CLOVIS

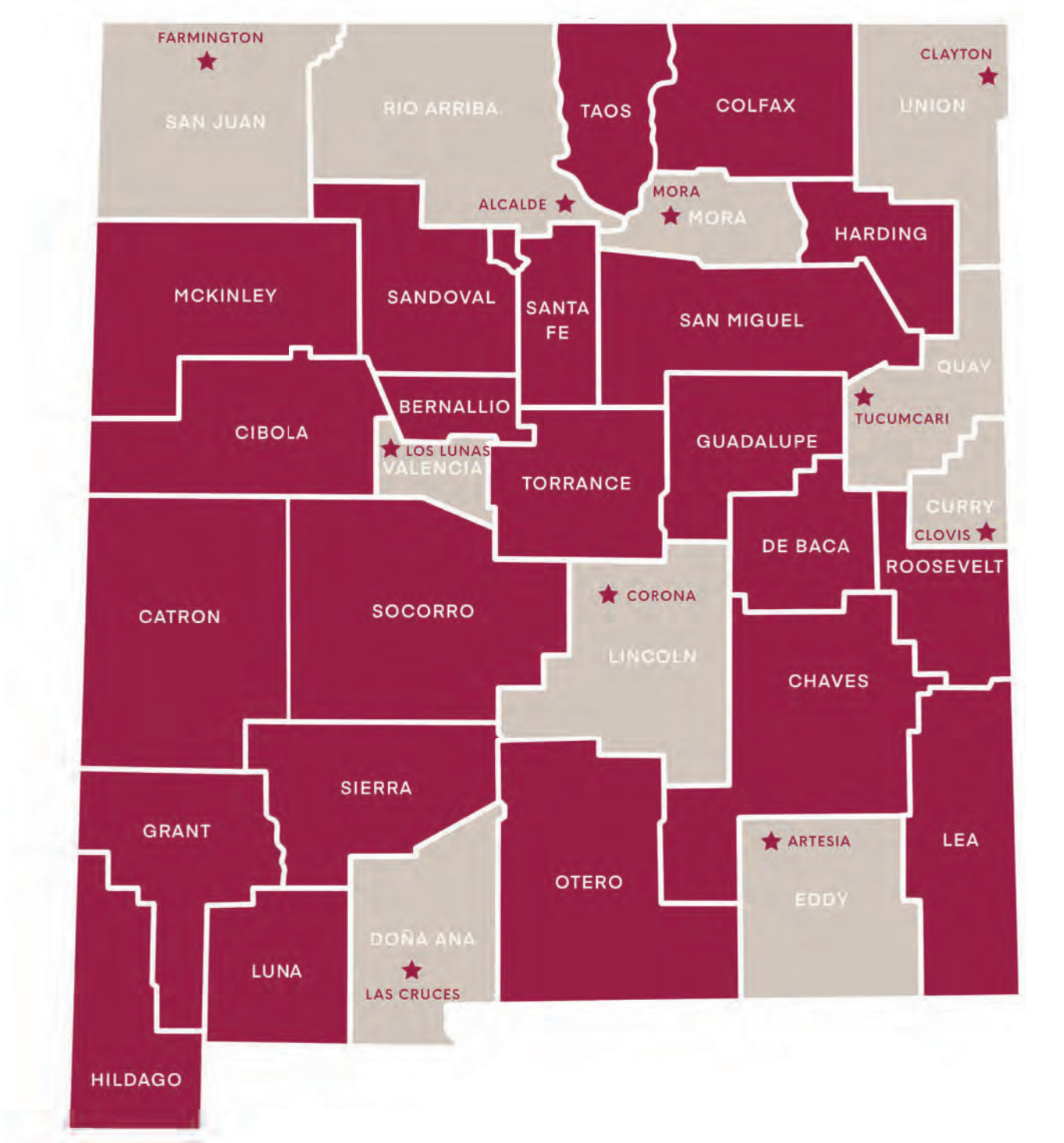
NM STATE

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.

www.clovissc.nmsu.edu

NMSU Agricultural Experiment Stations



★ Station Locations

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 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 New Mexico State University Agricultural Science Center at Clovis is Located 13 miles north of Clovis on State Road 288. The center is located in the Southern High Plains and is centrally located in the largest crop area in New Mexico. The center is comprised of 156 acres of land, which has an approximate 0.8% slope to the southeast. The center is located at 34.60o N, -103.22o W, at an elevation of 4,435 feet above sea level. The Olton clay loam soil at the center is representative of a vast area of the High Plains of New Mexico and the Texas Panhandle. Research at the center began in 1948, originally as dryland field research. Irrigation studies were initiated in 1960 when irrigation well was developed. Water for irrigation is derived from the Ogallala Aquifer. Since 2005, the center has improved its irrigation delivery by developing two center pivot irrigation systems and subsurface and surface drip irrigation systems.

Meeting the needs of New Mexico

Declining Ogallala Aquifer is the most important challenge faced by agriculture in eastern New Mexico, the breadbasket of the state, and in the Southern Great Plains. Increasing climate variability with high rainfall and temperature extremes is expected to make rainfed or limited irrigation agriculture more challenging. With rising costs of inputs, producing traditional high-input crops is becoming riskier. Degrading ecosystem services, poor soil health, lack of biodiversity are all affecting the resiliency of our cropping systems. Our research addresses current challenges experienced by farmers and prepares them to face future challenges. We focus on crop diversification, deficit irrigation management, and designing novel cropping systems that are resource-use efficient and resilient to future climatic uncertainty.

- Cropping Systems and Soil Management Program
- Water Efficient, Low Input, Well Adapted, Alternative Crops to Diversify Cropping Systems in the Southern High Plains
- Deficit Irrigation Management of Alternative Crops to Sustain Ogallala Aquifer Desert Adopted Guar Crop for New Mexico
- Circular Buffer Strips of Native Perennial Grasses to Improve Resiliency and Ecosystem Services of Center Pivot Irrigated Agriculture
- Enhancing the Breeding Potential of Valencia Peanut for Drought and Disease resistance in New Mexico.
- Management of Weed and Weed Resistance in Corn, Sorghum, and Small grain.
- Variety Testing in Corn and Sorghum for Grain and Forage Production.

Financial Report

Agricultural Science Center Clovis
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 Clovis	ALTERNATIVE FORAGE CROPPING	FORAGE & PERENNIAL CROPPING IN NM		$200,000.00	$2,784.23	$197,215.77	
Ag Science Ctr at Clovis	CIRCLES OF LIVE BUFFER STRIPS TO EN	CIRCLES OF LIVE BUFFER STRIPS TO EN		$447,071.30	$78,773.32	$368,297.98	
Ag Science Ctr at Clovis	COVER CROPS FOR IMPROVING SOIL HEAL	CLOVIS COVER CROP DEMONSTRATION		$158,552.96	$37,550.96	$121,002.00	
Ag Science Ctr at Clovis	CULTIVAR DVLPMNT PROJ GREAT PLAINS	CULTIVAR DEVELOPMENT WINTER		$33,000.00	$0.00	$33,000.00	
Ag Science Ctr at Clovis	DEVELOPMENT AND MANAGEMENT OF CANOL	DEVELOPMENT AND MANAGEMENT OF CANOL		$15,000.00	$4,595.62	$10,404.38	
Ag Science Ctr at Clovis	HATCH FEDERAL APPROPRIATIONS FY 21	CONSERVATION TILLAGE AND COVER S		$29,405.00	$20,908.48	$8,496.52	
Ag Science Ctr at Clovis	IMPROVING SOIL HEALTH AND ECOSYSTEM	IMPROVING SOIL HEALTH AND ECOSYSTEM		$19,431.53	$19,652.94	($221.41)	
Ag Science Ctr at Clovis	IMPROVING SOIL HEALTH AND ECOSYSTEM	CS IMPROVING SOIL HEALTH AND ECOSYS		$49,000.00	$0.00	$49,000.00	
Ag Science Ctr at Clovis	RESTR MAIN CURR USE GIFTS	SORGHUM SMALL PLOT TRIALS		$0.00	$0.00	$0.00	
Ag Science Ctr at Clovis	STRATEGIC TILLAGE MANAGEMENT IN DRY	STRATEGIC TILLAGE MANAGEMENT DRYLAN		$164,814.10	$24,530.44	$140,283.66	
Ag Science Ctr at Clovis	SUSTAINABLE BIOECONOMY FOR ARID REG	SUSTAINABLE BIOECONOMY AR-ANGADI		$81,270.24	$42,142.17	$39,128.07	
Ag Science Ctr at Clovis	SUSTAINABLE BIOECONOMY FOR ARID REG	SUSTAINABLE BIOECON FOR AR-ANGADI		$5,112.93	$1,501.30	$3,611.63	
Ag Science Ctr at Clovis	VALENCIA PEANUT BREEDING YEAR 2021	VALENCIA PEANUT BREEDING FY 2021		$14,766.00	$0.00	$14,766.00	
		Total Restricted Funds		**$1,217,424.06**	**$232,439.46**	**$984,984.60**	
Ag Science Ctr at Clovis	APPLIED CHARGES	IRRIGATION SERVICES ASC CLOVIS	$0.00	$5,500.00	$2,782.16	$2,717.84	($35,793.56)
Ag Science Ctr at Clovis	APPLIED CHARGES	VEHICLE SERVICES ASC CLOVIS	$0.00	$1,200.00	($11,258.90)	$12,458.90	($9,014.39)
Ag Science Ctr at Clovis	APPLIED CHARGES	CLOVIS GREENHOUSE	$0.00	($200.00)	$394.79	($594.79)	($1,476.49)
Ag Science Ctr at Clovis	OTHER SOURCES	IMPROVING GREEN WATER-PARAMVEER S.	$0.00	$6,470.82	$2,396.82	$4,074.00	($4,074.00)
Ag Science Ctr at Clovis	OVERHEAD TRANSFERS	INDIRECT COST RECOVERY-CLOVIS	$0.00	$1,000.00	$78.00	$922.00	($43,270.52)
Ag Science Ctr at Clovis	OVERHEAD TRANSFERS	START-UP ASC CLOVIS R. GHIMIRE	$0.00	$6,056.83	$4,033.78	$2,023.05	$0.00
Ag Science Ctr at Clovis	SALES & SERVICE	CLOVIS ASC SALES	$49,615.11	$10,000.00	$45,950.42	($35,950.42)	($40,919.36)
		Total Sales and Service Funds	**$49,615.11**	**$30,027.65**	**$44,377.07**	**($14,349.42)**	**($134,548.32)**
Ag Science Ctr at Clovis	STATE APPROPRIATIONS	ASC CLOVIS SALARY		$664,200.63	$697,244.75	($33,044.12)	
Ag Science Ctr at Clovis	STATE APPROPRIATIONS	CONSERVATION TILLAGE AND COVER CROP		$88,215.60	$88,215.44	$0.16	
Ag Science Ctr at Clovis	STATE APPROPRIATIONS	CLOVIS ADMIN		$34,125.00	$35,110.34	($985.34)	
Ag Science Ctr at Clovis	STATE APPROPRIATIONS	ENHANCEMENT CLOVIS-ANGADI		$43,000.00	$42,082.90	$917.10	
Ag Science Ctr at Clovis	STATE APPROPRIATIONS	ENHANCEMENT CLOVIS		$57,774.00	$37,273.81	$20,500.19	
Ag Science Ctr at Clovis	STATE APPROPRIATIONS	CLOVIS EXPANSION-DAIRY		$32,000.00	$32,266.91	($266.91)	
Ag Science Ctr at Clovis	STATE APPROPRIATIONS	CLOVIS SB		$14,930.00	$14,781.53	$148.47	
Ag Science Ctr at Clovis	STATE APPROPRIATIONS	ENHANCEMENT CLOVIS-HAGEVOORT		$43,072.00	$41,651.55	$1,420.45	
Ag Science Ctr at Clovis	STATE APPROPRIATIONS	ENHANCEMENT CLOVIS-MARSALIS		$17,000.00	$2,213.75	$14,786.25	
Ag Science Ctr at Clovis	STATE APPROPRIATIONS	ENHANCEMENT CLOVIS-PUPPALA		$43,600.00	$46,927.03	($3,327.03)	
Ag Science Ctr at Clovis	STATE APPROPRIATIONS	ENHANCEMENT CLOVIS-R. GHIMIRE		$17,000.00	$4,653.81	$12,346.19	
		Total State Appropriated Funds		**$1,054,917.23**	**$1,042,421.82**	**$12,495.41**	

2021
RESEARCH RESULTS

ORGANIC MATTER COMPONENTS AND SOIL AGGREGATE SIZE DISTRIBUTION WITH COVER CROP INTEGRATION IN A CROPPING SYSTEM

Investigators: Rajan Ghimire and Vesh R. Thapa, New Mexico State University, Agricultural Science Center, Clovis, NM

PROJECT OVERVIEW

A study was conducted to evaluate the effect of diverse cover crops (single as well as in mixture) on soil organic matter (SOM) components, and other soil health indicators under a limited-irrigation winter wheat (Triticum aestivum L.)-fallow/cover crops-sorghum (Sorghum bicolor L. Moench)-fallow/cover crop rotation. The experiment had three phases of crop rotation, eight treatments, and three replications. The rotation phases were winter wheat, sorghum, and fallow. All phases of the crop rotation were present each year, and cover crops were planted in each fallow period before winter wheat and sorghum. Cover crop treatments were arranged in a randomized complete block design within each rotation phase. Treatments included fallow (no cover crop); three sole cover crops: pea (Pisum sativum L.), oat (Avena sativa L.), and canola (Brassica napus L.); four cover crop mixtures: pea + oat mix, pea + canola mix, pea + oat + canola mix, and a six-species mixture of pea + oat + canola + hairy vetch (Vicia villosa Roth) + forage radish (Raphanus sativus L.) + barley (Hordeum vulgare L.). Cover crops were planted in late February following sorghum harvest in October of the previous year (spring cover crops) and in September (fall cover crops) following the previous year's wheat harvest in June. Irrigation water was applied to cover crops for seed germination only, after which no additional irrigation was applied. Spring cover crops were maintained in plots for three months, and fall cover crops were maintained for seven months before being chemically terminated. The flowering stage of oat was used as a reference to terminate all cover crops. After termination, the cover crop residues were left on the soil surface. Winter wheat was planted in the second week of October using a plot drill at a seeding rate of 55 lbs acre-1 with the drill spacing maintained at 15 inches. Soil fertility management was based on soil test recommendations. Soil samples were collected from 0 to 6-inch depth of all phases of crop rotation during summer (first week of June 2019 and 2020). The fallow plots were considered as a control to compare changes in SOM components and other soil health indicators due to cover cropping. The indicators used to assess soil health included a range of physical, chemical, and microbial/biochemical properties.

MEETING THE NEED OF NEW MEXICANS

Cover crops are not extensively practiced in New Mexico because of the additional costs associated with cover cropping and potential limited impacts on soil health. This study provides a basic understanding of cover cropping practices and their benefits to the soil in dry environments.

IMPACTS

This study revealed the benefits of cover cropping to increase SOM components and overall soil health under limited irrigation winter wheat-sorghum-fallow rotation. Oats and their mixture with other species had higher biomass as a spring cover crop than pea, canola, and PCmix. A mixture of legumes, grasses, and brassicas as cover crops diversifies substrate availability and supports higher microbial activity and nutrient turnover. The SOC and total N sequestration occurred particularly in intermediate-sized aggregates (250 µm–2 mm and 53–250 µm) in this soil. Although not all treatment comparisons were significant in all phases, this study highlighted the potential of integrating cover crops in crop rotations to improve soil health and resilience in semi-arid cropping systems.

Contact: rghimire@nmsu.edu

SORGHUM YIELD RESPONSE TO COVER CROPPING IN A LIMITED-IRRIGATION CONDITION

Investigators: Rajan Ghimire and Vesh R. Thapa, Agricultural Science Center, Clovis, NM 88101, USA

PROJECT OVERVIEW

This project evaluated the response of diverse winter cover crop species and their mixture on subsequent sorghum (Sorghum bicolor L. Moench) yield under limited irrigation in a no-till winter wheat (Triticum aestivum L.)-sorghum-fallow rotation. Cover crops were planted in fallow periods before each winter wheat and sorghum. Cover crop treatments included fallow (no cover crop); three sole cover crops: pea (Pisum sativum L.), oat (Avena sativa L.), and canola (Brassica napus L.); and four cover crop mixtures: pea + oat mix, pea + canola mix, pea + oat + canola mix, and a six-species mixture of pea + oat + canola + hairy vetch (Vicia villosa Roth) + forage radish (Raphanus sativus L.) + barley (Hordeum vulgare L.). Cover crops were planted in the last week of February in a fallow field using a plot drill (Great Plains 3P600, Salina, KS, USA), maintained in plots for three months, and chemically terminated at the flowering stage of oat (85-90 d). After termination, the cover crop residues were left on the soil surface.

Sorghum (cultivar NK 5418) was planted in the first week of June using a no-till drill (John Deere, Moline, IL, USA) at a seeding rate of 50,000 seeds acre-1 with the row spacing maintained at 2.5 ft. All sorghum plots received 86.5 lbs N acre−1 and 13.4 lbs S acre−1 from a mixture of urea, ammonium nitrate, and ammonium thiosulfate in liquid form at the time of planting each year. The experiment was maintained under limited-irrigation conditions, i.e., about 50% of the crop water requirement was applied only at critical growth stages because of limited water available for irrigated crop production. Irrigation water of 155, 125, 142, 138, and 242 mm was applied in 2016, 2017, 2018, 2019, and 2020 respectively. Sorghum was harvested at physiological maturity in the last week of October. Total yield was calculated as head + stalk after adjusting on an oven-dried basis.

MEETING THE NEEDS OF NEW MEXICANS

Cover cropping is not extensively practiced in New Mexico because of the additional costs associated with cover cropping and potential impacts on the subsequent crop yield in water-limited environments.

IMPACTS

The results of this study suggested that short-season spring-planted cover crops could increase soil carbon sequestration with no or low yield penalty to grain sorghum in limited-irrigation conditions. Diverse cover crops had the greatest amount of soil carbon storage, indicating the possibility of increasing sorghum yield by 8–40% in a good rainfall year. This study highlighted the need for maintaining sufficient organic residue cover in the field to enhance microbial activity, increase soil organic carbon (SOC) storage, and sustain crop yields. The detail of this study is available at https://www.mdpi.com/2073-4395/11/4/762

Contact: rghimire@nmsu.edu

COVER CROP EFFECTS ON SOIL WATER IN IRRIGATED SILAGE CORN AND SORGHUM PRODUCTION

Investigators: Rajan Ghimire and Wooiklee S. Paye, Agricultural Science Center, New Mexico State University, Clovis, NM 88101, USA

PROJECT OVERVIEW

A 2-year (2019 and 2020) study was conducted at New Mexico State University Agricultural Science Center in Clovis, NM, to evaluate the effect of winter cover cropping vs. no-cover crop on soil water balance in semi-arid irrigated corn silage production. Treatments consisted of a no-cover control (NCC) and three mixtures of six winter cover crop species. The first mixture consisted of all six species, which included grasses + brassicas + legumes (GBL), the second mixture had grasses + brassicas (GB), and the third mixture had grasses + legumes (GL). The grass species tested were annual ryegrass (Lolium multiflorum) and winter triticale (Triticale hexaploide Lart), brassicas were turnip (Brassicas rapa subsp. L.) and daikon radish (Raphanus sativus mar. Longipinnatus L.), and legumes included Austrian winter pea (Pisum sativum subsp. arvense L.) and berseem clover (Trifolium alexandrinum). All cover crops were planted in September and chemically terminated in April. Corn and sorghum werew planted in May and harvested in September. Soil volumetric water content (VWC) was measured every two weeks during the cover crop phase and weekly during the corn silage phase. The soil water storage (SWS) at each depth was determined by multiplying the VWC by the depth. Total SWS in the 100 cm profile was calculated by summing the SWS of all individual depths. The change in soil water storage (ΔS) was determined by subtracting the soil storage at the end of each phase from the soil water storage at the beginning of that phase. A negative ΔS showed soil water depletion, whereas a positive ΔS showed soil water storage.

MEETING THE NEEDS OF NEW MEXICANS

Water is critical for successful crop production in arid and semi-arid regions. Cover crops use soil moisture and potentially impact the subsequent crop production. Research on cover crop impacts on soil health, water dynamics, and subsequent crop yield will help design sustainable farming systems in New Mexico and rural communities across the world.

IMPACTS

Cover crops need water for their growth. Therefore, the net water balance was negative for all cover crop treatments regardless of the mixtures compared to NCC at the end of cover crop growth phases. However, cover crops also reduced soil temperature, surface residue on the ground conserved moisture during corn growth, and it controlled erosion, ultimately increasing the yield of the subsequent corn crop in the rotation. Corn and sorghum silage production were 9-26% and 18-32% greater, respectively, with cover cropping than without, and no difference in crop rotation-scaled water use. This study suggests the possibility of increasing water use efficiency or water conservation with cover cropping in semi-arid irrigated agroecosystems.

Contact: rghimire@nmsu.edu

GREENHOUSE GAS BALANCE OF SEMI-ARID IRRIGATED CROPPING SYSTEMS

Investigators: Rajan Ghimire and Pramod Acharya, New Mexico State University Agricultural Science Center, Clovis, NM, USA

PROJECT OVERVIEW

This study was designed to study soil organic matter and nitrogen loss as CO2 and N2O emissions and the net global warming potential of irrigated forage corn (Zea mays L.) and sorghum [Sorghum bicolor (L.) Moench] in rotation. Treatments compared were cover crop mixtures of grasses, brassicas, and legumes (GBL), grasses and brassicas (GB), grasses and legumes (GL), and a fallow (no cover crop, NCC). Grasses included annual ryegrass and winter triticale, brassicas included turnip and daikon radish, and legumes included pea and berseem clover. Cover crops were planted each year in mid-September and terminated by using a mixture of chemical herbicides in April. Cash crops, forage corn and sorghum, were planted in mid-May, about three weeks after cover crop termination, and harvested in September each year. CO2 and N2O emissions were monitored once a week during the cash crop growth phase (June to September) and once every two to four weeks during the cover crop phase (October to May). CO2 fluxes were measured by using Environmental Gas Monitoring System (EGM-5) portable CO2 gas analyzer (PP Systems, Amesbury, MA, USA). The soil respiration chamber was connected to the EGM-5 analyzer on top of PVC rings for 200 seconds in each plot, and accumulated CO2 gas was recorded. Aliquots of air entering the CO2 analyzer passed through a MIRA Pico Laser Analyzer (Aeris Technologies, Hayward, CA, USA) to determine N2O emissions. The CO2 eq. of farm operations and farm inputs were calculated using literature values. A conversion factor of 310 was used to estimate the CO2 equivalent of N2O emission.

MEETING THE NEEDS OF NEW MEXICANS

Increased global warming and climate change have severely impacted rural communities in New Mexico and across the arid/semi-arid southwest. The agriculture sector is one of the major contributors to global warming through greenhouse gas emissions, but our farmers and ranchers are unaware of management systems that contribute to global warming and other practices that improve the soil while reducing greenhouse gas emissions.

IMPACTS

Soil and environmental factors (soil and air temperature and moisture) affected the relative impact of cropping practices on CO2 and N2O emissions. Improving SOC storage while maintaining greenhouse gas emissions to the same level could improve efficiency while lowering the net environmental footprint of a farming system. This study suggested that adopting cover cropping and no-tillage management could maintain soil health and support forage producers by increasing the farm profitability through increased forage yield. The findings from this study could be implemented in the entire arid and semi-arid regions across the world, facing challenges due to soil degradation and dry climate.

Contact: rghimire@nmsu.edu

ORGANIC SEED TREATMENT STUDY IN VALENCIA PEANUT

Investigators: M. Ojha and N. Puppala

OBJECTIVE

To evaluate commercially available organic seed treatments on peanut yield and grade.

MEETING THE NEEDS OF NEW MEXICANS

Organic peanut growers can benefit from the seed treatment studies that will help in reducing the stand establishment due to fungal seedling diseases.

IMPACTS

- Can benefit from yield gains and grade
- Lower production cost due to early stand establishment and lesser weed competition
- Greater net returns
- Environmentally safe with no pesticides and chemicals

VALENCIA PEANUT BREEDING – ADVANCED BREEDING LINES

Investigators: N. Puppala1 and M. Ojha

OBJECTIVE

To develop a variety that can yield high, produce three or more kernels per pod, resistant to diseases, maintain red skin and taste of Valencia with high oleic chemistry.

MEETING THE NEEDS OF NEW MEXICANS

Superior varieties will help the growers benefit from high yields, high oleic peanuts which will help in longer shelf life, disease resistance and good nutritional qualities

IMPACTS

- Can benefit from yield gains and grade
- Lower production cost
- High oleic peanuts will help longer shelf life
- Good nutritional qualities

PERFORMANCE OF VALENCIA PEANUT VARIETIES

Investigators: N. Puppala1 and M. Ojha

OBJECTIVE

To evaluate Valencia peanut varieties that are commercially grown in eastern New Mexico and west Texas for pod yield and grade

MEETING THE NEEDS OF NEW MEXICANS

Superior varieties will help the growers benefit from high yields, high oleic peanuts which will help in longer shelf life, disease resistance and good nutritional qualities

IMPACTS

- Can benefit from yield gains and grade
- Lower production cost due to high yielding disease resistant varieties
- High oleic peanuts will help longer shelf life
- Good nutritional qualities

SCREENING OF VALENCIA PEANUT LINES FOR DROUGHT TOLERANCE

Investigators: N. Puppala1 and M. Ojha

OBJECTIVE

To screen advanced breeding lines of Valencia peanut for drought tolerance in eastern New Mexico and west Texas.

MEETING THE NEEDS OF NEW MEXICANS

Drought-tolerant varieties will help the growers conserve water by having a lower transpiration rate as the soil gets drier.

IMPACTS

- Can benefit by growing drought-tolerant varieties and helps in conserving the water for later growing season if the drought gets worse.
- Risk from aflatoxin can be reduced due to more water-use efficient peanut

COTTON VARIETY TRIAL

Investigators: N. Puppala1, M. Ojha and A. Scott

OBJECTIVE

To evaluate nine commercial cotton varieties suitable for eastern New Mexico

MEETING THE NEEDS OF NEW MEXICANS

The results from this trial will help the growers to decide which varieties perform better under Clovis and surrounding areas for yield and grade.

IMPACTS

- Can benefit a grower to select high yielding variety of cotton based on the traits of interest.

CIRCULAR BUFFER STRIPS (CBS) OF NATIVE PERENNIAL GRASSES IN A CENTER PIVOT

Investigators: Sangu Angadi, Paramveer Singh, Mallory Nielson, Rajan Ghimire, John Idowu and Ram Acharya

PROJECT OVERVIEW

Degrading ecosystem services under declining irrigation water resources and increasingly variable climate are threatening sustainability of Ogallala Aquifer irrigated agriculture in the Southern Great Plains. Decreasing well outputs have created partial pivots in the region, where part of the pivot is used for rainfed or minimally irrigated crops. In this USDA-NIFA funded project, we are evaluating novel concept of rearranging rainfed part of the pivot in the form of concentric circles of grass buffers alternating with crop strips to offer multiple benefits to the systems. Planting buffers with mixture of native cool and warm season grass species brings the system closure to natural grass prairie, which was resilient and sustainable for a long period of time. Even with relatively short, 4-5 ft tall grasses, the design allows to spread most benefits on the entire pivot, which is not possible with a line of tall tree rows growing on one side of the field.

MEETING THE NEEDS OF NEW MEXICANS

This project will address major challenges faced by farmers in New Mexico including declining water resources, climate change, loss of natural resources, degrading soil health, carbon sequestration and biodiversity.

IMPACTS

- Improve water conservation, water use efficiency and reduce water extracted for irrigation and sustain irrigation water resources
- Improve crop microclimate, productivity, resource use efficiency and climate resiliency of production agriculture in the region
- Reduce input use, greenhouse gas emissions and sequester carbon
- Improve biodiversity (plants, birds, insects, and microbes)

EFFECT OF DIFFERENT IRRIGATION AND FERTILITY ON GUAR PERFORMANCE

Investigators: Sangu Angadi, Mallory Nielson, and John Idowu

PROJECT OVERVIEW

Declining irrigation resources and increasing climatic uncertainty are compelling researchers to look for low water using, heat and water stress tolerant alternative crops for the region. Guar is a drought tolerant, legume crop that is native to semi-arid and arid regions of Pakistan and India. To improve productivity and adoption of guar in New Mexico, three diverse guar cultivars were evaluated under four different fertility and two different irrigation strategies.

MEETING THE NEEDS OF NEW MEXICANS

The US is one of the major importers of guar gum across the globe. Demand continues to increase due to unique properties of guar gum, which is used in many industries including oil and natural gas for fracking, food, cosmetics, and paper and textiles. Developing guar as an alternative crop will create an opportunity to grow a desert adopted crop in New Mexico with minimum inputs and supply locally sourced gum for industries in the region.

IMPACTS

Increasing fertility and water availability had a limited benefit to guar in semiarid environment of New Mexico. In spite of deep root system, guar biomass production benefited from in season irrigation. Guar responded to application of fertilizer over control, but fertility levels had no effect. Matador had the highest biomass production among guar cultivars. Seed yield also followed trend similar to biomass. This suggests that guar will be a crop for arid and semiarid regions line New Mexico, it will not benefit from higher resources availability like in Midwest or other higher rainfall regions.

DEVELOPING WINTER CANOLA AS A LOW INPUT ALTERNATIVE CROP FOR THE REGION

Investigators: Sangu Angadi, Mallory Nielson, and Paramveer Singh

PROJECT OVERVIEW

Lack of good rotation, declining irrigation resources and increasing climatic uncertainty are creating an opportunity to assess winter canola as an alternative crops for the region. It is a tap rooted broad leaf crop that has herbicide tolerance technologies incorporated. Canola oil is becoming an important edible oil in the country and protein rich canola meal, a byproduct after oil is extracted, is a valuable supplement for cattle industry. Our research has also shown forage potential of canola. Canola, especially winter types, are relatively new in the US. Better adopted and higher yielding cultivars are needed to expand canola industry. More recently, with involvement of European companies, canola hybrids are being introduced into the country. Therefore, research is needed to evaluate new cultivars that are being developed.

MEETING THE NEEDS OF NEW MEXICANS

Developing winter canola will have many benefits to both annual crop and cattle industry. As a rotational crop, it will make a wheat farmer a better wheat farmer, as he cleans his field of grassy weeds (with herbicide tolerance technology) and improves resource use efficiency. In addition to edible oil, the seed meal is a highly sought out supplement for cattle industry in the state and is currently imported from Canada.

IMPACTS

This will be a low input, rotational crop. Provides a major tool in controlling grassy weeds in winter wheat based rotation. Cattle industry in the region needs protein supplement, growing canola locally will produce canola seed meal protein supplement locally for our large cattle industry.

PROVIDING THE NEXT GENERATION WITH DAIRY EDUCATIONAL OPPORTUNITIES:

THE U.S. DAIRY EDUCATION & TRAINING CONSORTIUM

ISSUE: New Mexico dairies are the largest in the nation with an average herd size of 2,300 cows, more than ten times the average U.S. herd size (app. 223 cows). NM dairy owners employ approximately 1 employee/100 cows: predominantly hired, immigrant labor with limited experience in working in agriculture. Dairying is vastly becoming a highly technical, highly automated industry characterized by extended periods of very low margins. Highly skilled and technically proficient labor is an absolute must for optimal performance. However, limited educational opportunities exist for training and educating the ***next generation of owners, managers, and employees*** to prepare and refine a skilled and able dairy workforce to continue to provide wholesome dairy products for New Mexico, the nation, and the world, while sustainably managing animals, employees, and the environment.

WHAT HAS BEEN DONE: Given the unlikelihood of re-establishing an on-campus dairy herd for training and education, NMSU Dairy Extension established in 2008 the U.S. Dairy Education and Training Consortium (USDETC) together with the Univ. of Arizona and Texas A&M Univ. The USDETC, located in Clovis, NM utilizes Clovis Community College facilities and commercial dairy operations in the New Mexico and Texas border region to teach the next generation of dairy owners and managers during a 6-week, hands-on, capstone summer class advanced dairy herd management (ANSC 468). Students are instructed by leading faculty in the nation. The program is an intensive combination of classroom instruction, laboratory training, on-farm practice, and allied industry input. Many of the students leave Clovis with internships and job opportunities in hand. Area dairy producers, central to the success of the program, fully recognize and support the unique value, freely allowing students access and insight into their operations.

REACH: Reach of the program in 11 years: 498 students from 51 different universities. A survey of former students was conducted in 2017 to determine the impact of the consortium on their careers (62% response rate). Of the 213 respondents, 99 were currently still enrolled at a university, 111 were employed and 3 were not employed. Of the students enrolled at a university 37% were undergraduate students, 30% were working towards advanced degrees and 30% were obtaining a veterinary degree. Of those employed, 87 students had obtained a BS, while 11 completed their MS, 2 students were Ph.D.'s and 9 students had graduated with a DVM degree. Key finding: of the students who had entered the job market 34% had found employment on a dairy, 33% were employed in a dairy-related position (allied industry), 5% were in a non-dairy livestock position, 6% were in a non-dairy ag position and 21% were employed outside of agriculture. In short: 4 out of 5 former USDETC students are employed in agriculture, 2 out of 3 students are employed in the dairy industry, and 1 out of 3 students are working on, or managing a dairy.

IMPACT: When asked "What impact attending the consortium had on their current status", 92% replied important, very important, or extremely important. When asked about the impact the classes and experiential learning experiences had on their course work and subsequent careers, 44% replied extremely helpful, 35% very helpful and 15% helpful. When asked to rank the consortium classes as compared to other courses taken, 55% gave the consortium an A+ and 36% an A. When asked for comments, the hands-on experience and access to exceptional faculty were the student's main responses. In short: the USDETC has proven to be a positive alternative or complementary education opportunity for students who do not or have limited access to dairy courses or the related experiential learning experiences at their home universities.

NEXT: with the Dairy Consortium as a capstone dairy course, NMSU's College of Agricultural, Consumer and Environmental Sciences in June of 2017 reinstated an undergraduate minor in Dairy Science. As the Dairy Consortium continues to grow, expansion opportunities are being considered in addition to the open-lots of the Southwest, adding learning experiences in the barns of the Midwest and the free-stall operations of the West. All to provide the next generation of dairy owners and managers with excellent educational opportunities.

2021 GOALS & OBJECTIVES ACCOMPLISHMENTS SUMMARY

Investigators: G. Robert Hagevoort

MAJOR PROGRAM GOALS: DAIRY CONSORTIUM

USDETC: 2021 program adjusted in size and scope due to COVID receiving 35 students for 4 weeks instead of the normal 55-60 students for 6 weeks. This increases the total accomplishments to 560 students from 57 US Universities in 13 years (no program in 2020 due to COVID).

Junior Consortium: advisory role on the foundational committee and support with spring and fall program for Highschool students attending field days organized by dairymen in West Texas and Central Texas. Two programs were conducted in 2021(April, October). Structural meeting in January 2022 to determine the structure of the organization. Polled interest with New Mexico High Schools: working with Curry and Roosevelt County extension to replicate the program in 2022 New Mexico.

MAJOR PROGRAM GOALS: DAIRY WORKFORCE DEVELOPMENT

Training video development: Feeds & Feeding was developed with Diamond V released in March of 2020 at the HPDC. Maternity & Calf Care – Worker Safety was developed with IDA and released in the summer of 2021. Fitness for Transport is developed with NMPF FARM and Elanco, to be released at the 2022 HPDC.

On dairy training efforts: due to COVID and restrictions on in-person programming on-dairy activities have been delayed and are considered for 2022.

Extension programs/activities

Extension Agent Dairy Training: conducted agent dairy training October 27-29, 2021 (canceled twice in 2020 due to COVID), and 30 agents from TX (15) and NM (15) attended. The two-day program included updates on the dairy industry, crop, soil health, and water updates from TX and NM researchers, hands-on training on dairy safety, and calving management, media training, and two dairy tours.

PFOS/PFAO dairies: this issue set idle for the better part of 2 years but with recent action through the Defense bill and designation by EPA of PFOS sites under CERCLA, in September and October Highland Dairy was advised to prepare a Disposal and Depopulation Plan for submission to NMED, NRCS, NMLB for approval. I was asked to write the pieces as they relate to the actual depopulation and disposal plan. The plan is now under consideration by the agencies.

COVID-19 in the US Dairy Industry: Development, Delivery and Evaluation of Training Resources for Producers and Workers": project pivoted twice due to the rapidly developing nature of the pandemic.

1. 2020: Delivering COVID-19 training resources to dairy producers and workers (September-December 2020)
- Impact report: August 2020: NMSU CES *Program Highlights and Impacts*, page 3
2. 2021: Delivering Vaccine information and resources to dairy producers and workers (January-September 2021)
- First in West-Texas and later in New Mexico a well-functioning working relationship was developed with the respective Departments of Health (regional in TX, centralized in NM), as the departments realized that without a bridge to trusted local sources such as Cooperative Extension it was challenging to reach rural communities and within those communities the vulnerable populations, mostly agricultural workers without legal status.
- This is the time where the team developed a second set of educational video products in English, Spanish, and K'iche (COVID19 vaccine frequently asked questions), which was loaded onto iPads and is also available directly online (see products below).
- During the months of April-June, several combined education/vaccination clinics on dairy farms were conducted with the assistance of NMSU Dairy Extension both in West Texas and New Mexico as well as a week-long educational campaign in Idaho. New Mexico numbers are as follows:
- By the time the NMDOH was fully engaged in this process, the window of opportunity was slowly closing due to many of the farmworkers receiving vaccinations at other events. Producers who earlier had requested training/vaccination clinics did no longer have a need.
- Due to the surge of the Delta variant in July/August, there was increased interest for more farm education/vaccination clinics, however, NMDOH now has difficulty manning clinics due to the ongoing RN shortage.

- NMSU Dairy Extension has actively participated in training/vaccination clinics on 2 large New Mexico dairy farms in 2 different counties. As a result of our collaboration with NMDOH, we were able to facilitate an event at Southwest Cheese, the largest cheese plant in North America with an estimated number of employees between 300-400.
- It is difficult to estimate how many farms and farmworkers may have accessed and viewed the educational material made available online at work as part of on-farm training and education or privately.
- At the time of this writing October 2021(Year 1 - progress report) and signs of the waning of the Delta variant, the interest for on-farm clinics will likely subside for now, much like it did when COVID cases subsided in the early summer months (May/June).
- This may be a second time in the duration of this 2-year project, where the team may have to pivot to address emerging needs of producers related to the health and wellbeing of workers, which includes COVID prevention in the workplace, and could be presented in a bigger picture of preventative healthcare for dairy and ag workers.
- As a result of the outcomes of this project many producers have now a very positive opinion about collaborating with this CES/DOH model and have expressed interest in a continuing service providing general preventative health care regarding the prevention of the transmission of respiratory diseases (e.g., COVID-19, tuberculosis, influenza) not only on the farm but also at home, under the banner of Healthy at Home and Work.
- Influenced by the success of the current project providing critical healthcare education to difficult to reach populations, NMSU Cooperative Extension was successful in entering a new partnership with the CDC. This system-wide engagement is with the CDC's *Vaccinate with Confidence* communication campaign (https://pages.extension.org/excite). NMSU Extension was awarded funding in July of 2021 to promote the uptake of COVID-19 vaccinations through relevant messaging and innovative models for community action. The priority audience is rural and other hard-to-reach audiences.
- Additional references and program highlights:
- May 29, 2021, Las Cruces Sun: NMSU's Cooperative Extension, NM Department of Health offer mobile vaccination clinics
- June 1, 2021, NMSU News Release: NMSU's Cooperative Extension, New Mexico Department of Health offer mobile vaccination clinics
    - May 29, 2021, Las Cruces Sun: NMSU's Cooperative Extension, NM Department of Health offer mobile vaccination clinics
    - June 1, 2021, NMSU News Release: NMSU's Cooperative Extension, New Mexico Department of Health offer mobile vaccination clinics

1. 2021: Translation of training materials into K'iche: products

- 3 translated vignettes (January 2021) – Training Resources for Dairy Farm Workers
- 2 additional translated vignettes (June 2021) – COVID19 vaccine frequently asked questions
- Available on the following websites and linked websites:

    UT Health Dairy Farm Safety website

    NMSU Dairy Extension website

    NMSU College of Agriculture Consumer and Environmental Sciences website

- In addition, the videos have been downloaded onto 20 NMSU dairy Extension iPads for on dairy in-person training and are available to the user as a menu option in English, Spanish and K'iche.

1. 2022: year 2 of the project is still on hold: COVID may tell us what to do, otherwise general dairy worker health education will be the go-to route.

JOURNAL PAPERS 2021

- Paye, W., Begna, S., Ghimire, R., Angadi, S., Singh, P., Umesh, M.R, Darapuneni, M. K. 2021. Winter canola yield and nitrogen use efficiency in a semiarid irrigated condition. Agronomy Journal. 113:2053–2067. https://doi.org/10.1002/agj2.20611
- Begna S., S. Angadi, A. Mesbah, M. Umesh and M. Stamm. 2021. Forage Yield and Quality of Winter Canola–Pea Mixed Cropping System. Sustainability 13(4)2122. https://doi.org/10.3390/su13042122
- Summers H.M., E. Sproul, C. Seavert, S. Angadi, J. Robbs, S. Khanal, P Gutierrez, T. Teegerstrom, D.A. Zuniga Vazquez, N. Fan and J. Quinn. 2021. Economic and environmental analyses of incorporating guar into the American southwest. Agricultural Systems. 191: 103146. https://doi.org/10.1016/j.agsy.2021.103146
- Stamm M., R. Aiken., S. Angadi., J. Domicone, S. Dooley, J. Holman, J. Johnson, E. Kimura, K. Larson, J. Lofton, and D. Santra. 2021. Registration of KS4719' winter canola. J. Plant Registration. 2021:1-5. (https://doi.org/10.1002/plr2.2017)
- Singh, M., Singh, P., Singh, S., R. Saini, S. Angadi. Quantitative analyses of effects of deficit irrigation levels on yield and water productivity of vegetable crops. Nature Scientific Reports. 11:22095 (https://doi.org/10.1038/s41598-021-01433-w).
- Angadi S.V., Umesh, M.R., S. Begna, and P. Gowda. 2022. Light interception, agronomic performance, and nutritive quality of annual forage legumes as affected by shade. Field Crops Research. 275:108358 (https://doi.org/10.1016/j.fcr.2021.108358)
- Singh P, S.B. Begna, M. Stamm, D. VanLeeuwen, B. Schutte and S.V. Angadi. 2021. Seasonal Growth and Seed Yield of Winter Canola (Brassica napus L.) under Different Irrigation Strategies. Agronomy Journal (In review)
- Sainju, U.M., S. Dangi, D. Liptzin, and R. Ghimire. Relationship between soil organic matter, soil properties, and dryland crop yields. Agronomy Journal. DOI: 10.1002/agj2.20938.
- **Paye, W.S., R. Ghimire†, P. Acharya, A. Nilahyane, and A. Mesbah. 2022. Cover crop water use and corn silage production in semiarid irrigated conditions. Agricultural Water Management. 260:107275, https://doi.org/10.1016/j.agwat.2021.107275.
- Thapa V.R.*, R. Ghimire**, D. VanLeeuwen, V. Acosta-Martinez, and M.K. Shukla. 2022. Response of soil organic matter to cover cropping in water-limited environments. Geoderma, https://doi.org/10.1016/j.geoderma.2021.115497.
- Thapa, S., A. Bhandari, R. Ghimire, Q. Xue, F. Kidwaro, S. Ghatrehsamani, B. Maharjan, and M. Goodwin. 2021. Managing micronutrients for improving soil fertility, health, and soybean yield. Sustainability. 13: 11766. https://doi.org/10.3390/su132111766.
- Joshi, D., R. Ghimire, T.P. Kharel, U. Mishra, and S. Clay. 2021. Conservation agriculture for food security and climate change resilience in Nepal. Agronomy Journal. https://doi.org/10.1002/agj2.20830
- Sainju, U., D. Liptzin, S. Dangi, and R. Ghimire. 2021. Soil health indicators and wheat yield in response to long-term cropping sequence and nitrogen fertilization. Applied Soil Ecology. https://doi.org/10.1016/j.apsoil.2021.104182
- Obour, A., L. Simon, M. Schipanski, J. Holman, P. Carr, S. Fonte, R. Ghimire, N. Thandi, and H. Blanco-Canqui. 2021. Cover crops to improve soil and crop productivity in the US Semi-arid Great Plains. Agronomy Journal. https://doi.org/10.1002/agj2.20855.
- Wang, J., Zhang, S., U.M. Sainju, R. Ghimire, I. Muhammad, F. Zhao. 2021. A meta-analysis on cover crop impact on soil water storage, succeeding crop yield, and water-use efficiency. Agricultural Water Management. 256: 107085, https://doi.org/10.1016/j.agwat.2021.107085
- Ghimire, R.**, M.N. Parajulee, P. Acharya*, D. Dhakal, A. Hakeem, and K. Lewis. 2021. Residual soil nitrogen dynamics and soil acidification in continuous cotton production. Agricultural and Environmental Letters, https://doi.org/10.1002/ael2.20048.
- Thapa, V.R.*, R. Ghimire**, and M. Marsalis. 2021. Cover crops for the resilience of a limited-irrigation winter wheat-sorghum-fallow rotation: soil carbon, nitrogen and sorghum yield responses. Agronomy, https://doi.org/10.3390/agronomy11040762.
- Wang, J., Fu, X., R. Ghimire, U.M. Sainju, Y. Jia, and F. Zhao. 2021. Responses of soil carbon, nitrogen, enzyme, and bacteria to long-term fertilization. Applied Soil Ecology. https://doi.org/10.1016/j.apsoil.2021.103992.
- Sainju, U., R. Ghimire, and S. Dangi. 2021. Soil carbon dioxide and methane emissions and carbon balance with crop rotation and nitrogen fertilization. The Science of Total Environment. https://doi.org/10.1016/j.scitotenv.2021.145902.
- Paye, W., S. Begna, R. Ghimire**, S.V. Angadi, P. Singh*, M.R. Umesh, and M. Darapuneni. 2021. Winter canola yield and nitrogen use efficiency in a semiarid irrigated condition. Agronomy Journal. https://doi.org/10.1002/agj2.20611
- *Thapa, V.R., R. Ghimire**, V. Acosta-Martinez, M. Marsalis, and M. Schipanski. 2021. Cover crop effects on soil microbial community structure and enzyme activities. Applied Soil Ecology. https://doi.org/10.1016/j.apsoil.2020.103735.

- Joshi, D., R. Ghimire, T.P. Kharel, U. Mishra, and S. Clay. 2021. Conservation agriculture for food security and climate change resilience in Nepal. Agronomy Journal. https://doi.org/10.1002/agj2.20830
- Sainju, U., D. Liptzin, S. Dangi, and R. Ghimire. 2021. Soil health indicators and wheat yield in response to long-term cropping sequence and nitrogen fertilization. Applied Soil Ecology. https://doi.org/10.1016/j.apsoil.2021.104182
- Obour, A., L. Simon, M. Schipanski, J. Holman, P. Carr, S. Fonte, R. Ghimire, N. Thandi, and H. Blanco-Canqui. 2021. Cover crops to improve soil and crop productivity in the US Semi-arid Great Plains. Agronomy Journal. https://doi.org/10.1002/agj2.20855.
- Wang, J., Zhang, S., U.M. Sainju, R. Ghimire, I. Muhammad, F. Zhao. 2021. A meta-analysis on cover crop impact on soil water storage, succeeding crop yield, and water-use efficiency. Agricultural Water Management. 256: 107085, https://doi.org/10.1016/j.agwat.2021.107085
- Ghimire, R.**, M.N. Parajulee, P. Acharya*, D. Dhakal, A. Hakeem, and K. Lewis. 2021. Residual soil nitrogen dynamics and soil acidification in continuous cotton production. Agricultural and Environmental Letters, https://doi.org/10.1002/ael2.20048.
- Thapa, V.R.*, R. Ghimire**, and M. Marsalis. 2021. Cover crops for the resilience of a limited-irrigation winter wheat-sorghum-fallow rotation: soil carbon, nitrogen and sorghum yield responses. Agronomy, https://doi.org/10.3390/agronomy11040762.
- Wang, J., Fu, X., R. Ghimire, U.M. Sainju, Y. Jia, and F. Zhao. 2021. Responses of soil carbon, nitrogen, enzyme, and bacteria to long-term fertilization. Applied Soil Ecology. https://doi.org/10.1016/j.apsoil.2021.103992.
- Sainju, U., R. Ghimire, and S. Dangi. 2021. Soil carbon dioxide and methane emissions and carbon balance with crop rotation and nitrogen fertilization. The Science of Total Environment. https://doi.org/10.1016/j.scitotenv.2021.145902.
- Paye, W., S. Begna, R. Ghimire**, S.V. Angadi, P. Singh*, M.R. Umesh, and M. Darapuneni. 2021. Winter canola yield and nitrogen use efficiency in a semiarid irrigated condition. Agronomy Journal. https://doi.org/10.1002/agj2.20611
- *Thapa, V.R., R. Ghimire**, V. Acosta-Martinez, M. Marsalis, and M. Schipanski. 2021. Cover crop effects on soil microbial community structure and enzyme activities. Applied Soil Ecology. https://doi.org/10.1016/j.apsoil.2020.103735.
- Djaman, K., S. Allen, D.S. Djaman, K. Koudahe, S. Irmak, N. Puppala, M.K. Darapuneni and S.V. Angadi. 2021. Planting date and plant density effects on maize growth, yield, and water use efficiency. Environmental Challenges 6. DOI: 10.1016/j.envc.2021.100417
- Nayak, S.N., B. Aravind, S.S. Malvalli, B.S. Sukanth, R. Poornima, P. Bharati, K. Hefferon, C.Kole, and N. Puppala. 2021. Omics technologies to enhance plant-based functional foods an Overview. Frontiers in Genetics.
- Okello, D.K., M. Deom and N.Puppala. 2021. Registration of Naronut 2T. J. Plant Regist.2021;15:62–67. DOI: 10.1002/plr2.20086
- Haydee E.L, J. T.Baker, C.Yates, J. R.Mahan, M. D.Burow, N. Puppala, D. C.Gitz III, Y. Y. Emendack, N. Layland, G. L.Ritchie, J. Chen, David T.Tissue and P. R.Payton. 2021. Effect of elevated CO2 on peanut performance in a semi-arid production region. Agricultural and Forest Meteorology. Vol 308-309. DOI: 10.1016/j.agrformet.2021.108599

BOOK CHAPTERS

- Sainju, U., R. Ghimire, and J. Wang. 2022. Soil organic carbon, crop yield, and quality responses of cover cropping: a review. Advances in Soil Science Special Issue: Soil Organic Carbon and Feeding the Future – Crop Yield and Nutritional Quality (In Press).
- Ghimire, R., P. Bista, and S. Machado. 2022. Crop yield limitation by soil organic matter decline: a case study from the US Pacific Northwest. In: Saljnikov E., Mueller L., Lavrishchev A., Eulenstein F. (eds) Advances in Understanding Soil Degradation. Innovations in Landscape Research. Springer, Cham. https://doi.org/10.1007/978-3-030-85682-3_27.
- Ghimire R., V.R. Thapa, P. Acharya, J. Wang, and U.M. Sainju. 2021. Soil indicators and management strategies for environmental sustainability. In: Rakshit, A., Singh, S.K., Abhilash, P.C., Biswas, A. (Eds.). Soil Science: Fundamentals to Recent Advances. ISBN 978-981-16-0917-6

CONFERENCE PRESENTATIONS:

- Singh, P., S.V. Angadi, S. Begna, D. Dubois, R. Ghimire, O.J. Idowu and R. Lascano. 2021. Concept of Circular Buffer Strips of Native Perennial Grasses to Sustain Ogallala Aquifer. AGU International Annual Meeting, AGU, New Orleans, LA, Scope: International. (December 12-17, 2021).

- Angadi, S. 2021. Water Management in Stress Prone Environments: Lessons from New Mexico. Managing Nature's Resources in Organic Cropping Systems under Water-Limited Conditions Webinar Series (Virtual). Manitoba Organic Alliance (manitobaorganicalliance.com) Scope: International. (November 2021).

- Angadi, S., Singh, J., Sigh P., S. Begna., Gowda, P., I. Guzman., and Idowu, O. J. 2021. 2021 ASA-CSSA-SSSA International Annual Meeting, ASA-CSSA-SSSA Societies, Salt Lake City, UT, "Reducing Irrigation Water Use By Desert Crop Guar Using Deficit Irrigation Strategies", Scope: International. (November 2021).

- Singh P., S. Angadi, D. Dubois, R. Ghimire and O.J. Idowu. 2021. 2021 ASA-CSSA-SSSA International Annual Meeting, ASA-CSSA-SSSA Societies, Salt Lake City, UT, " Simple Design of Circular Grass Buffer Strips Enhances Water Productivity of Center Pivot Production Systems", Scope: International. (November 2021).

- Sapkota S., R Ghimire., Angadi, S. and Idowu, O. J. 2021. 2021 ASA-CSSA-SSSA International Annual Meeting, ASA-CSSA-SSSA Societies, Salt Lake City, UT, " Soil Carbon and Nitrogen Components Under Grass Buffer Strips and Adjacent Corn Strips in a Semi-Arid Irrigated Corn Production System", Scope: International. (November 2021).

- Pruitt D.J., M.N. Omer, O. J. Idowu, S. Sanogo, and S. Angadi. 2021. 2021 ASA-CSSA-SSSA International Annual Meeting, ASA-CSSA-SSSA Societies, Salt Lake City, UT, " Soil Carbon and Nitrogen Components Under Grass Buffer Strips and Adjacent Corn Strips in a Semi-Arid Irrigated Corn Production System", Scope: International. (November 2021).

- Singh P., S. Angadi, O.J. Idowu, C.E. Brewer, S.P. Chavaria, and C.J. Knox. 2021. 2021 ASA-CSSA-SSSA International Annual Meeting, ASA-CSSA-SSSA Societies, Salt Lake City, UT, " Graduate Fellows As Conduits to Sustainability Education in Middle School and Youth Settings: Communicating Science with Cultural and Community Relevancy", Scope: International. (November 2021).

- Singh, P., S.V. Angadi, R. Lascano, S. Begna, D. Dubois, R. Ghimire, and O.J. Idowu. 2021. Native Perennial Grasses as Circular Buffer Strips Improves Green Water Use Proportion in a Center Pivot Irrigation System. Soil and Water Conservation Society Annual Meeting (Virtual), Scope: International. (Jul 26-28, 2021) (First Prize Oral).

- Singh, P., S.V. Angadi, D. Dubois, R. Ghimire, O.J. Idowu and S. Begna. 2021. Simple Design of Circular Buffer Strips Enhances Productivity of Irrigated Center Pivot Production Systems. Western Society of Crop Science Annual Meeting (Virtual), Scope: Regional. (June 22-23, 2021) (First Prize Oral).

- Angadi, S., J. Singh, S. Begna and P. Singh. 2021. Deficit Irrigation Strategies to Fit Desert Crop 'Guar' in the Cropping Systems of Southern High Plains. 2021 Virtual UCOWR/NIWR Annual Water Resources Conference. Scope: International. (June 8-10, 2021).

- Singh, P., S.V. Angadi, D. Dubois, R. Ghimire, O.J. Idowu and S. Begna. 2021. Sustaining Ogallala Aquifer with Circular Buffer Strips of Native Perennial Grasses. The International Arid Lands Consortium Virtual Conference. Scope: International. (May 24-26, 2021) (Honorable Mention).

- Strategies for soil health and carbon management in semi-arid environments. Symposium on Continuing the Legacy of Cynthia Cambardella: Soil Health As the Cornerstone of Organic Agriculture, Salt Lake City, UT, November 2021.

- Omer, M.N., O.J. Idowu, R. Ghimire, S. Sapkota, and N. Pietrasiak. 2021. Variability of Soil Quality Measurements across a Field Under Alfalfa Production. ASA-CSSA-SSSA International Annual Meeting, Salt Lake City, UT.

- Thapa V.R., R. Ghimire, and W.S. Paye. 2021. Soil organic carbon and nitrogen responses to strategic tillage management in semiarid drylands. ASA-CSSA-SSSA International Annual Meeting, Salt Lake City, UT.

- Sapkota, S., R. Ghimire, S. Angadi, and O.J. Idowu. 2021. Soil carbon and nitrogen components under grass buffer strips and adjacent corn strips in a semi-arid irrigated corn production system. ASA-CSSA-SSSA International Annual Meeting, Salt Lake City, UT.

- Singh, P., S.V. Angadi, D. DuBois, O.J. Idowu, R. Ghimire, and S. Begna. 2021. The simple design of circular grass buffer strips enhances water productivity of center pivot production systems. ASA-CSSA-SSSA International Annual Meeting, Salt Lake City, UT.

- Acharya P. and R. Ghimire. 2021. Selected soil health indicators at cover crop termination in an irrigated forage corn-sorghum rotation. ASA-CSSA-SSSA International Annual Meeting, Salt Lake City, UT.

- Singh, P., S.V. Angadi, D. DuBois, O.J. Idowu, R. Ghimire, and S. Begna. 2021. Physiological response of irrigated corn with and without circular buffer strips of native perennial grasses. ASA-CSSA-SSSA International Annual Meeting, Salt Lake City, UT.

- Singh, P., S.V. Angadi, D. DuBois, O.J. Idowu, R. Ghimire, and S. Begna. 2021. Native perennial grasses as circular buffer strips enhance productivity of irrigated center pivot production systems. ASA-CSSA-SSSA International Annual Meeting, Salt Lake City, UT.

- Khadka-Mishra, S. and R. Ghimire. 2021. The benefits of carbon-farming and the status of carbon market. ASA-CSSA-SSSA International Annual Meeting, Salt Lake City, UT.

- Acharya, P., R. Ghimire, W.S. Paye. 2021. Greenhouse gas emissions and global warming potential of cover crop mixtures in irrigated forage production systems. ASA-CSSA-SSSA International Annual Meeting, Salt Lake City, UT.

- Sainju, U., R. Ghimire, and U. Mishra. 2021. Crop rotation with reduced nitrogen fertilization rate decreases nitrous oxide emissions and sustains dryland crop yield and nitrogen-use efficiency. ASA-CSSA-SSSA International Annual Meeting, Salt Lake City, UT.

- Paye, W., R. Ghimire, P. Acharya*, A. Nilahyane, A.O. Mesbah, and M. Marsalis. 2021. Cover crop water use and corn silage production in semiarid irrigated conditions. ASA-CSSA-SSSA International Annual Meeting, Salt Lake City, UT

- Thanpa, V.R., R. Ghimire, D. VanLeeuwen, V. Acosta-Martinez, and M.K. Shukla. 2021 Cover crop effects on soil organic matter components and soil aggregate size distribution in a semiarid cropping system. ASA-CSSA-SSSA International Annual Meeting, Salt Lake City, UT.

- Sainju, U.M., R. Ghimire, and S. Dangi. 2021. Crop rotation and nitrogen fertilization rate impact on soil carbon dioxide and methane emissions and carbon balance. ASA-CSSA-SSSA International Annual Meeting, Salt Lake City, UT.

- Acharya, P., R. Ghimire, Y. Cho, V. R. Thapa, and U. M. Sainju. 2021. Effects of cover crops on crop yield and soil profile carbon and nitrogen stock in a limited irrigation condition. Western Society of Crop Science (First place in student poster competition).

- Paye, W., R. Ghimire, P. Acharya, and M.A. Marsalis. 2021. Cover crop mixtures as alternative forage in the southern high plains silage corn production. Western Society of Crop Science. June 22-23, 2021.

- Singh, P., S.V. Angadi, R. Lascano, S. Begna, D. Dubois, R. Ghimire, and O.J. Idowu. 2021. Native perennial grasses as circular buffer strips improve green water use proportion in a center pivot irrigation system. Western Society of Crop Science (First place in student oral competition).

- Ghimire R. and S.M. Salehin. 2021. Soil organic carbon and nitrogen dynamics under dryland sorghum in New Mexico. Western Nutrient Management Conference Proceedings (Virtual), March 4-5, 2021.

EXTENSION AND OUTREACH VIDEOS:

- Mallory Nielson and Sangu Angadi. 2021. Guar Harvesting Combine in Action. https://youtu.be/Xx5Pofmbvps.

- Mallory Nielson, Paramveer Singh, Sangu Angadi, Mickie Wilkinson, and Rajan Ghimire. 2021. Circular Buffer Strips of Native Perennial Grass Mixtures. (Will be uploaded soon) (https://www.dropbox.com/s/3g9hncu3n3lkugk/CBS%201-4-2022%20update.mp4?dl=0)

- Ghimire, R., Sallenave, R., Smith-Muise, A. 2022. Using cover crops in New Mexico: impacts and benefits of selecting the right crops. NMSU Extension Circular (In press).

- Cover crops, alternative forages, and soil health. Joint TX & NM Extension Agent Dairy Training, Oct. 27-29, 2021, #Participants: 47

- Cover crops and soil health. ASC Clovis Field Day, Aug. 3, 2021, #Participants: 83
- Tillage management in dryland. ASC Clovis Field Day, Aug. 3, 2021, #Participants: 83
- Perennial and pasture carbon sequestration. ASC Clovis Field Day, Aug. 3, 2021, #Participants: 83
- Assessing diverse benefits of circular buffer strips. ASC Clovis Field Day, Aug. 3, 2021, #Participants: 83
- Cover crops, soil health, and water dynamics. NRCS Staff training, June 23-24, 2021, #Participants: 19.
- Do cover crops use water? NRCS Cover Crops Training, March 23, 2021, #Participants: 37.

Agricultural Science Center at Clovis

Faculty and Staff

Abdel Mesbah, Ph.D.
Superintendent

Naveen Puppala, Ph.D.
Peanut Breeder

Sangamesh Angadi, Ph.D.
Crop Physiologist

Rajan Ghimire, Ph.D.
Agronomist

Robert Hagevoort, Ph.D.
Extension Dairy Specialist

Valerie Pipkin
Administrative Assistant

Maria Nunez
Administrative Assistant

Aaron Scott
Manager, Farm/Ranch

Bryan Niece
Research Assistant, Sr.

Shelly Spears
Dairy Program Coordinator

Armando Buitrago
Research Assistant Professor

Manish Ojha
Research Assistant Sr.

Wooiklee Paye
Post Doc.

David Struthers
Laborer Sr.

Cooperators/Collaborators

Universities

1. Meagan Schipanski, Colorado State University
2. Charles Rice, Kansas State University
3. Charles West, Lindsay Slaughter, Texas Tech University
4. Megha N. Parajulee, Texas A&M Agri-life Lubbock
5. Stephen Machado, Oregon State University
6. A. Payton Smith/Ayush Gyawali, Texas A&M
7. Gautam Pradhan, North Dakota State University
8. Jun Wang, Fazu Zhao, Northwest University China
9. Kalyani Mishra, Babu Ram Khanal, Agriculture, and Forestry University Nepal
10. David Clay, South Dakota State University
11. Sindhu Jagadamma, University of Tennessee
12. Corinne Scown, UC Berkeley
13. New Mexico Agricultural Experiment Station
14. Mark Burow, Texas A&M University – AgriLife Research Center – Shallowater - Texas
15. Mike Deom – Department of Plant Pathology - University of Georgia, Athens – GA
16. David Okello – NaSARRI – Soroti, Uganda
17. Amade Muitia – IIAM – Mozambique

USDA locations

1. Upendra Sainju, USDA-ARS Sydney MT
2. Acosta-Martinez, USDA-ARS Lubbock TX
3. Allan Franzluebbers, USDA-ARS Raleigh NC
4. Sadikshya Dangi, USDA-ARS Sydney MT
5. USDA-National Institute of Food and Agriculture (NIFA)
6. USAID-Peanut and Mycotoxin Innovation Laboratory (PMIL)
7. Paxton Payton, USDA-ARS Cropping System Research Laboratory, Lubbock – Texas
8. Kelly Chamberlin – USDA-ARS, Wheat, and Peanut Research Laboratory, Stillwater – Oklahoma
9. Rebecca Bennett – USDA-ARS, Wheat, and Peanut Research Laboratory, Stillwater – Oklahoma

National Lab

1. Umakant Mishra, Argonne National Laboratory
2. Kathmandu Institute of Applied Sciences, Kathmandu, Nepal

Industry and non-government organizations

1. Curtis and Curtis Seeds, Clovis NM
2. Quivera Coalition, Santa Fe NM
3. New Mexico Peanut Research Board
4. National Peanut Research Board
5. Daniel Liptzin, Soil Health Institute

CLOVIS

New Mexico State University
2346 State Road 288, NM 88101-9998
www.clovissc.nmsu.edu