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# Los Lunas Plant Materials Center

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# 2024 Report of Activities

USDA NRCS Plant Materials Program operates 25 Plant Materials Centers (PMCs) throughout the country. Each Center is strategically located to support the conservation needs in a specific geographical and ecological region. The Los Lunas Plant Materials Center (NMPMC) serves the southwest arid and semi-arid region, including northeast Arizona, southeast Colorado, New Mexico, southeast Utah, and southwest Texas. The NMPMC focuses on conducting plant materials studies for improving soil health in range and agricultural land, for improving wildlife habitat, urban conservation, breeder and foundation seed production of conservation plant releases, and technology transfer for supporting NRCS field offices in the effort for helping people help the land. A key mission of NRCS Plant Materials Program is to develop improved conservation plants and release them for uses in addressing resource concerns. PMCs around the country, including NMPMC, have released hundreds of improved cultivars and pre-varietal germplasms. PMCs continue to maintain their respective releases and provided stock seeds or foundation materials to commercial seed producers who make improved conservation plant seed available to the market. Subsequently, the commercially produced seed is used in conservation programs including EQIP and CRP. NMPMC has released 41 grasses, forbs, trees, and shrubs for conservation needs in New Mexico and neighboring states. Currently, NMPMC maintains foundation and breeder seed for 14 grasses: Alma, Hachita, Arriba, Jose, Grenville, Niner, Vaughn, Nogal, Paloma, Redondo, Salado, Lovington, Viva, & Windbreaker.

## Study 1: Cover Crop and Tillage Practices for Improving Soil Health and Forage Production

This was the third and final year of a study designed to compare three forage crops commonly grown in New Mexico (forage corn, millet, sorghum-sudangrass) as cover crops mixed with a legume (cowpea) using three tillage treatments each year after terminating the cover crops. The specific objectives of the study were to measure the effects of tillage practices and species on forage production and forage quality, and the effects of different cover crops and tillage methods on soil health. The overall goal of this study was to enhance cover crop and tillage recommendations and better inform conservation planners on implementing conservation practices including Conservation Crop Rotation (328), Cover Crop (340), and Pasture and Hay Planting (512).

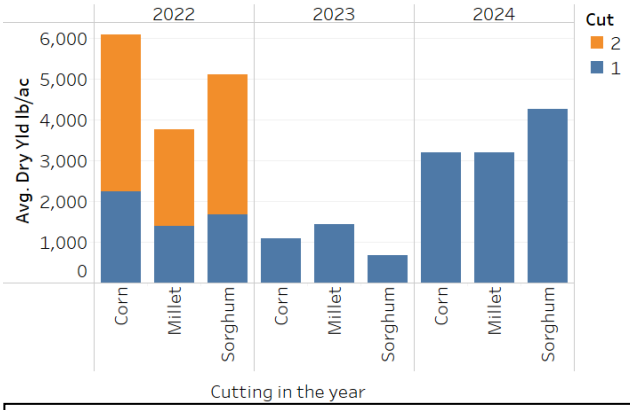



Fig. 1 Forage yield of corn, millet and sorghum-sudangrass in three tillage practices in three years. Forage was harvested two times in 2022 and one time in 2023 and 2024. The data represent average of all tillage treatments within a crop.

Fig. 1. shows greater forage yield in 2022 than 2023 and 2024 for all three forage crops (corn, sorghum, millet). This is due to two cuts being taken in 2022 and only one in subsequent years. Multiple harvests will increase the total annual forage productivity of these crops, but leaves less residue on the soil surface. The high yield in the second harvest of 2022 was mostly due to the increase in favorable growing temperatures and rainfall for these warm-season crops. Forage yields in 2023 were substantially lower than in 2024 although harvesting management was similar for both years. This is due to reduced rainfall and less irrigation in 2023 than in 2024 Rainfall amounts in the growing season (April to July) in 2023 (0.87-in) was considerably lower than in 2024 (3.78-in). The results are expected as soil moisture is a major constraint for annual summer forage production in arid Southwest. In addition, weed pressure was much greater in 2023 (Figs 4 & 5), which likely negatively impacted overall forage yield. Millet performed better in 2023, and as good as corn in 2024, suggesting it may have better drought tolerance compared to the other forage crops in exceptionally dry years. Millet exhibited healthier and more vigorous early-season growth than corn and sorghum in all years and had less iron chlorosis symptoms (the soil at the study site is a droughty, low fertility loamy fine-sand). Very early planting in 2023 (April 11) likely contributed to the low yield of sorghum compared to the millet and corn, which typically tolerate prolonged cool temperatures better than sorghum. The large differences in forage yields over the three years indicate the potential for increasing productivity by optimizing growing conditions and reducing weed pressure.

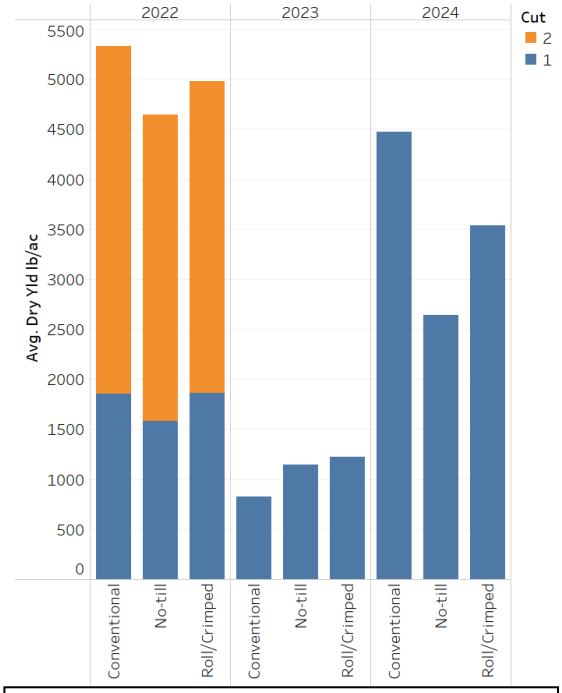



Fig. 2 Forage yield of corn, millet and sorghum-sudangrass in three tillage practices in three years. Forage was harvested two times in 2022 and one time in 2023 and 2024. The means represent average of all crops within a tillage treatment.

Fig. 2 shows inconsistency, impacted by year, in the influence of tillage systems on forage yields. Forage yields under the conventional tillage system were slightly lower than those under other conservation tillage methods in the drier year (2023) but outperformed in other years. In 2022 and 2024, conventional and roller crimped treatments outyielded no-till. Overall, the results indicate that reduced tillage systems (no-till and roller-crimper) can perform better in drier years by conserving soil moisture, which aligns with previous reports from the region. The effect seems to diminish when more overall water (rain and irrigation) is introduced to the system.

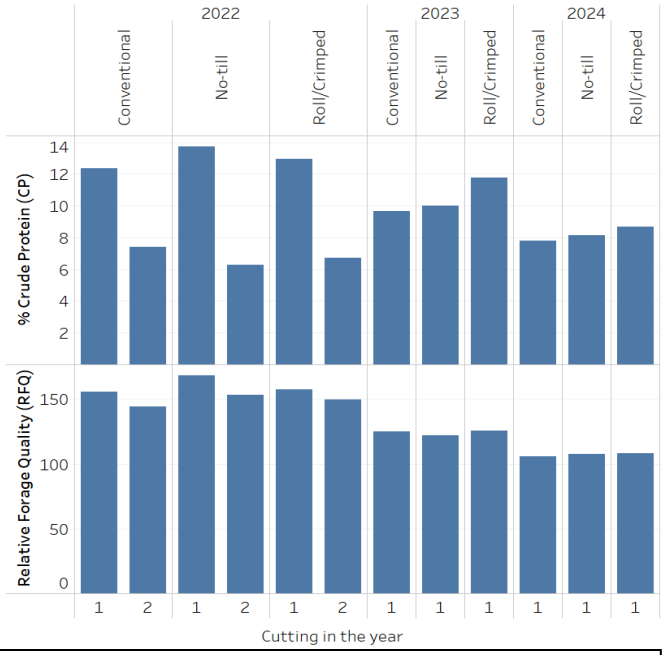
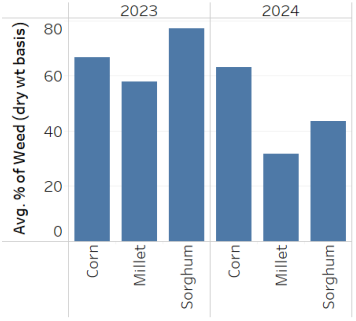
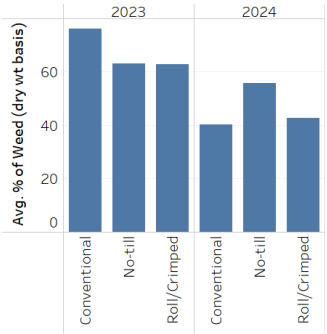



Fig. 3 Crude protein concentration and relative forage quality of forage corn, millet and sorghum-sudangrass in three years. Forage was harvested two times in 2022 and one time in 2023 and 2024. The data represent averages of three replications within each of forage crops and tillage treatments.

Fig. 3 shows mostly similar crude protein (CP) and relative forage quality (RFQ) of the three forage crops in all individual years. Nutritive value trends followed yield trends, as is common. That is, as yield increased, CP and RFQ decreased. A slight difference was observed in 2023 and 2024, when the forages had greater CP concentration and RFQ in 2023 compared to 2024. As expected, biomass in the second harvest of 2022 had lower CP and RFQ than in the first harvest, a common trend seen in previous studies. Greater CP in 2023 than in 2024 is due to lower yield in 2023, and thus lesser dilution of N taken from the soil in the biomass than in 2024.This was particularly noted in sorghum and was related to lower yield of sorghum in 2023 (Fig. 1). In 2024, since sorghum had greater biomass yields, CP was reduced and hence resulted in lower RFQ. Effect of tillage treatment was minimal on CP and RFQ in any given year and cut. Surprisingly, CP for most harvests was below 10%, a result unexpected when cowpea is part of the mixture. Low proportions of cowpea (data not shown) in the mixture, combined with advanced maturity of the cowpea likely contributed to this. Although 200 lbs. of ammonium sulfate fertilizer (56 lb N/ac) was applied in both years, heavy flood irrigations on the sandy soil likely leached much of the available N below the root zone where it was unable to contribute to protein levels in the plant.




The study fields have historically exhibited high populations of field sandbur and pigweed, two particularly pernicious weeds. No herbicides were applied during the study. Figures 4 and 5 present the weed data collected in 2023 and 2024. While all three crops showed variation between years, millet consistently demonstrated a lower weed biomass percentage (Fig. 4). Vigorous early-season growth contributed to increased plant competition and weed suppression. This finding, observed across both dry and wet growing seasons, reinforces millet's potential as a superior summer forage choice among the tested crops in terms of weed suppression, especially on high pH, low fertility, sandy soils.

Weed biomass, which reached as high as 80%, within the total dry biomass yield of the tested crops was evaluated under the three tillage systems for 2023 and 2024 (Fig. 5). In 2023, the no-till system had similar weed pressure to the

Fig. 4 & 5

roller-crimper tillage system and lower pressure than the conventional tillage system. In 2024, the no-till system showed greater weed pressure than the other two tillage systems. Although all tillage systems experienced reduced weed pressure in wet 2024 compared to dry 2023, the no-till system remained the most susceptible to increased weed pressure. Greater intensity of weeds in the no-till system is commonly observed as tillage and mechanical soil operations can contribute to weed control.

## Study 2: Soil health response to forage and cover cropping

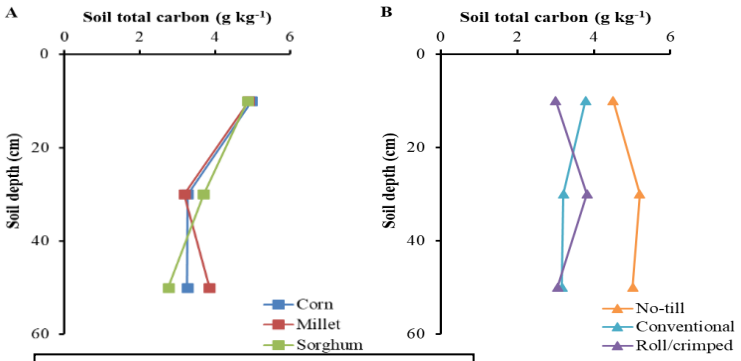



Fig. 6 Average soil total carbon (A &B)

Soil health status was measured by evaluating several carbon and nitrogen indicators, including total, labile, and microbial carbon and nitrogen fractions. For these assessments, soil samples were collected each year in May from 2022 to 2024 at three different depths (0–20 cm, 20–40 cm, and 40–60 cm). Figure 6 shows the total carbon and nitrogen response to tillage and cover cropping. The average soil total carbon was similar for all forage crops, except for a slightly greater C content under millet at 40–60 cm (Fig 6A). Comparing the tillage practice, no-till management showed consistently greater total carbon content in soil at all depths (Fig 6B). Likewise, the soil total nitrogen was similar under all forage cropping systems, except for 20–40 cm depths, where sorghum had greater N content than other forage crops (Fig. 7A). Also, it was greater under the no-tillage compared to conventional tillage and roll/crimped at 20–40 cm and 40–60 cm depths (Fig. 7B).

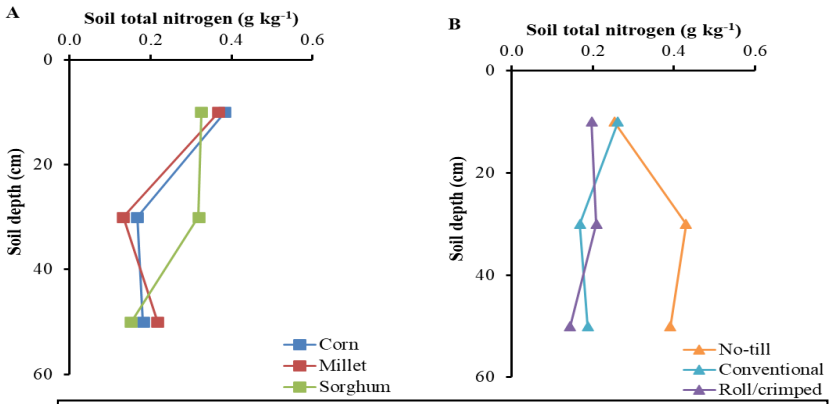



Fig.7 Total nitrogen (C&D) under different forage crops and tillage management (2022–2024)

Soil microbial indicators of health and productivity were measured by estimating microbial biomass carbon (MBC) and activity index, i.e., potentially mineralizable carbon (PMC). The average MBC was slightly greater in corn silage systems than other forage crops at 0–20 cm depth (Fig. 8A). At 20–40 cm and 40–60 cm, it was similar for all forage cropping systems. However, the MBC differed among the tillage systems at all depths; no-till systems had greater MBC, followed by conventional tillage systems (Fig. 8B), showing reduced or no disturbance favors soil microbial growth and activity. The

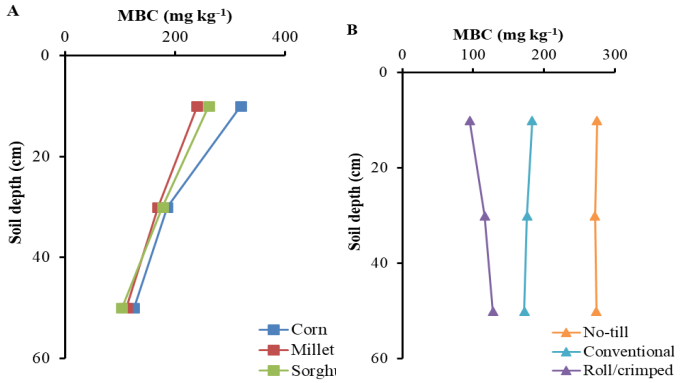



Fig. 8. Average microbial biomass carbon (MBC) (A&B)

microbial activity measured by PMC was similar for all forage cropping systems at all depths (Fig. 6C), but no-tillage management also showed greater PMC than other practices among tillage systems across all depths (Fig. 6D).

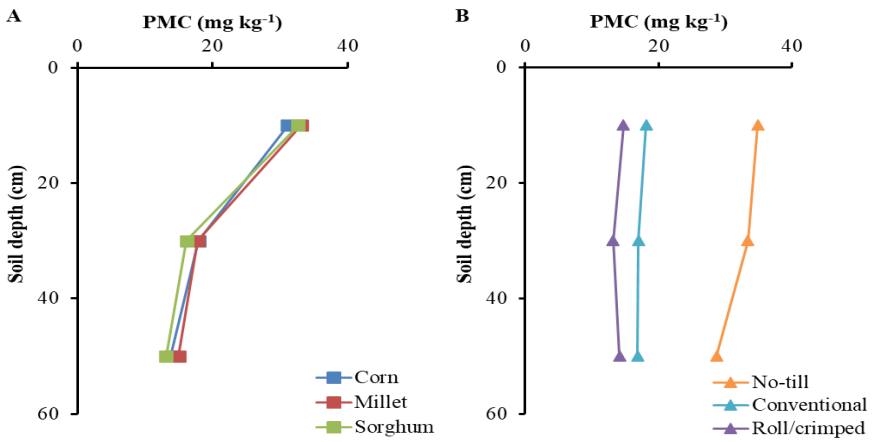



Fig 9 potentially mineralizable carbon (PMC) (A&B) under different forage crops and tillage management (2022–2024)

Soil inorganic nitrogen content is the total amount of plant-available nitrogen in soils. At all depths, the inorganic nitrogen content was mainly similar for all forage cropping systems (Fig. 10A). However, the inorganic nitrogen content was different among the tillage systems at all depths, with no-till systems having greater mineral nitrogen, followed by conventional tillage systems (Fig. 10B). More microbial mass and activity in the no-tillage system helped in faster nutrient cycling in the no-tillage system releasing more inorganic nitrogen.

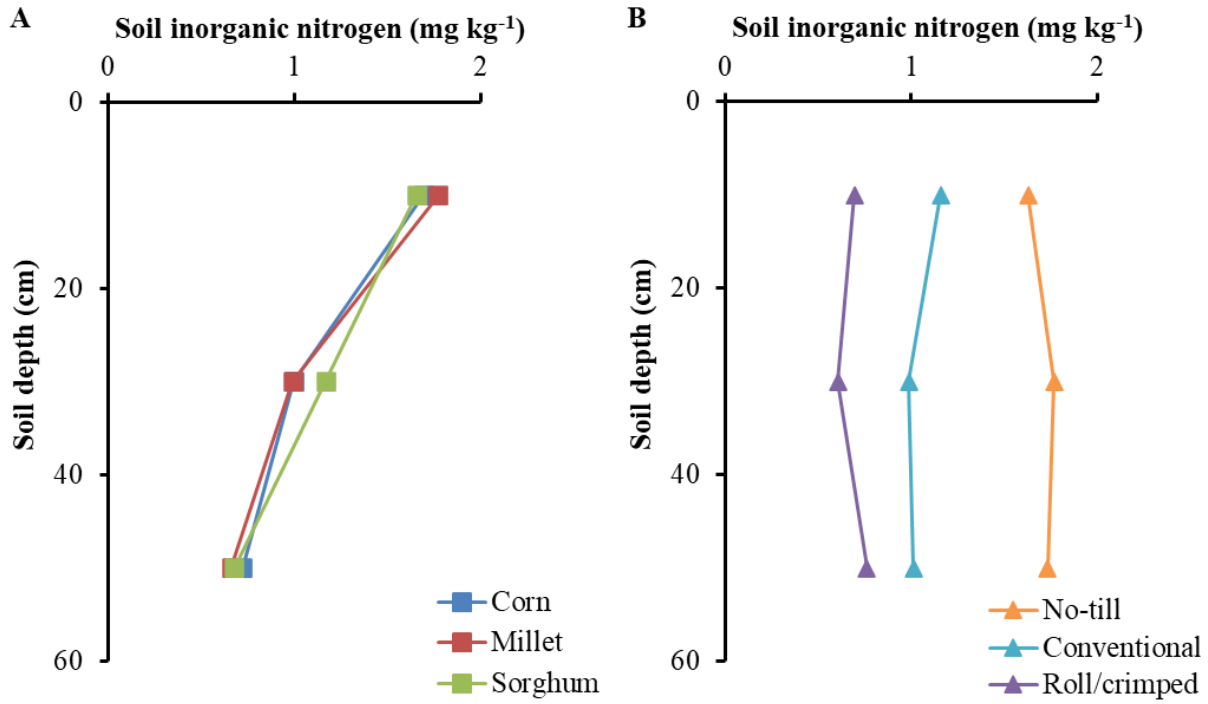
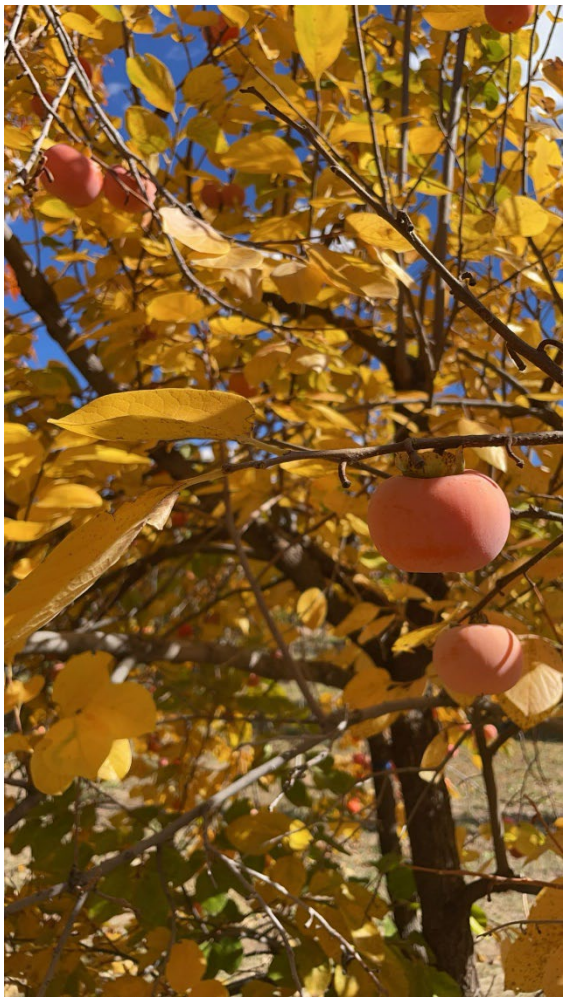



Fig. 10. Average soil inorganic nitrogen content under different forage cropping systems (**A**) and tillage management (**B**).

## Training and Outreach:



NMPMC had many outreach events in 2024. Throughout the year, NMPMC staff had presentations with local Soil and Water Conservation Districts such as Toas, Lee, Curry and Border focusing on native grasses and infiltration demonstrations totaling over 50 participants. In February, Rick and Keith held an irrigation training for the field office staff in NM along with the NM State Engineer, Eli Gnann. There was a total of 43 participants. In June, NMSU and NMPMC held a tour for students from an African Fellow Scientific Exchange Program with 10 attendees. Students from Africa came to tour the facility and in exchange, staff with NMSU will tour a facility in Africa potentially in 2025. In August, PMC participated in the Soil Carbon Conference Tour with 43 participants that came out to tour the facility. October 5th, the NMPMC participated in the NM Healthy Soil Workgroup Tour with 9 participants. On October 19, 2024, NMPMC and NMSU Los Lunas Ag. Sci. Center held an annual joint field day for members of community, local landowners, producers, and customers. NMPMC was able to highlight and share information on the NRCS-Plant Materials Program, conservation plants released by the NMPMC, plant selection and seed production processes, and the uses of improved native grasses not only in soil and water conservation but in rangeland and forage production in New Mexico and surrounding areas. The weather was not ideal this year which led to only 69 people in attendance. Grace Woodard and Tanka Kandel helped with a mentoring program with a local high school out of Albuquerque that met up through August and September teaching kids about soil classification, plant identification and range health assessments. October 28th, Valencia County Extension Office brought students out to the farm for a Fall Farm School Trip. Students where given coloring books and seeds from NRCS and sunflowers that were harvested this year. 33 students attended. On November 2, NMPMC helped with a soil judging competition that had three universities from California and one from team from NM. There were over 100 participants. In December, National Young Farmers Education Association came out for a farm tour with 158 attendees.

## Publications:

All release brochures can be located at https://www.nrcs.usda.gov/plant-materials/cp/releases for further information.

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