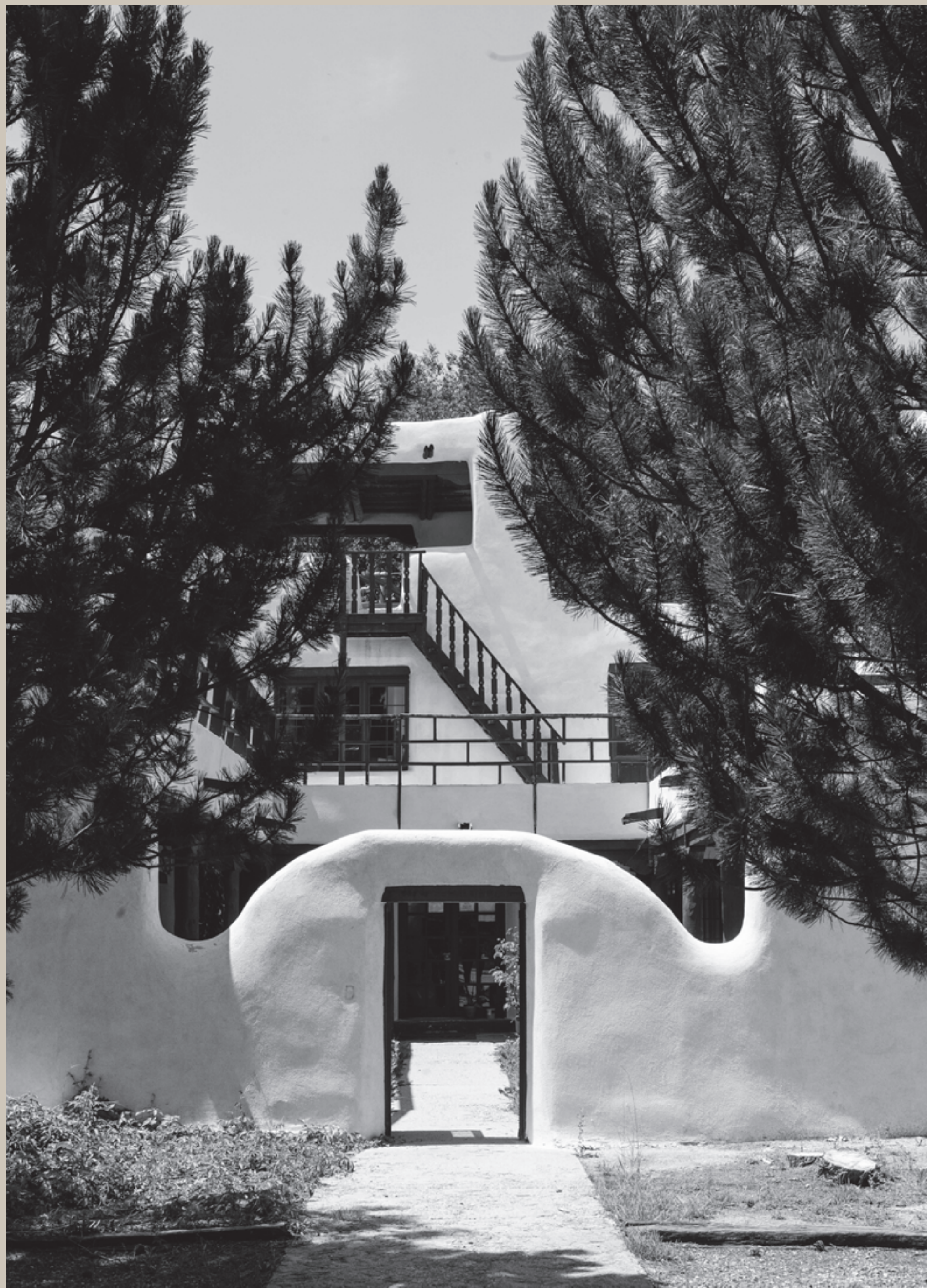
ALCALDE



ANNUAL REPORT 2021

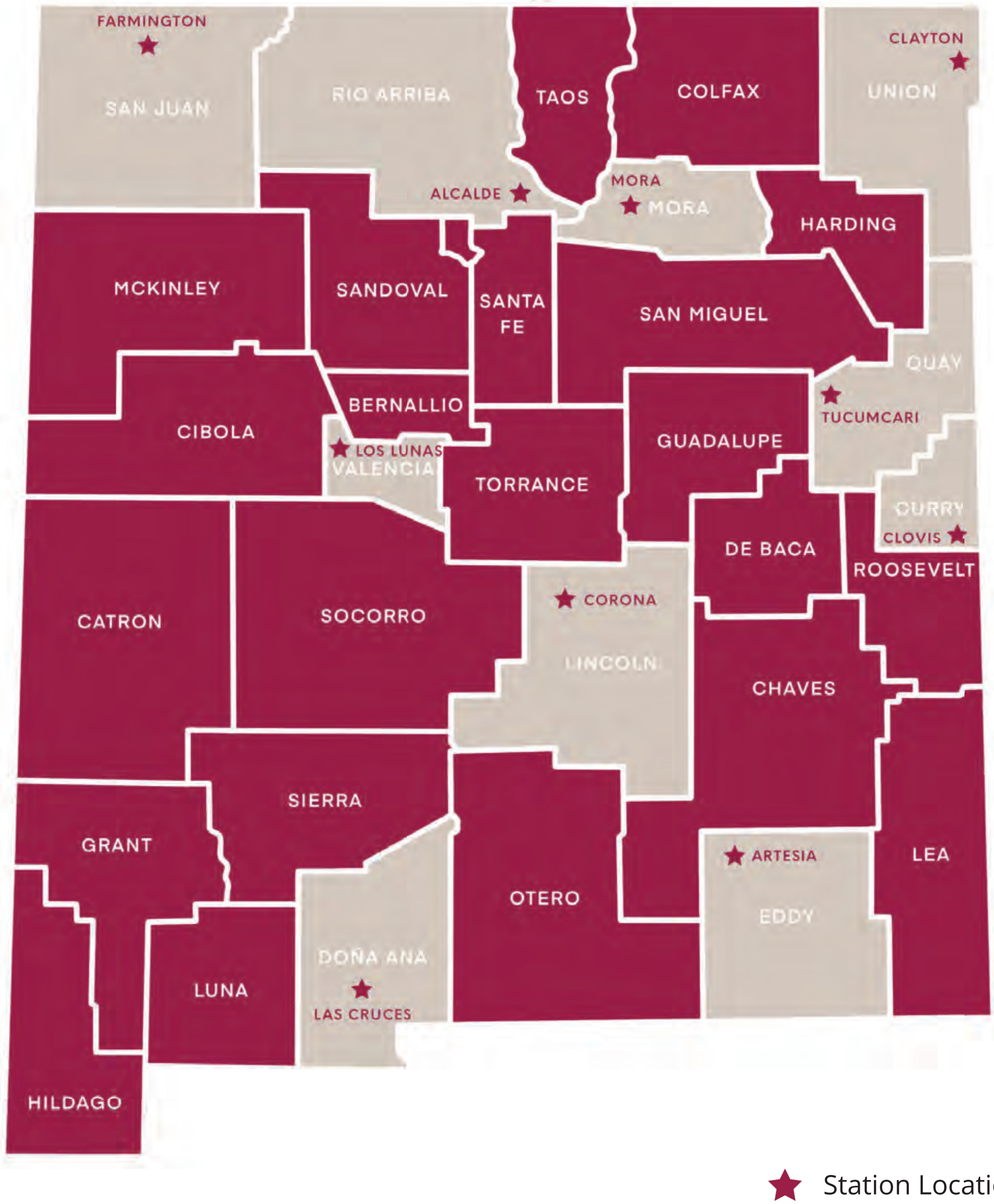
The NMSU Agricultural Experiment Station supports research that is addressing real-world problems. Research is at the core of NMSU's mission to improve upon the lives of people globally.

https://alcaldesc.nmsu.edu

MISSION

The Alcalde Sustainable Agriculture Science Center (SASC) mission is to conduct agricultural and natural resource research to benefit small-scale family farms and ranches of north-central New Mexico. Through testing of different crops, varieties, and production techniques, the goal is to provide new information that producers can adapt to their own operations for greater productivity and profitability. SASC serves as the headquarters for the Cooperative Extension Service's Rural Agricultural Improvement and Public Affairs Project (RAIPAP). CES RAIPAP provides programs in sustainable agriculture to the 13 northern counties that comprise the Small Farm and Ranch Task Force.

NMSU Agricultural Experiment Stations



Notice to Users of This Report

This report has been prepared to aid Science Center staff in analyzing the results of the 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 is authorized for release or publication without the written prior approval of the New Mexico Agricultural Experiment Station.

Any reference in this report to any person, or organization, or activities, products, or services related to such person or organization, is solely for informational purposes and does not constitute or imply the endorsement or recommendation of New Mexico State University, or any of its employees or contractors. NMSU is dedicated to providing equal opportunities in areas of employment and academics without regard to age, ancestry, color, disability, gender identity, genetic information, national origin, race, religion, serious medical condition, sex, sexual orientation, spousal affiliation, or protected veteran status as outlined in federal and state anti-discrimination statutes. The College of Agricultural, Consumer, and Environmental Sciences is an engine for economic and community development in New Mexico. ACES academic programs help students discover new knowledge and become leaders in environmental stewardship, food and fiber production, water use and conservation, and improving the health of all New Mexicans. The College's research and extension outreach arms reach every county in the state and provide research-based knowledge and programs to improve the lives of all New Mexicans.

Contents

Executive Summary

The Sustainable Agriculture Science Center (SASC) at Alcalde is located approximately seven miles north of Española and sits on 60 acres of property formerly known as the San Gabriel Ranch, which had been part of a large land grant given to General Juan Andres Archuleta, an officer in the Spanish Army in the early 1700s, by the Spanish Crown. The farm stretches from the Acequia de Alcalde almost to the Rio Grande along the lowest terrace and floodplain and is representative of the irrigated farmland along the Rio Grande, Rio Chama, Rio Embudo, and other smaller drainages in the area. Irrigated pasture and forages dominate these areas, but there are also numerous orchards and intensive, high-value fruit and vegetable producing operations.

Research at the Science Center focuses on crops and cropping systems for north-central New Mexico. The research includes various horticultural and agronomic crops as well as acequia hydrology. The Science Center has served as a weather station for the National Weather Service providing climatological data since 1953. Current research focuses on jujube variety development and testing (1 acre), pome and stone fruit production (2 acres), table grapes (1 acre), soil health and cover crops (3 acres), pollinator habitat, and buffer strips (3 acres), and high tunnel fruit and vegetable production (5000 square feet of covered growing space). The center also includes roughly 12 acres of forage crops including alfalfa, red clover, western wheatgrass, Russian wildrye, smooth brome, tall fescue, and orchardgrass, an additional 8 acres of derelict alfalfa stands, and 8.5 acres of fallow land. Six acres of the station are certified organic, and certified crops in 2021 included apple, peach, pear, plum, sweet and sour cherry, and cucumbers.

The Science Center also serves as the headquarters for the Cooperative Extension Service's Rural Agricultural Improvement and Public Affairs Project (RAIPAP), providing programs in sustainable agriculture, financial planning, and public policy skills in Bernalillo, Cibola, Guadalupe, McKinley, Mora, Rio Arriba, Sandoval, Santa Fe, San Miguel, Taos, Torrance and Valencia counties, as well as to the Jicarilla Apache Tribe and the 19 Pueblos of New Mexico.

Meeting the Needs of New Mexico

Working closely with Cooperative Extension Service specialists in the Rural Agricultural Improvement and Public Affairs Project (RAIPAP), the Sustainable Agriculture Science Center at Alcalde (SASC) serves the producers and consumers of north-central New Mexico. Most irrigated agricultural land in the region is cultivated by small-scale farmers and ranchers with fewer than 20 acres, and since 1952, our research has focused on enhancing the productivity, profitability, and sustainability of a long small-farming tradition. In 2002, the first certified organic acres at NMSU were established at SASC to better address issues in organic agriculture.

2021 Financial Summary

Agricultural Science Center Alcalde

Fiscal Year: 2021

Fiscal Period: 30-Jun-21

Department	Acct Type	Account Index Desc	Revenue YTD	Expense Budget	Expense YTD	Budget Balance Available YTD	Fund Balance Dr/(Cr)
Ag Science Ctr at Alcalde	HATCH FEDERAL APPROPRIATIONS FY 21	ADMIN/ALCALDE SAL		$18,080.00	$14,438.72	$3,641.28	
Ag Science Ctr at Alcalde	HATCH FEDERAL APPROPRIATIONS FY 21	SUSTAINABLE AG NORTH-CENTRAL NM O		$20,000.00	$329.80	$19,670.20	
Ag Science Ctr at Alcalde	HEALTH, SAFETY AND PSYCHOSOCIAL ORG	HEALTH, SAFETY & PSYCHOSOCIAL YR3		$3,000.00	$2,156.80	$843.20	
Ag Science Ctr at Alcalde	NM 2018 SPECIALTY CROP BLOCK GRANT	18/21 SCBGP JUJUBE TRIALS & MKTNG		$21,836.91	$4,512.00	$17,324.91	
Ag Science Ctr at Alcalde	NM 2020 SPECIAL CROP BLOCK PROGRAM	SCBGP-JUJUBE CULTIVARS/GERMPLASM		$63,888.68	$0.00	$63,888.68	
Ag Science Ctr at Alcalde	NM FY 17 SPECIALTY CROP BLOCK GRANT	17/20 SCBGP-VALUE ADDED JUJUBE		$33,618.70	$19,177.18	$14,441.52	
		Total Restricted Funds		**$160,424.29**	**$40,614.50**	**$119,809.79**	
Ag Science Ctr at Alcalde	APPLIED CHARGES	ASC ALCALDE VEHICLE	$0.00	($300.00)	$1,464.75	($1,764.75)	($2,071.87)
Ag Science Ctr at Alcalde	OVERHEAD TRANSFERS	OVERHEAD RECOVERY ASC-ALCALDE	$0.00	$0.00	$0.00	$0.00	($461.91)
Ag Science Ctr at Alcalde	SALES & SERVICE	ALCADE ASC SALES	$16,071.30	$2,500.00	$8,081.99	($5,581.99)	($36,135.66)
Ag Science Ctr at Alcalde	SALES & SERVICE	ALCALDE WORKSHOPS	$0.00	$500.00	$0.00	$500.00	($560.00)
		Total Sales and Service Funds	**$16,071.30**	**$2,700.00**	**$9,546.74**	**($6,846.74)**	**($39,229.44)**
							* see note
Ag Science Ctr at Alcalde	STATE APPROPRIATIONS	ASC ALCALDE SALARY		$255,552.04	$226,907.87	$28,644.17	
Ag Science Ctr at Alcalde	STATE APPROPRIATIONS	ALCALDE TEMP SALARY SAVINGS		$203.35	$1,195.28	($991.93)	
Ag Science Ctr at Alcalde	STATE APPROPRIATIONS	SUSTAINABLE AG IN NORTH-CENTRAL NM		$14,884.21	$14,884.21	$0.00	
Ag Science Ctr at Alcalde	STATE APPROPRIATIONS	ALCALDE ADMIN		$45,745.00	$42,031.62	$3,713.38	
Ag Science Ctr at Alcalde	STATE APPROPRIATIONS	SUSTAINABLE AG IN NORTH-CENTRAL NM		$20,000.00	$14,043.56	$5,956.44	
		Total State Appropriated Funds		**$336,384.60**	**$299,062.54**	**$37,322.06**	

Note: "( )" in the fund balance column indicates a positive number

Weather

There are three weather stations located at the Alcalde Science Center: 1) Soil Climate Analysis Network (SCAN) station through the Natural Resources Conservation Service (NRCS), 2) an automatic station administered by the NMSU Climate Center, and 3) a combination of manual and automatic readings collected for the National Weather Service. The NMSU station was down for 50 days during 2021, and the data set used for this report was completed and filled in using data from the SCAN station. With both data sets, only temperature data from Oct 1 is missing. This data is available online at https://wcc.sc.egov.usda.gov/nwcc/site?sitenum=2172.

Long-term annual precipitation (1953-present) is 9.69 inches and the average annual snowfall is 10.8 inches. In 2021, precipitation was below average with 7.82 inches. Most of the rain occurs during the North American Monsoon from roughly July through October and the average precipitation during these months is 5.56 inches. In 2021, only 4.05 inches of rain fell during these months and was followed by 61 days with no measurable precipitation.

The record low between 1953 and the present (-35 °F) was recorded on January 7, 1971, in the middle of a four-day string of below-zero temperatures. The record high for the same period of record is 102 °F recorded later the same year on July 14, 1971. The extreme high in 2021 was 102 °F recorded on July 11, and the low for the year was 5 °F recorded on February 15. The lowest high temperature was 16 °F, recorded the same day, and the highest low was 68 °F, recorded on July 20. In 2021, monthly mean temperatures were below average from January through March, above average from April through September, below average for October, and below average for the remainder of the year.

According to the USDA Hardiness Zone System, Alcalde lies within zone 6a with an average annual minimum temperature between -10 and -5 °F. Surrounding areas fall into zones 6b (-5 to 0 °F), and 7a (0-5 °F). Highlands within the service area fall within zones 5a (-20 to -10 °F) and 5b (-15 to -10 °F).

Freezing temperatures cut short the growing season for crops that are not cold-hardy, but late spring freezes are especially hazardous for fruit tree production in the northern valleys. At Alcalde, the average frost-free period (32 °F) from 1953 to the present is 146 days from 11 May to 4 Oct. The average length of time with temperatures above 28 °F for the same period is 166 days from April 29 to October 13, and the average period with temperatures above 25 °F is 186 days from April 17 to October 20. Table 3 shows the first and last dates of 32 °F as well as the season length. Out of the previous ten years, 2019 had both the latest and earliest 32 °F dates making for a 122-day frost-free period, the shortest season since 2007. The frost-free season for 2021 was below average at 140 days.

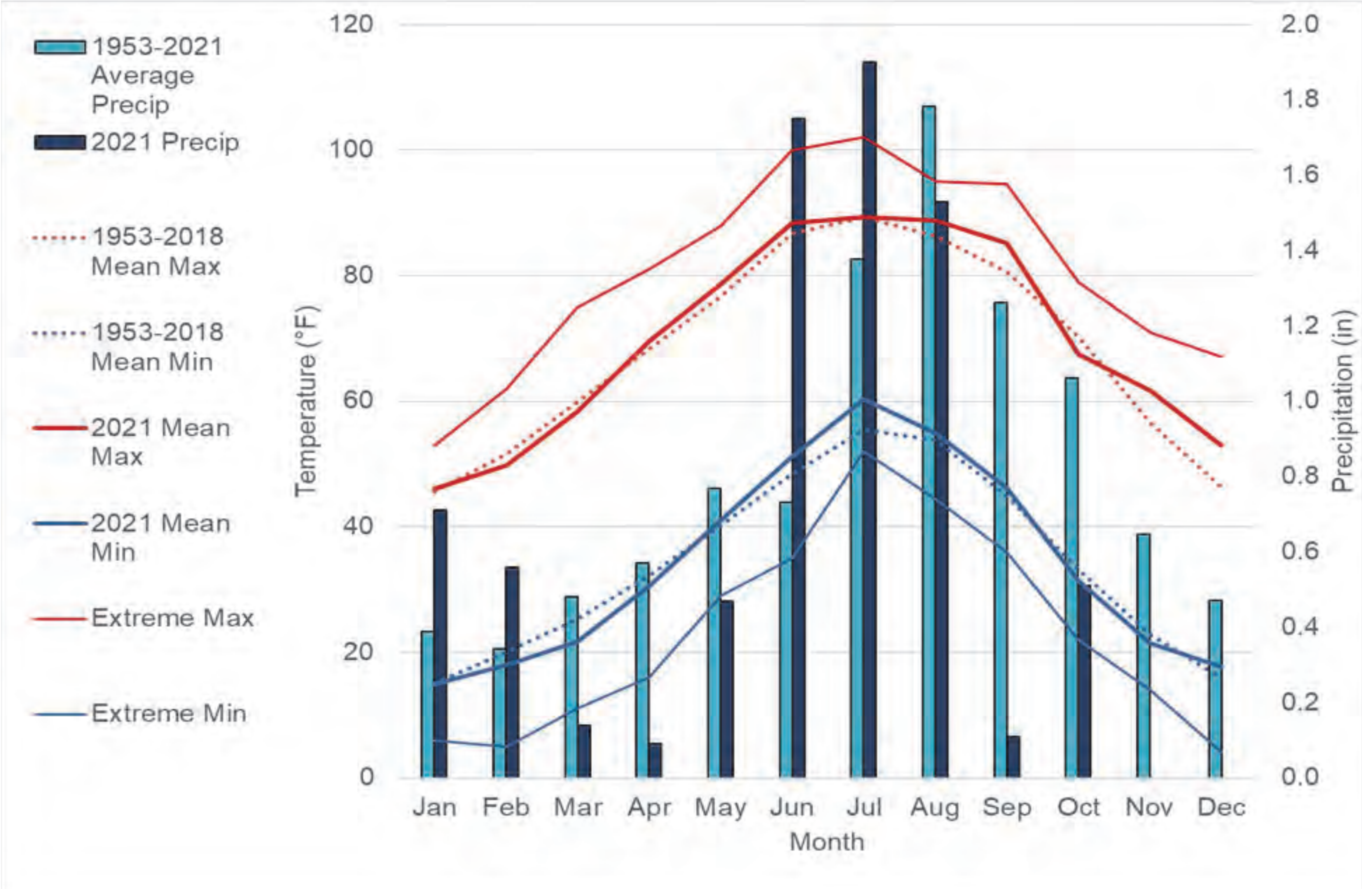


Figure 1. 2021 average monthly temperature and precipitation, 2021 total monthly precipitation, and extreme maximum and minimum temperatures compared to long-term mean data (1953-2021).

Year	Last	First	Season length (days)
2021	5/24	10/11	140
2020	5/22	9/29	130
2019	5/24	9/23	122
2018	5/3	10/15	165
2017	5/20	10/8	141
2016	5/8	10/5	150
2015	5/11	10/25	167
2014	5/15	10/13	151
2013	5/4	9/29	148
2012	5/28	10/7	132
2011	5/3	10/10	160
10-yr Mean	5/9	10/9	150
Long term Mean	5/11	10/4	146
Latest	6/8	10/25	
Earliest	4/15	9/9	

Table 1. First and last freeze (32 °F) dates and growing season length, 2010-2019, Alcalde, NM.

2021

RESEARCH RESULTS

JUJUBE CULTIVAR TRIAL AND MARKETING

Investigators: Shengrui Yao, Robert Heyduck, Steven Guldan, David Archuleta

BACKGROUND

Late frost is the most critical issue challenging fruit production in central and northern New Mexico. Most growers had five crops or less from 2010 to 2019. Good alternative crops with reliable yields are needed to diversify their operations and reduce risks. Jujube, also called Chinese date, adapts well to a wide range of soil and climate conditions. With its late-season start-up, same year flower bud initiation and bloom, and two months long blooming period, jujube produces a reliable crop in New Mexico. We have collected and imported 50+ varieties to 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 also suffered from irrigation issues.

POTENTIAL IMPACTS

The limited choices of commercially available cultivars to the jujube industry will be greatly improved with the NMSU jujube project. There are currently only 5-6 jujube cultivars commercially available in the United States with 'Li' as the dominant one. 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.

METHODS

The cultivar trial at NMSU Alcalde was established in April 2015 with 35+ cultivars as a randomized complete block design with two replicates.

The cultivars at Alcalde were: Chaoyang, Daguazao, Don Polenski, Dragon, Gaga, Honeyjar, Jinkuiwang, Jinsi2, Jinsi3, Jinsi4, Jixin, Junzao, Kongfucui, Lang, Maya, Mushroom, Pitless, Alcalde #1, Redland, Linyi Li, Li, GA866, Sherwood, Sihong, Liuyuexian, Jinchang, Shuimen, X38, So, Sugarcane, Teapot, Xiangzao, Xingguang, Zaocuiwang, Sandia, and Chico.

RESULTS

In general, jujube trees grew and produced well in 2021. Table 2 is the yield data of different jujube cultivars in 2021.

Table 2. Jujube yields for 2021.

Cultivar	Yield (g/tree)	Yield (lb/tree)	Cultivar	Yield (g/tree)	Yield (lb/tree)
Alcalde 1	8932	19.7	Junzao	1529	3.4
Banzao	13840	30.5	Kongfucui	11381	25.1
Chaoyang	9545	21.0	Lang	7306	16.1
Chico	2349	5.2	Li	10968	24.2
Daguazao	1583	3.5	Linyi Li	5631	12.4
Don Polenski	5434	12.0	Liuyuexian	8107	17.9
GA866	3284	7.6	Mayazao	12888	28.4
Gagazao	6660	14.7	Pitless	10125	22.3
Globe	-	-	Sandia	6704	14.8
Honeyjar	10912	24.0	Sherwood	8804	19.4
Jinchang #1	2694	5.9	Sihong	9125	20.1
Jinkuiwang	15629	34.3	Sugarcane	25885	57.0
Jinsi #2	6852	15.1	X38	2993	6.6
Jinsi #3	11295	24.9	Xiangzao	12260	27.0
Jinsi #4	483	1.1	Xingguang	5505	12.1
Jixinzao	6391	14.1	Zaocuiwang	7852	17.3

Average 7642 g/16.8 lb.

PEER-REVIEWED PUBLICATIONS

Yao, S. 2022. Low Temperature is Critical for Jujube Grafting Success in Frost-prone Northern New Mexico. HortTech 32:28-31.

FUNDING AMOUNT

$ 22,735

FUNDING SOURCE AND FUNDING DURATION

New Mexico Department of Agriculture 10/1/18-9/30/21

NC-140 ORGANIC APPLE ROOTSTOCK TRIAL AT ALCALDE

Investigators: Shengrui Yao, Robert Heyduck, Steve Guldan, David Archuleta

BACKGROUND

Apple is the number one fruit species in New Mexico. States with big apple operations utilize high-density planting and dwarfing rootstocks to boost crop production, yet there is limited research on what growing methods are most suitable for New Mexico apple growers.

Trees in high-density planting systems produce earlier crops with higher yields than the conventional systems; higher yields timed for better market pricing could generate more revenue for growers. The NC-140 program is a nationwide rootstock evaluation program for different temperate fruit species (apple, cherry, pear, etc.). We set up our first NC140 organic apple rootstock trial to test different rootstocks for organic planting with a tall spindle system at NMSU Alcalde Center in 2015.

POTENTIAL IMPACT

After another four years, when this project is complete, growers can adopt the top-performing rootstocks for high pH soils and the tall spindle production system to increase their revenue.

METHODS AND RESULTS

An organic apple rootstock trial with 11 rootstocks at 1.0 x 3.5 m planting density in a tall spindle training system was established in 2015. The cultivar was Modi, a selection from Italy, and the eleven rootstocks are G.11, G.16, G.202, G.214, G.222, G.30, G.41, G690, G.935, G.969, and M9-337 (control). The cultivar Liberty on G.935 was used as a pollinizer. Trees were planted in a certified organic plot and were managed organically with drip irrigation. Organic chicken manure was applied twice per year, beginning at 0.2 lb N/tree and increasing to 0.8 lb N/tree in 2021. The trees were trained to a tall spindle system following the protocols from the NC-140 group each year. The trees started to produce a light crop the second year after planting in 2016 but yield and quality varied by rootstock.

COVID work restrictions in 2020 reduced the amount of management on the trial. While irrigation continued, irrigation uniformity suffered, and this, coupled with a very dry 2020/2021 winter made nutrient management difficult. Trees had shown chlorosis before but were much more severe in 2021. We suspect that combined irrigation and precipitation were not sufficient to leach salts below the root zone, thus causing the increase in severity of chlorosis.

In 2021, even despite severe chlorosis, the overall yield was greater than in 2020. Rootstock G.890 had the largest trunk cross-sectional area (TCSA) among the 10 rootstocks tested (23.2 cm2), while G.222 and G.16 had the smallest (9.7 and 8.7, respectively). Rootstock G.30 had the highest yield among all rootstocks tested, followed by G.890, while G.222 and G.16 had the lowest yield (Table 3). Rootstock G.890 had the most suckers followed by G.935, and G.11 had the fewest. Chlorosis was severe this year in trees upon the rootstocks that had exhibited symptoms previously, especially G.41, G.30, G.16, G.935, and G.214.

The main concept for a tall spindle system is using the early crop to slow down vegetative growth. When late frosts eliminate fruit set, it becomes harder to curb vegetative growth, especially for those vigorous rootstocks like G.890 and G.202 which had grown wider than their allowed spacing. On the other hand, we may need some relatively stronger rootstocks for organic apple production in New Mexico with high pH soil and nitrogen as limiting factors. The weak rootstocks could end up with small trees.

Table 3. Appletree average yield/tree (kg), fruit number per tree, tree cross-sectional area (TCSA), and sucker counts per tree in 2021 at Alcalde, NM.

Rootstock	Fruit #	Yield (kg/tree)	Sucker	TCSA (cm^2)	Yield Efficiency (kg/cm^2)
G.11	53	4.9	0.3	10.7	0.163
G.16	31	2.2	2.5	8.7	0.272
G.30	50	4.1	0.9	14.7	0.186
G.41	58	5.4	0.9	10.5	0.109
G.202	30	2.2	1.1	9.7	0.308
G.214	97	9.0	0.6	17.4	0.110
G.222	39	4.2	0.4	15.1	0.129
G.890	94	8.5	3.5	23.2	0.293
G.935	60	5.1	2.3	13.8	0.207
G.969	61	5.3	1.3	12.7	0.337
M9-337	50	3.9	0.7	13.3	0.179

ASSOCIATED LONG-TERM PROGRAM OF RESEARCH (HATCH)

Sustainable Fruit Production in Northern New Mexico, Accession Number: 1008597, Project Number: NMYao-15H

FUNDING SOURCE AND DURATION

USDA Specialty Crop Block Grant through NMDA 2014-2017. Trial continues until 2025

COLLABORATION WITH EXTENSION

Shengrui Yao has split appointments of research (51%) and Extension (49%).

CHARACTERIZATION, GENOTYPING AND USES OF JUJUBE CULTIVARS/ GERMPLASM IN NEW MEXICO

Investigator(s): Shengrui Yao

BACKGROUND

The USDA imported various lines/varieties of jujubes in the early 1900s. Some breeding and line development took place at the USDA Chico, CA, research station. These and other jujube lines/varieties have become dispersed throughout the U.S. but their identities are unclear. Cultivars can be named differently in different areas or imported cultivars were renamed, and some may be synonymous. We will try to identify the synonyms and group jujube germplasm that exists in the U.S. There has not been much genetic or molecular work on jujubes for cultivar classification and grouping in the U.S.

This essential work on cultivar classification will allow effective and efficient research on jujubes in the future. Producers will benefit by having reliable information on jujube cultivars and their characteristics.

ASSOCIATED LONG-TERM PROGRAM OF RESEARCH (HATCH)

Sustainable Fruit Production in Northern New Mexico

FUNDING AMOUNT

$63,888

FUNDING SOURCE AND DURATION

New Mexico Department of Agriculture 10/1/20-9/30/23

COLLABORATOR

Dr. Dapeng Zhang—USDA-ARS Beltsville

JUJUBE OPEN-POLLINATED BREEDING AND SELECTION

Investigator(s): Shengrui Yao

BACKGROUND

In 2020, seeds were collected from five cultivars of jujube at Espanola, Albuquerque, and Leyendecker. Those maternal cultivars were 'Honeyjar', 'Dongzao', 'Zaocuiwang', 'So', and 'Mushroom'. This seed resulted from open pollination as opposed to controlled crosses. Some jujube cultivars are not self-fertile but can be pollinated by other cultivars in their proximity.

ACTIVITIES PERFORMED

These seeds resulted in a total of 175 seedlings which were transplanted into raised beds on June 20, 2021. Seedlings were arranged in a single row with one foot between plants. It is expected that not all seedlings will vary in tree vigor and fruit quality. Selection criteria will include tree growing habits, fruit size/shape, fruit quality, and yield efficiency.

ASSOCIATED LONG-TERM PROGRAMS OF RESEARCH (HATCH)

Sustainable Fruit Production in Northern New Mexico

FIELD EVALUATION AND MARKETABILITY OF 15 TABLE GRAPE CULTIVARS IN NEW MEXICO

Investigators: Gill Giese, Shengrui Yao, Kevin Lombard

BACKGROUND

Table grapes are a popular fruit among consumers. In New Mexico, there is potential to expand production and direct-market in farmers' markets, schools, and grocery stores. There is a lack of information on appropriate table grape varieties that producers can grow in northern New Mexico. This statewide effort to evaluate 15 cultivars for suitability to New Mexico's unique edaphic and climatic growing conditions is coupled with ongoing testing of each and in comparison to current market standard cultivars in various retail markets, venues to gauge, and quantify consumer acceptance of locally produced table grapes. The project will have three sites: Los Lunas, Alcalde, and Farmington. New table grape varieties offer advantages in cold hardiness, cluster architecture, phylloxera tolerance, and staggered ripening/timing in addition to improved taste/aroma and texture characteristics. Farmers and home gardeners need reliable identification of suitable varieties for local conditions. This project will accomplish evaluation trials at three sites with substantially different climates and soils that represent a substantial portion of New Mexico growing environments.

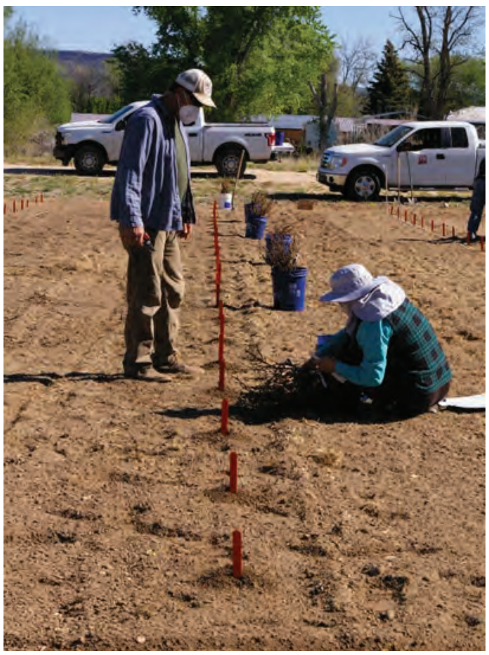


Table grapes offer a potential economic outlet for NM commercial grape producers, provide small and local market farmers an avenue of income diversification, and can increase the healthfulness of local diets, especially in regards to increasing the consumption of fresh fruit by children aged 6 to 12.

Figure 2. Grapes being transplanted into field at Alcalde, NM, May 6, 2020. (Photo by Amy Larsen)

ACTIVITIES PERFORMED

In 2020, only 6 of 15 cultivars were available, and of those planted, we saw very low survival. In 2021, The trial was completely replanted with 8 cultivars: Compassion, Faith, Gratitude, Hope, Everest, Himrod, Joy, and Swenson. We planted on June 2, 2021, and irrigation continued by drip.

FUTURE PLANS

A trellis will be constructed shortly, and cover crops sown in between the rows.

FUNDING AMOUNT

$52,818

FUNDING SOURCE AND DURATION

New Mexico Department of Agriculture, and Specialty Crop Research Initiative, 2019 to 2023

IMPLEMENTING SOIL HEALTH PRINCIPLES TO STUDY EFFECTS ON THE SOIL MICROBIOME AND PLANT HEALTH AND PRODUCTIVITY IN ORGANIC HOOP HOUSE VEGETABLE SYSTEMS

Investigators: Amy Larsen, Steven Guldan, Robert Heyduck, David Archuleta, David Salazar, Juan Lopez

BACKGROUND

The Natural Resources Conservation Service (NRCS) defines soil health as the "continued capacity of a soil to function as a vital, living ecosystem that sustains plants, animals, and humans." Measurable soil indicators like compaction, soil aggregation, infiltration, soil organic matter, and soil microbial community composition can serve to assess the vitality of the below-ground ecosystem, as well as its ability to nourish the above-ground plant system. Improving soil health depends on implementing good management principles, including minimizing disturbance and maximizing soil cover, biodiversity, and the presence of living roots.

Due to disruptive crop management practices - including intensive tillage, pesticide/fertilizer application, compaction, and bare fallow conditions - many agricultural soils are less fertile and have poor microbial diversity compared to undisturbed grassland or forest systems. Compost that has been processed to maximize microbial diversity may serve to re-inoculate degraded soils and improve soil health and function. This study seeks to examine whether the combination of microbial re-inoculation and implementation of soil health management principles in hoop house soils can improve soil fertility, plant health, and plant production. This study spans 4 years beginning with compost production in 2018, a tomato crop in 2019, a cucumber crop in 2021, and with a diverse cover crop mix generally sown each fall. Due to the pandemic in 2020, no vegetable planting or harvest occurred. This report covers 2020-2021 project activities; earlier activities are detailed in prior annual reports.

METHODS

Hoop House Trial Fall 2020-2021 The entire hoop house was seeded with a cover crop mix (daikon radish, Austrian winter peas, hairy vetch, rye) on October 2, 2020. By the spring of 2021, cover crops had made only a thin stand and instead of rolling, were terminated by string-trimmer. Tilled plots again were tilled on May 3. Microbially rich compost was added to the NT+C plots at a rate of 400 lb/ac on May 10, 2021; and NT+C cucumber seeds were soaked in the compost for 24 hours so that the compost microbes were in direct contact with the seed. Cucumbers were direct seeded on all plots on May 11, 2021; however, only about 25% survived due mostly to rodent damage. To replace seedlings, six-week-old cucumber starts were transplanted into plots on June 23, 2021, and under row covers for protection.

The experimental design includes four replicates of three treatment plots: Tilled; No-Till (NT); and No-Till + Compost (NT+C). Cucumbers were harvested twice weekly beginning July 22 and continuing through October 5, when frost ended production. Total and marketable fruit counts and weights were recorded for all plots at each harvest. Marketable fruit is cucumbers of a standard size/shape, without scarring or damage that would prevent them from being sold at markets.


Figure 3. Left: Cucumber transplants; Right: Marketable fruit (photos by Amy Larsen)

RESULTS

Total and marketable fruit weights for the replicated plots were averaged for the No-Till + Compost (NT+C), Till, and No-Till (NT) treatments. NT+C plots yielded about 2.5% higher than the other treatments. However, marketable fruit yields for NT+C were higher still: NT+C yielded 3.2% better than till and 6.5% better than no-till.

FUTURE PROJECT PLANS

Baseline soil tests (soil chemistry and PLFA) were performed for each plot on November 2, 2018, and final soil tests were completed on November 2, 2021. Once soil test data is analyzed and compared for the various plots, possible correlations can be made to understand soil conditions and these yield differences further.

BUILDING SOIL HEALTH AT PATA VIVA FARM IN LAS CRUCES, NM

Investigators: Amy Larsen, Steven Guldan, Robert Heyduck

BACKGROUND

Beginning in the fall of 2019 and continuing through 2021, Amy Larsen collaborated with Cruces Creatives and 'Seeding Regenerative Agriculture', a peer support network of farmers. The scope of work included providing educational presentations to the farmer network on soil testing options in the arid southwest, and collaborating on an on-farm research project in Las Cruces, NM.

The goal of the on-farm research trial is to measure changes in soil health in an irrigated intensive vegetable cropping system as it relates to land management. Changes in soil health over 5 years will be assessed by measuring soil biological, chemical, and physical indicators; performing plant tissue analysis, and comparing annual yields. Land management practices include conservation tillage, planting diverse cover crops, reduced fertilizer application over time, and addition of microbially diverse compost (aka BEAM or Johnson Su Bioreactor compost).

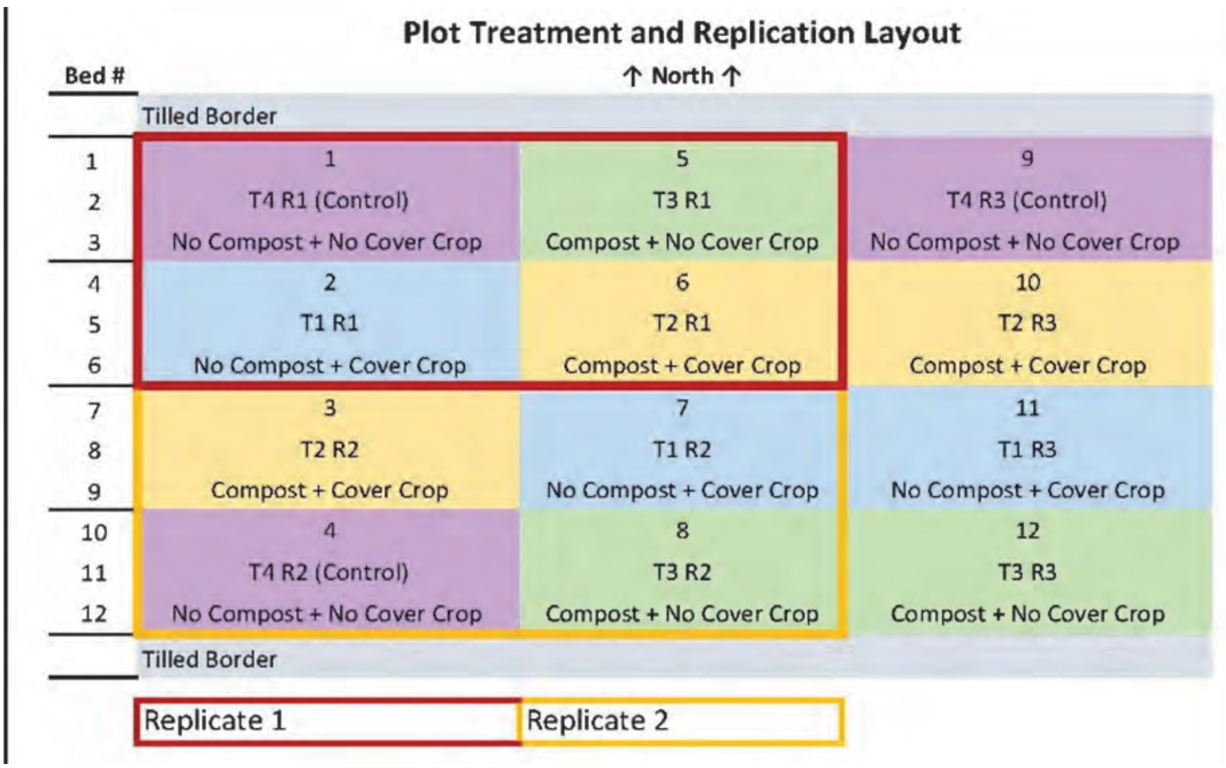


Figure 4. Research Plot Design

There will be two replications of four treatments, planned as follows: 1) cover crop; 2) cover crop plus compost; 3) compost, no cover crop; and 4) control: no cover crop or compost. Plots are arranged in a replicated split-plot design with Cover Crop Mix vs No Cover Crop Mix as whole plots and Johnson-Su Compost vs No Johnson-Su Compost as subplots. Plots will be maintained for 5 years (or for as long as funding is available), while data are collected.

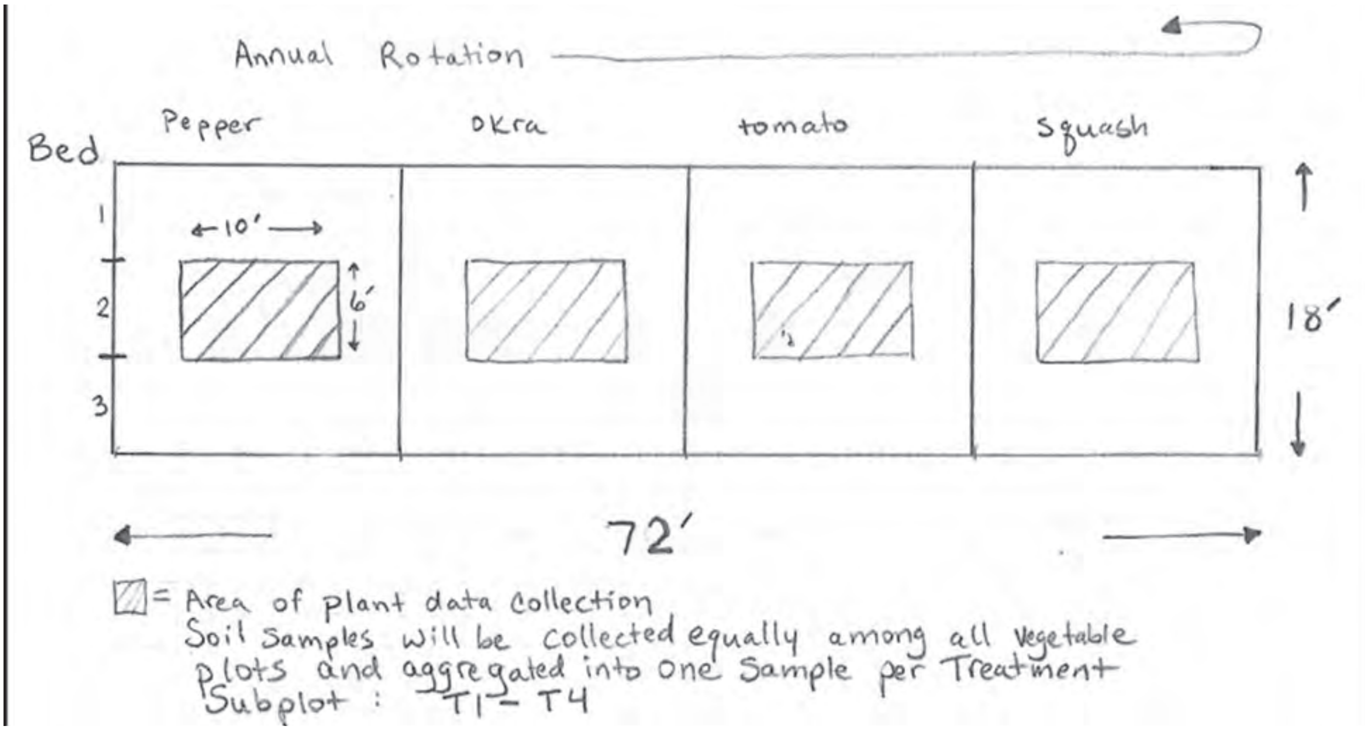


Figure 5. Treatment subplot detail.

Within each subplot, four crops will be sown in this order, west to east: pepper, okra, tomato, and squash. Each year, the crop will be planted one subplot over (eastward) until the fifth year, when the crops return to the same location as the first. Cover crop mix included triticale (20 lb/ac); hairy vetch (17 lb/ac); and clover (8 lb/ac).

All plots will be managed similarly with regards to conservation tillage and fertilizer; however, the cover crop vs. non-cover crop treatments may require different levels of irrigation, depending on the need. Cover crops will be terminated by roller crimping. In the spring of the first year, all plots will receive 750 lb/ac poultry meal (10-0-0). Given the farm's history of micronutrient deficiencies, a pre-plant liquid fertilizer blend will be applied as well. The fertilizer rate will be reduced by about half in years 2 and 3; by years 4 and 5 no fertilizer will be applied.

Annual plant tissue and soil sampling will be performed providing data on biological, chemical, physical, nutrient, and yield indicators. Soil samples were collected in fall 2020 for baseline measurements and will be collected every subsequent fall until the project is completed. Soil cores will be taken then aggregated into one soil sample/plot.

EDUCATIONAL WEBINARS

Three educational videos were recorded and are available online: a video describing the on-farm research project; and videos of two separate webinars focused on informing farmers of various soil lab and field testing options relevant to arid lands. The webinars were live and each attended by a handful of producers.

ASSOCIATED LONG-TERM PROGRAM OF RESEARCH (HATCH)

Sustainable Agriculture in North-Central New Mexico

OTHER FUNDING AMOUNT

$20,000.00 (New Mexico Zone Grant from the Santa Fe Community Foundation, through collaboration with Cruces Creatives. 2020-2021)

COLLABORATORS

Richard Family & Pata Viva Farm, Patrick DeSimio & Cruces Creatives, David & Hui Chun Su Johnson, John Idowu, Robert Flynn, and Rajan Ghimire.

SOIL HEALTH BENEFITS OF DIVERSE COVER CROP MIX

Investigators: Robert Heyduck, Amy Larsen, Steve Guldan, David Archuleta, Juan Lopez, Daniel Goodrich

BACKGROUND

Cover crops provide numerous soil health benefits including reducing erosion and compaction, fixing nitrogen, and increasing soil organic matter. They can improve soil aggregation and tilth by providing soil cover and a living root in the ground year-round. At Alcalde, we have been experimenting with mixes of cover crop species to achieve maximum soil-building functions in arid climates, under various irrigated systems. The goal of this study is to understand the soil building capacity of a cover crop mix (forage radish, winter pea, and oats) when combined with microbially rich compost inoculant (Johnson-Su Bioreactor Compost - JSB) or a legume inoculant.

ACTIVITIES PERFORMED

A 100 x 350-foot section of Field 9, which had been bare/fallow for several years, was tilled and harrowed on August 16. On August 24, before bed preparation, samples for baseline soil tests (routine soil chemistry and PLFA) were gathered from a representative section of the field. Three-foot beds were formed, and three replications of three treatments were applied, as follows: 1) Cover crop seed mix only without inoculants (control), 2) Cover crop mix + legume inoculant, 3) Cover crop mix with JSB compost inoculant. Each treatment plot is 9 feet wide, spanning three planting beds.

Figure 6. Left to Right: Drilling cover crop; Cover crop mix and compost (photos by Amy Larsen)

Cover crops were drilled on August 26. For each treatment plot, the seed mix consisted of: 16.5 lb oat/pea mix; 3 lb of radish, and 8 lb of cereal rye; and 15 lb of compost was mixed in with treatment 3 seed when it was drilled. Trials and adjustments of the grain drill opening were necessary to achieve similar rates of seeding across the three treatments, especially since the compost inoculant tended to stick to the seeds and prevented continual grain flow down the seed channels. Treatment 3 plots received 105 lb/ac of seed while treatments 1 & 2 received 110 lb/ac. Field 9 was flood irrigated as needed until acequia water was shut off in late November 2021. JSB Compost was applied to treatment 3 plots by drop spreader at a rate of 400 lb/ac on September 22 and was watered in.

RESULTS

Seed germination was more successful on the northern end (closer to the irrigation pipes) and less successful at the southern end of the field, which could be due to less water volume reaching the end of the field. Soil test data, therefore, will be restricted to a 50-ft section towards the north end of the field. Signs of elk and deer foraging on cover crop grasses are evident. Although plant biomass is reduced from foraging, the animals could be providing soil health benefits through 'integration of livestock', an NRCS Soil Health Principle.

FUTURE PROJECT PLANS

In the spring of 2022, we plan to terminate the cover crop by rolling and seeding a cash crop into the residue, most likely blue corn. We will examine yield, plant health, and other factors as they may relate to soil health and cover crop treatments.

Soil test data (routine soil chemistry and PLFA) will be collected in the future, analyzed, and compared to the baseline.

YOUTH/STUDENT OUTREACH AND TRAINING

Investigators: Amy Larsen, Robert Heyduck, Shengrui Yao, Steve Guldan, Juan Lopez

BACKGROUND

One objective listed in the Alcalde Science Center's strategic plan is to expand the K-20 outreach program to increase student awareness and participation in ACES programs and associated careers.

ACTIVITIES PERFORMED

A collaboration with Taos Land Trust and the Youth Conservation Corp led to involving students in apple and jujube fruit harvest at the Station, and subsequent donation of fruit to schools, and food banks in Taos and Abiquiu. We plan to expand the program to include not only harvest, but training on pruning, thinning, and irrigation.

The Alcalde Science Center frequently employs high school interns to work alongside the research team to gain insight into agricultural practices, research techniques, farm labor and equipment skills, and general work ethic.

Amy Larsen and David and Hui Chun Su Johnson spoke to a middle school science team (near Lubbock, TX) via Zoom about the Johnson-Su Bioreactor compost process and carbon sequestration. The students used this information for their project, which they planned to enter into a national STEM competition.

Figure 7. Left: YCC apple harvest; Right: Children making cider from Alcalde Science Center Apples (photos by Amy Larsen)

STREAMLINED NATIVE BEE MONITORING PROTOCOL FOR ASSESSING POLLINATOR HABITAT AND BEE BOWL COLLECTION

Investigator(s): Adrienne Rosenberg

BACKGROUND

The purpose of this research project is to assess native bee populations by comparing a native wildflower field to a field of the more traditional cover and cash crop alfalfa. The project is measuring diversity and collecting individual bees. The project will potentially aid in the conservation of acequia rights, create a demonstration site, establish easy planting methods, and invite native pollinators. According to professional entomologists, native bee data is extremely limited within New Mexico so this project may contribute to a wider understanding of the species present and habitat preferred in Northern New Mexico.

ACTIVITIES PERFORMED

The project established one native wildflower plot (44 x 103 ft) (2019) and used a section of an existing alfalfa field (44 x 103 ft) (2020). The wildflower plot was plowed, tilled, and broadcast planted in 2019. Watering was from the acequia and distributed through overhead sprinklers with a micro-sprinkler head attachment. Weeding was conducted during the 2019 season to keep weed species from suppressing the wildflowers, but in 2020 minimal weeding was conducted. For the alfalfa plot, water was delivered from the acequia through gated irrigation pipes. No weeding was necessary, and a 10-12 ft strip was cut around the plot to isolate the area from the larger field for the native bees. The field was cut three times for the alfalfa crop throughout the season.

A citizen science protocol written by the Xerces Society for Invertebrate Conservation, University of California Davis, Rutgers University, and Michigan State University called “Streamlined Native Bee Monitoring Protocol for Assessing Pollinator Habitat” was utilized to measure native bee diversity. Two transects per field (3 ft x 100 ft each) were established and used throughout the season. Each transect was walked within 7.5 minutes (totaling 15 minutes per plot) while counting native bees that landed on flowers within the transect. According to the protocol, bee abundance positively correlates with bee diversity. This count was performed several times throughout the season on each plot.

In addition, eight bee bowls, or bee traps, in the colors of yellow, blue, and white were placed 13-ft apart on a 100-ft transect in the middle of each plot for several daylight hours. Bee samples were collected and placed into vials on the same days the monitoring protocol was administered. The samples were then delivered to an entomologist to be pinned and identified. The plots were also photographed and floral and weed presence noted.

Figure 8. Visitors attending pollinator field day September 24, 2019 (photo by Amy Larsen)

PROBLEMS

The alfalfa plot did not establish well enough to measure in 2019. No data were gathered in 2019 on the alfalfa plot. This plot was replaced by the plot within the existing alfalfa field.

RESULTS

The research is still in progress. No results yet. The bees from the 2019 and 2020 seasons have been pinned and are being identified.

Figure 9. Clockwise from upper left: Bee bowl traps for pollinator collections and identification; pinned sampled specimens; Plains coreopsis, *Coreopsis tinctoria*; bumble bee (*Bombus* sp.) on blanketflower, *Gaillardia pullchella* (photos by Adrienne Rosenberg except upper right by Julieta Bettinelli)

INITIAL HEMP VARIETY TRIALS ACROSS NEW MEXICO ENVIRONMENTS

Investigators: Hanah Rheay, Catherine Brewer, Rebecca Creamer, Katie McCarver, Amy Larsen, Robert Heyduck

BACKGROUND

The project is led by the Department of Chemical and Materials Engineering and the Department of Entomology, Pathology, and Weed Science. The project involved the cultivation of CBD ('Sweetened' and 'Wife'), grain ('Anka' and 'Altair'), and fiber ('MS-77') hemp varieties at three NMSU Agricultural Science Centers: Leyendecker, Los Lunas, and Alcalde. The trials evaluated the suitability of different varieties to the unique climatic areas throughout the state and provided initial scouting opportunities for pests and diseases. Other extension agents that contributed to the planning and implementation of this project are Kevin Lombard (Farmington) and Jeff Anderson (Doña Ana County). Additional collaborating partners include Rich Global Hemp (located in Las Cruces, NM), who provided hemp seeds and guidance for best management practices of CBD hemp.

The NM hemp industry is faced with challenges entering this new industry and expanding hemp production, as farmers grapple with limited options for biomass utilization and potential detrimental interactions due to pests/diseases shared with other major crops. This work aims to address this problem by finding industrial varieties that are suitable for production in the state, evaluating the potential for establishing hemp market use outside of CBD, and identifying pests that are common to hemp fields.

The immediate research impacts realized by this project include identifying varieties that should be used for continued research and varieties that are not suitable to the location photoperiod and isolating problematic pests or pathogens present in the crop. The potential impacts for this project include developing recommendations for hemp farmers based on their location within the state, identifying the most relevant downstream uses for the biomass that is produced in NM, and establishing pest management guidelines for the region. This work primarily addresses one ACES Pillar: Food and Fiber Production and Marketing. Their work is not associated with any long-term program of research (Non-Hatch).

ACTIVITIES PERFORMED

For CBD types, 30 plants each of 'Wife' and 'Sweetened' were transplanted into beds at a 3-foot x 3-foot spacing in a randomized complete block. For the grain and fiber types, seeds were sown in 15-foot rows using an Earthway planter. This planting consisted of cultivars 'Altair', 'MS-77', 'Earlina', and 'Anka'. All sowing and transplanting occurred on July 20, 2021. Plantings were watered once or twice weekly using driplines.

Plants were harvested on September 29, 2021. CBD cultivars were tagged and hung in the shop to dry for two weeks. Grain types were gathered on tarps and left to dry in the shop. Fiber types were left in the field to age.

RESULTS

Yield data, as well as CBD extraction composition, will be presented later. We will conduct a similar one in 2022 to continue this work.

Figure 10. Left to right: Fiber-type hemp, CBD-type hemp (photos by Robert Heyduck); plants hanging to dry (photo by Amy Larsen).

ASSOCIATED LONG-TERM PROGRAM OF RESEARCH

Non-Hatch; Establishing Research Support and Recommendations for the NM Hemp Industry

FUNDING AMOUNT

$55,000

FUNDING SOURCE AND DURATION

$10,000 from the College of Engineering (COE), $20,000 from the Agricultural Experiment Station (AES), and $25,000 of seed grant funding were awarded from the NMSU Center of Excellence in Sustainable Food and Agricultural Systems. The funding extends through the summer of 2022.

COLLABORATORS

Farmington Agricultural Science Center, Rich Global Hemp, Doña Ana County Extension

COMMUNITY HYDROLOGY RESEARCH WITH THE RIO HONDO ACEQUIAS

Investigator(s): Lily Conrad

BACKGROUND

Commonly, complex water-sharing agreements in acequia irrigation communities of northern New Mexico are based on water data gathered irregularly by local water leaders. The Rio Hondo watershed in northern New Mexico is experiencing drought-induced flow reductions and changing water-sharing dynamics between the acequia networks, which rely on water from the same river. These changes in surface water availability and water-sharing agreements resulted in local water managers expressing a need for available data to appropriately distribute water between irrigators. The purpose of this research is to address community needs by installing a telemetry monitoring system on participating ditches and analyze the social impacts of real-time monitoring on adaptive capacity within the Rio Hondo acequia community.

Figure 11. The general instrumentation present at each telemetry site where A) shows the flume, stilling well, and equipment box and B) shows the equipment found inside each box. Each site has a pressure transducer recording water level. The datalogger is programed with a site-specific rating curve equation to derive discharge from the stage (photo by Lily Conrad).

ACTIVITIES PERFORMED

Founded based on public impact research and community science, this research is just the beginning of giving irrigators the ability to become stewards of local water resources information by having real-time access to water data through a web interface. A telemetry monitoring network was installed in collaboration between researchers and irrigators on participating irrigation ditches to remotely collect water stage, discharge, and conductivity data every 15 minutes (Figure 11). Data are automatically updated on a web interface first made available to the acequia communities for the 2020 irrigation season. Researchers maintained constant contact with the acequias and adjusted the monitoring website as necessary, to ensure it was meeting community needs. Telemetry discharge values were verified with manual flow measurements over the irrigation season and used to improve the accuracy of the rating curve equations on the dataloggers (Figure 12). Researchers worked very closely with stakeholders and acequia leaders throughout the introduction and use of the telemetry monitoring system. Researchers hypothesize that improving water data accessibility will likely increase community adaptive capacity in this rural, traditionally irrigated valley. The impact of the telemetry system was evaluated with pre-telemetry and post-telemetry surveys targeting several community-level adaptive capacity indicators.

Preliminary survey results from participant background questions indicate that besides delivering irrigation water, respondents from the Rio Hondo acequias greatly value the increased groundwater recharge associated with acequia ditches and irrigation. Due to this strong value, researchers installed monitoring stations on two flood-irrigated fields growing pasture grass within the Rio Hondo Valley to estimate shallow groundwater recharge from flood irrigation using a water budget approach. This portion of the research strives to quantify the benefits of groundwater recharge in an acequia-irrigated valley (the Rio Hondo Valley) in the context of climate change and changing streamflow regimes to better inform sustainable water management.

Figure 12. Student field assistants (Madison Groven and Coury Dorn) manually calculated discharge in an acequia (photo by Lily Conrad).

RESULTS AND NEXT STEPS

The adaptive capacity analysis has concluded, been summarized as a manuscript, and submitted to a journal for review and publication. Our study found that four of the seven adaptive capacity indicators significantly increased after the introduction of the acequia web interface: information diversity, cognitive social capital, leadership, and proactivity. This is the first study we know of within water resources science that addressed community concern with a tool and subsequently quantified how the tool impacted adaptive capacity with robust and adaptable survey methodology. This study demonstrates that bridging the gap between community need and hydrologic research through community science, sociologic analysis, and stakeholder engagement provides significant benefits for communities facing water management challenges.

The water budget analysis is currently underway and will be submitted to a journal in the coming months (early 2022). We calculated groundwater recharge with a water budget approach on two fields over two irrigation seasons (2020 and 2021) in the Rio Hondo Valley. Initial results indicate great annual and spatial variation when comparing irrigation events and total deep percolation estimates across both fields and irrigation seasons. Our results showed both fields have significant relationships between deep percolation and total water applied. Only one of the fields exhibited significant relationships between deep percolation and irrigation duration; groundwater level rise and deep percolation; as well as groundwater level rise and total water applied. The only significant differences when comparing irrigation events and deep percolation estimates across both fields were irrigation duration and the number of irrigation events. Mean groundwater level rise was also significantly different when comparing the two fields. These results indicate that surface water and groundwater are tightly connected in this area but variation in deep percolation and groundwater response exists between land managers and fields due to differing irrigation practices.

Figure 13. Lily Conrad meeting with Rio Hondo acequia mayordomos to discuss water data (photo by Sylvia Rodriguez).

Sustainable Farming Techniques in Northern New Mexico

Del Jimenez, Agricultural Specialist

High Tunnel Programs To date, we have a total of 1695 high tunnels up and producing incomes for our limited resource producers in Northern New Mexico. This year a total of five workshops were performed: two in New Mexico, two in Wyoming, and one in Colorado. It has increased season extension to where they have money coming in over a longer period throughout the year. Thirty-two copies of NMSU Circular 606 (High Tunnel Hoop House Construction for New Mexico) were mailed to individuals and groups requesting it and were given out to 48 people taking the high tunnel workshop.

Vegetable Gardening Program The gardening project has helped families produce food and improve their level of nutrition. I have seen an increase in interest in gardens in recent years. I have had requests for materials and information on gardening from 12 different people or groups.

Seed Program This project helps put land back in agriculture production and helped 44 individuals grow food for themselves and their community. I receive free seed from NMDA and give this seed free of charge to whoever needs seeds for gardens, pastures, or landscaping.

Bindweed Mite Program Field bindweed is a serious problem in New Mexico's cultivated land. Its roots can reduce soil moisture below the wilting point of many crop plants. Besides competing for nutrients and water, field bindweed can pull plants to the ground and smother them completely. The Bindweed mite program uses a biological mite to help control this weed. Bindweed mites were distributed at the Alcalde Field Day on August 10, 2021.

Livestock Programs This program helps livestock producers develop and implement sustainable ranching practices appropriate for their needs. It introduces alternative production techniques practical and applicable to the producer's requirements. Over 80% of agriculture receipts come from cattle sales in Northern New Mexico. I did the tagging in Rio Arriba County for all livestock showing at the Rio Arriba County Fair.
In Mora County, we discussed the importance of pregnancy testing of cattle with 26 people attending.

Small Animal Program This program promotes small animal production. We instruct growers on production practices of small animals that are sustainable. More family units are looking at small animals to produce food for their immediate use. A Workshop in Rio Arriba, Santa Fe, Jemez Pueblo, was done with an emphasis on poultry and rabbits. We had 48 people participate.

Outreach/ Community Engagement

- Virtual presentations to Seeding Regenerative Agriculture, a peer-supported farmer collective: "Lab Soil Test Options for Regenerative Agriculture in NM," February 5, 2021. "Field Soil Test Options for Regenerative Agriculture in NM," March 1, 2021.
- 2021 Annual Fruit Grower Workshop (Virtual Workshop), 8:30-12:00, March 11-12, 2021.
- Grafting Workshop. Alcalde, July 29, 2021, 5-7 pm.
- Compost Education Workshop: Full-day in-person workshop at Taos Land Trust, which included compost/vermicompost process and soil microbes training with microscopes. August 17, 2021.
- Recorded Webinars Posted on SASC Soil Regeneration & Health Webpage: "Building Healthy Soils at Pata Viva Farm" and "Healthy Soils Workshop" with Taos Land Trust.

Faculty and Staff

Full-time Staff

Steve Guldan- Ph.D.

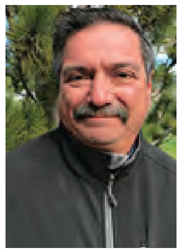
Superintendent and Professor

Elena Arellano

Administrative Assistant, General

Shengrui Yao- Ph.D.

Professor, Ext. Fruit Specialist



David Archuleta

Farm/ Ranch Supervisor (Retired 2021)

Robert Heyduck- M.S.

Research Scientist, Associate

Frozen Position

Field and Shop Technician

Part-time and Seasonal Staff

Amy Larsen- M.A.

Senior Research Assistant

Adrienne Rosenberg- M.A.

Editor

Juan Lopez

Farm/Ranch Laborer

Cooperators/Collaborators

NC-140 Collaborators

University of Kentucky, University of Wisconsin, University of Massachusetts, Utah State University, Agriculture and Agri-Food Canada, University of Vermont, University of Georgia, University of Massachusetts, University of Guelph, Auburn University, Pennsylvania State, Washington State University, Michigan State University, California Cooperative Extension, University of Idaho, University of Maryland, USDA-ARS/Plant Genetic Resources Unit, Purdue University, University of Minnesota, Cornell University, University of Illinois, Michigan State University, Ohio State University, Colorado State University, University of Maine, Rutgers University, North Carolina State University, Clemson University, Virginia Polytechnic Institute and State University (VA Tech), USDA-ARS/Washington, New Mexico State University

NMSU Science Centers and Researchers

Dr. Gil Giese—Los Lunas ASC
Dave Lowry—Leyendecker ASC
Dr. Kevin Lombard—Farmington ASC
Miranda Kersten—Los Lunas ASC
Dr. Chadelle Robinson--Agricultural Economics and Agricultural Business
Dr. Efren Delgado—Family and Consumer Sciences
Dr. Nancy Flores—Food Technology
Dr. John Idowu—Extension Plant Sciences
Dr. Robert Flynn—Artesia ASC
Dr. David Johnson—Civil Engineering
Leonard Lauriault—Tucumcari ASC
Dr. Alexander Fernald—Water Resources Research Institute
Dr. Rebecca Creamer— Entomology, Plant Pathology, and Weed Science (EPPWS)
Dr. Catherine Brewer—Chemical Engineering

Other Research Institutions

Dr. Dapeng Zhang—USDA-ARS Beltsville, MD
Dr. Carlos Ochoa—Oregon State University
Dr. Robert Myers—University of Missouri

Others

Dr. Olivia Carril
La Montanita Co-op
Cruces Creatives
Pata Viva Farm
NM Compost Coalition
NM Healthy Soils Champions | NACD
NM Healthy Soils Working Group
Soil Health in Mora
Rich Global Hemp

ALCALDE

New Mexico State University
371 County Road 40 P.O. Box 159
https://alcaldesc.nmsu.edu