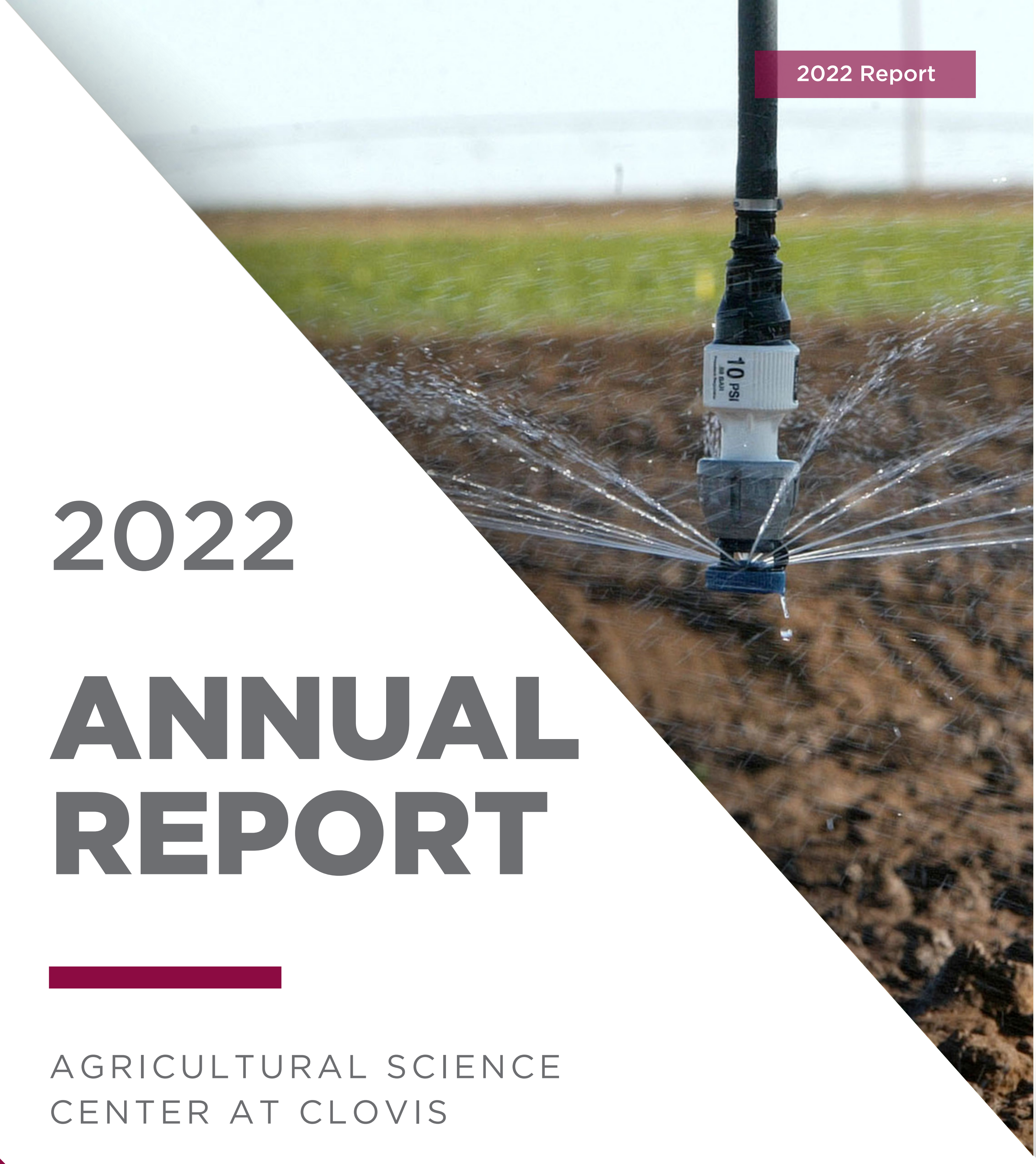
2022 Report



2022 ANNUAL REPORT

AGRICULTURAL SCIENCE CENTER AT CLOVIS

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

https://clovissc.nmsu.edu

NM STATE

Notice to Users of this Report

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

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

Any reference in this report to any person, organization, 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.

Agricultural Science Center Locations Map

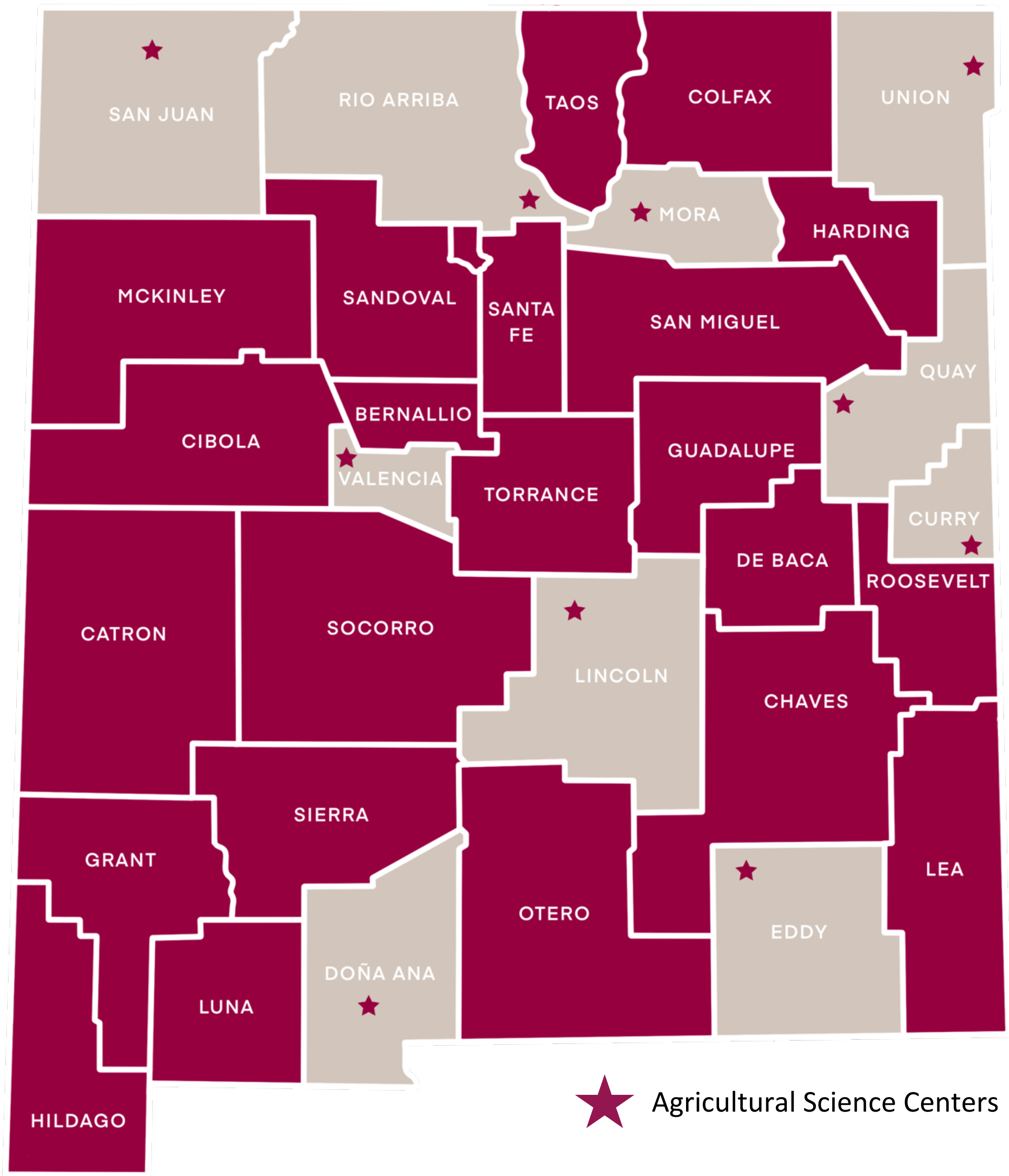


Table of Contents

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 in the Southern High Plains and is centrally located in the largest crop area in New Mexico. The Clovis ASC is comprised of 156 acres of land, which slopes approximately 0.8% to the southeast. The center is located at 34.60° N, -103.22° 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 an 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.

Research Projects

Perennial forages for limited irrigated southern great plains forage systems – Investigators: Rajan Ghimire, Mark A. Marsalis, Jourdan Bell

Perennial grasses for regenerating landscape during the transition to dryland – Investigator: Rajan Ghimire

Soil carbon and nitrogen cycling in irrigated forage rotations – Investigators: Rajan Ghimire and Pramod Acharya

Carbon sequestration and soil health improvements in arid and semiarid croplands – Investigators: Rajan Ghimire, Pramod Acharya, Vesh R. Thapa, Wooiklee S. Paye

How much tillage is too much? A report of occasional tillage study at the Agricultural Science Center, Clovis – Investigators: Rajan Ghimire, Wooiklee S. Paye, Vesh R. Thapa, and Hamza Badrari

Soil health impacts of circular grass buffer system in center pivot irrigated agriculture – Investigators: Rajan Ghimire, Sundar Sapkota, and Sangu Angadi

Long-term carbon and net greenhouse gas balance under cover cropping in a semiarid region – Investigators: Prakriti Bista, Rajan Ghimire, Stephen DelGrosso, and Melania Hartman

Soil moisture dynamics with cover cropping and compost application in sorghum – Investigators: Prakriti Bista, Olufemi Adebayo, Hamza Badrari, Rajan Ghimire, and Sangu Angadi

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

Effect of different irrigation and fertility on guar performance – Investigators: Sangu Angadi, Harjot Sidhu, Mallory Nielson, and John Idowu

Developing winter canola as a low-input alternative multipurpose crop for the region – Investigators: Sangu Angadi, Harjot Sidhu, and Paramveer Singh

Organic seed treatment study in Valencia peanut – Investigators: N. Puppala, M. Ojha, and S. Sanogo

Screening of Valencia Peanut lines for drought tolerance – Investigators: N. Puppala and M. Ojha

Valencia Peanut breeding – advanced breeding lines – Investigators: N. Puppala and M. Ojha

Performance of Valencia Peanut varieties – Investigators: N. Puppala and M. Ojha

Screening Of Valencia Peanut lines for stem rot disease resistance – Investigators: S. Subedi, M. Ojha, S. Madugula, S. Sanogo, and N. Puppala

Cotton variety trial – Investigators: N. Puppala, M. Ojha, and A. Scott

Perennial forages for limited irrigated southern great plains forage systems

Investigators: Rajan Ghimire (rghimire@nmsu.edu), Mark A. Marsalis, and Jourdan Bell

Project Overview: The purpose of this two-year research project is to evaluate the forage production of winter hardy Bermuda grass cultivars that are adapted to the semiarid Southern Great Plains (SGP) as an option to stabilize annual forage production (with and without interseeded alfalfa) and the economic viability of limited irrigated croplands. An annual sorghum-sudangrass will be used as the comparative control. Five forage treatments will be evaluated at the Texas A&M AgriLife Research facility at Bushland, Texas, and the New Mexico State University Agricultural Science Center in Clovis, New Mexico. Four perennial forages and forage blends will be compared to an annual sorghum-sudangrass forage. Plots will be replicated four times under deficit irrigation so that maximum irrigation does not exceed 2 gallons per minute per acre (GPMA).

Meeting the Needs of New Mexico: Drought-tolerant perennial forage systems may meet the forage needs of the livestock producers in the southern High Plains while sequestering carbon, improving overall soil health, reducing demand for the declining Ogallala aquifer water, and increasing the profitability of limited irrigation acreages across the southern High Plains.

Impact: Expected results will validate the forage production and economic benefit of a perennial forage establishment and production with limited irrigation for dairy production in NM.

Perennial grasses for regenerating landscape during the transition to dryland

Investigator: Rajan Ghimire (rghimire@nmsu.edu)

Project Overview: Limited annual precipitation and increasing scarcity of irrigation water are forcing many farmers in the semiarid Southern High Plains (SHP) of the US to transition to dryland farming. However, information is lacking on how soil health and forage supply can be maintained during the transition to dryland farming in semiarid regions. In a two-year study, we evaluated the effect of annual winter wheat (AWW), perennial wheat (PW), and warm-season perennial native grasses as transition strategies for soil health and forage supply in a landscape transitioning to semiarid dryland production. Treatments included an AWW monoculture, a PW monoculture, native grasses (NG), and a pasture crop (PC) consisting of AWW and NG mixture. Soil samples were collected seasonally during the spring and fall of each year and analyzed for selected soil health indicators, and forage dry matter yield and nutritive value were also analyzed.

Meeting the Needs of New Mexico: This study provides a basic understanding of the role of perennial grasses in restoring soil health and carbon storage in transitional drylands. For the farmers looking for an option to transition to dryland, native grass could be the best alternative as they regenerate themselves and help regenerate the landscape.

Impact: The study is still in progress. However, preliminary results show great potential for soil health improvement with perennial grasses in transitional lands. If successfully implemented, it will positively impact rural livelihoods due to multiple benefits of grassland restoration, including carbon sequestration, water quality improvements, soil erosion control, etc. While further research may be needed to determine the overall effect of transitioning to dryland farming on soil health, this study is showing soil health improvements and the supply of good quality forage by adapting perennial grasses in semiarid regions.

Soil profile carbon and nitrogen in limited-irrigation winter wheat-sorghum-fallow rotation

Investigators: Rajan Ghimire (rghimire@nmsu.edu) and Pramod Acharya

Project Overview: Farmers contribute to climate change mitigation through soil organic carbon (SOC) sequestration and greenhouse gas emissions mitigation. However, soil profile organic carbon (C) and nitrogen (N) response to soil health practices are inconsistent. We evaluated cover crop effects on soil C and N contents at 0-8, 8-16, 16-24, and 24-32 inch depths and crop yield in a winter wheat (Triticum aestivum L.)–sorghum (Sorghum bicolor L. Moench)–fallow rotation under limited-irrigation conditions. The experiment was established in 2016, and soil samples for this assessment were collected in 2021. Cover crop treatments compared were fallow (no cover crop), pea (Pisum sativum L.), oat (Avena sativa L.), canola (Brassica napus L.), pea-canola mixture (PCM), oat-pea mixture (OPM), pea-oat-canola mixture (POCM), and a six-species mixture (SSM) of POCM, hairy vetch (Vicia villosa Roth), forage radish (Raphanus sativus L.), and barley (Hordeum vulgare L.). The results of this study revealed the impacts of cover cropping on soil profile C and N storage. Five years of cover cropping did not considerably increase SOC storage. However, soil organic N (SON) was 8–14% greater in fallow than other treatments, except pea and OPM. The fallow treatment also had 54–156% and 11–72% higher inorganic N content than cover crop treatments at 8-16 and 16-24 inch depths, respectively. Sorghum grain yield was 33–97% higher following fallow and oat as cover crops than other treatments in 2020. Although oat cover crops enhanced sorghum yield in some years, OPM had the most SOC among cover crops. Cover cropping largely did not affect soil profile C and N contents under a limited-irrigation semiarid cropping system. Among cover crops, a pea and oat mixture appears to be most effective to improve crop production and increase soil organic carbon storage.

Meeting the Needs of New Mexico: Cover crops are not extensively practiced in New Mexico because of the additional costs associated with cover cropping and the 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. For the farmers looking for cover crop options, legume and grass mixture serve as the best cover crop for arid and semiarid regions.

Impact: This study revealed the benefits of cover cropping to increase SOC sequestration 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 other species alone. Although not all treatments significantly increase SOC, this study highlighted the potential of integrating cover crops in crop rotations to improve soil health and resilience in semiarid cropping systems. The detail of this study is available at https://doi.org/10.1007/s10705-022-10198-1.

Carbon sequestration and soil health improvements in arid and semiarid croplands

Investigators: Rajan Ghimire (rghimire@nmsu.edu), Pramod Acharya, Vesh R. Thapa, Wooiklee S. Paye

Project Overview: By storing carbon (C), soil can provide natural solutions to mitigate climate change. However, implementing C sequestration practices on a large scale is complex because sequestration rates vary with climatic conditions, soil types, and agricultural management. Studies suggest that agricultural strategies that increase the amount and diversity of C inputs improve crop nutrient availability and minimize soil disturbance can sequester C in soils. We are evaluating soil health improvement and C sequestration potential of reduced- and no-tillage, cover cropping, crop rotation, and perennial cropping practices in eastern New Mexico. The project is still in progress; soil organic carbon (SOC) and nitrogen (N) pools, soil microbial community structure, and enzyme activities are being monitored under dryland and irrigated cropping systems. Preliminary results show that a conventional tilled dryland crop-fallow system has 36% less SOC storage than irrigated crop fields in 0-6 inch depth. However, conservation systems that reduce soil disturbance and increase crop diversity restored 12% of SOC lost due to conventional tillage for several years. Alternative cropping system strategies, such as lowering the fallow period by cover cropping or crop rotation intensification, can sequester more than 200 kg C per ha (>100 kg per acre). Combining more than one practice, such as minimizing the intensity and frequency of tillage, crop rotations, cover cropping, and other regenerative soil management practices, can increase C sequestration in the semiarid southern Great Plains. Implementing policies that improve soil health can increase C sequestration and provide natural climate solutions to vast areas of the world, including resource-limited environments like Nepal.

Meeting the Needs of New Mexico: New Mexico farmers are experiencing crop failure due to frequent droughts and high-temperature events. Improving soil health and increasing soil carbon storage can enhance the resilience of the farming community because increased SOC can lead to improved water storage, nutrient cycling, and sustained crop production.

Impact: Developing a soil health management framework for arid and semiarid regions could provide economic, environmental, and societal benefits to rural communities in New Mexico and beyond because healthy soils sustain crop production and maintain a clean environment. Improved soil health and increased SOC sequestration can reduce both wind and water erosion problems.

How much tillage is too much? A report of occasional tillage study at the Agricultural Science Center, Clovis

Investigators: Rajan Ghimire (rghimire@nmsu.edu), Wooiklee S. Paye, Vesh R. Thapa, and Hamza Badrari

Project Overview: Tillage management that minimizes the frequency and intensity of soil disturbance can increase soil carbon (C) and nitrogen (N) sequestration and improve the resilience of dryland cropping systems, yet the impact of occasional disturbance on the permanence of SOC has not been well studied. This study evaluated the effect of four tillage management practices on soil dry aggregate size distribution, aggregate-protected C and N, mineral-associated organic matter carbon (MAOM-C), particulate organic matter carbon (POM-C), and corn and sorghum yields in a semiarid dryland cropping system. Tillage systems compared include conventional tillage (CT), strip-tillage (ST), no-tillage (NT), and Occasional tillage (OT) management in a corn-sorghum rotation. The first three tillage system plots were established in 2013, while occasional tillage was implemented in the fall of 2019 in long-term NT plots. After six different sampling events and soil analysis, we demonstrated that frequent soil disturbance disrupts soil aggregates, while one tillage operation in several years may not negate the benefits of long-term no-tillage. Soil macro-aggregates were 51–54% greater under ST, NT, and OT, while small and micro-aggregates were greater in CT. Conventional tillage reduced soil aggregate-associated C by 28–31% in macro-aggregates and 47-53% in small aggregates at 26 months (M) sampling compared to ST, NT, and OT. Aggregate associated N was generally similar under ST, NT, and OT, which was greater on average than under CT. Evaluating total SOC revealed that CT management resulted in 12–27% and 11–16% lower SOC concentration than NT, OT, and ST in 0–15 and 15–30 cm depth, respectively.

Meeting the Needs of New Mexico: This research was designed based on a farmer's question during one of the Clovis ASC field days. Farmers are asking: How much damage is done by occasional tillage in continuously no-tilled plots? Is there any room for mixing residue and soils or any other benefit of strategically timed tillage in the continuous no-tillage system? We established the occasional tillage study at our long-term tillage demonstration plots to address these questions. The study is ongoing, and we will continue to report what we learn from these plots.

Impact: Tillage is the basic farm operation every farmer does for successful crop production. This study suggests that while frequent intensive tillage can lower SOC and N storage, one tillage after several years of NT will have a minimal effect on soil C and N losses and soil structural stability in semiarid drylands. Further research may reveal how often and how aggressively we can till the long-term NT plots without negative impacts on soil properties in semiarid drylands. This study demonstrated no impact of one stubble mulch tillage after six years of continuous NT.

Soil health impacts of circular grass buffer system in center pivot irrigated agriculture

Investigators: Rajan Ghimire (rghimire@nmsu.edu), Sundar Sapkota, and Sangu Angadi

Project Overview: Soil degradation is a major threat to the sustainability of agroecosystems worldwide. The problem is more severe in arid and semiarid regions where irrigated acreage is declining. Grass buffer strips can be used to enhance ecosystem services in irrigated landscapes facing transition to dryland because it solves the problem of a partial pivot situation and utilizes dryland acreage for native grass production and ecosystem services provision. However, there is no documented evidence of circular buffer strips' impact on soil health and carbon cycling in semiarid agroecosystems. We are studying soil structural properties, including size distribution of dry soil aggregates, mean weight diameter (MWD), wind erodible fraction, aggregate associated C and N, and inorganic N under buffer strip grass (BSG), adjacent buffer strip corn (BSC), and continuous conventional corn (CCC) fields without grass buffer. Soil samples (0–20 cm depth) were collected in the spring, summer, and fall of 2021, after five years of circular grass buffer establishment in a center pivot irrigated cropping system. Soil properties were evaluated in grass-corn edges and at distances of 5, 10, 15, and 30 ft from the edges in corn strips, and 5, 10, and 15 ft from the edges in grass strips. Adjacent corn plots without grass buffers served as the control plot for this study. Response of dry soil aggregate properties and inorganic N varied between treatments and samplings. The CCC had 16.5–126% greater soil inorganic N than BSC. The wind erodible fraction (< 0.25 mm) was 4.83–30.1% less with BSC than with CCC. Edge effects of grass strips were observed for a few parameters in adjacent corn strips. Overall, there is a potential to reduce wind erosion and enhance SOC sequestration by improving soil structure and increasing soil organic carbon (SOC) in soil aggregates in semiarid cropping systems integrating circular grass buffer strips.

Meeting the Needs of New Mexico: Water availability for irrigated crop production throughout the year is becoming a challenge in NM because of declining water levels in streams, rivers, and underground aquifers. Irrigated crop production in eastern NM relies on the Ogallala Aquifer. However, the aquifer's water level is depleting at an unsustainable rate, negatively affecting crop production. In this context, developing an environmentally sustainable farming system that improves soil health and promotes SOC sequestration can reduce the water needed for crop production, prevent soil erosion, and support sustainable agricultural development.

Impact: Increasing soil aggregation and SOC storage in windy, water-limited dry environments is challenging yet critical for preventing soil erosion, improving health, and sustaining crop productivity. This study demonstrated circular grass buffer strips increased soil aggregates and SOC/N accumulation in aggregates. By increasing soil aggregation and SOC sequestration, circular strips of perennial grasses in corn fields would reduce wind erodibility compared to without buffer corn and could improve the sustainability of agriculture.

Long-term carbon and net greenhouse gas balance under cover cropping in a semiarid region

Investigators: Prakriti Bista (pbisa@nmsu.edu), Rajan Ghimire, Stephen DelGrosso, and Melania Hartman

Project Overview: A simulation study was conducted to understand the long-term (35 years) impact of cover cropping on soil organic matter (SOM) accumulation and mitigation of carbon and nitrogen loss as greenhouse gas (GHG) emissions in limited irrigated no-till winter wheat (Triticum aestivum L.)-sorghum [Sorghum bicolor (L.) Moench]-fallow system. Treatments considered were fallow no-cover crop) and two cover crops: pea (Pisum sativum L.) and oat (Avena sativa L). Cover crops (pea and oat) were planted in spring during the fallow periods before each winter wheat and sorghum crop, maintained for three months, and chemically terminated. Five (2016-2020) years of winter wheat and sorghum grain and residue yield, cover crop biomass, soil organic carbon, and soil organic nitrogen data were used to calibrate and evaluate the DayCent model. DayCent is an ecosystem model that can perform complete GHG analysis, explicitly representing soil processes such as SOM transformations, nitrification, and denitrification at a daily time step. Conversion factors 28 and 265 were used to estimate the CO2 equivalent of methane and nitrous oxide emissions for net GHG balance estimation. The model estimated that more than three decades of cover cropping could sequester 39 % to 43 % more SOC with cover cropping and no-tillage together compared to no-tillage fallow alone despite the limited irrigation management in the study agroecosystem. In addition, cover crops increased the potential of no-tillage fallow to reduce net GHG balance by 30.9 % to 70.5% while maintaining comparable cash crop yield. Cover cropping could improve soil health and sustainability of limited irrigation cropping systems while maintaining cash crop production.

Meeting the Needs of New Mexico: Effects of the rapid decline in Ogallala aquifer in soil health and crop production are aggravated by increased global warming, severely impacting rural communities in New Mexico and across the semiarid southwest. Knowledge of practices that promote soil organic matter building and minimize carbon and nitrogen loss for a water-limited environment can help farmers select the best management to improve soil and increase crop production while minimizing the environmental impact of the cropping system.

Impact: For cropping practice, the quantity and quality of residue produced significantly impact SOC sequestration and greenhouse gas emissions. This study showed a mixture of grass cover crops that produced a large number of residues and legume cover crops with low C/N residue supports rapid SOC accumulation and thereby net GHG mitigation while producing similar cash crop yield as fallow. Cover crops are grown for a few months partially replacing fallow and in fields transitioning to limited irrigated cropping systems could support the building of SOC and minimize the environmental footprint in semiarid regions.

Soil moisture dynamics with cover cropping and compost application in sorghum

Investigators: Prakriti Bista (pbisa@nmsu.edu), Olufemi Adebayo, Hamza Badrari, Rajan Ghimire, and Sangu Angadi

Project Overview: Soil moisture is vital for crop production and agricultural sustainability. A study was designed to evaluate the effect of cover crop and compost application on volumetric soil moisture content (θ) of a limited irrigated sorghum (Sorghum bicolor) cropping system under no-tillage at the Agricultural Science Center in Clovis, NM. Treatments included were no cover crop and no compost (fallow), pea (Pisum sativum) without compost (pea) and pea with compost application (PeaComp). The study had a split-plot design. The pea cover crop was planted in February and chemically terminated in May. Sorghum was planted in June and harvested in October. Soil water content was monitored using Onset sensors installed at 2 and 12-inch soil depths. The soil moisture data were collected in the logging interval of 5 min, wirelessly linked to HOBO RX3000 remote monitoring station, and downloaded using Hobolink software. The data from two months (July-October) of active sorghum growing period after sensor installation showed that fallow maintains numerically higher soil water (1.9 to 4.6%) than a pea and PeaComp in 2 and 12-inch soil depth. At 2-inch depth, PeaComp had the lowest water content due to lower mean water content in August, likely due to higher plant biomass accumulation and more water uptake during the physiological growth period. However, the PeaComp had a similar or higher mean water content as Pea in July, September, and October. Compost application increased mean water content (PeaComp = 33.29% vs. Pea = 31.09 %) at 12-inch soil depth compared to cover crop-only treatments.

Meeting the Needs of New Mexico: Increasing weather variability and the rapid decline of the Ogallala Aquifer in recent years pose a threat to valuable water resources in eastern New Mexico and across the Central and Southern Great Plains, impacting crop production in the region. Soil amendments and cover crops can build organic matter, regulate the soil temperature, minimize evapotranspiration, and conserve soil moisture. Research on the impact of compost and cover crops on soil water dynamics will help identify sustainable cropping practices for water-limited arid and semiarid regions.

Impact: This study showed that cover cropping could result in soil water loss during the cash crop phase compared to fallow treatment. Rapid plant growth likely resulted in the decline in soil moisture under compost application for a short period but ultimately became higher than treatments without compost. The findings from the study highlighted that compost application and cover cropping could improve soil water storage in the profile. Monitoring soil moisture during the cover crop, cash crop, and fallow periods can further quantity cover crop and compost effects on soil water dynamics.

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: The Ogallala is the largest aquifer in the US, which is supporting tens of millions of acres of irrigated agriculture in eight states in the Great Plains. Agriculture in the region faces multiple challenges including low water use efficiency, extreme wind, and water erosion, increasing climate extremes, decreasing soil health, and declining biodiversity. Rainfall in the region is low and distribution is unpredictable. Strong winds aggravate frequent drought and heat stress in the region. The situation is expected to deteriorate in the future climate with predicted higher temperatures. The Ogallala Aquifer, once considered a never-ending underground lake, is declining rapidly due to exploitation leaving many wells dry. 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 the novel concept of rearranging the 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 a mixture of native cool and warm season grass species brings the system closer to natural grass prairie, which was resilient and sustainable for a long period. Even with relatively short, 4-5 ft tall grasses, the design allows the spread of 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 Mexico: 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.

Impact: Circular Buffer Strips contribute to improving multiple ecosystem services in irrigated agriculture such as: 1). Improve water conservation, and water use efficiency, reduce water extracted for irrigation, and sustain irrigation water resources. 2). Improve crop microclimate, productivity, resource use efficiency, and climate resiliency of production agriculture in the region. 3). Reduce input use, greenhouse gas emissions, and sequester carbon 4). Improve biodiversity (plants, birds, insects, and microbes).

Effect of different irrigation and fertility treatments on guar performance

Investigators: Sangu Angadi, Harjot Sidhu, Mallory Nielson, and John Idowu

Project Overview: Declining irrigation resources and increasing climatic uncertainty are compelling researchers to look for low-water usage, 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 Mexico: The US is one of the major importers of guar gum across the globe. Demand continues to increase due to the 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.

Impact: Increasing fertility and water availability had a limited benefit to guar in the semiarid environment of New Mexico. Despite a deep root system, guar biomass production benefited from in-season irrigation. Guar responded to the application of fertilizer over control, NPK application of 40lb/ac produced the highest biomass. All cultivars had similar biomass production. Seed yields also followed a trend similar to biomass. This suggests that guar will be a crop for arid and semiarid regions in New Mexico, it will not benefit from higher resource availability like in the Midwest or other higher rainfall regions.

Developing Winter Canola as a low-input alternative multipurpose crop for the region

Investigators: Sangu Angadi, Harjot Sidhu, and Paramveer Singh

Project Overview: Crop diversification can address many concerns including lack of good rotation, declining irrigation resources, and increasing climatic uncertainty in winter canola, which can be used as fodder, oilseed, and protein-rich meal. The greatest advantage is that it can correct some of the monocot weed problems we have created with extensive monocropping. 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 the cattle industry. Our research has also shown the forage potential of canola. Canola, especially winter types, is relatively new in the US. Better adopted and higher-yielding cultivars are needed to expand the canola industry. More recently, with the 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 Mexico: Developing winter canola will have many benefits to both the 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 supplement for the cattle industry in the state and is currently imported from Canada.

Impact: This will be a low-input, rotational crop providing a major tool in controlling grassy weeds in winter wheat-based rotation. The cattle industry in the region needs protein supplements, and growing canola locally will produce canola seed meal protein supplements for New Mexico's large cattle industry. It also has the potential to produce biodiesel to run many farm vehicles to help the environment, save money, and produce byproducts that are in great demand in animal agriculture in the region.

Organic seed treatment study in Valencia Peanut

Investigators: N. Puppala (npuppala@nmsu.edu), M. Ojha, and S. Sanogo

Project Overview: The largest producers of organic peanut production in the U.S. among the arid southwestern states are New Mexico and Texas. The increasing demand for organic peanuts is the fastest-growing sector in the United States. Growers are attracted to organic peanut production because of higher price premiums for certified organic over conventional peanuts. Organic peanut production is traditionally confined to Valencia cultivars, mainly in the southwest part of the US. However, significant research and efforts have been made to convert conventional and organic farms. Many growers are interested in growing certified organic peanuts for organic processed peanut foods, but the wide range of biotic and abiotic stressors affect its production. The object of the project is to evaluate commercially available organic seed treatments on peanut yield and grade.

Meeting the Needs of New Mexico: Organic peanut growers can benefit from seed treatment studies that help reduce the stand establishment due to fungal seedling diseases.

Impact: Producers can benefit from yield gains and grade, lower production costs due to early stand establishment, lesser weed competition, and greater net returns. Environmentally safe with no pesticides and chemicals. Our two years of results have shown that using organic seed treatments has increased peanuts yields compared to untreated control.

Screening Of Valencia Peanut lines for drought tolerance

Investigators: N. Puppala (npuppala@nmsu.edu) and M. Ojha

Project Overview: Global warming and its impact on climate change affect crop plants' growth, development, and productivity. Developing new lines adaptable to climate change and able to withstand stress. The productivity of several crop species, including peanuts, has been negatively influenced by abiotic stresses and intensifies the problem of malnutrition and poverty across the globe. Drought and high temperatures or combinations are major abiotic constraints in peanut-growing regions. Mid and end-of-season droughts are crucial as they directly impact the pod yield and maturity. Water availability during the critical stage is the most important criterion for crop productivity in irrigated and dryland conditions. Without proper irrigation, peanuts may be frequently subjected to drought stress resulting in yield loss of up to 20% each year. The objective of this research is to screen advanced breeding lines of Valencia peanut for drought tolerance in eastern New Mexico and west Texas.

Meeting the Needs of New Mexico: Drought-tolerant varieties will help growers conserve water by having a lower transpiration rate as the soil gets drier.

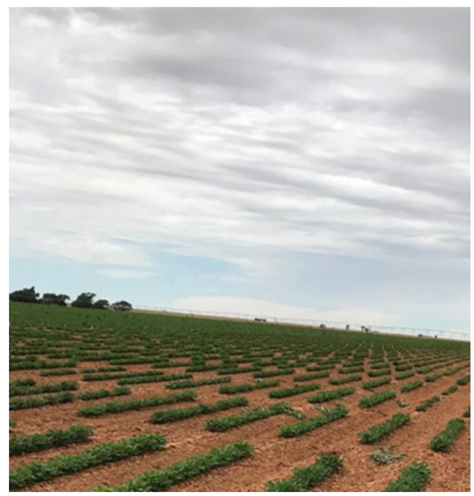
Impact: It can benefit producers by growing drought-tolerant varieties and helping to conserve water for later in the growing season if the drought worsens. The risk of aflatoxin can be reduced.

Performance of Valencia Peanut Varieties

Investigators: N. Puppala (npuppala@nmsu.edu) and M. Ojha

Project Overview: New Mexico State University Valencia peanut breeding program develops early maturing Valencia peanuts (less than 125 days) with red skin, three seeds per pod, sweet taste, and high yield. The new lines adapt to climate change and withstand heat and drought stress. Improving the nutritional quality of the Valencia peanuts with increased high oleic content to increase the shelf life. Screen germplasm for protein, oil, fatty acid, and amino acid composition. Combine disease resistances to web blotch, pod rot, and stem rot diseases. Use new breeding technologies, like marker-assisted selection, genomic selection, and high throughput phenotyping. Work closely with the seed companies to maintain the seed purity of the released cultivars. The research is conducted in a multi-state variety testing program, including private and public varieties. Each year varieties are tested in at least four major peanut-producing counties, namely: Portales, New Mexico, and three locations in Texas: Lubbock, Morton, and Plains. The objective of this project is to evaluate Valencia peanut varieties commercially grown in eastern New Mexico and west Texas for pod yield and grade.

Meeting The Needs of New Mexico: Superior varieties will help the growers benefit from high yields and high oleic peanuts, which will help in longer shelf life, disease resistance, and good nutritional qualities.



Impact: The newly developed peanut varieties resulted in lower production costs and increased shelf life with good nutritional qualities. The elite breeding lines developed from this program will assist the seed companies in decision-making depending on the trait of interest. As this data is across different environments and years, one can select a line that is performing better and know what can be expected in the pipeline compared to the existing check varieties.

Screening of Valencia Peanut lines for stem rot disease resistance

Investigators: N. Puppala (npuppala@nmsu.edu), S. Madugula, S. Sanogo, S. Subedi, and M. Ojha

Project Overview: Stem rot disease caused by *Athelia rolfsii* is a devastating disease of peanuts, which can cause severe yield losses of 10-40% and even up to 80% at higher temperatures and moisture conditions. Developing and planting resistant germplasm has been considered an effective disease management strategy. Resistant varieties development is the most effective, economically viable, and environmentally sound strategy to manage this disease. The objective of this work is to identify and standardize the effective technique of inoculating *Athelia rolfsii*, a fungal pathogen, on peanut plants to screen stem rot-resistant and susceptible germplasm. In addition, this project seeks to screen advanced breeding lines of Valencia peanuts for stem rot disease resistance under greenhouse conditions.

Meeting the Needs of New Mexico: Disease-resistant peanuts will help the growers reduce the input cost of fungicides, and organic growers will benefit from a rot-resistant stem peanut as no chemicals can be applied.

Impact: Producers can benefit by growing stem rot-resistant varieties and reducing the input cost of fungicides and fostering environmentally safe practices. This will benefit the growers in getting greater net returns.

Cotton variety trial

Investigators: N. Puppala (npuppala@nmsu.edu), M. Ojha, and A. Scott

Project Overview: Cotton production is increasing in Roosevelt and Curry counties due to prevailing drought conditions. Growers always need crops that can perform better under limited irrigation conditions. This research aims to evaluate all the commercial varieties from seed companies and provide unbiased data on yield, quality, and net return from each variety tested in the 2021 growing season. Improved seed technology and the technology fee associated with purchasing seed challenge the growers in deciding which variety gives good returns. This study will benefit the growers by comparing the production, quality, and economics associated with selecting the variety and the time to mature, as growers are interested in short-season maturing varieties that can yield higher. The object of this work was to evaluate eleven commercial cotton varieties suitable for eastern New Mexico.

Meeting the Needs of New Mexico: The results from this trial will help the growers to decide which varieties perform better in Clovis and surrounding areas for yield and grade.

Impact: It can benefit a grower to select a high-yielding variety of cotton based on the traits of interest.

Grants and Contracts

- Ghimire, R. (Idowu, O.J., Principal), "Expanding the STAR Program across Colorado and the West, "Sponsoring Organization: USDA/NRCS, Research Credit: $200,000, PI Total Award: $500,000, Current Status: Funded (2023 - 2028).

- Ghimire, R. (Principal)," Tripartite: Dual-Function Engineered Biochar for Excess Soil Phosphorus Sorption with Subsequent Slow Release for Cost-Effective and Sustainable Crop Production," Sponsoring Organization: USDA/NIFA, Research Credit: $200,000, PI Total Award: $800,000, Current Status: Funded (June 2023 - May 2027).

- Ghimire, R. (Principal), Angadi, S. (Co-Principal), et al., "Improving Climate Resilience Through Carbon Management and Soil Health Research, Outreach, and Education Activities", Sponsoring Organization: USDA/Natural Resources Conservation Service, Research Credit: 25%, PI Total Award: $995,000.00, Current Status: Active. (September 20, 2022 - September 30, 2024).

- Ghimire, R. (Idowu, O.J., Principal), TerraSync algae application for arid soil quality improvement, CarbonCaptis, LLC, $167,876.00 (Research Credit: $20,284), Description: An algae product called "TerraSync" will be tested in laboratory and greenhouse studies to assess impacts on crop and soils. Status: Active (August 2022 - August 2023).

- Ghimire R. (Principal), Establishing Soil Health and Carbon Farming Demonstration Plots at ASC Clovis, NMDA, $106,496.00 (Research Credit: $75,581), Description: Purchasing Gasmet GHG analyzer: $60,123 and Carbon farming project: $46,373., Status: Active (October 2022 - June 2022.

- Angadi S. Development and Management of Canola in the Great Plains Region," Kansas State University (USDA-NIFA-SAC Grant), $15,000.00, Status: Funded, Effective Start Date: September 1, 2022.

- Puppala, N. (Principal) Seed multiplication for Hampton Seed Farm. Total Award: $ 94,741. Status: Funded. (September 2022 to December 2023).

- Puppala, N. (Principal), Sponsored Research, "Valencia Peanut Breeding for Drought Tolerance - the Year 2022", Sponsoring Organization: National Peanut Board, Sponsoring Organization Is: Other, Research Credit: $4,560, PI Total Award: $4,560, Current Status: Funded. (January 1, 2022 - June 30, 2023).

- Puppala, N. (Principal), Sponsored Research, "Evaluating Corteva Breeding lines for yield and fiber analysis. Credit: $10,745, PI Total Award: $10,745, Current Status: Funded. (March 2022 - December 31, 2022).

- Puppala, N. Developing new varieties of peanuts to meet the nutritional requirements of RUFT CODEX Alimentarius and attractive agronomic profiles in the countries of PlyumpyField to obtain a proprietary variety certificate of interest. Total Award: $25,000

- Edgar D., S. Norris, N., Hill, K., Lombard, A. Mesbah, L., Bittner, C. Trueblood, T., Dean. Impacting Career Engagement in Agricultural, Consumer and Environmental Sciences. 2022. USDA

Research Publications

- Sapkota, S., R. Ghimire, S. Angadi, D. VanLeeuwen, P. Singh, O.J. Idowu. 2023. Soil health responses to circular grass buffer strips in center-pivot irrigated agriculture. Soil Science Society of America Journal. https://doi.org/10.1002/saj2.20495.
- Omer, M., O.J. Idowu, N. Pietrasiak, D. VanLeeuwen; A.L. Ulery; A.J. Dominguez; R. Ghimire, and M. Marsalis. 2023. Agricultural practices influence biological soil quality indicators in an irrigated semiarid agroecosystem. Pedobiologia. https://doi.org/10.1016/j.pedobi.2022.150862.
- Thapa, V.R., R. Ghimire, W.S. Paye, D. VanLeeuwen. 2023. Soil organic carbon and nitrogen respond to occasional tillage in a continuous no-tillage system. Soil and Tillage Research. https://doi.org/10.1016/j.still.2022.105619.
- Ghimire, R., D. Clay, S. Thapa, and B. Hurd. 2022. More carbon per drop to enhance soil carbon sequestration in water-limited environments. Carbon Management. http://dx.doi.org/10.1080/17583004.2022.2117082.
- Acharya, P., R. Ghimire, Paye, W.S., A. Ganguli and S.J. DelGrosso. 2022. Net greenhouse gas balance with cover crops in semiarid irrigated cropping systems. Scientific Reports, 12, 12386. https://doi.org/10.1038/s41598-022-16719-w.
- Paye, W.S., P. Acharya, R. Ghimire. 2022. Water productivity of forage sorghum in response to winter cover crops in semiarid irrigated conditions. Field Crops Research, https://doi.org/10.1016/j.fcr.2022.108552.
- Zhang, S., J. Wang, U.M. Sainju, and R. Ghimire. 2022. Soil water storage, winter wheat yield, and water-use efficiency with cover crops and nitrogen fertilization. Agronomy Journal, https://doi.org/10.1002/agj2.21028.
- Acharya, P., R. Ghimire, V. Thapa, Y. Cho, and U.M. Sainju. 2022. Soil profile carbon, nitrogen, and crop yields affected by cover crops in semiarid regions. Nutrient Cycling in Agroecosystems, https://doi.org/10.1007/s10705-022-10198-1.
- **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.
- Sainju, U.M., S. Dangi, D. Liptzin, and R. Ghimire. 2022. Relationship between soil organic matter, soil properties, and dryland crop yields. Agronomy Journal. DOI: 10.1002/agj2.20938.
- Ghimire, R., Paye, W., Marsalis, M. A., Sallenave, R. (in press). Using Cover Crops in New Mexico: Effects on Soil Moisture and Subsequent Cash Crops. Las Cruces, NM. Date Accepted: December 2022.
- Ghimire, R., Sallenave, R., Muise, A. (2022). Using cover crops in New Mexico: Impacts and benefits of selecting the right crops. New Mexico State University Cooperative Extension Service. https://pubs.nmsu.edu/_circulars/CR704.pdf
- Sapkota, S., Ghimire, R., Angadi, S., VanLeeuwen, D., Singh, P., Idowu, O. J. (2022). Soil health responses to circular grass buffer strips in center-pivot irrigated agriculture. Soil Science Society of America Journal. https://doi.org/10.1002/saj2.20495 (Available online).
- Umesh, M. R., Angadi, S., Begna, S., Gowda, P. H., Hagevoort, G. R., Lauriault, L. M., Darapuneni, M. K. (2023). Intercropping and species interactions on physiological and light use characteristics of forage cereals-legume combinations in semi-arid regions. Field Crops Res. 290, 108755. https://doi.org/10.1016/j.fcr.2022.108755.

- Okello, D.K., M. Deom and N.Puppala. 2022. Registration of Naronut 2R. J. Plant Regist.2022 published online October 2022. DOI: 10.1002/plr2.20248
- Djaman, K., S. Allen, D.S. Djaman, K. Koudahe, S. Irmak, N. Puppala, M.K. Darapuneni and S.V. Angadi. 2022. Planting date and plant density affect maize growth, yield, and water use efficiency. Environmental Challenges Vol (6). DOI: 10.1016/j.envc.2021.100417
- Puppala, N., S.N. Nayak, A.Sanz-Saez, C.Y. Chen, M.Jyostna Devi, N. Nivedita, Y. Bao, G.He, Sy M Traore, D.A. Wright, M.K. Pandey, and V. Sharma. 2022. Physiological and Molecular Basis of Drought and Heat Stress Tolerance to Enhance Productivity and Nutritional Quality of Peanuts in Harsh Environments. Frontiers in Genetics (Accepted).
- Shah, P, M. Pandey, S. N. Nayak, C. Chen, S. Bera, C. Kole, and N.Puppala. 2022. Next-Generation Breeding for Nutritional Traits in Peanut. Compendium of Crop Genome Designing for Nutraceuticals. Springer (Accepted).
- Umesh, M. R., Angadi, S., Begna, S., Gowda, P., Prasad, P. V. Vara (2022). Shade tolerance response of legumes in terms of biomass accumulation, leaf photosynthesis, and chlorophyll pigment under reduced sunlight. Crop Sci. 2022;1–15. https://doi.org/10.1002/csc2.20851
- Umesh, M. R., Lepcha, I., Begna, S., Gowda, P., Angadi, S. (2022). Nutritive Value and Silage Fermentation Characteristics of Forage Sorghum (Sorghum bicolor L.) Genotypes and Lablab (Lablab purpureus L.) Mixture. *American Journal of Plant Science, 13*(6), 723-733. https://doi.org/10.4236/ajps.2022.136048
- Umesh, M. R., Lepcha, I., Begna, S., Gowda, P., Angadi, S. (2022). Nutritive Value and Silage Fermentation Characteristics of Forage Sorghum (Sorghum bicolor L.) Genotypes and Lablab (Lablab purpureus L.) Mixture. *American Journal of Plant Science, 13*(6), 723-733. https://doi.org/10.4236/ajps.2022.136048.

Conference Presentations

- Kelly, C., E. Slessarev, M. Schipanski, S. Fonte, R. Ghimire, P. Brown, K. Jagadish, J. Pett-Ridge. 2022. Perennial grass conversion as rapid a rapid carbon sink: Long-term dryland system responses. AGU22 Fall meeting, Chicago, IL.
- Bista, P., M. Hartman, S.J. DelGrosso, V.R. Thapa, and R. Ghimire. 2022. Simulating cover crop impacts on long-term net greenhouse gas balance in a semiarid region. AGU22 Fall meeting, Chicago, IL.
- Ghimire, R., P. Acharya, V.R. Thapa, and W.S. Paye. 2022. Soil health and carbon management in water-limited environments: insights from western United States and beyond. AGU22 Fall meeting, Chicago, IL.
- Bista P., O. Adebayo, S.V. Angadi, and R. Ghimire. 2022. Soil moisture dynamics in limited irrigated sorghum with cover cropping and compost application. 67th New Mexico Water Conference. Las Cruces, MM and Online.
- Joshi, D.R., R. Ghimire, T.P. Kharel, U. Mishra, S.A. Clay, and D.E. Clay. 2022. Conservation agriculture for food security and climate resilience. ASA-CSSA-SSSA International Annual Meeting, Baltimore, MD.
- Singh, P., S.V. Angadi, D. DuBois, R. Ghimire, and O.J. Idowu. 2022. Circular grass buffer strips (CBS) system: a synergetic merger of native perennial grasses and annual crop in center pivot irrigated agriculture systems. ASA-CSSA-SSSA International Annual Meeting, Baltimore, MD (Second place in SSSA society-wide student oral/poster competition, and first in Soil and Water Management and Conservation Division).
- Sapkota, S., R. Ghimire, and S.V. Angadi, P. Singh, D. VanLeeuwen, and O.J. Idowu. 2022. Response of soil organic matter and nutrients to circular grass buffer integration in center-pivot irrigated cropping systems. ASA-CSSA-SSSA International Annual Meeting, Baltimore, MD.
- Acharya, P., R. Ghimire, E. Lehnhoff, and M.A. Marsalis. 2022. Cover crop forage potential and subsequent forage sorghum yield and nutritive value. ASA-CSSA-SSSA International Annual Meeting, Baltimore, MD.
- Singh, P., S.V. Angadi, R. Ghimire, D. DuBois, and O.J. Idowu. 2022. Soils of center pivot production systems better protected under innovative circular grass buffer strips. ASA-CSSA-SSSA International Annual Meeting, Baltimore, MD.
- Sapkota, S., R. Ghimire, and S.V. Angadi. 2022. Grass buffer effects on soil carbon and nitrogen components in center-pivot irrigated cropping systems. ASA-CSSA-SSSA International Annual Meeting, Baltimore, MD.
- Acharya, P., R. Ghimire, and W.S. Paye. 2022. Soil health changes in cover crop-integrated forage production systems under irrigated semiarid conditions. ASA-CSSA-SSSA International Annual Meeting, Baltimore, MD.
- *Badrari, H., R. Ghimire, O. Adebayo and A.O. Mesbah. 2022. Weed suppression potential of cover crops in semiarid regions. ASA-CSSA-SSSA International Annual Meeting, Baltimore, MD.
- Fademi, I., M.N. Omer, R. Ghimire, and O.J. Idowu. 2022. Winter cover crops and soil amendment effects on selected soil measurements in an arid agroecosystem. ASA-CSSA-SSSA International Annual Meeting, Baltimore, MD.
- Acharya P., R. Ghimire, M.A. Marsalis, E.A. Lehnhoff. 2022. Cover crops for improving forage sorghum yield and nutritive value in water-limited environments. Western Society of Crop Science Meeting, June 21-22, 2022, Fort Collins, CO (First place in student oral competition).
- Ghimire, R., W. Paye, V.R. Thapa. 2022. How much disturbance is too much? Soil health response of tillage systems in semiarid drylands. Third NAPA Biennial International Scientific Conference, May 27-29, 2022, Atlanta, GA.

- Subedi, S, M. Ojha, S. Madugula, S. Sanogo, D. Lozada, R. Steiner, and N. Puppala. 2022. Evaluation of Peanut germplasm for Resistance against *Athelia rolfsii*. APS Pacific Division Annual meeting. June 22, 2022, Virtual presentation.
- Subedi, S. Madugula, S. Sanogo, M. Ojha, and N. Puppala. 2022. Evaluation and standardization of Stem rot inoculation techniques for resistance selection in Peanut. APRES annual meeting, Dallas July12-14, 2022
- Ojha, M., N. Puppala and S. Madugula. Bio-fungicide seed treatments on Valencia peanut yield, grade, and diseases. APRES annual meeting, Dallas July12-14, 2022
- Puppala, N., M. Ojha, P. Payton, A. Young, J. Mahan, M. Burow, and H. Pham. 2022. Screening of Valencia breeding lines for drought tolerance. APRES annual meeting, Dallas July12-14, 2022
- Angadi, S., Singh, P., Sapkota, S., Wilkinson, M., Idowu, O. J., Ghimire, R., Gowda, P., A Community on Ecosystem Services Annual Conference, A Community on Ecosystem Services, Washington, DC, "Circular Buffer Strips of Perennial Grasses to Improve Multiple Ecosystem Services in Center Pivot Irrigated Agriculture in the Southern Great Plains", (December 13, 2022; Invited).
- Sapkota, S., Ghimire, R., Angadi, S., Singh, P., VanLeeuwen, D., Idowu, O. J., A Community on Ecosystem Services Annual Conference, A Community on Ecosystem Services, Washington, DC, "Circular Grass Buffers for Sustainability of Center-Pivot Irrigated Agriculture Facing Transition to Dryland: Response of Soil Organic Matter and Nutrients", (December 13, 2022).
- Wilkinson, M., Bundy, C. S., Angadi, S., Tryc, M., Skidmore, A., A Community on Ecosystem Services Annual Conference, A Community on Ecosystem Services, Washington, DC, "Effect of Perennial Grass Buffer Strips on Native Pollinator Species in Pivot Irrigated Corn". (December 13, 2022).
- Singh, P., Angadi, S., Dubois, D. W., Ghimire, R., Begna, S., A Community on Ecosystem Services Annual Conference, A Community on Ecosystem Services, Washington, DC, "Native Perennial Grasses as Circular Buffer Strips Improves Water Dynamics of Center Pivot Irrigated Production Systems". (December 13, 2022).
- Sidhu, H. S., Angadi, S., Idowu, O. J., Lauriault, L. M., Miller, F., Singh, P., 2022 ASA-CSSA-SSSA International Annual Meeting, Baltimore, MD, "Guar Fertility Management under Temporally Different Irrigation Regimes". (November 8, 2022).
- Omer, M. N., Idowu, O. J., Angadi, S., Darapuneni, M. K., 2022 ASA-CSSA-SSSA International Annual Meeting, Baltimore, MD, "Guar Growth and Yield As Affected By Cultivar and Seeding Density in New Mexico". (November 8, 2022).
- Boote, K. J., Adams, C., Ale, S., Shrestha, R., Hoogenboom, G., Angadi, S., Grover, K., O., 2022 ASA-CSSA-SSSA International Annual Meeting, Baltimore, MD, "Adopting the Cropgro Model to Simulate Growth and Production of Guar, Cyamopsis Tetragonoloba L, an Industrial Legume Crop". (November 7, 2022).
- Angadi, S., Cutforth, H., Begna, S., Ghimire, R., Advances in Agriculture and Food System Towards Sustainable Development Goals (AAFS 2022), All India Agricultural Students Association (AIASA), New Delhi, Bangalore, India, "Transforming Cropping Systems to Improve Ecosystem Services and Climate Resiliency", Invited and Keynote Address (August 23, 2022).

Cooperators and Collaborators

Collaborating Outside NMSU Campuses

1. Meagan Schipanski, Steve Fonte, Colorado State University
2. Augustine Obour, Kansas State University
3. Charles West, Lindsay Slaughter, Texas Tech University
4. Megha N. Parajulee, Katie Lewis, A Payton Smith, Texas A&M University
5. Jun Wang, Northwest University, China
6. Babu Ram Khanal, Agricultural and Forestry University Nepal
7. David Clay, Deepak Joshi, South Dakota State University
8. Deb Jaisi, University of Delaware
9. Sushil Adhikari, Auburn University
10. Sushil Thapa, University of Central Missouri
11. Sushil Lamichhane, University of New England, Australia
12. Kamal P. Adhikari, Manaaki Whenua - Landcare Research, Palmerston North, New Zealand
13. Mark Burow, John Cason, Texas A&M Agri-life Lubbock
14. Heidi, Laza, Texas Tech University
15. Alvaro Sanz-Saez, Charles Chen, Auburn University
16. Mike Deom, University of Georgia, Athens, Georgia
17. David Kalule, Uganda
18. Manish Pandey, ICRISAT, India
19. Monique Chan Huot, Nutriset, France
20. Spurthi Nayak, Dharward University, India
21. Mike Stamm, Kansas State University
22. Perry Miller, Montana State University
23. Kim Ogden, University of Arizona
24. Jason Quinn, Colorado State University

USDA Locations

25. Veronica Acosta-Martinez, USDA-ARS Lubbock, TX
26. Maysoon Mikha, USDA-ARS, Akron, CO
27. Stephen DelGrosso and Melania Hartman, USDA ARS Fort Collins, CO
28. Renee Arias, USDA-ARS, National Peanut Research Lab, Dawson, Georgia
29. Emendack, Yves, USDA-ARS, Cropping System Research Lab, Lubbock, Texas
30. Prasanna Gowda, USDA-ARS, Stoneville, MS
31. Robert Lascano, USDA-ARS, Lubbock, TX
32. Upendra Sainju, USDA-ARS Sydney, MT

National Lab

33. Courtland Kelly, Livermore National Laboratory
34. Umakant Mishra, Argonne National Laboratory

Industry and local non-government organizations (contributors in research)

35. Curtis and Curtis Seeds, Clovis, NM
36. Quivera Coalition, Santa Fe, NM
37. New Mexico Health Soils Program

Outreach Activities

- Touring ongoing research with Senator Heinrich's Staff, Clovis ASC, NM. August 22, 2022
- First Dryland Soil Health workshop, Clovis ASC, NM. July 18-20, 2022
- ASA-CSSA-SSSA International Annual Meeting, November 6, 2022 - November 9, 2022.
- Cultivating Young Minds Program, Clovis ASC, NM. October 13-14, 2022. Approximately 732 students participated from 14 elementary schools.
- College of AECS Open House Workshop, Las Cruces, NM. April 9, 2022. The Clovis ASC participated with four posters.
- YouTube Videos, Circular Buffer Strips of Native Perennial Grasses at NMSU Clovis. (January 26, 2022) (https://youtu.be/utKl1yq78CA).

Advisory Committee

- Paul Stout (Chairman)
- Spencer Pipkin
- Rex Rush
- Blake Curtis
- Eric Palla (Vice Chairman)
- Jim Chandler
- Craig Breashears
- Steve Bailey
- Albin Smith
- Jim Sours
- Ron Schaap
- Rachel Armstrong
- Steven Schaap

Personnel

- 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
- Prakriti Bista, Ph.D., Research Scientist
- Valerie Pipkin, Administrative Assistant
- Maria Nunez, Administrative Assistant
- Aaron Scott, Manager, Farm/Ranch
- Dawson Moon, Assistant Manager, Farm/Ranch
- Akash Bajagain, Research Assistant Sr.
- Shelly Spears, Dairy Program Coordinator
- Armando Buitrago, Research Assistant Professor
- Manish Ojha, Research Assistant Sr.
- Dara Brammer, Laborer