2022 Report

# 2022

# ANNUAL REPORT

## LEYENDECKER PLANT SCIENCE CENTER

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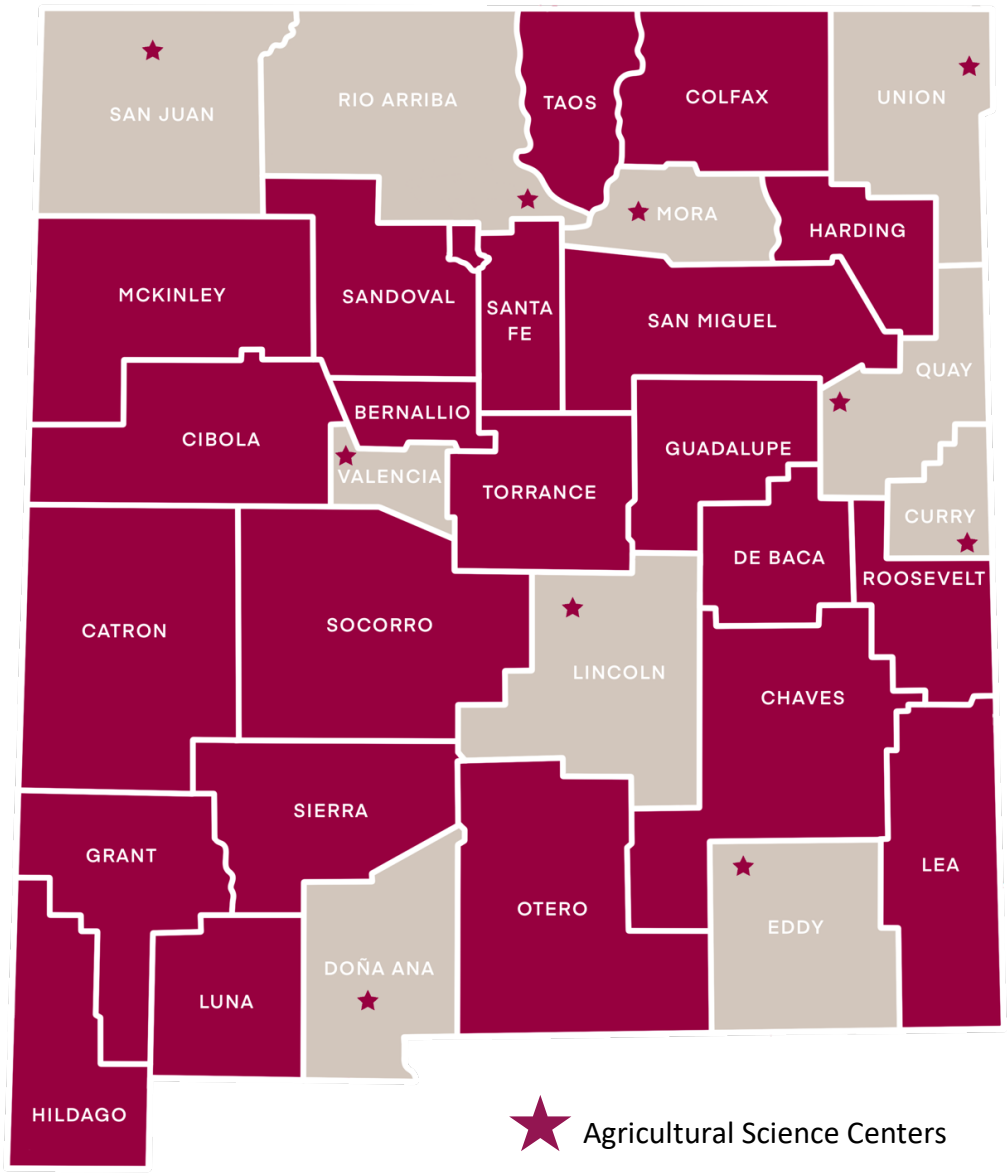
## Agricultural Science Center Locations Map



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## Executive Summary

In 2022, research trials increased over the previous year and crop focus included chile, cotton, alfalfa, onions, pecans, jujube, guar, guayule, corn, wheat, oats, sudan, native trees, and cover crop mixes. Crop breeding/advancement continued for several programs such as alfalfa, chile, onions, and cotton. Plant pathology and insect vector/biological control research were also carried out. Additionally, micro-irrigation technology/sensor studies were installed and remote sensing with drones was conducted on the pecan trees by members of the College of Engineering. Sustainability initiatives continued to grow and progress with the installation of another subsurface drip irrigation system which will provide water for a long-term cover crop rotation/soil health research trial. The coming growing season will see this system become fully automated in its operational capacity. Wireless internet was augmented in both speed and coverage of the center to better accommodate digital agriculture initiatives and drone/remote sensing trials. Irrigation architecture and application continue to be a broad area of concern for New Mexico and thus, is of utmost importance to research efforts at Leyendecker Plant Science Research Center.

## Research Projects

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Evaluating a new herbicide for Yellow Nutsedge (*Cyperus esclulentus*) in Chile Pepper – Investigators: Schutte, B. J.

Comparison of water movement in pecan fields under different irrigation scenarios – Investigators: Alexander Fernald, Richard Heerema, and Jorge Preciado

Mesquite common garden study – Investigators: Kristen Bowers and David Thompson

# 2019-2023 Alfalfa Variety Trials at Las Cruces

**Investigators**: Ian Ray (iaray@nmsu.edu) and Christopher Pierce

**Project Overview**: Evaluate forage yield performance of 24 commercial alfalfa varieties and advanced NMSU breeding lines under standard irrigation management (trial 1) and deficit irrigation management (trial 2) from 2020 to 2023. The goal is to identify alfalfa varieties that perform well under variable irrigation management strategies in south-central New Mexico.

**Meeting the Needs of New Mexico**: Limited water resources threaten New Mexico's $148 million alfalfa industry. The alfalfa variety trials conducted at Las Cruces are intended to help local farmers identify currently available alfalfa varieties that they can grow and which can be productive under highly variable soil moisture conditions, including deficit irrigation management. Farmers can purchase seeds of these varieties to grow on their farms to help conserve water and ensure good profits.

**Impact**: This research identified 11 alfalfa varieties (including 4 new NMSU varieties) that ranked in the top-yielding group under both well-watered and deficit-irrigation management over 3-years (i.e., 2020, 2021, and 2022). Each of these varieties also outperformed the NMSU drought-resilient variety, NuMex Bill Melton. Two of these new NMSU varieties are also performing well elsewhere in NM and the central valley of CA. These outcomes suggest that one or both of these NMSU populations may have good potential for commercial release. In the meantime, farmers can purchase seeds of several currently available varieties that we identified, which will grow well under variable soil moisture in south-central NM. These outcomes will benefit agricultural sustainability, yield stability, and water conservation in NM.

**Funding Acknowledgement**: Hatch project 1012275-NMRAY17H, Genetic Improvement of Alfalfa Germplasm for New Mexico. Multiple Alfalfa Seed Companies. NM Hay Association.

# 2022-2025 Alfalfa Variety Trials at Las Cruces

**Investigators**: Ian Ray (iaray@nmsu.edu) and Christopher Pierce

**Project Overview**: Evaluate forage yield performance of 18 commercial alfalfa varieties and new advanced NMSU breeding lines under standard irrigation management (trial 1) and deficit irrigation management (trial 2) from 2023 to 2025. The goal is to identify alfalfa varieties that perform well under variable irrigation management strategies in south-central New Mexico.

**Meeting the Needs of New Mexico**: Limited water resources threaten New Mexico's $148 million alfalfa industry. The alfalfa variety trials conducted at Las Cruces are intended to help local farmers identify currently available alfalfa varieties that they can grow and which can be productive under highly variable soil moisture conditions, including deficit irrigation management. Farmers can purchase seeds of these varieties to grow on their farms to help conserve water and ensure good profits.

**Impact**: This research study was planted in October 2022 and will begin providing yield data in 2023. Hence, no impact occurred in 2022. However, based on the data that will be collected from this study, we will identify new alfalfa varieties that rank in the top-yielding group under both well-watered and deficit-irrigation management in 2023, 2024, and 2025. Performance for each of these varieties will also be compared relative to the NMSU drought-resilient variety, NuMex Bill Melton. Based on the outcomes, farmers will be able to purchase seeds of several currently available varieties that we will identify, which will grow well under variable soil moisture in south-central NM. The data will also be used to identify superior NMSU varieties to move forward for commercialization. Collectively, these outcomes will benefit agricultural sustainability, yield stability, and water conservation in NM.

**Funding Acknowledgement**: Hatch project 7001870-NMRAY22H, Genetic Improvement of Alfalfa Germplasm for New Mexico. Multiple Alfalfa Seed Companies. NM Hay Association.

# 2022-2024 NMSU alfalfa seed increase blocks at Las Cruces

Investigators: Ian Ray (iaray@nmsu.edu) and Christopher Pierce

**Project Overview**: NMSU will conduct bee-pollinated breeder seed production under cage isolation for 10 new elite NMSU alfalfa varieties in 2022, 2023, and 2024. Such seed increase approaches are needed to generate sufficient seed to plant and evaluate these varieties for yield performance and nutritional quality at multiple locations in NM and CA. NMSU populations that perform well in these regional trials will be advanced for commercial marketing via exclusive release agreements with alfalfa industry partners.

**Meeting the Needs of New Mexico**: The seed generated in this project will be used to determine the suitability of 10 advanced NMSU alfalfa breeding lines for commercial release based on regional variety trial performance. Superior new NMSU varieties will be identified to provide NM farmers with new productive, drought-resilient varieties that can help conserve water, ensure good farm profits, and meet the livestock industry's feed demands.

**Anticipated Impact**: Ten seed increase blocks were planted in March 2022. One to three pounds of seed per block were produced in the summer of 2022. Along with seed from 8 other alfalfa industry varieties, we used seed from the 10 NMSU seed blocks to plant the 2022 Las Cruces alfalfa variety trial in October 2022. Additional seed produced from these blocks in 2023 and 2024 will be used to plant and test the 10 varieties at other locations in CA and NM beginning in 2023. Yield data from future trials will identify superior NMSU alfalfa lines that perform well under variable irrigation management strategies over multiple years and locations in the southwest US. Superior NMSU varieties will be advanced for commercialization via exclusive release agreements with alfalfa industry partners to benefit agricultural sustainability, yield stability, and water conservation in New Mexico’s future.

**Collaborating Agricultural Science Centers**: ASCs at Artesia, Farmington, Las Cruces, and Los Lunas.

**Funding Acknowledgement**: Hatch project 7001870-NMRAY22H, Genetic Improvement of Alfalfa Germplasm for New Mexico. Multiple Alfalfa Seed Companies. NM Hay Association.

# Genomics-breeding for the development of genetically improved chile pepper cultivars in New Mexico

**Investigators**: Dennis N. Lozada (Lead PI; dlozada@nmsu.edu) Seyed Shahabeddin Nourbakhsh (Co-PI) Soum Sanogo (Co-PI) Stephanie Walker (Co-PI)

**Project Overview**: The project aims to implement novel genomics-assisted breeding tools to facilitate the development of genetically improved pepper cultivars at the NMSU Chile Pepper Breeding and Genetics Program. Genetic mapping approaches have identified important genes related to chile pepper blight resistance, yield, plant morphology, fruit shape and quality, and machine harvestability traits. Several lines with improved resistance to pepper blight, which can be used as parents to develop resistant chile cultivars, were also identified. By using modern genetic techniques, it is expected that cultivars with improved characteristics which will have a significant impact on New Mexico chile pepper growers will be developed.

**Meeting the Needs of New Mexico**: Chile peppers are important cultural and economic crops in the state of New Mexico. The current project uses novel genetic techniques to accelerate the development of genetically improved pepper cultivars. Breeding objectives are related to improving yield, machine harvestability, fruit quality, and nutritional traits using modern genomics approaches. Several chile pepper cultivars with potential as parental lines for hybridization and cultivar development have been identified. Overall, the development of new chile pepper cultivars with improved yield, resistance to diseases, flavor, and quality will have a positive economic and consumer impact on New Mexican growers.

**Impact**: For more than a hundred years, chile pepper has been regarded as New Mexico's major vegetable crop. Total production in recent years, nevertheless, has been hampered by diseases, lower yields, and costs associated with manual labor. The current project aims to circumvent these issues through novel genomic techniques to develop genetically improved varieties. Genomic approaches such as genetic mapping and genomewide selection will help facilitate informed breeding and selection decisions for the development of genetically improved cultivars. Phenotypic and marker-assisted selection has identified at least five potential chile pepper cultivars that can be used as parental lines for breeding improved yield and machine harvestability. Moreover, a breeding line with improved resistance to pepper blight has been selected as a candidate for release as a new cultivar with increased resistance. Altogether, genomics breeding is expected to accelerate the development of cultivars with improved characteristics which can benefit New Mexican growers and consumers.

**Collaborating Agricultural Science Centers**: Los Lunas Agricultural Science Center

**Funding Acknowledgement**: USDA-Hatch Capacity Grant; New Mexico Chile Association; New Mexico Chile Commission; USDA-NIFA

# Initial Hemp variety trials across New Mexico environments

**Investigators**: Catherine Brewer (cbrewer@nmsu.edu) and Rebecca Creamer

**Project Overview**: This project established a two-year variety trial at three NMSU ASC locations to study the cultivation of different hemp types throughout the state. The primary goal of the project was to investigate the suitability of cannabidiol (CBD), grain, and fiber hemp types for NM production. Data was collected to compare how the yields and chemical profiles of the hemp varieties change when grown under conditions different than those of the locations where the varieties were bred to perform.

**Meeting the Needs of New Mexico**: The main purpose of this project is to strengthen the NM hemp industry, which experiences financial losses and difficulties entering the market during the first two years of legal hemp production in NM. Challenges plaguing stakeholders across the supply chain have included instability of variety genetics, risk of crops exceeding legal tetrahydrocannabinol (THC) limits, issues with manufacturing quality control, and a lack of infrastructure. NM producers have described an overwhelming need for understanding how local environments interact with hemp genetics to identify varieties that are successful in the region.

**Impact**: The underlying impact across all investigations has been to develop hemp variety recommendations for NM hemp farmers based on their location. Other impacts generated by this project include the establishment of procedures for university researchers to receive state licensure for hemp production, dissemination of treatments of interest to increase crop yields, and identification of crop residues with potential for value-added products. This work further generated educational impacts by expanding the experience and knowledge of university faculty and staff that can be used to create university courses and training materials.

**Collaborating Agricultural Science Centers**: Leyendecker Plant Science Center, Agricultural Science Center at Los Lunas, Sustainable Agriculture Science Center at Alcalde

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# Long-Term soil health site at Leyendecker Plant Science Research Center

**Investigators**: John Idowu (jidowu@nmsu.edu); Mohammed Omer, Ibukunoluwa Fademi, and Rajan Ghimire

**Project Overview**: The goal of this project is to establish a long-term soil health research and demonstration site at Leyendecker Plant Science Research Center to test how different soil health practices affect long-term soil quality, greenhouse gas emissions, soil moisture utilization, and crop yields. Soil health management treatments include three tillage systems: conventional tillage, strip tillage, and no-tillage, three cover crop treatments: no cover crop, single cover crop, and mixed cover crops, and two organic amendment treatments: no amendment and compost/biochar amendment.

**Meeting the Needs of New Mexico**: The long-term soil health demonstration site will assist with training crop producers, agriculture support professionals, and New Mexico stakeholders on soil health management principles and practices, thereby building resilient agriculture and enhancing adaptation to climate change in the region.

**Impact**: The soil health demonstration site will serve as a training facility for producers, educators, agriculture consultants, and stakeholders in New Mexico, and provide an opportunity to learn about soil health principles, how to improve soil health, sequester carbon, mitigate greenhouse gas emission, and attain sustainable crop productivity while minimizing the costs of production. This site will also help understand how various management practices affect soil health in the short- and long-term. Information about the cost of implementing alternative management practices will be documented and made available to producers. The site will also serve as a training facility for undergraduate and graduate students studying sustainable agriculture.

*Soil health site planted to cover crops at Leyendecker Plant Science Research Center*

**Funding Acknowledgement**: NMDA Health Soil Program; USDA-NIFA

# Nutrient management in guayule

**Investigators**: John Idowu (jidowu@nmsu.edu); Mohammed Omer, Mark Cruz, and Sam Wang

**Project Overview**: Guayule (*Parthenium argentatum*) is a desert-adapted shrub that can serve as a domestic source of natural rubber in the southwestern United States. Since guayule is a newly cultivated crop in the desert southwest, its optimal crop management practices and fertilization requirements in different growing regions are yet to be established. Understanding the response of guayule to nitrogen and phosphorus fertilization will help farmers to optimize their resources. Therefore, the objective of this study is to evaluate the effects of nitrogen and phosphorus rates on guayule growth and yields in sandy loam soil under furrow irrigation.

**Meeting the Needs of New Mexico**: Commercial production of guayule provides an opportunity for the US to have a domestic rubber supply, thus cutting down on current imports of natural rubber and enhancing farmers' income in the guayule growing regions including New Mexico. Guayule provides an opportunity for farmers in New Mexico to grow an alternative perennial crop that has industrial value. This will diversify their production system thus providing an alternative income stream.

**Impact**: Farm income has become challenged due to rising farm inputs costs and non-matching produce prices. Therefore, farmers in New Mexico need to engage in the production of more profitable alternative crops to enhance farm profit. Guayule is an alternative crop that can increase the income stream of farmers. Research on nutrient management of guayule was initiated at Leyendecker PSRC and through field days and grower visits, trial results were shared on the fertilization needs of guayule. Grant funding was obtained to develop guayule which is an industrial crop capable of increasing farm profitability compared to many of the current field crops.

**Funding Acknowledgement**: USDA-NIFA

*Guayule Nutrient Management Plot at Leyendecker Plant Science Research Center*

# Breeding for cold tolerance in guayule

**Investigators**: John Idowu (jidowu@nmsu.edu); Mohammed Omer, Mark Cruz, Sam Wang

**Project Overview**: Guayule (*Parthenium argentatum*) is a desert-adapted shrub that can serve as a domestic source of natural rubber in the southwestern United States. Guayule is currently grown mostly in southern Arizona (USDA Plant Hardiness Zone 9) characterized by a mild winter climate. Expanding guayule production to include regions of higher latitudes in the southwest (USDA Plant Hardiness Zones 6 - 8) will allow production in many more geographical zones and will increase domestic rubber production, potentially allowing more farmers to benefit from the bioeconomy of a new industrial crop. This study is focused on breeding new lines of guayule that are more cold-tolerant compared to the existing cultivars.

**Meeting the Needs of New Mexico**: Commercial production of guayule provides an opportunity for the US to have a domestic rubber supply, thus cutting down on current imports of natural rubber and enhancing farmers' income in the guayule growing regions including New Mexico. Guayule provides an opportunity for farmers in New Mexico to grow an alternative perennial crop that has industrial value. This will diversify their production system thus providing an alternative income stream.

**Impact**: Farm income has become challenged due to rising farm inputs costs and non-matching produce prices. Therefore, farmers in New Mexico need to engage in the production of more profitable alternative crops to enhance farm profit. Guayule is an alternative crop that can increase the income stream of farmers. Research on developing cold-tolerant lines of guayule was initiated at Leyendecker PSRC. This research is ongoing and through the development of new cold-tolerant cultivars, guayule planting zones will be expanded in New Mexico. Grant funding was obtained to develop guayule which is an industrial crop capable of increasing farm profitability compared to many of the current field crops.

**Funding Acknowledgement**: USDA-NIFA

*Guayule Cold Tolerant Study at Leyendecker Plant Science Research Center*

# Potassium and phosphorus effects on the growth of cotton

**Investigators**: John Idowu (jidowu@nmsu.edu) and Mohammed Omer

**Project Overview**: There is a need to revise the fertilizer rates for recently developed cotton (*Gossypium hirsutum*) cultivars in New Mexico since the cotton fertilizer recommendations being used in the state were developed over 30 years ago. Therefore, three rates of nitrogen (50, 100, and 150 kg N $ha^{-1}$) and potassium (0, 100, and 200 kg $K_2O$ $ha^{-1}$) were tested on a glandless (NuMex COT 17 GLS) and a conventional glanded (Acala 1517-08) cotton cultivar at NMSU Leyendecker Plant Science Research Center located in Las Cruces.

**Meeting the Needs of New Mexico**: Fertilizer recommendations for cotton production in New Mexico were developed over three decades ago. There is a need to reexamine these recommendations, especially for the recently developed cotton cultivars to help producers optimize the lint yield and fiber quality of cotton produced in New Mexico. The output of this study will assist cotton growers to remain profitable in New Mexico.

**Impact**: The results of the first year of this study were shared with cotton growers who attended a cotton field meeting at Leyendecker Plant Science Research Center in 2022. Farmers were able to see the different fertilization treatments in the field and asked specific questions related to management practices. A fertilizer management guide will be developed after analyzing the second-year results of the trial and this will be made available to cotton farmers.

*Cotton at Harvest in Potassium and Phosphorus Trial at Leyendecker Plant Science Research Center*

**Funding Acknowledgement**: USDA-Hatch

# Seeding density effect on growth and yield of guar cultivars

**Investigators**: John Idowu (jidowu@nmsu.edu); Mohammed Omer

**Project Overview**: Guar (*Cyamopsis tetragonoloba* (L). Taub) is a leguminous, drought-resistant crop adapted to arid and semi-arid regions. Guar has been traditionally cultivated for food, industrial uses, and for building soil health. While Asia is the major producer and exporter of guar, the demand for it is high in the USA, especially in the oil and gas industry. Increasing the domestic production of guar will reduce reliance on imports. For sustainable production of guar, agronomic optimization such as establishing appropriate seeding density is essential. The objective of this study was to evaluate the effects of seeding density on guar growth and yield.

**Meeting the Needs of New Mexico**: Farmers in New Mexico are seeking alternative rotation crops that can benefit and add value to their cropping systems. This has become essential due to many challenges being faced by crop producers in the state. One of the major challenges is to reduce the amount of irrigation water needed for crop production. Guar is a low-water use and water-efficient crop that thrives very well in New Mexico. Growing guar can help farmers in the state diversify their income and build sustainability and resiliency into the cropping system across different agroecosystems in New Mexico.

**Impact**: Crop production in New Mexico is facing several challenges, including irrigation water availability, and farmers are looking for ways to improve farm profitability. Guar is an alternative crop that requires much less water for good seed yield compared to many cultural crops in New Mexico. Guar is suited to dry climates and can enhance the income of farmers in New Mexico. Guar is an annual legume that produces guar gum from its seeds for industrial uses. Research being conducted on guar will enable producers in the state to know the best crop management practices for optimal guar growth and yield. Guar production in New Mexico can help farmers attain long-term economic and cropping system sustainability.

*Guar Field Ready for Harvest at Leyendecker Plant Science Research Center*

**Collaborating Agricultural Science Centers**: Los Lunas ASC; Tucumcari ASC and Clovis ASC

**Funding Acknowledgement**: USDA-NIFA

# Effect of Biochar on soil quality indicators

**Investigators**: John Idowu (jidowu@nmsu.edu); Mohammed Omer, Ibukunoluwa Fademi, and Rajan Ghimire

**Project Overview**: Biochar is carbon made by burning organic material in a low-oxygen or no-oxygen environment. Since biochar is porous and persists in soil for a long time, utilizing biochar as a soil amendment may benefit soil moisture retention. Water scarcity in arid regions has increased and hence the need to improve soil moisture retention. Biochar has been reported to have positive effects on soils in many other regions, but few studies have been documented for arid southwest. The main goal of this study is to evaluate the impacts of biochar on soil moisture retention and the health of arid soils.

**Meeting the Needs of New Mexico**: Irrigation water availability is a critical challenge facing the arid southwest including New Mexico. Farmers in the state are seeking ways to improve moisture retention in their farm soils. The application of biochar as a soil amendment can increase soil moisture retention thus reducing the amount of soil water required for crop production. This can help farmers in the state build drought-resilient soils in the face of climate change that is currently happening in the region.

**Impact**: Farmers are learning more about biochar from the results of this study. Additionally, hands-on training was conducted in 2022 on how farmers can produce biochar on their farms using available biomass wastes. Results of this research have shown that biochar can improve the soil moisture holding capacity of sandy soils and benefit other soil health indicators such as soil aggregation and soil microbial community. These results have been shared with stakeholders in New Mexico and some have indicated their willingness to produce biochar from the biomass wastes on their farms for soil application. This research is ongoing to document the long-term impacts of biochar on soils and crops.

**Funding Acknowledgement**: NMDA Healthy Soil Program; USDA-NIFA; USDA-Hatch

*Field Plots Amended with Biochar at Leyendecker Plant Science Research Center*

*Picture of biochar applied to soil*

# Assessing crop rotations and herbicide methods for improved weed control in chile

**Investigators**: Schutte, B. J. (Principal, bschutte@nmsu.edu), Lehnhoff, E. A. (Co-Principal),

**Project Overview:** Some of the most difficult-to-control weeds in chile pepper are species in the Solanaceae family. Solanaceae weeds are not controlled by many herbicides registered for chile, which necessitates their management in a previous rotational crop. This study is evaluating herbicides for Solanaceae weed control in the rotational crop sorghum, preceding chile pepper. By combining crop rotation and herbicides to reduce difficult-to-control weeds, and by clarifying factors that influence weed communities in chile pepper fields, this project will develop recommendations for rotations that reduce weed pressure in chile pepper.

**Meeting the Needs of New Mexico**: Weeds are perennially one of the greatest challenges affecting chile production. Many weed species in chile pepper are not controlled by any herbicide that can be applied to this crop. Further, many weed species in chile pepper are generally not controlled with cultivation because these weed species emerge in crop rows and throughout the crop growing season. Thus, weeds in chile pepper must be removed via hand hoeing, which substantially reduces the profitability of chile pepper production. To reduce reliance on hand hoeing, this project is developing cost-effective, immediately practicable weed control strategies by evaluating herbicides for controlling weeds in sorghum grown before the year of chile pepper production.

**Impact**: Chile pepper farmers need immediate solutions for the weeds that are commonly controlled with expensive hand hoeing. This project is addressing the need for cost-effective, practicable weed control by combining crop rotation and herbicides to reduce difficult-to-control weeds. Early results indicate that difficult weeds in chile pepper can be controlled with herbicides applied in sorghum grown before the year of chile pepper production. Thus, crop rotations with sorghum may be means for chile pepper farmers in New Mexico to reduce reliance on costly hand hoeing and remain competitive in the chile pepper production industry that is global in scope.

**Funding Acknowledgement**: New Mexico Chile Association

# Allelopathic cover crops for pest suppression in Chile Pepper in the Southwest

**Investigators**: Schutte, B. J. (Principal, bschutte@nmsu.edu), Lehnhoff, E. A. (Co-Principal), Acharya, R. (Co-Principal), Creamer, R. J. (Co-Principal), Bundy, C. S. (Co-Principal), Sanogo, S. (Co-Principal)

**Project Overview**: High costs for weed control and yield loss from soil-borne diseases are severe threats to chile pepper production in the United States Southwest. To address these threats to chile pepper, we are developing ecologically-based tactics that target both weeds and soil-borne pathogens. Specifically, we are establishing optimum management practices for barley and mustard cover crops that are incorporated into soil shortly before chile pepper seeding. Based on our preliminary studies and reports in the literature, we expect mustard and barley cover crops will suppress weeds, reduce requirements for hand hoeing, and inhibit infection on chile pepper plants by soil-borne pathogens.

**Meeting the Needs of New Mexico**: In 2021, chile pepper was planted on 8,700 acres in New Mexico and provided approximately $44.9 million in cash receipts to growers. Although chile pepper is an important component of the agricultural economy in New Mexico, continued production of this crop in this state is threatened by both reliances on hand hoeing and soil-borne diseases that reduce crop yield. This project is developing non-pesticidal tactics for reducing hand hoeing and incidences of soil-borne diseases in chile pepper. By reducing needs for both labor and pesticides, tactics derived from this project are expected to enhance farmer incomes and preserve natural resources in New Mexico.

**Impact**: Weeds and soil-borne diseases reduce farm profits by diminishing crop yields and increasing production costs. To address weeds and soil-borne diseases in chile pepper production, we are developing ecologically-based tactics that target both weeds and soil-borne diseases. Specifically, we are developing best management practices for cover crops that reduce weeds and diseases in chile pepper. Our initial results revealed optimal strategies for obtaining pest suppression from cover crops and clarified circumstances where cover crops have no consequence on weeds and soil-borne diseases. By determining conditions that cause cover crops to suppress chile pepper, we generated information that allows New Mexico farmers to make appropriate decisions on adopting an ecological technique for pest management.

**Collaborating Agricultural Science Centers**: Agricultural Science Center at Los Lunas

**Funding Acknowledgement**: US Department of Agriculture/National Institute of Food and Agriculture NIFA

# Evaluating a new herbicide for Yellow Nutsedge (Cyperus esclulentus) in Chile Pepper

**Investigators**: Schutte, B. J. (Principal, bschutte@nmsu.edu)

**Project Overview**: Yellow nutsedge (*Cyperus esculentus*) is a problematic weed in chile pepper production. Current strategies for controlling yellow nutsedge in chile pepper include hoeing and herbicides. To complement this set of strategies, a new herbicide was recently registered for yellow nutsedge control in chile pepper. Although a promising new option for yellow nutsedge in chile pepper, this herbicide (imazosulfuron) has yet to be evaluated against the conventional herbicides and practices for yellow nutsedge control in chile pepper. The objective of this research is to determine yellow nutsedge responses to imazosulfuron and conventional herbicides for yellow nutsedge in chile pepper.

**Meeting the Needs of New Mexico**: Yellow nutsedge (*Cyperus esculentus*) is a problematic perennial weed found in chile pepper fields in New Mexico. Chemical strategies for controlling yellow nutsedge in chile pepper were recently expanded to include a new herbicide — imazosulfuron. Recommendations and effective use of imazosulfuron require studies that evaluate this herbicide under field conditions, as well as studies that determine this herbicide's effects on yellow nutsedge tubers (i.e., belowground regenerative structures). This study compared imazosulfuron against conventional herbicides for the duration of control and tuber mortality in yellow nutsedge. By generating and disseminating information on a new herbicide, this study provided New Mexico chile pepper farmers with opportunities to reduce production expenses by using a herbicide in place of hand hoeing.

**Impact**: New Mexico farmers have an opportunity to use a new herbicide for a problematic weed in chile pepper. However, prior to this study, the new herbicide was not yet studied in the context of New Mexico chile production. This project discovered instances when the new herbicide provides short and long-term benefits in chile pepper production in New Mexico. Thus, this project developed immediately applicable guidance for chile pepper farmers who use herbicides to control weeds and maximize crop yield.

**Funding Acknowledgement**: New Mexico Chile Commission

## Comparison of water movement in pecan fields under different irrigation scenarios

**Investigators**: Alexander Fernald (afernald@nmsu.edu), Richard Heerema, and Jorge Preciado

**Project Overview**: This research is part of the Secure Water Future project, this project delivers novel tools and techniques for a water-stressed region, enabling thriving agriculture, healthy ecosystems, and community resilience in an uncertain climate future from the field to regional scales.
The name of the research is "Comparison of water movement in pecan fields under different irrigation scenarios; implications to the water cycle". The project is going to evaluate the best irrigation scenario for the Mesilla Valley. The main objective is to make projections for the different irrigation systems and evaluate the implications that each scenario has on the water cycle.

**Meeting the Needs of New Mexico**: This project is important because is going to help Mesilla Valley farmers to have the information to have better irrigation practices and grow pecans in an optimum way in the valley. In addition to it, communities are going to have information once is ready to be presented to help them to make decisions that support their community and help them to conserve water.

**Impact**: We are working on a water balance that will give us information on where the water is going and look for alternatives or actions that could be implemented to get the most benefit of the water that is been applied at the pecan fields and have better water management practices. The goals for the project are to make projections of the different irrigation methods to grow sustainable pecans in the Mesilla Valley and know the implications of them on the water cycle

**Funding Acknowledgement**: This work is supported by Agriculture and Food Research Initiative Competitive Grant no. 2021-69012-35916 from the USDA National Institute of Food and Agriculture

## Mesquite common garden study

**Investigators**: Kristen Bowers (kebowers@nmsu.edu) and David Thompson

**Project Overview**: The purpose of this study is to measure the impact of native arthropod herbivores on the growth (height, canopy cover, and stem diameter) of native trees. This field study includes five tree species that are native to the southwestern US, including New Mexico. Half the trees are treated with insecticides to exclude native herbivores.

**Meeting the Needs of New Mexico**: This study provides insight into which arthropod herbivores have the greatest effect on the growth and spread of mesquite and related trees. We have trained student interns to plant trees, apply treatments and collect data. In addition, this project is an international collaboration between New Mexico and the South African government.

**Impact**: This is the first study to measure the impact of native arthropod herbivores on mesquite and related trees.

**Funding Acknowledgement**: Rhodes University, South Africa

## Grants and Contracts

Robbins, K. (PI) and Ray, I. (Co-Principal), "Remote Sensing for Modeling Development Curves and Accelerated Breeding of Climate Resilient Crop Varieties", Sponsoring Organization: Cornell University / Foundation for Food and Agricultural Research. Ray Research Credit: $25,374.00, Total Award: $797,878.00, Current Status: Funded. (February 1, 2021 - January 31, 2024).

Ray, I. (Principal). “Genetic Improvement of Alfalfa (Medicago sativa L.) Germplasm for New Mexico”, Sponsoring Organization: USDA-NIFA Hatch funds. Current Status: Approved. $6,300 annually (Oct. 1. 2022 – Sept. 30. 2027).

Ray, I. (Principal). "Fee-based alfalfa variety testing at Las Cruces”,  Multiple seed company sponsors. Status: Funded, $5,675.00 (October 1, 2022 - December 31, 2025).

Ray, I. (Principal). "Fee-based alfalfa variety testing at Las Cruces," Multiple seed company sponsors. Status: Funded, $6,450.00 (October 1, 2019 - December 31, 2023).

Lozada, D. N., and Guzman, I. “ Enhancing Nutritional Quality and Yield of New Mexican Chile Peppers using Genomics-assisted Breeding”; Amount: $477,074; Sponsor: US Department of Agriculture-National Institute of Food and Agriculture (USDA-NIFA) (Funded, Ongoing project)

Lozada, D.N., Sanogo, S. “Development of Phytophthora capsici resistant chile pepper (Capsicum spp.) cultivars for New Mexico growers; Amount: $10,000; Sponsor: New Mexico Chile Commission (Funded, Ongoing project)

Lozada, D. N., Walker, S., Tonnessen, B., Coon, D. “Genomics-assisted breeding for the development of machine harvestable chile peppers in New Mexico.” Amount: $342,250; Sponsor: New Mexico Chile Association (Funded, Ongoing project)

Lozada, D.N., Nunez, G., Coon, D., Lujan, P., Dura, S., Sanogo, S. "Genomics-assisted Breeding for the Improvement of Chile Peppers (Capsicum spp.) in New Mexico,". Amount: $12,000.00; Sponsor: USDA HATCH Capacity Grant (Funded, Ongoing project)

Western Sustainable Agriculture Research and Education GW21-220; $37,000; field trials completed; lab component continuing through December 2023

Assessing crop rotations and herbicide methods for improved weed control in chile.  New Mexico Chile Association, July 2022-June 2024, $55,443. Funded & active

Reducing hand hoeing and eliminating seed bank deposits with post-directed herbicides.  New Mexico Chile Commission, May 2022-April 2023, $5,528. Funded & active

Allelopathic cover crops for pest suppression in chile pepper in the Southwest.  USDA NIFA Crop Protection and Pest Management Program, September 2021-September 2024, $191,173.  Funded & active

## Research Publications

Singh, L., Pierce, C., Santantonio, N., Steiner, R., Miller, D., Reich, J., Ray, I. (2022). Validation of DNA Marker Assisted Selection for Forage Biomass Productivity under Deficit Irrigation in Alfalfa. The Plant Genome 15(1):e20195. https://doi.org/10.1002/tpg2.20195. Published March 2022.

Collaborative publication with ASCs at Artesia, Farmington, Las Cruces, Los Lunas, Tucumcari
Lauriault, L. M., Ray, I., Pierce, C., Djaman, K., Flynn, R. P., Marsalis, M. A., Havlik, C., Martinez, G., West, M. (2022). The 2022 New Mexico Alfalfa Variety Test Report. Las Cruces, NM: Agricultural Experiment Station and Cooperative Extension Service, New Mexico State University.
https://pubs.nmsu.edu/variety_trials/alfalfa_2022.pdf
Published: December 2022.

Khokhar, E., Lozada, D.N., Nankar, A., Hernandez, S., Nourbakhsh, S., Coon, D. High-throughput digital tool characterized fruit phenotypic diversity among New Mexican chile pepper, HortScience. https://doi.org/10.21273/HORTSCI16815-22 .

Lozada, D N., Barchenger, D.W., Coon, D., Bosland, P.W. Multi-locus association mapping uncovers the genetic basis of yield and agronomic traits in chile pepper (Capsicum spp.). Crop Breeding, Genetics, and Genomics 2022;4(2):e220002; https://doi.org/10.20900/cbgg20220002. (in collaboration with Los Lunas ASC)

Lozada, D. N., Bosland, P.W., Barchenger, D.W., Haghshenas-Jaryani, M., Sanogo, S., Walker, S. Chile pepper (Capsicum) breeding and improvement in the “multi-omics” era. Frontiers in Plant Science 2022. 13:879182. https://doi.org/10.3389/fpls.2022.879182.

Sanogo, S., Lamour, K., Kousik, C., Lozada, D.N., Parada-Rojas, C., Quesada-Ocampo, L., Wyendandt, A., et al. Phytophthora capsici, 100 Years Later: Research mile markers from 1922 to 2022. https://doi.org/10.1094/PHYTO-08-22-0297-RVW .

Nagila, A., S. Sanogo, O. J. Idowu, B. J. Schutte. 2022. Biomass production of an overwinter cover crop with biofumigation properties in New Mexico. HortTechnology 32: 559-566

Agarwal, P., B. J. Schutte, O. J. Idowu, R. L. Steiner, E. A. Lehnhoff. 2022. Weed suppression versus water use: Efficacy of cover crops in water-limited agroecosystems. Weed Research 62:24-37 (Collaborative with Agricultural Science Center at Los Lunas)

## Cooperators and Collaborators

**Collaborating with Main Campus (and other ASC) Faculty**
Los Lunas Agricultural Science Center
Artesia Agricultural Science Center
Alcalde Agricultural Science Center

**NMSU, University, State, and Federal Collaborations**
IR-4
Water Resource Research Institute
Aggie Innovation Center

**Industry & Tribal**
N-Drip
Bridgestone
Helena
Golden Acres
Bayer

## Outreach Activities

**Youth/Student Outreach**

- Wildlife Habitat Education Program (WHEP) State 4-H contest held at Leyendecker
    - 4-H members from throughout the state of New Mexico gathered on the NMSU campus for its annual State Conference. Part of the week-long conference is competitions, one of which was held at the Leyendecker PSRC facility.
- Silver City FFA chapter visit to Leyendecker
    - Chapter advisor and students toured Leyendecker and discussed farming and agricultural practices unique to the farm itself and the Mesilla Valley. Topics included irrigation techniques, soil health, crop varieties, drone technology, etc.
- Sustainable Production of Agronomic Crops (NMSU Students Field Tour)

**Farmer Outreach**

- Biochar and Soil Health Field Day
- Cotton Incorporated Growers Meeting and Field Tour

**Community/International Outreach**

- Tour and discussion with NM State Representative Micaela Lara Cadena
    - The Representative visited the Leyendecker Research Center to become more familiar with issues facing the constituents in her district. Topics included water scarcity, irrigation infrastructure, drought-tolerant crops and varieties, production practices, market accessibility, value-added opportunities, etc.
- Universidad de Sonora (Unison) Tour (Faculty and Graduate Students)
    - Two professors and ten graduate students from Universidad de Sonora traveled from Mexico to explore opportunities at Leyendecker and within the Ag Experiment Station system for potential graduate study programs.
- Tour and Discussion with Catapult (a data analytics services and consulting group)
    - Several representatives from Catapult toured the Leyendecker facility and discussed the needs for data collection and subsequent processing. Also discussed was disseminating real-time data to stakeholders of New Mexico.
- American Association for Agricultural Education (AAAE) farm talks and tour
- Inter-American Institute for Cooperation on Agriculture (IICA) farm visit and tour
- NMSU Employee Appreciation Picnic- provide 50 hay bales for seating and decor
- AGRO 483- Sustainable Production of Agronomic Crops
    - Dr. Kulbushan Grover's students came out to discuss agronomic practices utilized at Leyendecker. Soil, equipment, plant health, integrated pest management and crop rotation were points of discussion.

**Field Day**

The annual field day is a free event for community members. This is the perfect opportunity for producers to tour and see the research projects that are being conducted at Leyendecker and also to ask questions and get answers in a one-on-one setting.

## Personnel

Dave Lowry – Superintendent

Eric Nez – Farm Manager

Autumn Martinez – Administrative Assistant

Orlando Moralez – Farm Supervisor

Wade Robinson – ASC Laborer

Pablo Holguin – ASC Laborer

Isaac Medrano - ASC Laborer