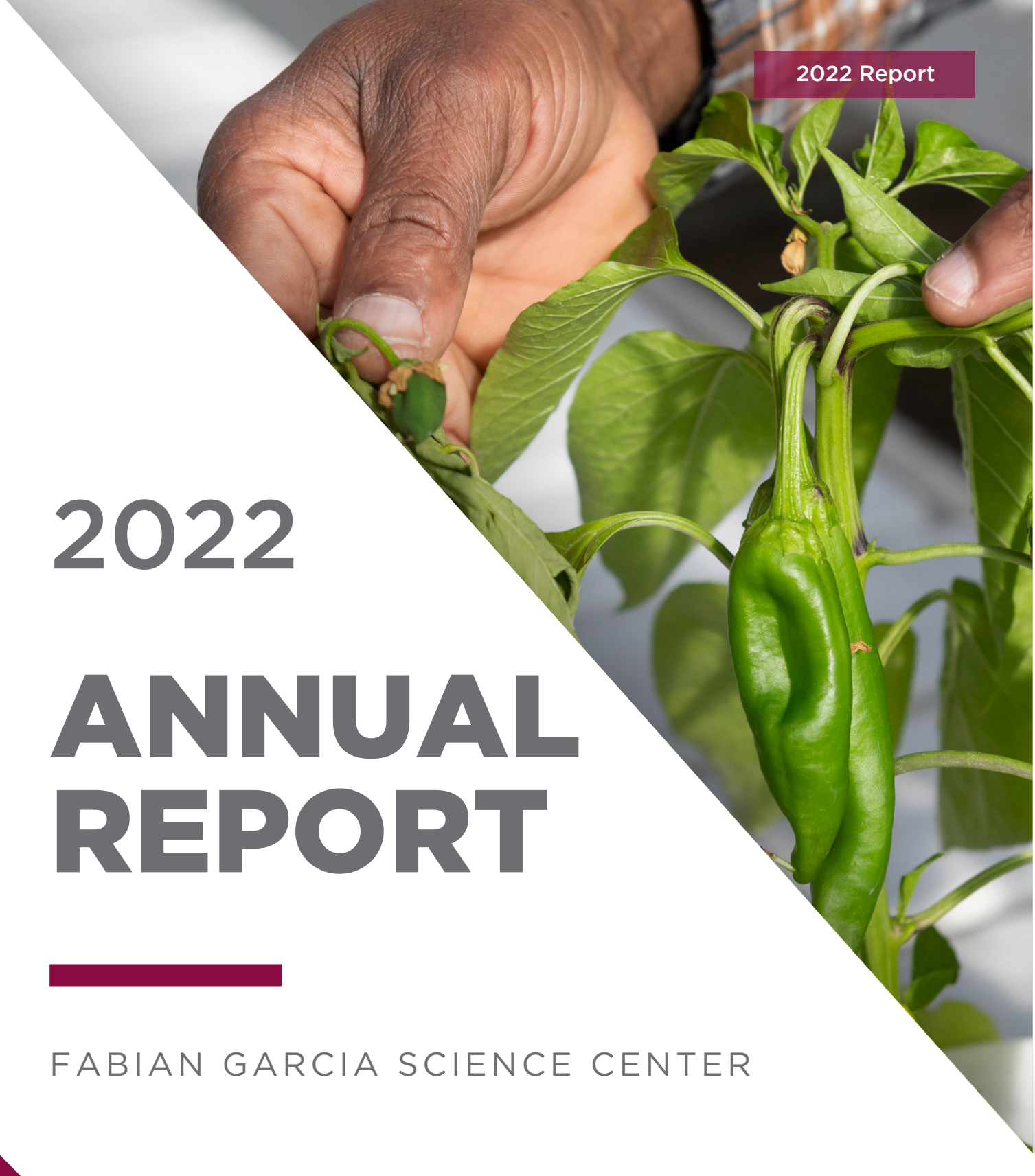

2022 ANNUAL REPORT

FABIAN GARCIA SCIENCE CENTER

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

This report has been prepared to aid Science Center staff in analyzing the results of various research projects from the past year and to record data for future reference. These are not formal Agricultural Experiment Station Report research results. The reader is cautioned against drawing conclusions or making recommendations as a result of the data in this report. In many instances, data represents only one of several years' results that will ultimately constitute the final formal report. Although staff members have made every effort to check the accuracy of the data presented, this report was not prepared as a formal release.

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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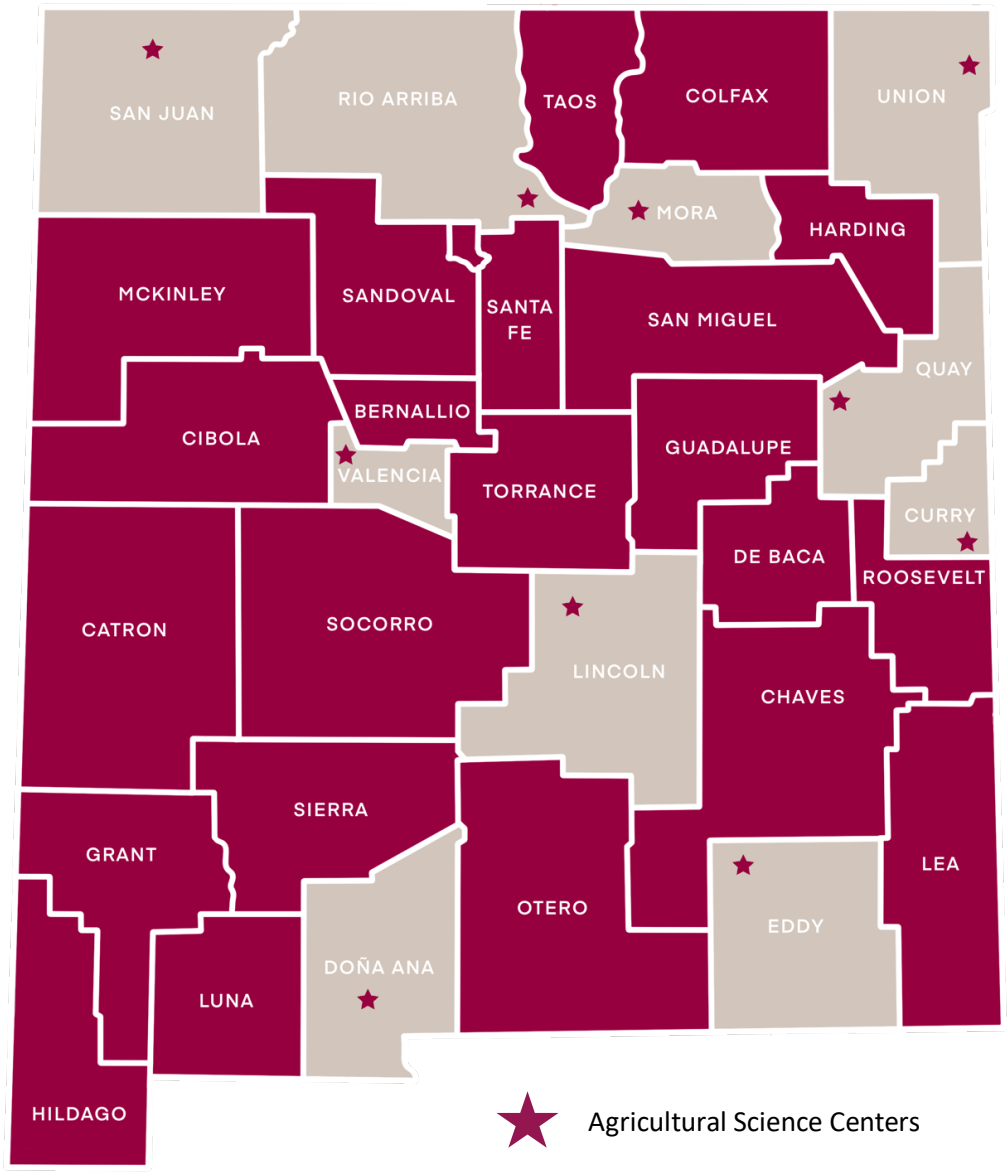
Agricultural Science Center Locations Map



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Executive Summary

The Fabian Garcia Science Center supports a wide variety of agricultural research on 47 acres located less than a mile from the NMSU main campus in Las Cruces. The center hosts research on plant breeding, regionally adapted and alternative crops, viticulture, algae, brackish water, and best management practices in its research plots and greenhouses. In addition, a student-run greenhouse hosts growing space for clubs, the Floral Team, the Horticulture Forum, and classes such as greenhouse retailing. The botanical garden and gazebo are community favorites for photographs and simply enjoying the seasonal landscapes.

Current research at the Center on plant breeding focuses on drought-resilient varieties of alfalfa, onion cultivars resistant to diseases and pests, and chile peppers that can be mechanically harvested more efficiently. Researchers at Fabian Garcia are also looking at ways to reduce reliance on declining freshwater through irrigation with brackish water, utilizing regionally adapted cover crop mixtures that are adapted to hotter and drier climates, and testing of alternative, water-saving crops such as guar. The Jose Fernandez Garden at the Heritage Farm continues to support vegetable growers in the region through testing of underutilized and heat-tolerant vegetables and demonstrating management practices such as solarization for weed control. Research on microalgae is contributing to our understanding of the role it can play in sustainable energy sources, human nutrition, and soil health.

It's an exciting time for research at the center!

Research Projects

Brackish Groundwater, Crop Quality, and Water Conservation: An Extraordinary Proposition – Investigators: Geno A. Picchioni, Ivette Guzman, Brian Schutte, Manoj Shukla

Greenhouse and Screenhouse Maintenance of Alfalfa Genetic Stocks – Investigators: Ian Ray and Christopher Pierce

Characterization of onion phenotypes exhibiting fewer Iris yellow spot (IYS) symptoms and release of onion germplasm for IYS mitigation – Investigators: C.S. Cramer and I. Guzman

Chile pepper breeding for improved quality and mechanization – Investigators: Stephanie Walker and Danise Coon

Optimizing agronomic management for guar production in New Mexico – Investigators: Kulbhushan Grover

Salinity tolerance of guar genotypes – Investigators: Kulbhushan Grover, Devinder Sandhu

Guar and other legumes for forage production in mixture with grasses – Investigator: Kulbhushan Grover

Breeding for Fusarium basal rot resistance in onion – C.S. Cramer

Reducing costs and improving environmental safety of onion herbicide programs – Investigators: C.S. Cramer, Brian Schutte

The Jose Fernandez Garden (JFG) underutilized and heat tolerant vegetable trials – Investigators: Stephanie Walker, Brad Tonnessen, Danise Coon, Israel Joukhadar

Cover Crops for the Southwest – Investigators: Richard Pratt, Brian Schutte, Kevin Lombard, Koffi Djman, Michael Patrick

Optimizing Selection Pressures and Pest Management to Maximize Algal Biomass Yield [OSPREY] – Investigators: Alina Corcoran and Shawn Starkenburg

Wooten Dry Country Plants Greenhouse – Investigator: Sabine Green

Brackish Groundwater, Crop Quality, and Water Conservation: An Extraordinary Proposition

Investigators: Geno A. Picchioni, Ivette Guzman, Brian Schutte, Manoj Shukla

Project Overview: Irrigating crops with brackish groundwater may reduce stress on the declining freshwater supplies to support the production of salt tolerant halophytes. We are investigating the potential for brackish groundwater to elevate the levels of human health-promoting phytonutrients in three native halophyte species (Lepidum alyssoides, Atriplex canescens, and A. lentiformis), and in two domesticated vegetable crops. Improved phytonutrient profiles could change the perception of salinity from being an agricultural threat to being a value-added product.

Meeting the Needs of New Mexico: There is an urgent need to use impaired water resources like brackish groundwater to supplant freshwater withdraws, enhance New Mexico's water security, and maintain its agricultural viability. This freshwater conservation practice will improve the image of semiarid agriculture to the public, since historically, irrigated agriculture in arid and semiarid regions consumes more fresh water than any other industry. Nursery and greenhouse growers, horticultural scientists, and US Bureau of Reclamation personnel have become aware of our project to study halophyte crops for cultivation with brackish groundwater and reverse osmosis concentrate and to use salinity as a value-added product.

Impact: Significant brackish groundwater (BGW) reserves are available in New Mexico to lessen our dependence on declining freshwater resources. A hidden benefit of BGW may be its main feature—salinity—that is known to up-regulate a plant's antioxidant defense system, such as increased concentrations of total plant phenolics (TPs) as previously shown with laboratory salts. These secondary plant metabolites are beneficial to human health. After 15 days in greenhouse conditions, CaSO4-dominated BGW desalination concentrate and NaCl-dominated lab solutions at 8 dS/m increased TPs in Lactuca sativa (leaf lettuce, a glycophyte) and in Beta vulgaris (Swiss chard, a halophyte) by 15% to 20%. The value-added increase represents potential economic gains of $1 to $2 per square foot of greenhouse space per year that could motivate growers to use BGW as a freshwater replacement. Parallel economic gains in the deferral of desalination and brine disposal costs would also be realized. Using untreated brackish groundwater and reverse osmosis concentrate to enhance the crop's nutritional value is an extraordinary proposition to counteract the megadrought.

Cooperating Agricultural Science Centers: FGSC-only project.

Greenhouse and Screenhouse Maintenance of Alfalfa Genetic Stocks

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

Project Overview: NMSU regularly maintains 500+ alfalfa plants at a Fabian Garcia Research Center greenhouse and screen house. Seeds and seedlings produced from these plants are used to establish multiple field research studies involving hundreds of replicated elite alfalfa populations. These populations are extensively characterized for yield productivity under deficit irrigation management and nutritional value. DNA may also be isolated from the plant tissue and used to develop extensive DNA sequence databases. Integrated analysis of DNA sequence and field-based data are conducted to identify genetic factors influencing forage yield and forage nutritive value to develop drought-resilient alfalfa cultivars for the arid southwestern U.S.

Meeting the Needs of New Mexico: Limited water resources threaten New Mexico's $148 million alfalfa industry. These plants are being used to develop drought-resilient alfalfa varieties to benefit NM agricultural sustainability. Such varieties can help farmers conserve water, ensure good farm profits, and help meet the NM livestock industry's feed demands.

Anticipated Impact: In 2022, over 2800 alfalfa plants were grown in the greenhouse/screen house for seed production and generating seedling transplants. We transplanted 2500 of these seedlings, which represented 10 new NMSU varieties, into seed-increase isolation blocks in spring 2022. Seed was produced from these 10 blocks in the summer of 2022 and used to plant two alfalfa variety trials (well-watered and deficit-irrigation management) in Las Cruces in October 2022. Seed produced from these blocks will also be used to plant and test the 10 varieties at other locations in CA and NM beginning in 2023. Yield data from these studies will identify 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 NM agricultural sustainability, alfalfa yield stability, and water conservation.

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

Funding Acknowledgement: Hatch project 1012275-NMRAY17H and 7001870-NMRAY22H, Genetic Improvement of Alfalfa Germplasm for New Mexico. Alforex Seed LLC. NMSU Grant GR5196, Marker Assisted Breeding in Elite Alfalfa Germplasm to Enhance Biomass Productivity During Drought.

Characterization of onion phenotypes exhibiting fewer Iris yellow spot (IYS) symptoms and release of onion germplasm for IYS mitigation

Investigators: C.S. Cramer (cscramer@nmsu.edu), I. Guzman

Project Overview: Onion stakeholders have identified onion thrips and Iris yellow spot virus as the greatest pest and disease threats to onion yield and economic sustainability. The onion industry in the US is valued at farm gate annually at $900-1,000 million. Onion germplasm is being developed and evaluated which is less impacted by onion thrips and Iris yellow spot. When exposed to high onion thrips pressure and conditions conducive for Iris yellow spot disease development, NMSU breeding lines exhibited fewer thrips per plant and a lower disease severity early in the growing season, and greater bulb size at harvest than a commercial cultivar grown under the same conditions.

Meeting the Needs of New Mexico: Our research demonstrated that our evaluation method was successful in reliably producing disease symptoms which is essential for disease resistance development. Germplasm has been developed that expresses lower disease severity as a result of selection. Our target audience can use this information and germplasm to develop disease-resistant onion cultivars. Based upon a conducted economic analysis, onion germplasm resistant to onion thrips and/or IYS could increase profits by $1,000 per ha per year when compared with current marketable yields and management practices. Based upon the annual hectarage of onions grown in New Mexico, the promising resistant breeding lines from our program could increase grower profits for the NM onion industry by $2.7 million.

Impact: With onion cultivars that are resistant to onion thrips and Iris yellow spot, fewer onion bulbs will be lost to diseases and pests. With fewer bulb losses, fewer acres of onions will need to be grown to satisfy domestic onion demand. Fewer onion acres with higher productivity reduces environmental impacts while increasing economic sustainability.

Funding Acknowledgement: USDA-NIFA, SCRI through Washington State Univ.

Chile pepper breeding for improved quality and mechanization

Investigators: Stephanie Walker, swalker@nmsu.edu, Danise Coon

Project Overview: This project supports NM chile pepper growers, producers, and consumers through conventional breeding methods to develop new cultivars with higher mechanical harvested yield and improved quality. Replicated trials of advanced chile pepper breeding lines are conducted including: 1) NM-type green chile breeding lines developed for increased mechanical harvest efficiency; 2) highly pigmented paprika and NM 6-4 lines for improved fruit size and yield; 3) open-pollinated cayenne peppers with high yield, heat, and soluble solids. New cultivars are released when proven to be superior compared to standard control varieties over multiple seasons and locations.

Meeting the Needs of New Mexico: Chile breeding efforts support the long-term profitability of New Mexico's signature crop and help spur the adoption of mechanical harvest to address continuing labor challenges. This program strives to develop new improved chile pepper varieties based on feedback from growers, industry, and consumers. In addition to mechanical harvest efficiency, increasing the yield, standardizing the heat, and increasing pigment while safeguarding the tradition New Mexico-type chile flavor beloved by consumers are all priorities of our conventional breeding efforts.

Impact: This program has developed several exceptional breeding lines that are undergoing evaluation in advanced replicated trials. In 2021, 'NuMex Odyssey' was released. This NM-type green chile was shown to have higher mechanical harvest efficiency than standard varieties. In 2022, a commercial seed increase was conducted by a Hatch farm to make this new cultivar more widely available. The use of mechanical harvest efficient cultivars like 'NuMex Odyssey' and converting NM-type green chile acreage to mechanical harvest will result in $875,000 annual additional profits to NM chile growers.

Collaborating Agricultural Science Centers: Seed increase for the chile pepper breeding lines is conducted at the Leyendecker PSRC. The NM-type green chile breeding lines evaluation at the Heritage Farm continues long-term efforts conducted at the Los Lunas ASC.

Funding Acknowledgement: This project was supported by NMSU AES, the NM Chile Association, the NM Chile Commission, and USDA NIFA through UC Davis collaborators.

Optimizing agronomic management for guar production in New Mexico

Investigator: Kulbhushan Grover

Project Overview: There is a need to generate information on the performance and response of guar to different management practices including row spacings when planted on raised beds in the region. The current study involves evaluating the response of guar genotypes and their seed yield production when planted as single rows in the middle of the 40" raised beds vs two rows planted per bed.

Meeting the Needs of New Mexico: It is important to address declining water availability in the context of increased climatic variability in arid New Mexico. Sustainable use and conservation of water and food and fiber production are the two major pillars of economy and community development as identified by the NMSU ACES initiative. Guar or Clusterbean (Cyamopsis tetragonoloba L.) is a high-value alternative crop that can be grown for fresh pods for vegetables, or for protein-rich high-quality forage for animals, or for seed to produce guar gum. Guar research conducted through the NIFA-funded project Sustainable Bio-economy for Arid Region (SBAR) at NMSU has already shown that guar can be successfully grown in New Mexico conditions and can help reduce reliance on imports. This project will help in developing management practices for guar production in the region.

Impact: The results obtained from this research will help determine optimum spacing for growing guar seeds in the region. The region-specific information generated through local research will help answer growers' questions about adopting guar production into local agriculture.

Funding Acknowledgement:
USDA NIFA- Sustainable Bioeconomy for Arid Regions
USDA NIFA-HSI Education program

Salinity tolerance of guar genotypes

Investigators: Kulbhushan Grover, Devinder Sandhu

Project Overview: A study involving the response of guar genotypes to different levels of salinity was conducted in collaboration with researchers at the USDA-salinity laboratory, Riverside, CA. Field studies were performed in the previous season.

Meeting the Needs of New Mexico: Guar is known for its drought tolerance. Salinity is an important issue in irrigated arid regions including New Mexico. Evaluating the performance of guar under different salinity levels will help identify tolerant genotypes as well as understand the underlying tolerance mechanisms.

Funding Acknowledgement:
USDA NIFA-CAP, Sustainable Bioeconomy for Arid Regions (SBAR).
USDA NIFA-HSI Education program

Guar and other legumes for forage production in a mixture with grasses

Investigator: Kulbhushan Grover

Project Overview: The current project focuses on evaluating guar and other legumes in a mixture with sorghum for their biomass production and forage quality.

Meeting the Needs of New Mexico: Guar can be an alternative legume forage crop in the region that uses less water and produces an optimum amount of good quality forage. The legume + grass mixture may help in producing balanced quality forage.

Impact: The adoption of guar can provide an alternative forage option to growers under limited water conditions. The results from this research will help growers in optimizing their forage production.

Breeding for Fusarium basal rot resistance in onion

Investigator: C.S. Cramer (cscramer@nmsu.edu)

Project Overview: Fusarium basal rot (FBR) is a soil-borne fungal disease that causes a disintegration of the onion bulb basal plate thus killing a plant growing in the field. Onion stakeholders have identified FBR as a severe disease threat to onion yield and economic sustainability. Breeding for host plant resistance to FBR may eliminate the detrimental effects of the disease. Onion germplasm was evaluated for susceptibility to FBR by inoculating onion bulbs with a virulent isolate of the disease causing pathogen. After 21 days of incubation, bulbs were evaluated for disease severity. Onion germplasm was identified that exhibited a lower disease severity than an FBR-susceptible and an FBR-resistant onion cultivar used in the evaluation. Selection for reduced disease severity proved successful as severity has decreased over successive generations of selection.

Meeting the Needs of New Mexico: Our research demonstrated that our evaluation method was successful in reliably producing disease symptoms which is essential for disease resistance development. Germplasm has been developed that expresses lower disease severity as a result of selection. Commercial seed companies can use this information and germplasm to develop FBR-resistant onion cultivars. This will result in improved onion cultivars that growers in New Mexico can use to improve their productivity.

Impact: With onion cultivars that are resistant to FBR, fewer onion bulbs will be lost to disease. With fewer bulb losses, fewer acres of onions will need to be grown to satisfy domestic onion demand. Fewer onion acres with higher production reduces environmental impacts while increasing economic sustainability.

Funding Acknowledgement: USDA-NIFA, Hatch funds

Reducing costs and improving environmental safety of onion herbicide programs

Investigators: C.S. Cramer, Brian Schutte (bschutte@nmsu.edu)

Project Overview: Onion weed management programs benefit from residual herbicides applied at crop seeding. Residual herbicides currently registered for application at onion seeding include bensulide and DCPA. Applications of both herbicides are relatively expensive and potentially have high environmental impacts. Pendimethalin is less expensive and has a lower environmental risk than bensulide and DCPA. It is traditionally applied when dry bulb onions have 2 to 9 true leaves. Newer registrations allow for pendimethalin applications after onion germination before onion emergence. A post-planting, delayed preemergence application of pendimethalin resulted in similar or better control of annual weeds than current weed control methods using bensuilde and DCPA herbicides or pendimethalin applied at the 2-leaf stage for autumn-sown and winter-sown onions in New Mexico. This same application of pendimethalin did not impact onion stand and bulb yield while also not leaving any detectable residues on onion bulbs after harvest.

Meeting the Needs of New Mexico: A post planting, delayed preemergence application of pendimethalin could provide comparable or better control of annual weeds as currently used herbicides in autumn-sown and winter-sown onions in New Mexico while reducing herbicide costs by 92-95% ($99-$156/acre) and reducing the legacy costs on the environment by 74-88%. This simple switch could save the NM onion industry $1 million per year.

Funding Acknowledgement: New Mexico Department of Agriculture, Specialty Crop Block Grant Program

The Jose Fernandez Garden (JFG) underutilized and heat-tolerant vegetable trials

Investigators: Stephanie Walker, swalker@nmsu.edu, Brad Tonnessen, Danise Coon, Israel Joukhadar

Project Overview: The Jose Fernandez Garden (JFG) was established at NMSU's Heritage Farm to evaluate underutilized and heat-tolerant vegetables to determine relative productivity under environmental conditions found in southern New Mexico. In addition to variety evaluation, we strive to implement and demonstrate best management practices for sustainable farming. The JFG program goals include: 1) Variety trials to assess underutilized and heat-tolerant vegetables in southern NM; 2) Seed saving to preserve genetic resources and improve the performance of vegetable varieties in arid land production; and 3) Community engagement to assess the vegetable quality and share research-based findings.

Meeting the Needs of New Mexico: Increasing local production of vegetables begins with identifying varieties that will provide high yields and desirable qualities for local consumers. The JFG vegetable trials provide replicated data on types of vegetables and specific cultivars that are solid performers in southern New Mexico conditions.

Impact: The heat-tolerant lettuce study identified that Romaine-type lettuce provided the highest yields and greatest heat tolerance of those tested. Of the Romaine-type lettuces in the trial, 'Sparx' was the best performer. An additional finding was the high productivity of Bitter Melon in southern NM. This cucurbit is relatively unknown in the US but was highly sought after by individuals familiar with the crop. Project collaborators feel that there is promising commercial potential for this crop in NM, providing an additional source of income to NM vegetable producers.

Funding Acknowledgement: The JFG program was supported by the ACES Jose Fernandez Memorial Chair.

Cover Crops for the Southwest

Investigators: Richard Pratt, Brian Schutte, Kevin Lombard, Koffi Djman, Michael Patrick

Project Overview: The new project will identify cover crop species adapted to hot summer conditions and only modest supplemental irrigation. Suitability for production in the organic transition phase will also be evaluated in conjunction with grower-collaborators. In addition, their potential for seed production will also be examined in cooperation with a regional organic seed company.

Meeting the Needs of New Mexico: Cover crops can provide many ecosystem services to cropping systems. Their adoption has been slow in semi-arid regions because of limited information about their adaptation and water needs. This project is sponsored by a NIFA organic transitions project to explore potential cover crop species that are well adapted to our region, and that will withstand hotter, drier climates with only modest supplemental irrigation. Ideal cover crops will also provide multiple benefits to growers such as forage and weed suppression. In a preliminary study, we examined millet, cowpea, and millet cowpea mixtures.

Collaborating Ag. Science Centers: Farmington Ag. Science Center

Funding Acknowledgement: Organic Transitions (NIFA) "Bridging Traditional Agriculture and Climate-Adaptive Organic Agriculture in the Southwest"

Optimizing Selection Pressures and Pest Management to Maximize Algal Biomass Yield [OSPREY]

Investigators: Lead PI Alina Corcoran (acor@nmsu.edu), Lead Co-PI Shawn Starkenburg (shawns@lanl.gov), Omar Holguin, Jon Shurin, Jason Quinn, Steve Eacker, Ivan Liachko, Charley O'Kelly, Jake Nalley

Project Overview: This DOE award is a four-year project in its final year led by Dr. Alina Corcoran, an NMSU affiliate faculty member, and built around the outdoor cultivation of microalgae. The team consists of one national lab partner Los Alamos National Lab, three industrial partners Cyanotech Corporation (Kailua-Kona, HI), Phase Genomics, Inc. (Seattle, WA), Qualitas Health, Inc. (Imperial, TX), and three University Partners Colorado State University (Fort Collins, CO), New Mexico State University (Las Cruces, NM), University of California San Diego (San Diego, CA). Fabian Garcia is one of four outdoor testbeds involved in this project. The project aims to make algal strains more productive and resilient to environmental stressors. Total award funding is $5M

Meeting the Needs of New Mexico: Microalgae can be a sustainable energy source but also have a positive impact as an alternative source of nutrition for humans and livestock and a natural fertilizer improving soil health and plant growth. Advancing research in microalgae can significantly benefit agriculture in New Mexico. Microalgae can also be used to help in water conservation, where it is capable of being grown on alternative water sources and not impacting our freshwater resources.

Impact: The outdoor testbed facility for microalgae testing at Fabian Garcia has been a significant success, advancing microalgae research and revolutionizing the way we think about sustainable energy production. The facility has produced three journal articles in the past year and provided mentorship and training to two postdocs and three graduate students. This investment in algal research and mentorship has helped to build a strong foundation for the future of microalgae research and ensure the continued success of the testbed site.

Funding Acknowledgement: Department of Energy Award Number: DE-EE0008902

The Wooten Dry Country Plants Greenhouse

Project Overview: The Wooten Dry Country Plants Greenhouse is a student-run greenhouse, to provide growing space for undergraduate clubs within the Plant and Environmental Science (PES) department to experiment and fundraise. The NMSU Floral Team as well as the Horticulture Forum have space in the greenhouse. Additionally, a special topics course (greenhouse retailing) is taught in this space.

Plant products produced by the students are sold on campus during chartered club fundraisers and are used for recruiting purposes. Plant enthusiasts from Las Cruces and as far as El Paso attend and support such fundraising efforts, creating a client base that is also a sponsor base. Students learn critical timing and evaluation skills to conduct the sales.

Impact: Undergraduate students learn: Plant propagation, scheduling and timing, marketing, interpersonal communication skills, math, budgeting, planning and ordering (supply chain), fertilization techniques, pest management, critical thinking, and teamwork.

Funding Acknowledgement: All funding for this area has come through the direct sale of the plants grown in the greenhouse or through PES funding for repairs.

Grants and Contracts

- Picchioni GA. New frontiers for plant and water issues in the southwestern U.S.—Landscape ecology, human health, and curriculum enhancement. USDA-NIFA-Hatch project. 2018-2023.
- Picchioni GA, Guzman I, Schutte B, Shukla M. Exploring the benefits of brackish groundwater and halophytes for human health. USDA-NIFA-AFRI Foundational Knowledge of Plant Products. $190,000. 2021-2023.
- Hatch project 1012275-NMRAY17H (expired) and 7001870-NMRAY22H (renewal), Genetic Improvement of Alfalfa Germplasm for New Mexico.
- Alforex Seed LLC. NMSU Grant GR5196, Marker Assisted Breeding in Elite Alfalfa Germplasm to Enhance Biomass Productivity During Drought. Amount: $381,000.
- Characterization of onion phenotypes exhibiting fewer Iris yellow spot (IYS) symptoms and release of onion germplasm for IYS mitigation, Washington State Univ., $543,555 (2018-2023)
- Reducing costs and improving environmental safety of onion herbicide programs, NMDA Specialty Crop Block Grant Program, $43,712 (2021-2023).
- Walker, S. (Principal), Sponsored Research, "Breeding for Mechanical Harvesting in Peppers II", Sponsoring Organization: University of California, Davis, Sponsoring Organization Is: Other, Research Credit: $150,000.00, PI Total Award: $150,000.00, Current Status: Currently Under Review. (October 1, 2020 - January 30, 2023).
- Walker, S. (Principal), Coon, D. Sponsored Research, "Development of Improved Chile Cultivars for New Mexico Growers (2021-2022)", Sponsoring Organization: New Mexico Chile Commission, Sponsoring Organization Is: Other, Research Credit: $15,000.00, PI Total Award: $15,000.00, Current Status: Funded. (April 17, 2022 - April 16, 2023).

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.
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- Shahabeddin Nourbakhsh, S. and C.S. Cramer. 2022. Onion germplasm possesses lower early season thrips numbers. Horticulturae 8:123. https://doi.og/10.3390/horticulturae8080123.
- Shahabeddin Nourbakhsh, S. and C.S. Cramer. 2022. Onion size measurements as predictors for onion bulb size. Horticulture 8:682. https://doi.og/10.3390/horticulturae8080682.
- Ortega, F., Hill, T., Van Deynze, A., Walker, S. Identification of QTLs involved in easy destemming for New Mexico pod-type green chile. Preparing to submit. Collaborative publication with UC Davis.
- Hill, T., Cassibba, V., Joukhadar, I., Tonnessen, B., Havlik, C., Ortega, F., Sripolcharoen, S., Visser, B. J., Stoffel, K., Thammapichai, P., Garcia-Llanos, A., Chen, S., Hulse-Kemp, A., Walker, S., Van Deynze, A., 2023, Genetics of Destemming in Pepper: A step towards mechanical harvesting, Frontiers in Genetics, section Plant Genomics, Special Issue - Research Topic: Solanaceae VIII: Biodiversity, Climate Change and Breeding. 14:1114832, DOI: 10.3389/fgene.2023.1114832 Collaborative publication with UC Davis.
- Walker, S., Funk, P., Joukhadar, I., Place, T., Havlik, C., Tonnessen, B. (2021). 'NuMex Odyssey', a New Mexico-type Green Chile Pepper for Mechanical Harvest. HortScience 56 (12), 1605-1607. Collaborative publication with the Los Lunas ASC, USDA-ARS.
- Sandhu, D., A. Pallete, M. William, J.F.S. Ferreira, A. Kaundal, and K. Grover. 2022. Salinity responses in 24 guar genotypes are linked to multigenic regulation explaining the complexity of tolerance mechanisms in planta. Crop Science: https://doi.org/10.1002/csc2.20872
- Acharya, B.R.; Sandhu, D.; Dueñas, C.; Ferreira, J.F.S.; Grover, K. 2022. Deciphering molecular mechanisms involved in salinity tolerance in Guar (Cyamopsis tetragonoloba (L.) Taub.) using transcriptome analyses. Plants 2022, 11, 291. https://doi.org/10.3390/plants11030291
- Sanchez, Monica R., Thomas C. Biondi, Yuliya A. Kunde, Wyatt Eng, Jakob O. Nalley, Eneko Ganuza, Blake T. Hovde, Alina A. Corcoran, and Shawn R. Starkenburg. "The Genome Sequence of an Algal Strain of Nannochloropsis QH25." Microbiology Resource Announcements 11, no. 12 (2022): e00921-22.
- Corcoran, Alina A., Juliette Ohan, Erik R. Hanschen, Anthony Granite, Heather Martinez, F. O. Holguin, Blake T. Hovde, and Shawn R. Starkenburg. "Scale-dependent enhancement of productivity and stability in xenic Nannochloropsis cultures." Algal Research 68 (2022): 102892.
- Jebali, Ahlem, Monica R. Sanchez, Erik R. Hanschen, Shawn R. Starkenburg, and Alina A. Corcoran. "Trait drift in microalgae and applications for strain improvement." Biotechnology Advances (2022): 108034.

Intellectual Property

Release of 'NuMex Odyssey' a mechanical harvest-efficient NM-type green chile.

Cooperators and Collaborators

NMSU
Richard Pratt
Brian Schutte
Kevin Lombard
Koffi Djman
Michael Patrick
Christopher S. Cramer

Other Universities/ Federal/ State/ Tribal Partners
Emily Lockard - CSU
Dine Community College
Allen Van Deynze and Theresa Hill, UC Davis
Paul Funk, USDA-ARS

Industry Partners
Aaron Waltz, Phospholutions, Inc.
Pueblo Seed and Food Co.

Outreach Activities

- NMSU Onion Field Day, June 29, 2022, 7 presentations were made, and 73 individuals were present.
- NM Chile Conference (Feb. 1, 2022) - Presented latest research findings and initiatives to chile growers and industry reps.
- NM Agriculture Sustainability Workshop (June 27-29, 2022). Hybrid lecture and field demonstrations on critical areas supporting sustainable agriculture for NM.
- Jose Fernandez Memorial Garden Ceremony (May 13, 2022). Coordinated with NMSU Foundation in presenting ceremony commemorating the Jose Fernandez Garden project.
- Field tours and presentations delivered on guar research to various stakeholders at Fabian Garcia Plant Science Center, Las Cruces:
    - December 9, 2022-Presented information on guar research to a visiting scientist.
    - October 21, 2022- Presented information on guar research to a local community resident.
    - September 22, 2022-Provided an overview of guar research and its potential in regional agriculture to several students.
    - August 29, 2022- Presented information on guar research to a group of growers visiting from western India.

Personnel

Dave Lowry – Program Operations Director
Anthony Aranda – Farm Ranch Manager
Autumn Martinez – Administrative Assistant
Liberato Valdes – Senior Laborer
Florencio Flores – Laborer