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LEYENDECKER PLANT SCIENCE RESEARCH CENTER

2023 ANNUAL REPORT

THE NMSU AGRICULTURAL EXPERIMENT STATION SUPPORTS RESEARCH THAT ADDRESSES REAL-WORLD PROBLEMS. RESEARCH IS AT THE CORE OF NMSU'S MISSION TO IMPROVE THE LIVES OF PEOPLE GLOBALLY.

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NOTICE TO USERS OF THIS REPORT

These are not formal Agricultural Experiment Station research results. Readers are cautioned against drawing conclusions or making recommendations as a result of the summaries in this report. In many instances, data represents only one of several years' results that will ultimately constitute the final formal report for a project.

None of the data are authorized for release or publication without the written prior approval of the New Mexico Agricultural Experiment Station.

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AGRICULTURAL SCIENCE CENTER LOCATIONS MAP



EXECUTIVE SUMMARY

Several trials were undertaken at Leyendecker Plant Science Research Center in 2023. Trials conducted include chile and alfalfa variety evaluations and genetic improvements; cover crops and crop rotation influence on chile production; insect pest control, and fertility management in cotton; jujube cultivar trials; agrivoltaics influence on tomato production; agronomic optimization, and breeding of guayule for Southern New Mexico; soil health management; and impacts of biochar on soil carbon. Many of these studies are ongoing and have a significant impact on crop production practices and farm profit of producers in southern New Mexico. Meanwhile, digital agriculture initiatives have continued at the center with several soil moisture sensors and technologies being tested for optimizing irrigation of crops. The application of drones and remote sensing for crop monitoring and input management has also continued at the center.



RESEARCH HIGHLIGHTS



THRYVON COTTON RESEARCH

Investigator: Scott Bundy (cbundy@nmsu.edu)

PROJECT OVERVIEW

This research was sponsored by Bayer Crop Sciences to evaluate the impact of insect pests on different cotton varieties in southern New Mexico. The insects of focus were sucking pests, specifically thrips. Thrips populations, along with plant injury rating, were documented for the various varieties for the early growing season when thrips are a threat to cotton. Seasonal development of the plants was documented, and yield was taken at the end of the season.

MEETING THE NEEDS OF NEW MEXICO This research provides important information on how various varieties of cotton do in southern New Mexico. This is especially important for newly developed transgenic cotton lines used for sucking pest management. It further helps to determine the fit of these varieties for the unique environmental conditions of southern New Mexico and the state.

IMPAC

Cotton is among the top agricultural commodities of New Mexico. Insect pests cause major economic losses to cotton in the state. Thrips are one of the most important early-season pests of cotton. They can greatly reduce cotton stand establishment and cause injury to terminal growth, which impacts yield, etc. Transgenic cotton varieties target sucking pests including thrips. This research evaluates the impact of thrips populations in southern New Mexico on these important varieties, thus providing valuable data for their efficacy against thrips under our unique growing conditions.



FUNDING ACKNOWLEDGMENT:

Bayer Crop Sciences

DEVELOPMENT OF IMPROVED CHILE CULTIVARS FOR NEW MEXICO GROWERS

Investigators: Stephanie Walker (swalker@nmsu.edu), Danise Coon, and Israel Jokhadar

PROJECT OVERVIEW

This project continues long-term breeding efforts in developing new chile pepper cultivars and germplasm emphasizing mechanization, yield, and other traits critical for New Mexico's chile producers. Replicated trials of high ASTA, high-yielding paprika types, and high-yielding, open-pollinated cayenne peppers were conducted in 2023. Seed increases were made of promising breeding lines, including NM-type green chile lines developed for mechanical harvest and easy destemming.

MEETING THE NEEDS OF NEW MEXICO New Mexico's chile crops are widely renowned for flavor and quality, but acreage in the state is well below the peak seen in the mid-1990s even as chile pepper consumption in the US continues to increase. Development of new cultivars and germplasm that are efficient for mechanical harvest, provide increased yield, and possess improved qualities prized by growers, processors, and consumers will put New Mexico's chile crops on a more competitive path with other producing countries and ensure the long-term strength of the industry in the state.

IMPACT

Currently, New Mexico growers are dealing with continued labor shortages, adverse growing conditions, water demand, and expensive seeds. Describing and publicizing all the improved qualities and the unique flavor of openpollinated NM-type chile will increase demand for the product, and implementing mechanization will allow NM growers to keep up with demand even with continuing labor challenges.

FUNDING ACKNOWLEDGMENT:

NM Chile Association, CHIP/AES





REDUCING HAND HOEING IN CHILE PEPPER BY CONTROLLING WEEDS IN A ROTATIONAL SORGHUM CROP

Investigators: Brian Schutte (bschutte@nmsu.edu) and Erik Lehnhoff

PROJECT OVERVIEW

Broadleaf weeds in chile pepper may be reduced with rotational grass crops, provided such crops encourage weed emergence and feature effective weed control methods that permit rotation to chile pepper the following growing season. To test this hypothesis, we are studying the effects of postemergence, non-residual herbicides applied in sorghum on weeds and weed management in chile pepper grown on the same land as sorghum in the subsequent year. The results of this study are expected to facilitate the development of new management strategies for the most problematic weeds in chile pepper.

MEETING THE NEEDS OF NEW MEXICO

This project will benefit the New Mexico chile industry by addressing short- and long-term problems in weed management. In the short term, this project will develop an immediately applicable method for weeds that are difficult to control in chile pepper fields. This new method is expected to reduce reliance on costly hand hoeing. Thus, in the long term, this project will produce the information needed for sustained chile pepper production in New Mexico.

IMPACT

Recognizing the impacts of weeds on crop yield and harvest efficiency, chile pepper growers routinely hire labor crews to hand hoe their fields. This reliance on hand hoeing is threatening the continued production of chile pepper in New Mexico because agricultural labor is increasingly expensive and difficult to obtain. By developing cultural and chemical strategies for managing weeds in chile pepper, this project is expected to generate information that will reduce requirements for hand hoeing in chile pepper.

FUNDING ACKNOWLEDGMENT:

New Mexico Chile Association



PROTECTING NM CHILE AND TOMATO CROPS FROM DISEASE WHILE GENERATING ELECTRICITY THROUGH AGRIVOLTAICS

Investigators: Stephanie Walker (swalker@nmsu.edu), Marisa Thompson, and Olga Lavrova

PROJECT OVERVIEW

The New Mexico chile crop experiences diminished yields due to beet curly top virus (BCTV) to varying degrees every year. This virus is transmitted by beet leafhopper insects. Plants infected with the virus commonly exhibit symptoms such as yellow curled leaves, stunted growth, abnormal or absent fruit development, and, in severe cases, plant death. Interestingly, studies indicate that beet leafhoppers show a preference for non-shaded areas. This project assessed the incidence of both beet leafhopper populations and beet curly top virus incidence in agrivoltaic fields where solar panels partially shade the chile plants. This investigation aims to understand the potential impact of this shading on the prevalence of BCTV as well as yield and other chile production factors.

MEETING THE NEEDS OF NEW MEXICO

The overarching objective of this project is to address challenges confronting New Mexican farmers such as increasing temperatures and escalating disease pressures on crops through the implementation of applied agrivoltaic research. If the findings reveal plant and economic advantages of this innovative system, farmers will gain access to research-backed knowledge that can be applied on their farms. This directly affects the residents of New Mexico, as the sustainable production of food by farmers ensures that citizens have continued access to locally grown foods.

This project holds significant potential for broad impacts within New Mexican communities. Findings may indicate ways in which solar panel installations can be employed to safeguard and enhance agricultural production. The installation of solar panels in New Mexico has seen an increase, with 6.45% of the state's electricity currently being generated from these systems. As these trends continue, landowners and farmers will require guidance on the integration of these technologies into their land, including insights into the potential effects and benefits these systems could have on production. The outcomes of this research will serve as a valuable resource for individuals in New Mexico who are interested in agrivoltaics.

FUNDING ACKNOWLEDGMENT:

NMDA Specialty Crop Block Grant Program



DEVELOPING REGION-SPECIFIC GUIDELINES FOR SELECTING COVER CROP SPECIES IN NEW MEXICO

Investigators: Brian Schutte (bschutte@nmsu.edu), Mark Marsalis, Kevin Lombard, and Rajan Ghimire

PROJECT OVERVIEW

A principal challenge for agriculture is to fulfill increasing demands for food, fiber, and bioenergy while minimizing negative environmental impacts. Addressing this challenge involves replacing external inputs of energy and agrochemicals with the management of biodiversity in crop production systems. Means for diversifying crop production systems include cover crops between periods of cash crop growth. Cover crops provide multiple ecosystem services linked to agricultural soils, which are foundations for crop yield formation. The purpose of this project is to develop region-specific guidelines for selecting cover crop species in New Mexico.

MEETING THE NEEDS OF NEW MEXICO

Current guidelines for selecting cover crop species in New Mexico include qualitative descriptors on performance (Excellent, Very Good, Good) derived from national and state-level summaries. Such generalizations are useful. But, to help New Mexico farmers and crop consultants select species best for their location, selection guidelines should include information on cover crop performance resulting from studies conducted within their region within New Mexico.

IMPACT

By generating information that will help farmers and consultants select cover crop species and mixtures ideally suited for their region of New Mexico, this project will enhance agroecosystem resiliency to climate change and create conditions that sustain productivity in the future.

FUNDING ACKNOWLEDGMENT:

U.S. Department of Agriculture, Natural Resources Conservation Service

COLLABORATING AGRICULTURAL SCIENCE CENTERS:

Clovis Agricultural Science Center, Farmington Agricultural Science Center, and Los Lunas Agricultural Science Center



ALLELOPATHIC COVER CROPS FOR PEST SUPPRESSION IN CHILE PEPPER IN THE SOUTHWEST

Investigators: Brian Schutte (bschutte@nmsu.edu), Erik Lehnhoff, Soum Sanogos, Rebecca Creamer, Scott Bundy, and Ram Acharya

PROJECT OVERVIEW

High costs for weed control and yield loss from soil-borne diseases are threats to chile pepper production in New Mexico. To address these threats, this project is developing an ecologically based tactic that targets both weeds and soil-borne pathogens. Specifically, this project is evaluating pest-suppressive cover crops that are incorporated into soil shortly before chile pepper seeding. Results from this study indicate a cover crop species that suppresses weed emergence, reduces requirements for hand hoeing and is expected to inhibit infection on chile pepper plants by soil-borne pathogens.

MEETING THE NEEDS OF NEW MEXICO

In 2022, chile pepper was the seventh most valuable crop in New Mexico, providing approximately \$46.2 million in cash receipts to growers in this state. Despite the importance of chile pepper in New Mexico's agricultural economy, chile pepper production in New Mexico is threatened by factors including, but not limited to, high costs for labor for weeding and soil-borne diseases that reduce crop yield. This project will help sustain the production of chile pepper in New Mexico by developing methods that reduce reliance on labor for weeding incidence of disease in chile pepper fields.

IMPACT

With the knowledge gained from this study, farmers will be able to select a cover crop that improves profitability by diminishing pesticide and hand labor requirements in chile pepper. Further, farmer adoption of tactics in this study will promote biological diversity and soil conservation in New Mexico's agroecosystems, as well as reduce reliance on synthetic pesticides and hand labor in chile pepper production.

FUNDING ACKNOWLEDGMENT:

U.S. Department of Agriculture, NIFA Crop Protection and Pest Management Program

COLLABORATING AGRICULTURAL SCIENCE CENTERS:

Los Lunas Agricultural Science Center



PROJECT OVERVIEW

Biochar is carbon made by burning organic material in a low-oxygen or nooxygen 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 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. In addition, we are investigating how locally produced biochar from pecan wood waste could benefit soil health in southwestern New Mexico.

MEETING THE NEEDS OF NEW MEXICO Water retention and carbon sequestration are critical challenges facing soil management in the arid southwest including New Mexico. Farmers in the state are seeking ways to improve carbon sequestration and moisture retention in their farm soils. The application of biochar as a soil amendment can sequester carbon and 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.

Farmers are learning more about biochar from the results of this study. Additionally, hands-on training was conducted in 2023 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, increase soil organic carbon, 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 ACKNOWLEDGMENT: USDA-NIFA; NMDA Health Soil Program







Biochar Preparation from Pecan wood waste at Leyendecker Plant Science Research Center. A. Finished Biochar (cooled by water); B. Pecan Wood Pyrolysis (middle of the burning process); C. Pecan wood waste in the ring of fire kiln (beginning of the burning process.

IMPACT

NUTRIENT MANAGEMENT IN 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 K2O 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 this study were shared with cotton growers and agricultural support professionals. A fertilizer management guide will be developed from the trial and this will be made available to cotton farmers.



FUNDING ACKNOWLEDGMENT:

USDA-Hatch

Cotton trial plots at Leyendecker Plant Science Research Center

OPTIMIZING THE GROWTH OF GUAYULE IN SOUTHERN NEW MEXICO

Investigators: John Idowu (jidowu@nmsu.edu), Mohammed Omer (NMSU), Mark Cruz (Bridgestone Americas Inc.), and Sam Wang (Bridgestone Americas Inc.)

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. In addition, the nutrient requirement of guayule is also being investigated.

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 input costs and nonmatching 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 and nutrient management, 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 ACKNOWLEDGMENT:

USDA-NIFA

The guayule field at Leyendecker Plant Science Research Center

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

MEETING THE NEEDS OF NEW MEXICO 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.

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 serves as a training facility for producers, educators, agriculture consultants, and stakeholders in New Mexico, and provides an opportunity to learn about soil health principles, how to improve soil health, sequester carbon, mitigate greenhouse gas emissions, and attain sustainable crop productivity while minimizing the costs of production. Research conducted in the soil health plots is advancing our understanding of how various management practices affect soil health in the short- and longterm. Information about the cost of implementing alternative management practices is being documented and made available to producers. Graduate and undergraduate students are currently working at this site to conduct research and learn about sustainable agriculture in southwestern New Mexico. A field day was held in 2023 to share the results of the impact of soil health practices on soil and crops with stakeholders.

FUNDING ACKNOWLEDGMENT:

USDA-NIFA; NMDA Health Soil Program



Cover crops treatments at Leyendecker Plant Science Research Center

JUJUBE CULTIVAR TRIALS

Investigators: Shengrui Yao (yoas@nmsu.edu) and Robert Heyduck

PROJECT OVERVIEW

We have collected and imported over 50 varieties to the New Mexico State University Alcalde Center and established cultivar trials at NMSU Alcalde Center (2015), Los Lunas Center (2015), Tucumcari Center (2016) and Leyendecker Center (2017). Plantings at Alcalde, Los Lunas, and Leyendecker are all growing and producing well, but Tucumcari had severe grasshopper damage in the planting year and suffered from irrigation issues.

MEETING THE NEEDS OF NEW MEXICO Late frost is the most critical issue challenging fruit production in central and northern New Mexico. Most growers had five crops or fewer from 2010-2019. Suitable alternative crops with reliable yields are needed to diversify their operations and reduce risk. Jujube, also called Chinese date, adapts well to a wide range of soil and climate conditions. With its late-season start-up, sameyear flower bud initiation and bloom, and two-month-long blooming period, jujube produces a reliable crop in New Mexico.

IMPACT

The limited choices of commercially available cultivars for the jujube industry will be improved with the NMSU jujube project. There are currently only 5-6 jujube cultivars commercially available in the United States of which 'Li' is dominant. The New Mexico State University Alcalde Center jujube program has been evaluating more than 50 cultivars in the past eight years and has identified 8-10 fresh-eating cultivars. Those cultivars will give growers nationwide more choices with extended maturation dates and achieve a \$1-2 premium per pound. The jujube acreage nationwide is expected to increase significantly.

FUNDING ACKNOWLEDGMENT:

Trials were established through Specialty Crop Block Grant projects through the New Mexico Department of Agriculture

COLLABORATING AGRICULTURAL SCIENCE CENTERS:

Sustainable Agricultural Science Center at Alcalde and Los Lunas Agricultural Science Center



2019-2023 ALFALFA VARIETY TRIALS AT LAS CRUCES

Investigators: Christopher Pierce (cpierce@nmsu.edu) and Dr Ian Ray (retired August 2023)

PROJECT OVERVIEW

MEETING THE NEEDS OF NEW MEXICO

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.

This research identified 11 alfalfa varieties, including 4 NMSU-bred varieties, that ranked in the top-yielding group under both well-watered and deficit-irrigation management over 4-years (i.e., 2020, 2021, 2022, and 2023). Each of these varieties outperformed the NMSU drought-resilient variety, NuMex Bill Melton. Utilizing results from this trial and similar alfalfa variety trials conducted at the Farmington Agricultural Science Center (ASC), Los Lunas ASC, and locations in California, three NMSU-bred alfalfa populations are in the final stages of approval for variety release in 2024. 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.

IMPACT

Limited water resources threaten New Mexico's \$172 million alfalfa industry. The alfalfa variety trials conducted throughout New Mexico, are intended to help farmers identify currently available alfalfa varieties that they can grow, and which can be productive under highly variable soil moisture conditions. Additionally, these trials help to identify superior NMSU alfalfa varieties suitable for commercialization. Collectively, alfalfa variety evaluation and development benefits agricultural sustainability, yield stability, and water conservation in New Mexico.

FUNDING ACKNOWLEDGMENT:

NIFA-Hatch, Multiple Alfalfa Seed Companies, and the NM Hay Association

COLLABORATING AGRICULTURAL SCIENCE CENTERS:

Farmington Agricultural Science Center and Los Lunas Agricultural Science Center



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 trails will be advanced for commercial release with alfalfa industry partners.

MEETING THE NEEDS OF NEW MEXICO Alfalfa seed produced from ten populations will be used for testing at Leyendecker PSRC, Los Lunas ASC, and other locations in California and New Mexico. 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 to benefit agricultural sustainability, yield stability, and water conservation in New Mexico and throughout the Southwest.

IMPACT

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 NMSU varieties will be identified to provide New Mexico farmers with new productive, drought-resilient varieties that can help conserve water, ensure good farm profits, and meet the livestock industry's feed demands.

FUNDING ACKNOWLEDGMENT:

NIFA-Hatch, Multiple Alfalfa Seed Companies, and the NM Hay Association

COLLABORATING AGRICULTURAL SCIENCE CENTERS:

Los Lunas Agricultural Science Center



2022-2025 ALFALFA VARIETY TRIALS AT LAS CRUCES

Investigators: Christopher Pierce (cpierce@nmsu.edu) and Dr Ian Ray (retired August 2023)

PROJECT OVERVIEW

Evaluate forage yield performance of 18 alfalfa varieties, 10 new advanced NMSU breeding lines, under standard irrigation management (trial 1) and deficit irrigation management (trial 2) at Las Cruces, NM from 2023 to 2025. Additionally, the 10 advanced NMSU breeding lines are also being evaluated at the Los Lunas ASC. The goal is to identify alfalfa varieties that perform well under variable irrigation management strategies in central and south-central New Mexico.

MEETING THE NEEDS OF NEW MEXICO

Results from the first production year in 2023 indicate that several NMSU-bred alfalfa populations perform as well or better than two commercial check cultivars, AmeriStand 803T and NuMex Bill Melton. First production year data is not sufficient to be conclusive of long-term variety performance. However, several NMSU populations appear to exhibit good biomass performance under standard irrigation water management strategies. Further data collection in 2024 will strengthen our knowledge of variety performance under both irrigation management strategies. These early results indicate that several NMSU-derived alfalfa varieties could be suitable for future utilization by New Mexico hay growers.

IMPACT

Limited water resources threaten New Mexico's \$172 million alfalfa industry. The alfalfa variety trials conducted throughout New Mexico, are intended to help farmers identify currently available alfalfa varieties that they can grow, and which can be productive under highly variable soil moisture conditions. Additionally, these trials help to identify superior NMSU alfalfa varieties suitable for commercialization. Collectively, alfalfa variety evaluation and development benefits agricultural sustainability, yield stability, and water conservation in New Mexico.

FUNDING ACKNOWLEDGMENT:

NIFA-Hatch, Multiple Alfalfa Seed Companies, and the NM Hay Association

COLLABORATING AGRICULTURAL SCIENCE CENTERS:

Los Lunas Agricultural Science Center



PROJECT OVERVIEW

This collaborative project with Cornell Univ., Virginia Tech, and two private industry partners, is designed to accelerate the development of highperforming crop varieties (alfalfa, corn, soybean, wheat) with greater resilience to changes in climate. NMSU is collecting multispectral aerial imagery, forage yield, and nutritional quality data from 24 alfalfa varieties grown under wellwatered and deficit irrigation management during 2021-2023. Our collaborators are building open-source plant breeding software to conduct integrated analysis of these, and many other, large data sets to determine how well crop aerial imagery data correlates to stable yield performance/quality across different environments.

MEETING THE NEEDS OF NEW MEXICO

In 2023, NMSU conducted 32 aerial imagery flights and collected over 72,000 multispectral images from multiple alfalfa varieties grown under well-watered and deficit irrigation management. Forage quality and yield data were also collected from these varieties over multiple harvests (>1700 data points). This data is being utilized to develop new software and techniques that alfalfa breeders can utilize in variety evaluation. Ultimately, the process for alfalfa variety evaluation could be shortened by three to four years. This could mean a faster cycling of available alfalfa varieties for New Mexico alfalfa growers.

IMPACT

Limited water resources threaten New Mexico's \$172 million alfalfa industry. NMSU is collaborating with Cornell University, Virginia Tech, and private industry partners to develop and evaluate new plant breeding tools that can accelerate the development of crop varieties with greater resilience to changes in climate.

FUNDING ACKNOWLEDGMENT:

Foundation for Food and Agriculture Research Program and NIFA-Hatch



BY THE NUMBERS







RESEARCH PUBLICATIONS

- Fademi, I., Ghimire, R., Djaman, K., Idowu, O. J., 2023 ASA-CSSA-SSSA International Annual Meeting., ASA-CSSA-SSSA, St Louis, MO, "Evaluation of Greenhouse Gas Emissions in an Irrigated Arid Cropping System.", (October 2023). <u>https://scisoc.confex.com/scisoc/2023am/meetingapp.cgi/Paper/150506</u>
- Fademi, I., Omer, M. N., Ghimire, R., Djaman, K., Idowu, O. J., 2023 ASA, CSSA, SSSA International Annual Meeting, ASA, CSSA, SSSA, St Louis, MO, "Cover Crops, Tillage, and Organic Amendment Effects on Selected Soil Quality Indicators in Irrigated Arid Cropping System", (October 30, 2023). https://scisoc.confex.com/scisoc/2023am/meetingapp.cgi/Paper/150484

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- Omer, M. N. (Presenter), Cruz, V. M., Wang, G., Idowu, O. J., 2023 ASA, CSSA, SSSA International Annual Meeting, ASA, CSSA, SSSA, St Louis, MO, "Evaluating the Impact of Nitrogen and Phosphorus Fertilization on Guayule in Southern New Mexico", (November 1, 2023). ttps://scisoc.confex.com/scisoc/2023am/meetingapp.cgi/Paper/150149
- Leonard Lauriault, Ian Ray, Chris Pierce, Koffi Djaman, Robert Flynn, Mark Marsalis, Charles Havlik, and Margaret West (2023). The New Mexico Alfalfa Variety Test Report. Las Cruces, NM: Agricultural Experiment Station and Cooperative Extension Service, New Mexico State Univ. <u>https:/pubs.nmsu.edu/variety_trials/AVT23.pdf</u>

GRANTS AND CONTRACTS

- Reducing hand hoeing and eliminating seed bank deposits with post-directed herbicides. New Mexico Chile Commission. \$55,443. Funded & active.
- Protecting NM Chile and Tomato Crops from Disease while Generating Electricity through Agrivoltaics. NMDA Specialty Crop Block Grant Program 2 yr, \$27,601. Funded & Active.
- Developing region-specific guidelines for selecting cover crop species in New Mexico and establishing a technological framework that allows remote monitoring of cover crop performance. Funded by the USDA Natural Resources Conservation Service, May 2023-December 2027, \$250,000.
- Allelopathic cover crops for pest suppression in chile pepper in the Southwest. Funded by the USDA NIFA Crop Protection and Pest Management Program, September 2021-September 2024, \$191,173.
- Using Biochar for Soil Health Improvement in Arid Southwest. Funded by USDA-NIFA, \$250,000. On-going.
- Using Biochar for Soil Health Improvement in Arid Southwest. Funded by NMDA Healthy Soil Program. \$200,000. On-going.
- Optimizing the growth of Guayule in southwestern New Mexico. Funded by Sustainable Bioeconomy for Arid Regions NIFA grant. \$3,000,000. On-going.
- Hatch project 7001870-NMRAY22H, \$6300 in 2023, Project is still active without funding in 2024.
- Foundation for Food and Agriculture Research (FFAR) Proximal sensing for modeling GR0006809, \$25,374.67, NMSU's participation/funding from this grant reached completion January 31st, 2024.

OUTREACH ACTIVITIES

- International Student Recruitment Event Hosted potential graduate students from the University of Chihuahua
- A.I. in Agriculture tour Hosted graduate and undergraduate students to learn about technology used in agriculture
- Soil Health Workshop Biochar demonstration and cover crop workshop
- Leyendecker PSRC Field Day Showcased different research trials at the center to the public
- Radio Interviews with KGRT and Magic 105 about Science Centers and field days
- Hosted Tarleton State Agricultural Communicators of Tomorrow
- Assisted NMDA with collecting water samples from the Rio Grande
- Hosted Sustainable Crop Production class engaged in laboratory and field tours
- The 2024 Pedometrics Conference field tour of the long-term soil health site at Leyendecker



PEOPLE





COOPERATORS AND COLLABORATORS

- New Mexico Department of Agriculture
- Bridgestone Americas Inc.
- N Drip
- Tal-Ya Agriculture Solutions
- Cotton Incorporated
- Corteva
- Gowan
- FMC
- ASC Los Lunas
- ASC Alcalde
- ASC Clovis

GRADUATE STUDENTS

- Ram Singh Insa, MS student in Agricultural Biology
- Dr. Mohammed Omer (Postdoctoral Scientist)
- Ibukunolowa Fademi (PhD Student)

ASC PERSONNEL



JOHN IDOWU

Research Coordinator



DAVE LOWRY

Program Operations Director



ERIC NEZ

Farm Manager (Departed position in Dec. 2023)



AUTUMN MARTINEZ

Administrative Assistant



ORLANDO MORALEZ

Farm Supervisor



WADE ROBINSON

Ag Science Center Laborer



PABLO HOLGUIN

Ag Science Center Laborer



ISAAC MEDRANO

Ag Science Center Laborer



CURTIS ANDERSON

Equipment Mechanic



ZACHARY COLEMAN

Ag Science Center Laborer