graminum*) feeding. We used bioassays in which sorghum plants were infested with either sugarcane aphids or greenbugs, then after 48 hours the aphids were removed and replaced with either sugarcane aphids or greenbugs which were then counted after 96 hours. To estimate the differential defense responses in sorghum after sugarcane aphid and greenbug herbivory, we employed a gene expression study in which sorghum plants were infested with either sugarcane aphids or greenbugs for 48 hours and analyzed using qrt-PCR. For qrt-PCR, the housekeeping primer, *Tubulin*, was compared to pathogenesis related target genes *PR1* and *PR10*. Our results show that there was a significant difference in the salicylic acid produced between sugarcane aphid infested plants and greenbug infested plants. *PR1* expression was lower in sugarcane aphid infested plants than in uninfested plants and *PR1* expression is much higher in greenbug infested plants than uninfested plants. Collectively, our results suggest that greenbug infested sorghum plants are

more resistant to sugarcane aphids and that greenbugs induce stronger defense responses in sorghum plants than sugarcane aphids.

Fruits

FRUIT1

Field evaluation of Rio Red grapefruit transplants grown under protective nets in South Texas

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Protecting young *Citrus* transplants from the Huanglongbing (HLB) disease caused by *Candidatus* Liberibacter asiaticus vectored by Asian citrus psyllid (ACP) (*Diaphorina citri* Kuwayama), is critical for long term sustainability of citriculture. The only viable approach currently available to the growers is through physical exclusion of the ACP by means of covering the trees with protective nets. This practice has not been evaluated so far in South Texas weather conditions. It is important to understand the tree physiological parameters influenced by the protective nets. Best management practices need to be optimized considering the modulation of micro climate under the protective nets. Therefore, the objectives of this study are to evaluate the morphometrics of young Rio Red grapefruit (*Citrus paradisi* Macfad) trees grafted onto Sour orange (*Citrus aurantium* L) rootstock grown under protective nets. Transplants are currently being grown under various mesh size nets and are being evaluated for ACP exclusion and tree growth parameters such as height, trunk caliper, canopy volume and stem water potential. Micro climatic conditions under these bags are being monitored to correlate the differences in tree physiology. Our preliminary results suggest that the trees grown under the protective nets have significantly higher growth compared to trees grown without them. This is the first report on evaluation of various mesh sizes of protectives nets on a commercial scale in South Texas Rio Red grapefruit production.

FRUIT2

Examining the Impact of Seed Orientation on Root and Stem Morphology of *Citrus aurantium* L.

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Sour orange (*Citrus aurantium* L.) is one of the primary rootstocks used for citrus propagation. Apart from being tolerant to phytophthora and alkalinity, it is compatible with Rio Red grapefruit (*Citrus paradisi*) and

Marrs Sweet Orange (*Citrus sinensis*), the two major cultivars grown in South Texas. Although it is a vigorous rootstock, approximately 15% of the seedlings are discarded at various stages of its growth in the nursery due to abnormal morphologies. This is a major concern, thereby necessitating to optimize growing conditions. Seed orientation while sowing might influence aspects such as uniformity, percentage of emergence, and possibly correlates with root and stem morphology. Different geometrical orientation of the seed such as horizontal (radicle pointing at 0º), upright (radicle pointing down at 90º), and inverted (radicle pointing up 270º) positions were evaluated in coconut coir and Murashige and Skoog medium. Percent of emergence, primary root and shoot length, shoot-and-root dry weight (biomass allocation), and root and stem-base crookedness are being analyzed. Differential whole seed *PIN2*, an important gene in polar auxin transport controlling plant growth and development will also be studied. Expression levels of *PIN2* in seeds subject to sterilization procedures with no further sowing will be compared to seeds sterilized and sown into coconut coir and Murashige and Skoog medium for 7 days. Our preliminary results indicate that there is a significant variation in structural characteristics of seedling due to orientation of sowing. Seeds sown inverted have adverse growth relative to vertical and horizontal counterparts. Results from this study will be beneficial for increasing the productivity of citrus nurseries and also contribute towards establishing healthy citrus orchards.

Molecular Biology

MOLBIO

Complete genome sequencing and comparative genome analysis of a new strain *Bdellovibrio* sp. LBG001, a potential antibiotic agent

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The use of conventional antibiotics in agriculture with the associated environmental problems necessitates a suitable alternative. *Bdellovibrio*, a predatory Gram-negative bacteria suggests to be potential as an alternative application for bacterial pathogen control and therapy. In this study, a novel *Bdellovibrio* sp. LBG001 was isolated from soil. LBG001 genome was assembled into 1 contig. It has a genome length of 3,582,323 with a GC content of 43.1% and 3395 coding sequences. LBG001 genome contains 22 antibiotic resistance genes and an incomplete prophage. Invitro assessment shows its predatory potential on all tested 10 Gram-negative bacteria. Comparative genomic analysis with ten other available *Bdellovibrio* strains suggests 720 to be the orthologous core genes shared while 897 genes were unique to LBG001 only. Phylogenomic analysis based on 16S rRNA, house-keeping genes and core-genome orthologous clusters reveal LBG001 belong to a new species other than any other type species in the genus *Bdellovibrio*. The ANI, AAI, dDDH of (< 79%, <72%, <17%) respectively with members of the genus further confirms the strain to be a member of a new species in the genus *Bdellovibrio*. This study, therefore, presents a novel *Bdellovibrio* strain with its potential for future biotechnological application and basic research of predatory bacteria.