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.

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Notice to Users of This Report

This report has been prepared to aid Science Center staff in analyzing the results of the various research projects from the past year and to record data for future reference. These are not formal Agricultural Experiment Station Report research results. The reader is cautioned against drawing conclusions or making recommendations as a result of the data in this report. In many instances, data represents only one of several years' results that will ultimately constitute the final formal report. Although staff members have made every effort to check the accuracy of the data presented, this report was not prepared as a formal release. None of the data is authorized for release or publication without the written prior approval of the New Mexico Agricultural Experiment Station.

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Conversion Table for English and Metric (SI) Units

The following conversion table is provided as an aid for those who may wish to convert data appearing in this report from English (U.S.) units to Metric (SI) units, or vice versa. (Calculations are approximations only.)

To convert English to Metric, multiply by	English (U.S.) units	Metric (SI) units	To convert Metric to English, multiply by
2.540	inches (in)	centimeters (cm)	0.394
0.305	feet (ft)	meters (m)	3.281
1.609	miles (miles)	kilometers (km)	0.621
0.093	square feet (ft2)	square meters (m2)	10.764
2.590	square miles (mile2)	square kilometers (km2)	0.386
0.405	acres (ac)	hectares (ha)	2.471
28.350	ounces (oz)	grams (g)	0.035
29.574	fluid ounces (fl oz)	milliliters (mL)	0.034
3.785	gallons (gal)	liters (L)	0.264
0.454	pounds (lbs)	kilograms (kg)	2.205
907.185	ton (2000 lbs) (t)	kilograms (kg)	0.001
0.907	ton (2000 lbs) (t)	metric tonnes (t) or Megagrams (Mg)	1.102
1.000	parts per million (ppm)	ppm (mg/kg)	1.000
1.121	pounds/acre (lbs/ac)	kilograms/hectare (kg/ha)	0.892
2.240	tons/acre (t/ac)	Megagrams/hectare (Mg/ha)	0.446
16.018	pounds per cubic feet (lbs/ft3)	kilograms per cubic meter (kg/m3)	0.062
0.070	cubic feet/acre (ft3/ac)	cubic meters/hectare (m3/ha)	14.291
73.078	ounces/acre (oz/ac)	milliliters/hectare (mL/ha)	0.014
62.710	bushels/acre (corn: 56# bu)	kilograms/hectare (kg/ha)	0.016
67.190	bushels/acre (wheat: 60# bu)	kilograms/hectare (kg/ha)	0.015
125.535	Cwt/acre (100 wt)	kilograms/hectare (kg/ha)	0.008
0.042	Langleys (Ly)	Megajoules (MJ)/m2	23.900
(°F-32)÷1.8	Fahrenheit (°F)	Celsius (°C)	(°C x 1.8) + 32

For additional helpful English-Metric conversions, see: https://www.extension.iastate.edu/agdm/wholefarm/html/c6-80.html and https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/null/?cid=stelprdb1043619

Contents

Executive Summary

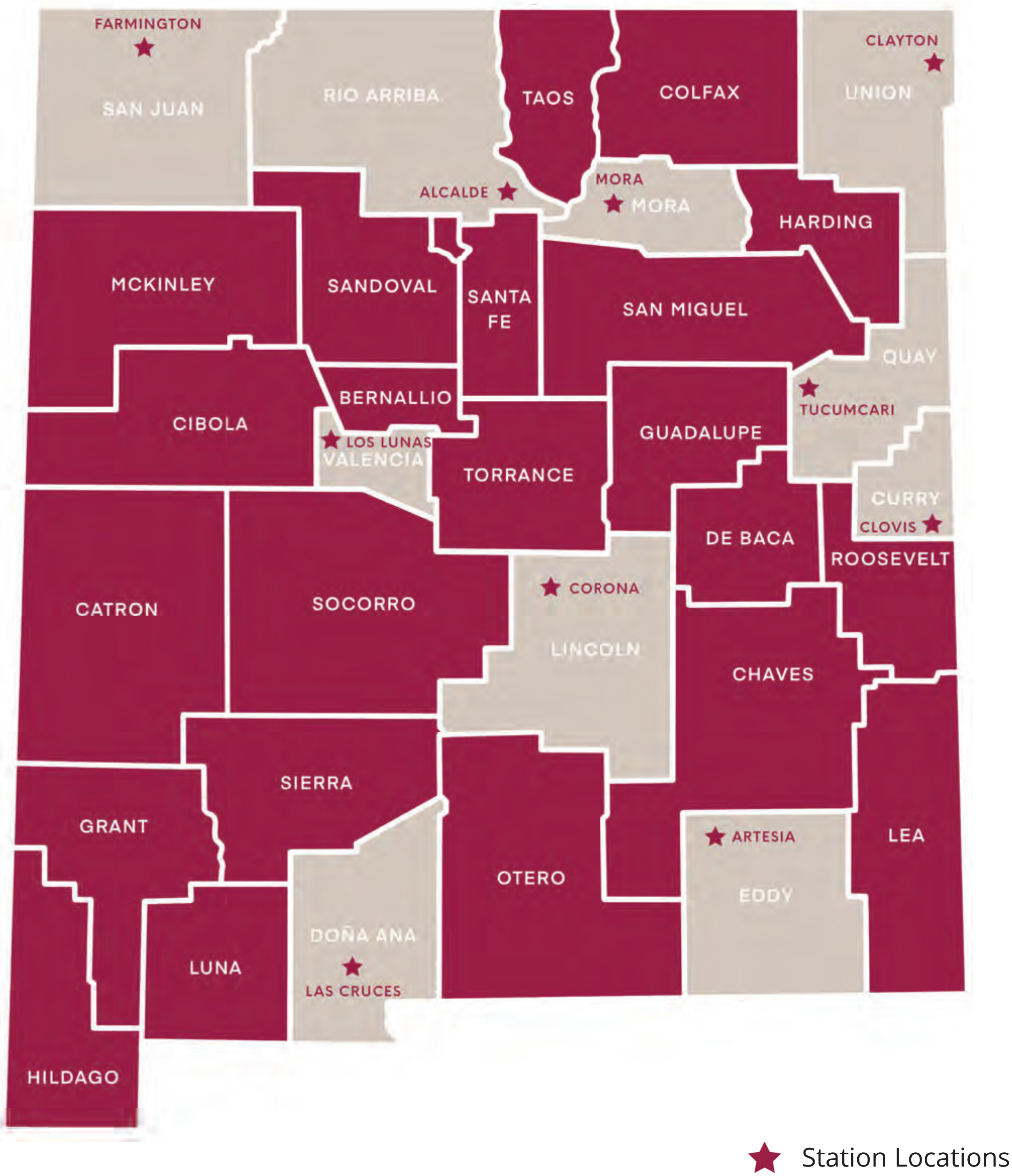
The New Mexico State University Agricultural Science Center at Clovis is Located 13 miles north of Clovis on State Road 288. The center is located in the Southern High Plains and is centrally located in the largest crop area in New Mexico. The center is comprised of 156 acres of land, which has an approximate 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.

NMSU Agricultural Experiment Stations



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

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

Investigators: Vesh R. Thapa1, Rajan Ghimire1,2,, and Mark A. Marsalis3*

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2New Mexico State University, Agricultural Science Center, Clovis, NM 88101, USA
3New Mexico State University, Agricultural Science Center, Los Lunas, NM 87031, USA;

OBJECTIVE

To evaluate 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.

MATERIALS AND METHODS

The study was conducted from 2016-2020 at the New Mexico State University (NMSU), Agricultural Science Center (ASC) near Clovis, NM. The experiment was established under no-tillage management in 2015. The experimental field was previously under conventional management of irrigated corn (Zea mays sp.) and sorghum production for several years. The cover crop plots (60 ft × 40 ft) were established in a randomized complete block design with eight treatments and three replications in each crop rotation phase of the winter wheat-sorghum-fallow/cover crop. 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). Irrigation water was applied to cover crops only for seed germination each year, after which no additional irrigation was applied. All cover crops were maintained in plots for three months before being 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. The amount of irrigation water applied during the sorghum period was relatively higher in 2020 than in previous years because of extremely dry conditions.

Sorghum was harvested at physiological maturity in the last week of October in all years by hand-harvesting a bundle grain sample from the 6th and 7th row at 20 ft lengths, whereas stalks were harvested from the same row at 5 ft length in each plot. Sorghum aboveground biomass (head and stalk) was collected in plastic bags, brought to the laboratory, and heads were thrashed using a plot combine thresher (Wintersteiger, Ried im Innkreis, Austria) to separate the grain. The moisture percentage of sorghum grain was determined with a moisture meter (GAC 2100b, DICKEY-john Corporation, Auburn, IL, USA), whereas stalks were oven-dried at 65 °C for 72 h to determine dry weight. Sorghum grain yield was adjusted to 12% moisture. Total yield was calculated as head + stalk after adjusting on an oven-dried basis.

RESULTS

The sorghum grain yield was comparable among treatments in the first three years (i.e., 2016, 2017, and 2018), while the sorghum grain yield in 2019 was the greatest under oats and the lowest under canola (Table 1). In 2020, sorghum grain yield decreased with cover cropping compared to fallow.

The year 2020 was relatively dry, leading to significant moisture stress on sorghum following cover crop treatments. Five-year (2016-2020) average sorghum grain yield was 6.1-14.8% lower under cover crop plots compared to fallow plots. Among selected soil health indicators, potentially mineralizable nitrogen (N) could be the best predictor for sorghum grain yield. 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. Detail of this study is available at https://www.mdpi.com/2073-4395/11/4/762

Table 1. Sorghum grain yield (SGY) and total yield (TY) during 2016-2020.

Treatment†	2016	2017	2018	2019	2020	2016-2020 avg.
			SGY (lbs acre^{-1})			
Fallow	6535	7410	5111	7911	8791	7152
Pea	6562	6733	4648	8003	5014	6192
Oat	6657	6202	4631	8661	7441	6719
Canola	6728	6293	5945	6191	5598	6151
Pea+Oat mix	7025	6516	4910	7790	4470	6142
Pea+Canola mix	6640	6236	5221	6912	5464	6095
Pea+Oat+Canola mix	6355	7207	5297	7509	5191	6312
Six-species mix	7187	5891	5145	7211	5592	6205
			TY (lbs acre^{-1})			
Fallow	14336	16593	13255	15298	28117	17520
Pea	14945	14818	12598	17555	23405	16664
Oat	14763	13860	14063	15925	26407	17004
Canola	15052	15320	15191	11501	22634	15940
Pea+Oat mix	15486	14771	12884	16770	20156	16013
Pea+Canola mix	14938	13660	14383	15205	21292	15895
Pea+Oat+Canola mix	14355	14085	14635	17049	24634	16952
Six-species mix	16426	14780	14754	15503	25228	17338

†Six-species mix: pea + oat + canola + hairy vetch + forage radish + barley

EFFECT OF COVER CROPS ON SOIL WATER DYNAMICS IN SEMI-ARID IRRIGATED SILAGE CORN PRODUCTION

Investigators: Wooiklee S. Paye1, Rajan Ghimire1,2, Pramod Acharya2, Abdelaziz Nilahyane3, Abdel O. Mesbah2,4, and Mark A. Marsalis5*

1Agricultural Science Center, New Mexico State University, Clovis, NM 88101, USA
2PES Department, New Mexico State University, Las Cruces, NM 88003, USA
3Mohammed VI Polytechnic University, Benguerir, Morocco
4EPPWS Department, New Mexico State University, Las Cruces, NM 88003, USA
5Agricultural Science Center, New Mexico State University, Los Lunas, NM 87031, USA

OBJECTIVE

Evaluate the effect of winter cover cropping vs no-cover crop on soil water balance in semi-arid irrigated corn silage production.

MATERIALS AND METHODS

A 2-year (2019 and 2020) study was conducted at New Mexico State University Agricultural Science Center in Clovis NM. The treatments were arranged in a randomized complete block design with four replications. 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 were annual ryegrass (*Lolium multiflorum*), and winter triticale (*Triticale hexaploide Lart*), the 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*). In each year, cover crops were planted in September using a double-disc opener (Model 3P600, Great Plains Inc., Salina, KS, USA), and chemically terminated in April the following year. The seeding rates for each cover crop species are presented in (Table 1).

Corn Silage variety P18-28 AM was planted in May each year using a four-row John Deere MaxEmerge planter (Deere Moline, IL, USA) at a targeted plant population of 25,000 ac-1, and harvested in September. A single dose of 150 lbs ac-1 N, and 26 lbs ac-1 S were applied to all treatments as a liquid mix and immediately followed by irrigation after corn planting. Silage corn was fully irrigated, but cover crops were only irrigated once after planting to help with germination.

Soil volumetric water content (VWC) was measured every two weeks during the cover phase, and weekly during the corn silage phase using a dielectric capacitance probe (PR 2/6 soil profile probe, Delta-T Devices, Cambridge, UK) equipped with a data logger. The probe is designed to take soil moisture readings at six depth increments (0-10, 10-20, 20-30, 30-40, 50-60, and 90-100 cm). Therefore, VWC at the 40-50 and 60-90 cm depths were estimated by taking averages of the VWC at 30-40 and 50-60 cm, and 50-60 and 90-100 cm depths, respectively. 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.

RESULTS

Cover treatments significantly influenced the seasonal soil water balance in both cropping years. The net ΔS was negative for all cover crop treatments regardless of the mixtures compared to NCC at the end of cover crop growth phases (Figure 1). The GB mixture had the highest negative ΔS among the cover crop treatments compared to the GBL and GL mixtures in 2019. Only the NCC had a net recharge of soil water after cover crops termination in both years, but to a lesser extent in 2020 than in 2019. However, the soil water was recharged in all cover crop treatments but NCC resulted in soil water depletion after corn harvest each year. This suggests that cover used a significant amount of water during their growth but leaving their residue on the surface helped to conserve moisture during the corn silage growth phase.

Table 1. Winter cover crop species and mixes: Grasses + Brassicas + Legumes (GBL), Grasses + Brassicas (GB), and Grasses + Legumes (GL) and their seeding rates in 2019 and 2020

Table 1. Winter cover crop species and mixes: Grasses + Brassicas + Legumes (GBL), Grasses + Brassicas (GB), and Grasses + Legumes (GL) and their seeding rates in 2019 and 2020

	Cover Crop Mixes and Seed rate		
Cover Crop Species	GBL	GB	GL
	-----------lbs/acre----------		
Berseem clover	2	-	4
Austrian winter pea	4	-	8
Annual ryegrass	8	12	12
Winter triticale	16	16	16
Turnip	2	2	-
Daikon radish	2	4	-

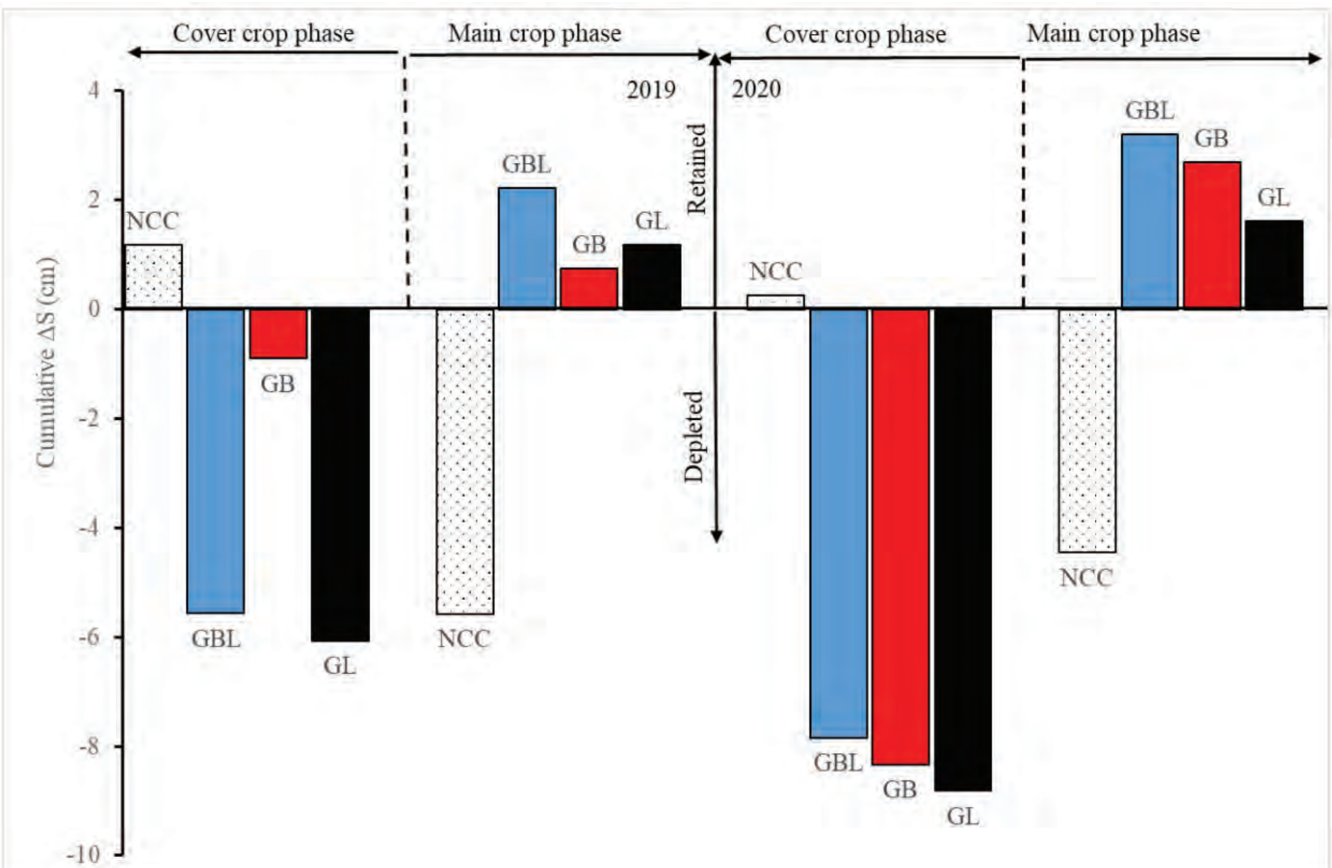

Figure 1. Cumulative change in soil water storage in the 1-m soil profile at different phases in cover crop and corn silage production system 2018–2020. Positive values indicate soil water storage and negative values indicate soil water depletion. Treatments, GBL = grasses + brassicas + legumes, GB = grasses + brassicas, GL = grasses + legumes.

COVER CROPS EFFECT ON CORN SILAGE YIELD AND FORAGE NUTRITIVE VALUES UNDER SEMI-ARID CONDITIONS

Investigators: Wooiklee S. Paye1, Rajan Ghimire1,2, Pramod Acharya2, Abdelaziz Nilahyane3, Abdel O. Mesbah2,4, and Mark A. Marsalis5*

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4EPPWS Department, New Mexico State University, Las Cruces, NM 88003, USA
5Agricultural Science Center, New Mexico State University, Los Lunas, NM 87031, USA

OBJECTIVE

To document the forage nutritive values of three mixtures of six winter cover crop species and their effect on corn silage yield and forage nutritive values.

MATERIALS AND METHODS

The study was conducted at New Mexico State University Agricultural Science Center at Clovis, NM, in 2019 and 2020. The study site has a semi-arid climate and an Olton clay loam (fine, mixed, super active, thermic Aridic Paleustolls) soil. The site had winter wheat (*Triticum aestivum*) and oat (*Avena sativa*) under no-tillage management before establishing the experiment. Treatments included 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 were annual ryegrass (*Lolium multiflorum*) and winter triticale (*Triticale hexaploide Lart*), the 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*). The treatments were arranged in a randomized complete block design with four replications. In each year, cover crops were planted in September using a double-disc opener (Model 3P600, Great Plains Inc., Salina, KS, USA) and chemically terminated in April the following year.

Corn Silage variety P18-28 AM was planted in May each year using a four-row John Deere MaxEmerge planter (Deere Moline, IL, USA) at a targeted plant population of 25,000 ac-1 and harvested in September each year. A single dose of 150 lbs ac-1 N and 26 lbs ac-1 S were applied to all treatments as a liquid mix and immediately followed by irrigation after corn planting. Silage corn was fully irrigated, but cover crops were only irrigated once after planting to help with germination.

Before each year's cover crop termination, samples were collected by cutting the aboveground biomass at the soil surface from 10.8ft2 sections from each cover crop plot and then combined into one composite sample per plot. The fresh weight was determined, and the samples were oven-dried to a constant weight at 150°C to determine total dry matter yield. Similarly, forage sorghum yield was determined by harvesting a 41ft2 section of each plot during harvest using a plot silage harvester and receiving wagon equipped with a weighing scale to determine fresh silage yield. Approximately 2.2 lbs of the fresh composite samples were then taken from each plot and oven-dried similarly as cover crop biomass, and total yield was determined. Both cover crop and corn silage samples were then sent to a commercial laboratory for forage nutritive value analysis.

RESULTS

Cover crop biomass and corn silage yield and forage nutritive values are presented in Table 1. Cover crop biomass yield was not significantly different among treatments. Percent dry matter (DM) and crude protein (CP) were also similar among cover crop treatments. The GL mix had 45% NDF, which was lower than the GBL and GB mixtures. However, non-fat carbohydrates (NFC) and relative forage quality (RFQ) were higher in the GL mix than in the GBL and GB mixtures. Macronutrients such as phosphorus (P), calcium (Ca), and magnesium (Mg) were higher in the GBL and GL mixtures which had legumes than the GB mix, which had no legumes. Corn silage yield was 16–26% higher among cover crop mixtures than NCC. Accept CP which was higher with NCC; corn silage forage nutritive values were similar among all treatments. The RFQ and forage potential (Milk/ton) was comparable between cover crops biomass and corn silage, indicating that these cover crop mixtures can provide good alternative winter forage for dairy farmers in the southern High Plains.

Cover crop biomass forage nutritive values at NMSU-ASC 2019 and 2020

Treatments	Yield(t/a)	DM %	CP %	NDF %	NDFD 48hr %	NFC %	Fat %	TND %	P %	Ca %	K %	Mg %	RFQ	Milk/ton (lbs/ton)
Cover Crop Biomass														
NCC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GBL	2.8	94.8	14.3	47.7	70.1	26.3	2.30	66.3	0.29	0.65	3.04	0.18	175	3367
GB	2.4	94.5	14.5	49.5	69.6	24.8	2.30	66.1	0.27	0.41	3.07	0.16	169	3301
GL	2.5	94.4	15.2	45.3	68.9	27.7	2.40	66.5	0.31	0.69	3.00	0.20	181	3309
Corn Silage														
NCC	9.30	99.6	8.6	40.7	64.1	44.5	2.20	71.2	0.21	0.30	0.30	0.15	205	3572
GBL	10.8	98.7	7.5	42.9	62.3	42.6	2.40	69.5	0.19	0.29	0.29	0.15	188	3438
GB	10.5	98.8	7.8	40.2	61.9	45.8	2.60	71.2	0.20	0.27	0.27	0.14	202	3550
GL	11.8	98.8	7.8	41.9	64.0	43.8	2.30	70.9	0.19	0.19	0.28	0.14	198	3558

COVER CROP EFFECTS ON SOIL ORGANIC MATTER COMPONENTS AND SOIL AGGREGATE SIZE DISTRIBUTION IN A SEMIARID CROPPING SYSTEM

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OBJECTIVE

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.

MATERIALS AND METHODS

The study was conducted in 2019 and 2020 at the New Mexico State University (NMSU), Agricultural Science Center (ASC) near Clovis, NM. The experiment was established under no-tillage management in fall 2015 in a field that was previously under conventional management of irrigated corn (*Zea mays* sp.) and sorghum production for several years. 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. Within each rotation phase, cover crop treatments were arranged in a randomized complete block design.

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. During 2016-2018, however, cover crops after both wheat and sorghum were planted in late February and terminated in mid-May. All cover crops were planted using a 20-ft wide plot drill (Great Plains 3P600, Salina, KS). 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 varieties TAM 113 (2015-2018) and TAM 114 (2019-2020) were planted in the second week of October using a plot drill (Great Plains 3P600, Salina, KS) at a seeding rate of 55 lbs acre-1 with the drill spacing maintained at 15 inches. Sorghum cultivar NK 5418 was planted in the first week of June using a no-till drill (John Deere, Moline, IL) at a seeding rate of 50,000 seeds acre-1 with the row spacing maintained at 30-inch spacing. Soil fertility management was based on soil test recommendations for both wheat and sorghum. About 50% of the crop water requirement was applied for both crops only at critical growth stages, such as jointing, booting, heading, and grain filling, because of limited water available for irrigated crop production.

Soil samples were collected from 0 to 5.9-inch depth of all phases of crop rotation during summer (first week of June 2019 and 2020). The sampling time represented three different phases of fields after cover crop termination: at termination time, 36 days after termination, and a year after termination of the active wheat growth stage. The fallow plots were considered as a control to compare changes in SOM components and other soil health indicators due to cover cropping. Three soil cores were collected diagonally from each plot using a core sampler (0.79-inch diam.), composited and thoroughly homogenized, and analyzed for various soil processes indicators. The indicators used to assess soil health included a range of physical, chemical, and microbial/biochemical properties.

RESULTS

On average, oats and treatments containing oats in the mixtures produced the greatest biomass as a spring cover crop, while in fall cover crops, biomass production was highest under pea and canola mixture, followed by canola and pea in 2019. The fall cover crops in 2020 were killed by snow and freezing temperatures; thus, biomass yield was not determined. Quality analysis of cover crop biomass at the time of termination showed that oats and their mixtures had higher C: N ratios than pea, canola, and pea + canola mix.

Oats and pea as cover crops played a crucial role in improving soil health, specifically in soil organic carbon (SOC) and nitrogen (N) accumulation (Table 1). Grass cover crops such as oats produced higher biomass and contributed more SOC and N levels. Legumes and brassicas favored early mineralization of the residue and rapid recycling of the soil nutrients, leading to increased N availability. The mixture of legumes, grasses, and brassicas diversified microbial substrate availability, supported higher microbial activity, and increased nutrient turnover. Pea as a sole cover crop or in mixture had higher inorganic N and particulate organic carbon contents. The SOC and total N concentrations were higher in intermediate-sized aggregates (250 µm-2 mm and 53- 250 µm). Overall, six-species mix and oats had higher wet aggregate stability than fallow. This study suggested that SOC, soil pH, labile organic N, mineral-associated organic N, and microbial biomass carbon are the minimum data set for soil health assessment in semiarid environments. This study strengthened that a mixture of species with higher biomass and C: N ratios, such as oats with legume and brassica, could diversify substrate availability and quality and improve overall soil health and resilience. Detail of this study is available at https://www.sciencedirect.com/science/article/abs/pii/S0016706121005772

Table 1. Response of selected soil health indicators to winter wheat-sorghum-cover crop rotation in 2019 and 2020.

Treatment †	pH	Inorganic N	LON	24h-CO_2-C	72h-CO_2-C	MBC	SOC	Total N	POC	PON	MAOC	MAON	WAS (%)
	At cover crop termination time												
		(lbs $acre^{-1}$)											
Fallow	7.3	13.7	17.8	26.6	67.4	542	16182	1357	5873	210	8990	938	29.4
Pea	7.3	11.5	17.0	34.2	86.7	500	15494	1333	4880	183	10526	1113	34.7
Oat	7.3	8.48	16.8	43.0	114	572	17106	1463	5377	178	11481	1193	39.9
Canola	7.4	11.5	16.3	30.8	77.6	432	14081	1200	3841	125	10180	1055	28.2
Pea+Oat mix	7.3	12.0	18.0	34.4	76.1	513	15644	1335	4856	202	10721	1096	36.8
Pea+Canola mix	7.2	16.2	22.7	45.9	110	584	16617	1378	5301	134	11199	1185	34.4
Pea+Oat+Canola mix	7.2	10.2	17.9	43.1	94.6	589	16216	1384	5076	169	11106	1198	35.4
Six-species mix	7.1	15.9	18.9	31.0	76.5	577	15597	1327	4743	138	10788	1124	43.8
	36 days after cover crop termination												
Fallow	7.3	24.7	26.1	14.5	35.9	612	14906	1454	3264	197	11571	1237	21.0
Pea	7.6	23.0	24.3	17.0	44.5	716	16918	1618	5502	385	12279	1194	28.8
Oat	7.4	18.0	21.8	20.7	55.2	579	16594	1570	4313	249	11393	1158	36.3
Canola	7.5	19.3	22.6	19.4	40.6	650	15968	1593	4787	365	10989	1158	30.7
Pea+Oat mix	7.5	15.9	18.9	15.1	43.4	580	14961	1451	3790	257	11083	1159	28.0
Pea+Canola mix	7.2	21.2	22.5	25.8	50.9	749	15833	1513	4544	260	11076	1183	28.7
Pea+Oat+Canola mix	7.4	17.5	20.3	27.4	54.8	654	16329	1526	5258	356	10984	1110	29.1
Six-species mix	7.3	17.5	20.7	26.7	56.4	669	16713	1598	5481	368	11188	1171	29.7
	A year after cover crop termination or active wheat growth stage												
Fallow	7.5	10.1	13.3	45.9	95.5	845	17626	1584	6053	214	11467	1267	30.7
Pea	7.7	11.4	15.4	40.0	82.9	891	17589	1563	5938	203	11595	1273	32.7
Oat	7.5	12.3	17.0	41.1	84.9	844	16400	1427	4627	84.8	11648	1279	37.8
Canola	7.7	10.8	16.8	37.7	79.0	756	16206	1339	5534	114	10702	1070	33.4
Pea+Oat mix	7.3	12.0	17.2	51.3	99.0	821	17875	1566	5907	237	11688	1228	38.8
Pea+Canola mix	7.5	9.72	12.3	44.2	97.2	834	17492	1492	5668	83.0	11686	1274	35.2
Pea+Oat+Canola mix	7.5	11.8	14.6	40.9	85.0	806	16628	1403	5522	145	11255	1195	30.3
Six-species mix	7.6	11.2	16.2	44.5	99.0	973	19234	1435	6416	118	12383	1172	42.5

† Six-species mix: pea + oat + canola + hairy vetch + forage radish + barley mixture, Inorganic N: inorganic nitrogen; LON: labile organic nitrogen; 24h-CO_2-C: 24h-carbon dioxide-carbon; 72h-CO_2-C: 72h-carbon dioxide-carbon; MBC: microbial biomass carbon; SOC: soil organic carbon; Total N: total nitrogen; POC: particulate organic carbon; PON: particulate organic nitrogen; MAOC: mineral-associated organic carbon; MAON: mineral-associated organic nitrogen; and WAS: wet aggregate stability

COVER CROP EFFECTS ON CARBON AND NITROGEN CYCLING AND GREENHOUSE GAS BALANCE IN SEMI-ARID IRRIGATED CROPPING SYSTEMS

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OBJECTIVE

This study aimed to evaluate CO_2 and N_2O emissions, net GHG balance (GHG_{net}), greenhouse gas intensity (GHGI), yield-scaled GHG emissions, and soil properties in an irrigated forage corn (*Zea mays* L.) -sorghum [*Sorghum bicolor* (L.) Moench] rotation.

MATERIALS AND METHODS

The study was established on the Olton clay loam soil (fine, mixed, superactive, thermic Aridic Paleustolls) at the New Mexico State University Agricultural Science Center (ASC), Clovis, NM. The study area has a hot, dry, semi-arid environment. The study was conducted in a no-till corn and sorghum rotation with winter fallow starting late September to early May of the subsequent year. Both corn and sorghum were present each year, and cover crops were planted to replace fallow following both corn and sorghum crops. Treatments included 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 using a double-disc drill opener (Model 3P600, Great Plains Manufacturing, Inc., Salina, KS, USA), maintaining 6-inch row spacing. Cover crop seeding rates were determined based on individual seed size and germination potential to maintain a comparable plant population on each species combination. All the cover crops were terminated by using a mixture of chemical herbicides. Cash crops, forage corn and sorghum, were planted in mid-May, about three weeks after cover crop termination, and harvested in September each year.

CO_2 and N_2O 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). Polyvinyl chloride (PVC) rings of 4-inch diameter and 4-inch height were installed in each experimental plot about 8-inch away from the crop row. The rings were removed during field operation and re-installed at the same spot after completing the fieldwork. CO_2 fluxes were measured by using Environmental Gas Monitoring System (EGM-5) portable CO_2 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 CO_2 gas was recorded. Aliquots of air entering the CO_2 analyzer passed through a MIRA Pico Laser Analyzer (Aeris Technologies, Hayward, CA, USA) to determine N_2O emissions.
The GHG_{net} from CO_2 and N_2O was calculated by using an equation for soil heterotrophic respiration method slightly modified from Sainju (2020) as described below:

GHG_{net} (kg CO_2 eq. ha^{-1} yr^{-1})=CO_2 eq. of (farm operations + farm inputs + soil heterotrophic respiration + N_2O emission – crop residue returned to the soil) where, CO_2 eq. of farm operations included installation and use of the central pivot; farm inputs include production, transportation, storage, transfer, and application of fertilizers, pesticides, and herbicides; cash crop and cover crop planting and cash crop harvesting. The CO_2 eq. of farm operations and farm inputs were calculated using literature values. A conversion factor of 310 was used to estimate the CO_2 equivalent of N_2O emission because the GWP of N_2O is 310 times higher than CO_2 on a 100-yr timescale.

RESULTS

The CO2-C emissions trend in cover crop-forage corn rotation had consistently higher fluxes when standing crop or cover crop was present in the field. The highest fluxes were observed during the corn growing phase in both years. Also, NCC treatment had lower emissions than cover crop mixtures in the cover crop phase of the rotation. CO2-C emission across years and cover crop phase were 10.3–10.8 times greater in cover crop treatments than the NCC (Table 1). However, CO2-C emissions did not vary among treatments during the corn phase of the rotation. Regardless of crop growth phase and years, CO2-C emission in cover crop treatments was 1.29–1.39 times higher than NCC.

CO2-C emission in cover crop-forage sorghum rotation also had a consistent trend of higher fluxes when standing cover crop, or cash crop was present in the field, and the highest flux peaks were observed in the sorghum growth phase in both years (Fig. S3A). CO2-C emission across years and cover crop phase were 5.38–7.65 times higher in cover crop mixtures than NCC, which also did not take account of system C balance (Table 1). During the sorghum growth phase, no significant differences were observed among treatments. Cover crop mixtures had 1.54–2.01 times higher CO2-C emissions than NCC when at the system scale.

Soil N2O-N emissions were inconsistent in cover crop and corn phases across years (Fig. S2B). The N2O-N emission did not differ among treatments (Table 1). GL mixture had 79–99% greater N2O-N emissions than NCC and GBL across years during the corn phase of the rotation. Soil N2O-N emissions in the cover crop-sorghum rotation were inconsistent in both phases and years. Under the GBL mixture, N2O-N emissions were 4.48 times higher than in NCC but similar to GB and GL in the sorghum phase (p = 0.06) (Table 1). It was negative during the cover crop phase in both years. No treatment differences were observed across crop growth phases and years.

Cover crop inclusion in forage cropping systems significantly increased CO2 and N2O emissions while they had no effects on GHGnet, GHGI, and yield-scaled CO2 and N2O emissions compared to NCC. Cover cropping did not necessarily reduce GHG emission in semi-arid irrigated forage systems, but the yield benefits from cover crops at the same environmental cost compared to NCC demonstrate its potential as a climate-smart management practice. Compared to NCC, cover crops utilized residual N to prevent it from being lost in the environment. Adopting such management practices not only maintains soil health but also supports forage producers by increasing farm profitability through forage yield benefits.

Table 1. Average CO2-C and N2O-N emissions under diverse cover crop treatments from 2018–2020.

	CO_2-C emission				N_2O-N emission			
	Forage corn		Forage sorghum		Forage corn		Forage sorghum	
	Cover crop phase §	Cash crop phase	Cover crop phase	Cash crop phase	Cover crop phase	Cash crop phase	Cover crop phase	Cash crop phase
Treatment†	(CO_2-C kg ha^{-1} day^{-1})				(N_2O-N g ha^{-1} day^{-1})			
NCC	7.79b‡	162	10.5b	85.8	-3.42‡	10.2b	-13.5	7.68b
GBL	84.3a	136	80.3a	113	-5.96	9.18b	-13.1	34.4a
GB	78.2a	157	62.7a	85.7	-8.76	14.2ab	-16.3	16.1ab
GL	83.8a	155	56.5a	100	-10.2	18.3a	-6.31	15.3ab
Year								
2018/19	42.6	167	38.1b	92.6	-19.4b	9.33b	-9.09	10.1b
2019/20	84.4	138	66.9a	99.9	5.25a	16.6a	0.79	26.7a

† NCC – no cover crops control; GBL – grasses, brassicas, and legumes mixture; GB – grasses and brassicas mixture; GL – grasses and legumes mixture where grasses include annual ryegrass and triticale, brassicas include daikon radish and turnip, and legumes include berseem clover and winter pea.

‡ Mean values (± standard error) followed by different lowercase letters in a column indicate significant differences among cover crop treatments or between years ($p \leq 0.05$, LSD test).

§ In 2018/19 cropping year, the cover crop phase represented the CO_2-C monitored from November 20, 2018, to May 15, 2019, and cash crop from May 16, 2019, to September 5, 2019, whereas in 2019/20 cropping year, cover crop phase represented CO_2-C monitored from September 6, 2019, to May 14, 2020, and cash crop phase from May 15, 2020, to September 3, 2020.

ORGANIC SEED TREATMENT STUDY IN VALENCIA PEANUT

Investigators: M. Ojha and N. Puppala

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OBJECTIVE

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

MATERIALS AND METHODS

The experimental trial was planted on June 10, 2021, in 36-inch rows under center pivot irrigation. The study site was on an organic peanut grower's field in Tokio, Texas. Soil type is an Amarillo-Acuff-Olton, and elevation is 3300 feet above sea level. Individual plots consisted of two rows which were 36-inch wide and 10 feet long. There were four replications for each entry, planted in a randomized complete block. Individual plots were planted at a seed rate of five seeds/foot. Plots were planted with a John Deere Max Emerge planter fitted with cone metering units.

The details of the seed treatments are provided in Table 1, along with the application type (seed treatment or liquid) and rate of application. The list of treatments evaluated included a chemical (Dynasty) product for comparison. The previous crop was cotton.

The irrigation amount was roughly 1.5 inches per week except at planting when 3 inches of water was applied. Peanuts were dug on October 18, 2021, and left for a week for drying. Peanuts were thrashed with a small plot thrasher. Individual plot weights were recorded after drying the samples to 8% moisture. The plot yield was converted to pounds per acre, and the results are reported in Table 2. Peanut quality, as measured by Total Sound Mature Kernels (TSMK), was graded using 500 grams of pods. The plot yield was converted to pounds per acre and economic net return was also calculated based on the U.S. Department of Agriculture's (USDA) Commodity Credit Corporation (CCC) which uses the percentage of sound mature kernels (SMK) and sound splits to compute the basic loan value of the load and the results are reported in Table 1. The loan price for Valencia-type regular peanuts that were for 2021 was $ 5.39 per percent as announced by USDA for the 2021 crop. We used the price for organic type peanuts that is almost twice that of regular peanuts $ 10.80 per percent.

Statistical Analysis

All data were subjected to SAS® procedures for a test of significant difference between varieties. Mean separation procedures (protected (P<0.05) least significant differences) were used to determine where differences exist.

Results and Discussion

Peanut pod yield data along with TSMK for the 2021 seed treatment study are presented in Table 2. The average pod yield was higher when the seeds were treated with organic quantum (2407 lb/ac), Larise Vita (2183 lb/ac), Chemical check (2098 lb/ac), Mycostop (2002 lb/ac), Organic VSC (2002 lb/ac) and untreated check (1576 lb/ac). These 11 treatments were significantly different for yield and net return per acre. The average pod yield for the trial was 1921 lb/ac. There was no significant difference between the grades among the treatments.

Table 1. Details of seed treatment and rate of application.

S.N	Company	Product name	Application type	Application Rate
1	AKX-602	Bio Fungicide	Liquid IF	1 Qt/ac
2	AKX-612	Bio Stimulant	Liquid IF	1 Pt/ac
3	AKX 618	Bio Stimulant	Liquid IF	1 Pt/ac
4	Untreated Check	Untreated check	None	N/A
5	Chemical check (Dynasty)	Raw Peanut Seed	Seed treatment	1 g/kg seed
6	Garlic	Agroenergy resources	Liquid IF	3%
7	Larise Vita	Bio fungicide	Powder	1 g/kg seed
8	Mycostop	Bio fungicide	Seed treatment	2.5g/kg seed
9	Organic Quantum	Bio fungicide	Liquid IF	1 Pt/ac
10	Organic VSC	Bio fungicide	Liquid IF	1 Pt/ac
11	Prestop	Bio fungicide	Seed treatment	1 g/kg seed

IF = in furrow application

Table 2. One-year average pod yield, total sound mature kernels (TSMK) grade, and net return ($)

S.N	Inoculant	Pod Yield (lb/ac)	Grade (TSMK)	Net Return ($/ac)
1	AKX-602	1597 gh	67.7	584.40 e
2	AKX-612	1909 de	64.2	662.27 d
3	AKX 618	1769 f	67.8	647.33 d
4	Untreated Check	1576 h	67.0	570.47 e
5	Chemical check (Dynasty)	2098 bc	66.6	754.90 bc
6	Garlic	1885 e	64.8	659.03 d
7	Larise Vita	2183 b	68.3	804.77 ab
8	Mycostop	2002 cd	68.1	736.30 c
9	Organic Quantum	2407 a	64.9	844.53 a
10	Organic VSC	2002 cd	67.9	734.60 c
11	Prestop	1704 fg	67.2	617.90 de
	Mean	**1921**	**66.7**	**692.41**
	LSD 0.05	113	3.3	52.79
	Pr > F	<0.0001	NS	<0.0001

±Means followed by the same letter is not significantly different at a *p-value* of 0.05
Loan value for organic Valencia-type peanuts was calculated at $ 10.40 per percent

VALENCIA PEANUT BREEDING – ADVANCED BREEDING LINES

Investigators: N. Puppala1 and M. Ojha

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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.

MATERIAL AND METHODS

Site description and experimental design

The field experiments were conducted at three locations; in a research farm of USDA Lubbock, Texas, and a commercial peanut grower's field in Portales, New Mexico, and Morton, Texas. Either cotton or CRP grass was the previous crop in each location. The soil type in USDA Lubbock is brown and sandy loam, with smaller areas of grayish-brown, silty clay loams and the elevation is 2900 feet. The soil type of Portales and Morton is an Amarillo-Acuff-Olton and Amarillo loamy fine sand respectively. The experimental design in each location was a randomized complete block with three replications.

Management

Plots were planted on May 24 at USDA Lubbock, June 8 at Portales, and May 17 at Morton. Plots were planted with a John Deere Max Emerge planter fitted with cone metering units at a seed rate of five seeds/foot. Each plot has two rows which were 36 inches wide and 12 feet long at Portales, and 40 inches wide and 12 feet long at both Lubbock and Morton. Cultivation practices included conventional tillage before planting peanuts. Intercultural operations were done when necessary for the normal growth and development of the crop. The crop was irrigated roughly 1.5 inches per week except at planting when 3 inches of water was applied.

Harvesting

In USDA, Lubbock, peanuts were dug on October 1, 2021, and thrashed on the same day with a small plot thrasher (Kingaroy Engineering Works, Kingaroy Australia). Peanuts were dug on September 30 at Morton, Texas, and October 15 at Portales, New Mexico, and left for a week for drying. Individual plot weights were recorded after drying the samples to 8% moisture. The plot yield was converted to pounds per acre and economic net return was also calculated based on the U.S. Department of Agriculture's (USDA) Commodity Credit Corporation (CCC) which uses the percentage of sound mature kernels (SMK) and sound splits to compute the basic loan value of the load and the results are reported in Table 1. The loan price for Valencia-type peanuts was $5.393 per percent as announced by USDA for the 2021 crop.

STATISTICAL ANALYSIS

Data for each variable were analyzed using the PROC MIXED model in SAS 9.3 (SAS Institute). An LSD t-test was used for mean separation involving entries (Steele and Torrie, 1989).

RESULTS AND DISCUSSION

The average pod yield and net return of the top 16 varieties are shown in Table 1. The highest average pod yield for all locations was shown by NMSU 6 (3886lb/ac) followed by NMSU 16 (3830 lb/ac), NMSU 4 (3792 lb/ac), and NMSU 5 (3785 lb/ac). The average net return for all three locations was higher for NMSU 6 ($ 932.9), followed by NMSU 16 ($ 919.3), NMSU 4 ($ 910.0), and NMSU 5 ($ 908.5).

Table 1. One year average of pod yield and net return for top 16 varieties

Location	Lubbock	Portales	Morton		
Variety	Yield (lb/ac)	Yield (lb/ac)	Yield (lb/ac)	Average of all locations Yield (lb/ac)	Average of all locations Return ($/ac)
NMSU 1	3396 abcde	3310 efg	4122 abcd	3609 cdef	866.3 cdef
NMSU 2	3622 ab	3727 abc	3315 e	3555 defg	853.0 defg
NMSU 3	3638 ab	3186 fg	4130 abcd	3651 bcde	876.4 bcde
NMSU 4	3658 a	3434 def	4284 abc	3792 abc	910.0 abc
NMSU 5	3493 abc	3709 abcd	4154 abc	3785 abc	908.6 abc
NMSU 6	3606 ab	3496 bcde	4558 a	3887 a	932.9 a
NMSU 7	3186 def	3807 a	3928 bcd	3640 bcdef	873.8 bcdef
NMSU 8	3646 ab	3363 efg	4066 abcd	3692 abcd	886.0 abcd
NMSU 9	3654 ab	3106 g	3146 e	3302 h	792.7 h
NMSU 10	3453 abcd	3212 fg	3638 de	3434 fgh	824.2 fgh
NMSU 11	2791 g	3736 abc	3840 cd	3456 efgh	829.2 efgh
NMSU 12	3043 fg	3461 cdef	4308 abc	3604 cdef	865.0 cdef
NMSU 13	3420 abcd	3878 a	3840 cd	3713 abcd	891.0 abcd
NMSU 14	3114 ef	3913 a	3945 bcd	3657 bcde	877.7 bcde
NMSU 15	3364 bcde	3390 ef	3307 e	3354 gh	805.0 gh
NMSU 16	3307 cdef	3771 ab	4412 ab	3830 ab	919.2 ab
Mean	**3399**	**3531**	**3937**	**3623**	**869.4**
LSD	292	282	507	206	49.6
Pr > F	0.0001	0.0001	0.0001	0.0001	0.0001

±Means followed by the same letter is not significantly different at a *p-value* of 0.05
The loan value for Valencia-type peanuts was calculated at $ 5.40 per percent

PERFORMANCE OF VALENCIA PEANUT VARIETIES

Investigators: N. Puppala1 and M. Ojha

New Mexico State University, Agricultural Science Center at Clovis, NM 88101

OBJECTIVE

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

MATERIAL AND METHODS

Site description and experimental design

The field experiments were conducted at three locations; in a research farm of USDA Lubbock, Texas, and a commercial peanut grower's field in Portales, New Mexico, and Morton, Texas. Either cotton or CRP grass was the previous crop in each location. The soil type in USDA, Lubbock is a brown and sandy loam, with smaller areas of grayish-brown, silty clay loams and an elevation is 2900 feet. The soil type of Portales and Morton is an Amarillo-Acuff-Olton and Amarillo loamy fine sand respectively. The experimental design in each location was a randomized complete block with three replications.

Management

Plots were planted on May 24 at USDA Lubbock, June 8 at Portales, and May 17, 2021, at Morton. Plots were planted with a John Deere Max Emerge planter fitted with cone metering units at a seed rate of five seeds/foot. At Portales, each plot has two rows which were 36 inches wide and 12 feet long and at Lubbock and Morton, plots were 40 inches wide and 12 feet long. Cultivation practices included conventional tillage before planting peanuts. Intercultural operations were done when necessary for the normal growth and development of the crop. The crop was irrigated roughly 1.5 inches per week except at planting when 3 inches of water was applied.

Harvesting

In USDA, Lubbock, peanuts were dug on October 1, 2021, and thrashed on the same day with a small plot thrasher (Kingaroy Engineering Works, Kingaroy Australia). Peanuts were dug on September 30 at Morton, Texas, and October 15 at Portales, New Mexico, and left for a week for drying. Individual plot weights were recorded after drying the samples to 8% moisture. The plot yield was converted to pounds per acre and economic net return was also calculated based on the U.S. Department of Agriculture's (USDA) Commodity Credit Corporation (CCC) which uses the percentage of sound mature kernels (SMK) and sound splits to compute the basic loan value of the load and the results are reported in Table 1. The loan price for Valencia-type peanuts was $5.393 per percent as announced by USDA for the 2021 crop.

STATISTICAL ANALYSIS

Data for each variable were analyzed using the PROC MIXED model in SAS 9.3 (SAS Institute). An LSD t-test was used for mean separation involving entries (Steele and Torrie, 1989).

RESULTS AND DISCUSSION

Among all, four varieties, namely M-2, GT-108, PR-42, and M-7 showed higher average pod yield compared to the check cultivar, Valencia-C (Table 1). The net return was higher for the M-2 ($763.0), followed by GT-108 ($ 692.1), PR-42 ($ 679.4), and M-7 ($ 677.8). The average yield for the trial was 2738 lb/ac. Lubbock location yields were lower compared to the other two locations as no supplemental irrigation was provided after 60 days of planting.

Table 1. Average yield and net return of twelve variety

Location / Variety	Lubbock Yield (lb/ac)	Portales Yield (lb/ac)	Morton Yield (lb/ac)	Average of all locations Yield (lb/ac)	Average of all locations Net Return ($/ac)
NuMex-308	1387 ab	3496 ab	3146 abc	2676 b	642.4 b
NuMex-309	1621 ab	3123 b	2791 bc	2512 b	602.9 b
NuMex-310	1379 ab	3274 ab	3380 abc	2678 b	642.7 b
GenTex-108	1533 ab	3505 ab	3614 ab	2884 ab	692.1 ab
GenTex-289	1242 b	3540 ab	3444 abc	2742 ab	658.2 ab
NuMex-KC-5	1154 b	3434 ab	3735 a	2774 ab	665.8 ab
NuMex-M-2	1855 a	3762 a	3920 a	3179 a	763.0 a
NuMex-M-6	1291 b	3683 a	2815 bc	2596 b	623.1 b
NuMex-M-7	1597 ab	3487 ab	3388 abc	2824 ab	677.8 ab
NuMex-PR-25	1162 b	3594 ab	3259 abc	2672 b	641.1 b
NuMex-PR-42	1468 ab	3345 ab	3678 a	2831 ab	679.4 ab
VAL-C	1444 ab	3310 ab	2727 c	2493 b	598.4 b
Mean	**1428**	**3463**	**3325**	**2738**	**657.2**
LSD	555	537	853	485	116.5
Pr > F	0.01	0.4	0.005	0.0001	0.0001

±Means followed by the same letter is not significantly different at a *p-value* of 0.05
The loan value for Valencia-type peanuts was calculated at $ 5.40 per percent

4. SCREENING OF VALENCIA PEANUT LINES FOR DROUGHT TOLERANCE

Investigators: N. Puppala1 and M. Ojha

New Mexico State University, Agricultural Science Center at Clovis, NM 88101

OBJECTIVE

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

MATERIAL AND METHODS

Site description and experimental design

The field experiments were conducted at three locations, in a research farm of USDA Lubbock, Texas, on a commercial peanut grower's field in Portales, New Mexico, and Morton, Texas. Either cotton or CRP grass was the previous crop in each location. The soil type in USDA, Lubbock is a brown and sandy loam, with smaller areas of grayish-brown, silty clay loams and the elevation is 2900 feet. The soil type of Portales and Morton is an Amarillo-Acuff-Olton and Amarillo loamy fine sand respectively. The experimental design in each location was a randomized complete block with three replications.

Management

Plots were planted on May 24 at USDA Lubbock, June 8 at Portales, and May 17, 2021, at Morton. Plots were planted with a John Deere Max Emerge planter fitted with cone metering units at a seed rate of five seeds/foot. At Portales, each plot has two rows which were 36 inches wide and 12 feet long and at Lubbock and Morton, plots were 40 inches wide and 12 feet long. Cultivation practices included conventional tillage before planting peanuts. Intercultural operations were done when necessary for the normal growth and development of the crop. The crop was irrigated roughly 1.5 inches per week except at planting when 3 inches of water was applied at Portales. The plots were planted on the outside of the center pivot irrigation spans at Morton to mimic drought conditions with less amount of water during each irrigation. At USDA, ARS Cropping System research lab in Lubbock, the plots are not given any irrigation following 60 days after planting.

Harvesting

In USDA, Lubbock, peanuts were dug on October 1, 2021, and thrashed on the same day with a small plot thrasher (Kingaroy Engineering Works, Kingaroy Australia). Peanuts were dug on September 30 at Morton, Texas, and October 15 at Portales, New Mexico, and left for a week for drying. Individual plot weights were recorded after drying the samples to 8% moisture. The plot yield was converted to pounds per acre and economic net return was also calculated based on the U.S. Department of Agriculture's (USDA) Commodity Credit Corporation (CCC) which uses the percentage of sound mature kernels (SMK) and sound splits to compute the basic loan value of the load and the results are reported in Table 1. The loan price for Valencia-type peanuts was $5.393 per percent as announced by USDA for the 2021 crop.

STATISTICAL ANALYSIS

Data for each variable were analyzed using the PROC MIXED model in SAS 9.3 (SAS Institute). An LSD t-test was used for mean separation involving entries (Steele and Torrie, 1989).

RESULTS AND DISCUSSION

Among all, four varieties, namely V7, V21, C-76, and V4 showed higher average pod yield compared to the check cultivar, Valencia-C (Table 1). The net return was higher for the V7 ($790.8), followed by V21 ($ 739), C-76 ($733.5), and V4 ($ 720.4). The average yield for the trial was 2500 lb/ac.

Table 1. Average yield and net return of drought-tolerant varieties in 2021.

Location	Lubbock	Portales	Morton	Average of all locations	Average of all locations
Variety	**Yield (lb/ac)**	**Yield (lb/ac)**	**Yield (lb/ac)**	**Yield (lb/ac)**	**Return ($/ac)**
V4	2759 abc	3665 a	2581 a	3002 a	720.4 a
V7	3025 ab	4383 a	2476 ab	3295 a	790.8 a
V21	2751 abc	4099 a	2388 ab	3079 a	739 a
V30	2226 bc	2431 b	1831 bc	2163 cde	519.1 cde
V42	2936 ab	2591 b	1396 cd	2308 cd	553.8 cd
V47	2097 bc	2591 b	1097 d	1928 de	462.8 de
V48	3501 a	3780 a	1460 cd	2914 ab	699.3 ab
V112	1823 c	2280 b	1250 cd	1785 e	428.3 e
V142	2420 bc	2591 b	1250 cd	2087 cde	500.9 cde
V174	2799 ab	2822 b	1662 cd	2428 bc	582.6 bc
C-76	2751 abc	3869 a	2549 a	3056 a	733.5 a
Val-C	2218 bc	2529 b	1129 d	1959 cde	470.1 cde
Mean	**2609**	**3136**	**1756**	**2500**	**600.1**
LSD	946	797	697	498	119.4
Pr > F	0.007	<0.0001	0.0004	0.0001	0.0001

±Means followed by the same letter is not significantly different at a *p-value* of 0.05
The loan value for Valencia-type peanuts was calculated at $ 5.40 per percent

PERFORMANCE OF COTTON VARIETIES, 2021

Investigators: N. Puppala1, M. Ojha and A. Scott1

1New Mexico State University, Agricultural Science Center at Clovis, NM 88101

OBJECTIVE

To evaluate nine commercial cotton varieties suitable for eastern New Mexico.

MATERIAL AND METHODS

The cotton variety trial was planted on April 27, 2021, in 30-inch rows under center pivot irrigation. Soil type is an Olton silty clay loam, and the elevation is 4,435 feet. Individual plots consisted of single, 30-inch rows 30 feet long. The number of entries evaluated in 2021 was nine (Three varieties from Phytogen, and six from BASF seed company). There were four replications for each entry, planted in a completely random block. Individual plots were planted at a seed rate of 5 seeds/foot. Plots were planted with a John Deere Max Emerge planter fitted with cone metering units.

On April 7, 2021, the planting area was strip-tilled and a pre-plant burndown was done by spraying herbicide Roundup Power Max (1 qts/ac) along with Panther SC (10 Oz/ac). The fertilizer applied was 45-35 N: P, along with 6.3 pounds S and 2 qts/ac Zinc on April 12. On April 13, the planting area was treated with herbicide Satellite hydrocap (3 pts/ac) as pre-emergence application along with liquid fertilizer (45 pounds N/acre) @10 gallon/ acre. After planting on April 30, 2021, herbicides Brawl (0.8 pts/ac), Roundup Power Max (1qts/ac), accuvant (4oz/ac), and Caparol (1.6pts/ac) were applied and irrigated. An insecticide Acephate 97S (4 Oz/ac), was applied for the control of thrips, and a foliar fertilizer 20-20-20 (5lb/ac) to promote early root shoot and leaves in young plants were done on June 5. On July 8, a growth regulator Stance (2oz/ac), Carbine (2.8 oz/ac) to control cotton fleahoppers, and Warrant (1.5qts/ac) to control pre-emergence of grass and broadleaf weeds were applied. On July 22, Stance (2.5 oz/ac) and foliar fertilizer (2lb/ac) were applied. On August 5, Prevathon (20 Oz/ac) to control cotton bollworm, Stance (3 oz/ac), were applied. Growth regulator Stance was applied in the Low Rate Multiple (LRM) strategy from the early squaring stage to the boll development stage. Prevathon (14oz/ac) was again applied on August 18 along with plant growth regulator Pix (24 Oz/ac) on September 1. The final application of a cotton defoliant Folex (1pt/ac) to remove cotton leaves from the plant and Super boll (40 oz/ac) to open a mature cotton boll was applied on October 9.

The total irrigation amount was 7.7 inches applied over the growing period. The plots were harvested on November 4, 2021, with a cotton stripper. Individual plot weights were recorded. For fiber quality, each plot was hand-harvested with 25 bolls randomly picked within a plot. The fiber samples were sent to the Louisiana State University ginning lab after calculating the lint percent from 25 boll samples.

STATISTICAL ANALYSIS

All data were subjected to SAS® procedures for a test of significant difference between varieties. Mean separation procedures [(protected ($P<0.05$) least significant differences] were used to determine where differences exist. The USDA loan calculator for the year 2020 was used for estimating loan value and estimated net return $ per acre.

RESULTS AND DISCUSSION

Yield data and quality traits for the 2021 cotton trial are presented in Table 1, lint yield for the nine varieties in the trial, ranging from 563 to 1697 lb/ac with a trial average of 1105 lbs/acre. The estimated net return was $ 837 for PHY 332, followed by $ 818 for PHY 400. The average net return was $ 539. We had a 2-4 D herbicide drift that affected all varieties except the Phytogen varieties that had Enlist trait that provides tolerance to 2,4-D choline, and it did not affect the yield.

Table. 1. New Mexico 2020 Cotton Variety Performance Test - Agricultural Science.

Company name	Variety name	Seed (cotton)	Lint yield	Bales	Lint (%)	Boll wt.	L	Uni.	SFI	Str	MIC	Mat	Loan value	Est net ret.	Rank
		lbs/a	lbs/a	per a		g							cents/lb.	$/a	
1	DP 1822	2043 BC	840 BC	1.7 BC	41.2 DE	5.5BC	1.3 AB	83.1 B	7.8AB	31.1 BC	4.3 C	81.8AB	55.8 A	401BC	7
2	DP 2020	2246 B	910 BC	1.9 BC	40.4 E	5.2 BC	1.2 BC	82.4 B	8.4 A	28.7 D	4.2 C	81.8 AB	56.7 AB	443 B	5
3	F2334	1331 D	563 D	1.2 D	42.2BCDE	5.0 C	1.2 A	84.1A B	7.5 AB	30.2 CD	4.4 BC	81.5ABC	56.3 AB	273 C	9
4	FM1730	2469 B	1025 B	2.1 B	41.4 CDE	5.6 B	1.2ABC	83.6A B	6.9 B	31.1 BC	4.5 ABC	82.3 A	56.4 AB	498 B	4
5	FM2498	1707 CD	736 CD	1.5 CD	43.2 ABC	6.4 A	1.2 AB	84.1B A	7.9 AB	27.7 D	4.6 AB	82.3 A	56.8 AB	362 BC	8
6	PHY 332	3913 A	1686 A	3.5 A	43.1ABCD	5.5 BC	1.8 C	84.3 A	7.9 AB	32.8 BA	4.4 BC	80.5 D	57.3 A	837 A	1
7	PHY205	3842 A	1697 A	3.5 A	44.2 A	5.7 B	1.1 D	82.8A B	7.7 AB	32.5 AB	4.7 AB	82.0 AB	54.7 C	804 A	3
8	PHY400	3669 A	1637 A	3.4 A	44.7 A	5.3 BC	1.2 C	84.4 A	8.0 AB	33.6 A	4.3 C	80.8 CD	57.3 A	818 A	2
9	ST4993	1514 D	852 BC	1.8 BC	43.6 AB	5.5 BC	1.2 ABC	84.8 A	7.2 B	31.3 BC	4.7 A	81.3BCD	56.5 AB	420 B	6
	Trial Mean	**2526**	**1105.1**	**2.3**	**42.7**	**5.5**	**1.2**	**83.8**	**7.7**	**31.1**	**4.4**	**81.6**	**56.4**	**539.4**	
	CV	13.3	16.7	16.7	3.1	7.4	2.7	1.5	9.9	3.9	4.4	0.8	1.6	7.6	
	Pr>F	<0.0001	<0.0001	<0.0001	0.0013	0.0058	0.2976	0.2835	<0.000 1	<0.0001	0.0076	0.0047	0.0158	<0.0001	
	LSD0.05	491.7	268.85	0.55	1.91	0.59	0.04	1.88	1.11	1.75	0.28	0.92	1.32	138.22	
	Pr>F	<0.0001	<0.0001	<0.0001	0.0013	0.0058	<0.0001	0.2976	0.2835	<0.0001	0.0076	0.0047	0.0158	<0.0001	

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

Investigators: Sangu Angadi, Mallory Nielson and Paramveer Singh

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RATIONALE

Declining Ogallala Aquifer is threatening irrigated agriculture and the sustainability of the rural economy in the region. In addition, a limited number of crops grown in the region have led to problems like grassy weeds problem in wheat. Therefore, growing a crop like canola, which uses much less water and other inputs compared to corn, can offer many benefits. Canola is a broadleaf and has multiple herbicide tolerances incorporated into some of its cultivars. That will help in weed management in the rotation. In addition, it is expected to offer other rotational benefits. Canola oil is becoming 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, are 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.

OBJECTIVES

1) To assess growth, winter survival, and productivity of new winter canola open-pollinated cultivars and hybrids.

MATERIAL AND METHODS

The experiment location was NMSU Agricultural Science Center in Clovis NM (34° 35' N, 103° 12' W, and elevation of 1348 m above mean sea level). These trials are part of the National Winter Canola Variety Trials conducted by Mr. Mike Stamm, the canola breeder from Kansas State University. For the 2020-21 growing season, 18 open-pollinated and 14 hybrid canola were seeded separately in two trials on September 14, 2020, using a plot drill. Plots were 30 ft long and 6 ft wide and had 11 rows. The trial was irrigated with 13 inches of water.

MATERIAL AND METHODS

Design: RCBD
Replications: Three
Treatments:

1) Open Pollinated Trial:
    a. Population 500,000 plants per ac
    b. Total entries: 18

2) Hybrid Trial:
    a. Population 300,000 plants per ac
    b. Total entries: 14

Table 1. Winter canola open-pollinated variety trial at Clovis, NM in 2020-21.

Variety	Stand Count (0-10)	Vigor Rating (1-5)	Winter Survival (0-100)	Bloom Date (days)	Maturity (days)	Height (inch)	Lodging (%)	Shatter Loss (%)	Test Weight (lbs/Bu)	Seed Yield (lbs/ac)
KS4662	8	4	32	98	168	43	0	0	48.6	2478
KS4677	8	3	38	97	167	41	0	0	48.3	2722
KS4719	7	3	33	100	167	38	0	0	48.7	1803
KSR4765	7	2	36	102	166	37	0	0	49.8	1851
KSR4767	6	2	40	102	167	38	0	0	50.5	2679
KSR4844S	7	3	43	101	167	41	0	0	53.3	2745
KSR4848	7	3	37	101	166	39	0	0	50.9	2763
KSR4854S	7	3	38	103	167	39	0	0	48.9	2659
KSUR1212	7	3	41	98	166	39	0	0	48.2	2344
Griffin	7	3	34	96	169	35	0	0	50.2	2378
Surefire	8	4	37	97	168	38	0	0	49.3	2312
Riley	6	3	48	101	167	36	0	0	49.6	2447
Wichita	7	3	36	100	166	38	0	0	49.2	2071
CP225WRR	6	2	30	99	168	36	0	0	48.7	2128
CP320WRR	8	3	36	98	167	37	0	0	50.8	2842
CP1022WC	6	2	42	103	169	39	0	0	50.4	2377
Torrington	7	3	44	100	168	37	0	0	49.9	2115
Star 930W	7	3	34	101	167	36	0	0	50.2	2246
Average	**7**	**3**	**38**	**100**	**167**	**38**	**0**	**0**	**49.8**	**2387**

RESULTS:

Extreme dry winters and warmer summer temperatures during the canola flowering period negatively affected its productivity during the season (Table 1 & 2). Average open-pollinated cultivars produced 2,387 lbs per ac, which was nearly 1/3rd less compared to the 2019-20 season. Among cultivars, KS4677 and CP320WRR were the best performing open-pollinated cultivars with 2,722 and 2,842 lbs per ac yield. Canola hybrid yields were similar or slightly lower compared to open-pollinated cultivars. The mean hybrid yield was 2,296 lbs per ac, which was also about 1/3rd less than the previous year. Plurax CL and PT293 hybrids produced the highest seed yield during the season.

The year also recorded lower fall vigor and winter survival. The year started as a wet fall. But, soon after rainfall stopped and we had an extremely dry winter with very little snow. Spring continued to be dry. When canola started flowering air temperature increased unusually high and that affected flowering, fertilization, and pod development. For a couple of weeks after flower initiation, we could not see any developing pods. Fortunately, flowering continued, and later flowers produced pods. Lower test weight compared to previous years also indicates a stressful year. Winter canola hybrids did not produce a higher yield compared to open-pollinated this year. In general, hybrids produce 10 to 15% more yield, but seed cost is also higher. More research is needed to assess hybrids over open-pollinated cultivars.

Table 1. Winter canola open-pollinated variety trial at Clovis, NM in 2020-21.

Variety	Stand Count (0-10)	Vigor Rating (1-5)	Winter Survival (0-100)	Bloom Date (days)	Maturity (days)	Height (in) (inch)	Lodging (%)	Shatter Loss (%)	Test Weight (lbs/Bu)	Seed Yield (lbs/ac)
CP1055WC	7	3	51	97	168	38	0	0	45.8	2238
CP1077WC	7	4	55	99	170	42	0	0	43.8	2360
Hermione	6	2	56	104	168	36	0	0	45.2	2223
MH 17HID007	6	3	48	101	168	36	0	0	44.8	2259
KWS Farry CL	6	2	54	101	166	37	0	0	43.6	2460
Plurax CL	7	3	60	102	166	36	0	0	52.2	2734
PT264	7	3	57	101	167	38	0	0	47.6	2260
PT271	7	3	50	104	167	38	0	0	49.0	2204
PT275	6	2	50	102	168	38	0	0	50.3	2359
PT293	7	3	45	101	167	40	0	0	50.7	2710
PT297	6	2	59	103	166	38	0	0	50.1	2047
PX126	7	3	56	102	168	39	0	0	49.7	2537
PX128	7	2	56	103	168	41	0	0	47.9	1788
PX131	6	2	58	102	168	37	0	0	50.1	1969
Average	**7**	**3**	**54**	**102**	**167**	**38**	**0**	**0**	**47.9**	**2296**

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

RATIONALE

Degrading ecosystem services under declining irrigation water resources and increasingly variable climate are threatening the 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 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 closure 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 spreading most benefits on the entire pivot, which is not possible with a line of tall tree rows growing on one side of the field.

Each component of the design (**perennial** species, **buffer** strip, **circular design,** and **multiple** circles) could add or improve benefits to the system. Expected efficiencies in the **water cycle** include 1) reduced evaporation and runoff losses of rainfall and irrigation water, 2) conserving high-intensity precipitation, off-season rainfall, and snowfall, 3) improved soil water storage, and crop water use efficiency. CBS could improve food **productivity** through reduced stress (e.g. water, wind, temperature), less crop damage (windblown soil abrasion), improved resource use efficiency (e.g. transpiration fraction, reduced input losses), improved **soil health** (e.g. soil structure, organic matter content, infiltration rate, water holding capacity) and **biodiversity** (e.g. pollinators, beneficial insects, nutrient cycling). CBS is also expected to reduce **greenhouse** gas emissions by reducing production inputs to perennial grasses, and improving resource-use efficiency, CO_2 fixation, and sequestration. In addition, producers get some **management benefits** (e.g. well pressure management, pivot maintenance). Preliminary results are promising with improvements in grain yield (>20%), microclimate, water conservation, and biomass production in border rows. This system may improve the long-term sustainability and profitability of irrigated agriculture in the region while reversing the degraded soil quality and ecosystem over time.

OBJECTIVES

- To evaluate the effect of circular grass buffer strips on the physiology of corn.
- To compare growth, and yield of corn with and without circular grass buffer strips.

MATERIALS AND METHODS

A long-term project was initiated at the New Mexico State University Agricultural Science Center, Clovis (34.60˚N, 103.22˚W, elevation 1331m). A mixture of native warm-season and cool-season grasses (Warm-season grasses were side oats grama, big bluestem, Blackwell switchgrass, indiangrass, and Cool Season grasses were Jose tall wheatgrass and western wheatgrass) were planted on August 8, 2016 (started with a USDA-NIFA seed grant) on a quarter section of a pivot. The quarter facing southwest direction was selected as it is the predominant wind direction in the region (Figure 1a). A Quarter section of nearby pivot facing the same direction without CBS served as control. The outermost strip was a grass strip (30 ft wide), which alternated with 60 ft wide crop strips. With a new USDA-NIFA funding, the trial was continued in 2021. Pioneer 1138 AML cultivar of corn was planted on 05/04/2021 with 0.76 m row spacing. Each crop strip in CBS had 24 corn rows. A total of 330 mm of irrigation was applied to corn in CBS and control. Grass strips of CBS received 152 mm of irrigation to ensure good biomass recovery from the previous drought year (2020). As the corn grew above grass height (benefit of CBS is minimum on corn), the grass was swathed on 31 st July 2021.

Physiological (photosynthetic rate, water potential, and chlorophyll fluorescence) and agronomic measurements (plant height and biomass) were taken at V-6, and tasseling. In addition, agronomic measurements were also taken at R2/3, R4, and harvest maturity. Physiological measurements were taken at noon, on a fully opened corn leaf. LI-COR 6400 portable photosystem was used to measure leaf photosynthetic rate. A continuous source fluorometer (Model OS 30p, Opti -Science) was used to measure fluorescence. A pressure bomb apparatus was used to measure leaf water potential. Both physiological and agronomic measurements were taken at various distances from the outer edge in both CBS and control. In CBS, all these observations were taken only in the first crop strip.

For biomass sampling, 4 plants from different rows were harvested, chopped, and fresh weight was recorded. Samples were oven-dried at 65 °C for 72 h. Dry biomass weight was recorded when constant dry weights were obtained after drying for three days. At maturity, 10 plants were hand-harvested for biomass. To assess the effect on large plots and integrate effects on different locations in the edge, 12 passes of 8 rows wide were harvested in the CBS pivot and control pivot. In CBS, each crop strip had 3 passes, two sharing edges with grass strips and one in the middle (Fig 1b). The seed yield was adjusted to a standard seed moisture content.

RESULTS AND DISCUSSION

The photosynthetic rate of corn at tasseling was greater in CBS than CT at all sampling distances, indicating enhanced physiological activity (Table 1). Less negative leaf water potential suggests that corn in the control pivot experienced a higher level of water stress than CBS, even though both received the same amount of irrigation. At all five distances, corn was taller and had more biomass than CT in 2021 (Table 2). Unlike 2020, which was an extremely dry decreased seed yield at the outer edge in CBS due to relatively less irrigation amount received by the first three crop rows and also competition between grass and corn for water, 2021 was relatively wetter, especially during the water-sensitive tasseling stage. A total of 9, 12, and 7% higher seed yield was found in CBS as compared to CT across three 8-row passes in CBS (Figure 2) with an overall 9% seed yield benefit. The three-year data indicates that this system proves beneficial across both dry and wet growing seasons. In addition, perennial grass buffer strips were used by birds to lay eggs. Thus, converting under/un-utilized part of partial pivots may not only improve agricultural productivity but also can increase water use-efficiency and wildlife activity.

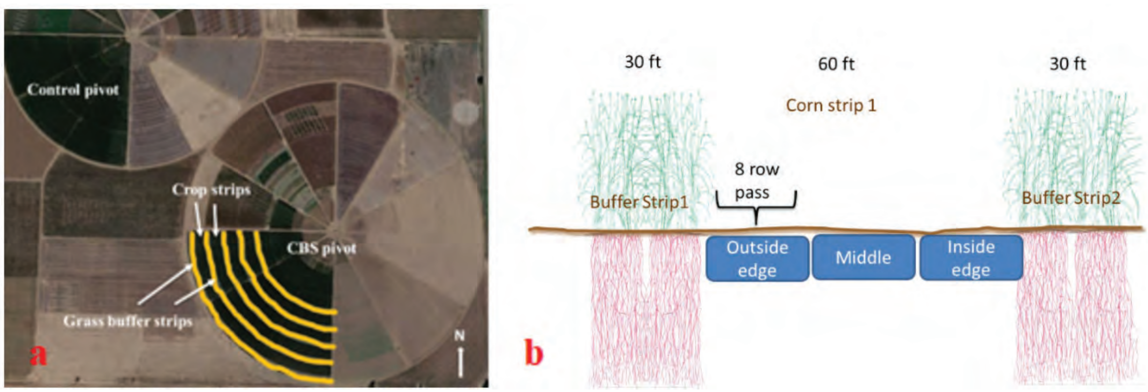

Figure 1. (a) Location of CBS and control pivot at ASC, Clovis. (b) Three harvest passes (each having 8 rows) of corn strip in CBS. Since there were 4 corn strips, a total of 12 passes were harvested. A similar number of passes were harvested in the control pivot.

Table 1. Comparison of mid-day photosynthesis, leaf water potential, and chlorophyll fluorescence of corn at tasselling between first crop strip of CBS and control at different distances from the outer edge of respective center pivot circles in 2019 and 2020 at ASC, Clovis.

Distance from outer edge (m)	Photosynthetic rate at tasseling ($\mu molm^{-2}s^{-1}$)		Leaf water potential at tasseling (bar)		Florescence (F_v/F_m)	
	Buffer	Control	Buffer	Control	Buffer	Control
2019						
1.5	8.5	3.4	-19.0	-22.8	0.76	0.70
3.8	12.0	6.9	-18.5	-21.1	0.80	0.69
9.1	21.0	11.9	-18.2	-19.9	0.79	0.75
14.5	17.1	14.1	-19.0	-19.6	0.81	0.76
16.7	13.9	15.3	-18.7	-19.8	0.81	0.70
2020						
1.5	27.1	26.8	-14.2	-15.5	0.76	0.79
3.8	28.9	24.8	-13.1	-14.8	0.78	0.79
9.1	30.4	26.0	-11.8	-13.0	0.81	0.79
14.5	30.3	27.3	-12.6	-12.3	0.80	0.80
16.7	33.0	30.5	-12.3	-11.9	0.79	0.79
2021						
1.5	35.0	32.9	-10.8	-13.4	0.77	0.75
3.8	37.8	34.1	-10.2	-12.6	0.77	0.75
9.1	39.9	36.9	-9.6	-12.2	0.80	0.76
14.5	37.7	42.7	-10.1	-11.6	0.79	0.78
16.7	36.1	39.9	-10.2	-11.3	0.76	0.78

Table 2. Comparison of plant height and biomass of corn at maturity between first crop strip of CBS and control at different distances from the outer edge of respective center pivot circles in 2019 (top) and 2020 (bottom) at ASC, Clovis.

Distance from outer edge (m)	Plant Height (cm)		Biomass at maturity (Kg ha^{-1})	
	Buffer	Control	Buffer	Control
2019				
1.5	140	120	7191	5418
3.8	160	152	11698	8575
9.1	176	164	15093	12001
14.5	160	162	14848	14949
16.7	167	138	13830	13445
2020				
1.5	142	118	8595	6456
3.8	179	156	12019	9207
9.1	194	177	15865	11227
14.5	186	184	14287	13950
16.7	179	183	14569	12489
2021				
1.5	209	187	16790	16469
3.8	231	212	19558	18870
9.1	240	226	21546	20720
14.5	234	225	20804	18135
16.7	234	228	21074	19440

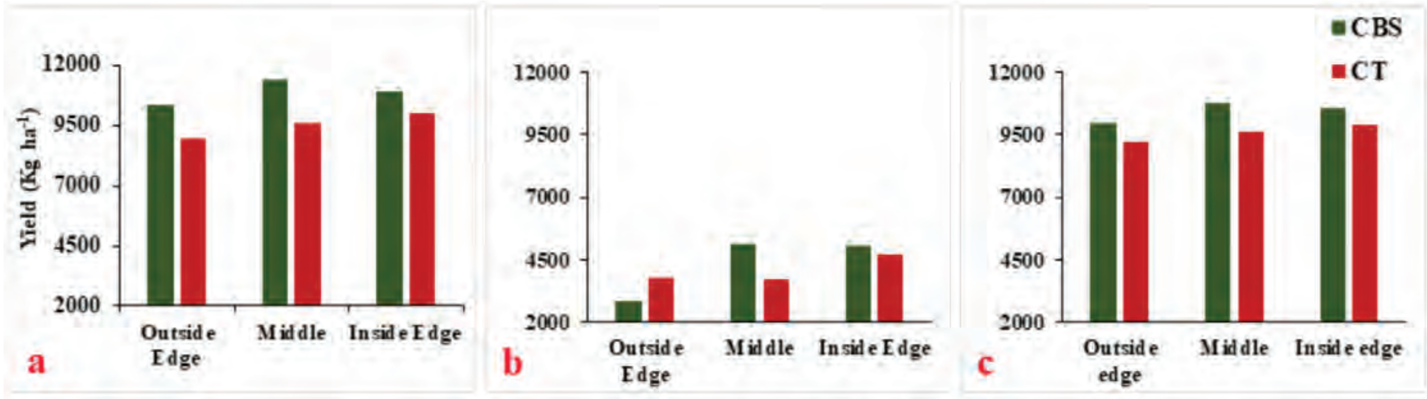

Figure 2. (a) Combine seed yield (kg ha-1) in control (CT) and circular buffer strip (CBS) pivots in 2019 (a), 2020 (b), and 2021 (c). The outer edge, middle, and inside edge combine passes covered 8 corn rows each.

EFFECT OF DIFFERENT IRRIGATION AND FERTILITY ON GUAR PERFORMANCE

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RATIONALE

Guar (Cyamopsis tetragonoloba L.) is a drought-tolerant, legume crop that is native to semi-arid and arid regions of Pakistan and India. In the United States (US), guar gum demand continues to increase due to unique properties found in it, which are used in many industries including oil and natural gas, food, cosmetics, and paper and textiles. The US is one of the major importers of guar gum across the globe.

Currently, guar production is primarily located in parts of Texas in the US, but expanding the area north and west into cooler regions of the southern High Plains will reduce market volatility. Previous studies have shown that different cultivars of guar exhibit unique qualities that increase crop yield in different climatic situations. Studies have also looked at how guar performs in different water and irrigation stresses. Consequently, this study looks at how diverse guar cultivars improve nutrient use efficiency at higher fertility levels if water was applied during preseason or in-season irrigation applications.

OBJECTIVES

2) To assess growth, biomass production, and yield formation by diverse guar cultivars under different nutrient levels and range of water availabilities.

3) To study water extraction patterns of guar cultivars under a range of nutrient and irrigation levels.

MATERIAL AND METHODS

The experiment location was NMSU Agricultural Science Center in Clovis NM (34° 35' N, 103° 12' W, and elevation of 1348 m above mean sea level). For this experiment, 20:20:20 fertilizer was used to create different fertility levels among plots. Three cultivars of guar, Kinman, Judd 66, and Matador, were used. For seasonal biomass measurements, above-ground samples were collected from a randomly selected meter length of guar and were oven-dried to constant weight for a few days at 55 C. For seed yield and harvest biomass measurements, plants were harvested from 2 m lengths were harvested, oven-dried, and threshed using a plot combine Data was analyzed using SAS.

Design: Split Plot

Treatments:

3) Factor 1(Main Plot): Irrigation
   a. Pre-irrigation (5 in)
   b. In-season irrigation (6.1 in)

4) Factor 2 (Sub-Plot): Fertilization
   a. NPK 0 lbs of 20:20:20 NPK/ac (0 NPK)
   b. NPK 20 lbs of 20:20:20 NPK/ac (20 NPK)
   c. NPK 40 lbs of 20:20:20 NPK/ac (40 NPK)
   d. NPK 60 lbs of 20:20:20 NPK/ac (60 NPK)

5) Factor 3 (Sub-Sub-Plot): Cultivar
   a. Kinman
   b. Matador
   c. Judd 66

Rainfall: During the guar growing season (6/7/21 - 11/4/21) we received 13.17 inches of rainfall. This is about average for this region.

Pot Size: 30 ft x 10 ft

Replications: 4

RESULTS AND DISCUSSION

Preliminary analyses of the first year are showing a significant effect of irrigation, fertilization on seasonal biomass production and seed yield, while cultivar differences were less significant (Table 1; Fig. 1).

Above-ground biomass was affected by irrigation treatments. Early in the season, when guar plants were small, guar growth was similar whether it received water through in-season irrigation or by water extraction from the soil from pre-season irrigation. During the two weeks of June and July, Clovis received a total of 7.10 inches of rain. Which made it difficult to compare irrigation treatments because both treatments received a large amount of rainfall in a short amount of time. However, at later stages by 84 days after planting, soil water from pre-season irrigation was not sufficient and guar from in-season irrigation produced more biomass than it. Guar plants were larger and flowering and pod production was initiated by that time, which needed extra water resources to support that growth and development. Small pre-irrigation of 5 in was not sufficient to support it. However, with significant differences in the later growth stages, it suggests that spaced-out irrigation treatments increase the production of guar. Similarly, seed yield also showed significant differences among irrigation treatments. Pre-irrigation (PI) had a considerably lower seed yield than NPI.

When looking at fertilization treatments, generally, as fertilization increased, biomass also increased but very slightly. Statistically speaking, we are seeing a significant difference between no fertilizer (0 NPK) and with fertilizer during most biomass harvests (Table 1). However, there is no significant difference in the above-ground biomass between the three treatments using fertilizer (20 NPK, 40 NPK, and 60 NPK). We see this in seed yield as well. No fertilizer treatment is significantly lower than other fertilizer treatments, regardless of how much was added. This again suggests that guar is a low input crop that rarely responds to higher inputs. This suggests that if the production is the same with 20 NPK and 60 NPK, to save money and fertilizer, treatment can be held to 20 NPK. However, further replications and/or experiments need to be performed to fully understand this theory.

The three cultivars, Kinman, Matador, and Judd66, showed very little differences in both above-ground biomass and seed yield. Judd66 variety had the greatest biomass after 44 days while Kinman variety had the greatest biomass after 63 days, and Matador had the highest biomass after 84, 107, and 140 days. This may indicate different varieties grow more or less at different stages of their life cycle. For instance, Judd66 may be more successful during the early growth stages, while Kinman grows best during mid-growth phases, and Matador grows the most in the later stages. Such findings may suggest when is the best time of the growing season to irrigate or fertilize these three varieties. Matador had the highest seed yield but this was not significant among the other cultivars.

Table 1: Preliminary results of above-ground biomass and seed yield of guar under two irrigation treatments, four fertility treatments, and three guar cultivars in 2021. Biomass was taken roughly every 3 weeks and shown as days after planting (DAP).

Treatments	Biomass 1 44 DAP (kg/ha)	Biomass 2 63 DAP (kg/ha)	Biomass 3 84 DAP (kg/ha)	Biomass 4 107 DAP (kg/ha)	Biomass 5 140 DAP (kg/ha)	Seed Yield Harvest (lbs/ac)
Irrigation						
Pre-irrigation (PI)	317 a	3601 a	4100 b	4670 b	4237 b	1632 b
In season irrigation (NPI)	371 a	3646 a	5522 a	6011 a	5687 a	2163 a
LSD	58	421	440	380	274	130
Fertilization						
0 NPK	358 a	3356 b	4478 a	4923 b	4524 b	1687 b
20 NPK	304 a	3302 b	4698 a	5238 ab	5076 a	1956 a
40 NPK	335 a	4115 a	5011 a	5598 a	5104 a	1957 a
60 NPK	378 a	3721 ab	5058 a	5602 a	5143 b	1989 a
LSD	82	595	622	536	388	184
Cultivar						
Kinman	346 ab	3923 a	4858 a	5347 ab	4934 ab	1829 a
Matador	301 b	3297 b	4961 a	5686 a	5157 a	1977 a
Judd 66	385 a	3650 ab	4615 a	4988 b	4794 b	1886 a
LSD	71	516	539	465	336	160

PERFORMANCE OF DRYLAND GRAIN SORGHUM VARIETIES

Investigators: B. Niece1, A. Mesbah1, A. Scott1

1New Mexico State University, Agricultural Science Center at Clovis, NM

OBJECTIVE

To evaluate grain yield components of dryland grain sorghum varieties submitted for testing in the New Mexico Corn and Sorghum Performance Trials.

MATERIALS AND METHODS

The grain sorghum variety trial was planted June 24, 2021, in 30-inch rows under center pivot irrigation. Soil type is an Olton silty clay loam and elevation is 4,435 feet. Individual plots consisted of two, 30-inch rows 20 feet long. There were three replications for each entry, planted in a randomized complete block. Individual plots were planted at a rate of 29,000 seeds/acre. Plots were planted with a John Deere Max Emerge planter fitted with cone metering units.

On May 1, the planting area was fertilized with 60 lb N/ac, 9 lb/ac Sulphur, 30 lb/ac of P2O5, and 2 qt/ac of chelated Zinc. At plant herbicide applications included Atrazine (2.0 pt/ac),and Warrant (2 qt/ac).

No irrigation was applied. Precipitation during the period after planting until the harvest was 6.7 inches.

The plots were harvested on November 7, 2021, with a WinterSteiger combine. Individual plot weights were recorded using a Harvest Master HM 800 Classic Grain Gage, which was also used to determine percent moisture and test weight (lb/bu). Reported yields are adjusted to standard 14.0% moisture and bushel weight of 56 pounds.

STATISTICAL ANALYSIS

All data were subjected to SAS® procedures for the test of significant differences between varieties. Mean separation procedures ((protected ($P<0.05$) least significant differences)) were used to determine where differences exist.

RESULTS AND DISCUSSION

Yield data for the 2021 grain sorghum trial are presented in Table 1, Grain yields, for the 23 varieties in the trial, ranging from 102.9 to 33.0 bushel/acre with a trial average of 68.3 bushel/acre.

Table 1. New Mexico 2021 Dryland Grain Sorghum Performance Test - Agricultural Science Center at Clovis

Company Name	Variety Name	Relative Maturity		Grain Yield	Grain Yield	Moisture at Harvest	Test Weight
				lb/a	bu/a	%	lb/bu
Dyna-Gro Seed	M72GB71	MF	17	6101	109.0	7.2	61.1
Sorghum Partners	251	E	4	5958	106.4	7.5	60.1
Dyna-Gro Seed	GX21965	MF	15	5332	95.2	7.7	61.1
Dyna-Gro Seed	GX20970	MF	14	5243	93.7	6.7	60.7
Dyna-Gro Seed	M60GB31	ME	8	5088	90.9	7.3	60.1
Dyna-Gro Seed	M67GB87	M	13	5026	89.8	7.0	59.5
Dyna-Gro Seed	GX20998	M	12	4918	87.8	6.3	58.8
Sorghum Partners	SP 43M80	ME	2	4743	84.7	8.1	61.1
Dyna-Gro Seed	GX20973	ME	10	4647	83.0	7.4	60.4
Dyna-Gro Seed	M59GB94	E	7	4617	82.5	7.2	61.2
Dyna-Gro Seed	M59GB57	E	6	4566	81.5	6.8	58.7
Dyna-Gro Seed	M63GB78	M	11	4551	81.3	5.5	60.2
Dyna-Gro Seed	M60GB88	ME	9	4529	80.9	7.2	59.2
Sorghum Partners	SP 68M57	M	3	4470	79.8	6.1	59.1
Dyna-Gro Seed	M71GR91	MF	16	4305	76.9	6.1	61.3
Dyna-Gro Seed	M54GR24	VE	5	3190	57.0	6.4	59.1
Sorghum Partners	SP 25C10	E	1	2734	48.8	6.7	57.4
		Trial Mean		4707	84.0	6.9	59.9
		LSD (P > 0.05)		NS	NS	NS	NS
		CV		17.8	17.8	11.2	1.8
		F Test		0.0965	0.0965	0.2251	0.0854

PERFORMANCE OF FORAGE CORN VARIETIES

Investigators: B. Niece1, A. Mesbah1, A. Scott1

1 New Mexico State University, Agricultural Science Center at Clovis, NM

OBJECTIVE

To evaluate the dry matter and green forage yield and nutritive value of forage corn submitted for testing in the New Mexico Corn and Sorghum Performance Trials.

MATERIALS AND METHODS

All 29 corn entries were planted on May 15, 2021, in 30-inch rows under center pivot irrigation. Soil type is an Olton clay loam and elevation is 4,435 ft. Individual plots consisted of two, 30-inch rows, 20 feet long. Plots were planted at a rate of 27,000 seeds/acre with a two-cone planter (Table 1).

Before planting, the planting area was fertilized with 40 lb N/ac, 3 qt zinc, and, 47 lb/ac of P2O5. Additional nitrogen was applied on May 13 (122 lb N/ac). Sulfur was applied on May 13 (22 lb/ac). Pre-plant herbicide applications included Panther, LV 6, and Glyphosate at rates of 2 oz/ac, 20 oz/ac, 32 oz/ac respectively. At plant herbicide applications included Atrazine (1 pt/ac), DiFlexx (16 oz/ac), Balance Flex (3 oz/ac) and Warrant (1.5 qt/ac). Diflexx and Warrant herbicides were applied on 1 July at 16 oz/ac and 1.5 qt/ac respectively. Onager miticide (16 oz/ac) was applied on 15 June. Two insecticides were applied on July 31 (Prevathon, 20 oz/ac; Oberon, 8 oz/ac).

The total irrigation amount was 18.9 inches applied from May to August at varying rates during the growing season. Monthly amounts were 2.5, 2.2, 6.25, and 7.9 inches for May, June, July, and August, respectively. Precipitation during the period after planting until the harvest was 5.7 inches.

Plots were harvested on September 6, 2021, with a tractor-drawn commercial forage chopper and forage material was collected in a large basket where plot weight was determined. After plot weight was recorded, approximately 500 grams of freshly cut forage were placed in brown paper bags for later estimation of moisture content and nutritive value. Samples were dried for 72 hours before dry matter determination. Dry forage was ground with a Thomas-Wiley Mill to pass a 1 mm screen and ground material was sent to the University of Wisconsin for quality analyses via near-infrared reflectance spectroscopy (NIRS) and Milk 2006 technology.

STATISTICAL ANALYSIS

Varieties/hybrids were assigned randomly to plots in a randomized complete block design with 3 replications. Data were subjected to SAS® procedures for the test of significance for differences ($P < 0.05$) among entries and mean separation procedures (protected least significant difference) were used to determine where differences occurred.

RESULTS AND DISCUSSION

Data for the forage corn performance trial are presented in Table 2. The highest dry matter yields were above 9.8 tons/ac for the trial. The average dry matter yield was 8.6 tons/acre and significant differences existed among varieties for both dry and green forage yields. All forage nutritive value parameters differed ($P < 0.05$) among the varieties and estimates included moisture at harvest, crude protein, ADF, NDF, NDFD-48hr, starch, ash, milk/ton, milk/acre, and RFV.

Table 1. New Mexico 2021 Forage Corn Performance Test - Agricultural Science Center at Clovis

Brand/Company Name	Hybrid/Variety Name		Dry Forage	Green Forage	Moisture Harvest	CP	ADF	NDF	NDFD 30hr	Starch	Ash	TDN	NE_l	Milk/ Ton	Milk/ Acre
			t/a	t/a	%	%	%	%	%	%	%	%	Mcal/lb	lb/t	lb/a
Dyna-Gro Seed	D57TC29	25	8.7	24.8	72.0	8.0	27.0	49.9	54.3	16.8	4.8	64.7	0.665	3143	27239
Dyna-Gro Seed	D54VC14	23	8.6	24.6	72.8	8.8	28.0	50.1	51.1	17.4	5.0	66.0	0.679	3223	27803
Bayer/Dekalb	DKC61-80	33	8.6	24.6	69.9	8.9	24.8	46.0	53.2	21.6	4.8	66.5	0.684	3248	27903
BH Genetics	BH 8704VIP3110	20	8.6	24.5	73.5	9.1	25.8	47.9	52.9	17.7	4.7	64.6	0.663	3113	26675
BH Genetics	X21042	19	8.6	24.4	73.0	8.9	26.4	48.1	53.1	19.4	4.6	65.8	0.677	3197	27326
Wilbur-Ellis/Integra	Integra 6891 3110	9	8.5	24.2	72.3	9.4	26.1	48.1	52.7	17.2	5.1	64.6	0.663	3112	26400
Dyna-Gro Seed	D58VC65	27	8.5	24.2	70.7	9.7	24.3	46.3	53.9	21.0	4.4	67.3	0.693	3312	27990
Dyna-Gro Seed	D55VC80	24	8.4	24.0	72.7	8.3	27.2	50.1	53.8	18.8	4.5	66.8	0.688	3293	27685
Wilbur-Ellis/Integra	Integra 6880 VT2P	8	8.3	23.8	72.9	9.0	25.8	47.2	53.1	20.6	4.7	66.5	0.685	3251	27060
Wilbur-Ellis/Integra	Integra 6641 SS	2	8.3	23.6	74.1	8.8	25.5	47.0	51.7	20.8	4.5	65.6	0.675	3182	26305
Bayer/Dekalb	DKC70-64	31	8.3	23.6	73.6	9.4	28.1	50.5	51.3	16.6	4.9	65.4	0.673	3171	26218
BH Genetics	BY8705VIP3110	16	8.2	23.6	72.9	8.8	26.5	48.9	53.6	18.4	4.9	65.9	0.678	3217	26534
Wilbur-Ellis/Integra	Integra 6695 TRE	3	8.2	23.5	73.0	8.7	25.4	46.4	53.3	24.0	4.6	68.9	0.711	3437	28306
Dyna-Gro Seed	D57VC17	26	8.2	23.5	71.6	9.4	25.7	46.6	51.3	20.7	5.1	65.9	0.678	3198	26323
Wilbur-Ellis/Integra	Integra 6720 SS	5	8.2	23.4	71.7	9.1	25.7	47.3	52.8	21.0	4.6	66.9	0.689	3283	26919
Wilbur-Ellis/Integra	Integra CX001117 TRE	11	8.2	23.4	73.5	8.7	24.8	46.2	54.0	22.5	4.4	67.0	0.690	3291	26977
BH Genetics	BH 8732VT2P	13	8.2	23.4	72.0	9.1	24.1	44.1	52.8	24.4	4.7	67.7	0.698	3331	27231
Dyna-Gro Seed	D53TC19	22	8.2	23.3	73.2	8.9	28.2	51.1	52.4	16.7	4.8	65.7	0.676	3195	26105
Dyna-Gro Seed	D58VC90	28	8.1	23.3	73.3	8.5	25.8	46.6	54.9	23.7	4.6	68.6	0.708	3413	27805
Bayer/Dekalb	DKC67-66	30	8.1	23.3	72.5	8.8	26.9	49.4	53.3	18.6	4.5	66.0	0.679	3214	26165
BH Genetics	BH 8703VIP3110	15	8.0	23.0	71.8	8.8	26.2	48.6	53.2	19.9	4.6	67.0	0.689	3290	26460
Wilbur-Ellis/Integra	Integra CX001118 VT2P	10	8.0	22.9	73.6	8.8	27.4	49.6	52.1	15.9	5.5	63.7	0.653	3050	24451
BH Genetics	BH 8400PCE	12	8.0	22.9	74.0	8.2	25.8	46.3	52.1	23.8	5.0	67.6	0.696	3329	26665
Dyna-Gro Seed	D52DC82	21	8.0	22.8	74.4	8.1	26.9	48.2	54.2	21.0	4.9	67.2	0.692	3311	26378
BH Genetics	XP 8670TRE	18	7.9	22.7	72.9	8.7	26.5	48.8	51.2	20.2	4.5	66.4	0.684	3245	25738
Wilbur-Ellis/Integra	Integra 6709 VT2P	4	7.9	22.6	73.1	8.5	26.9	49.5	52.9	17.9	4.7	65.4	0.672	3178	25078
BH Genetics	X20044VIP3110	17	7.9	22.4	71.6	9.0	25.8	47.4	52.4	20.9	4.6	66.9	0.689	3284	25801
Wilbur-Ellis/Integra	Integra 6811 VT2P	7	7.8	22.4	72.2	9.0	26.3	48.2	52.4	21.8	4.4	68.2	0.703	3371	26459
Wilbur-Ellis/Integra	Integra 6621 SS	1	7.8	22.3	73.6	9.4	26.0	46.8	51.3	20.8	5.0	66.3	0.682	3223	25124
Wilbur-Ellis/Integra	Integra 9678 VT2P	6	7.8	22.2	74.1	9.5	27.3	49.1	50.3	19.0	5.0	66.4	0.683	3232	25137
Dyna-Gro Seed	D58QC72	29	7.7	22.0	72.2	9.1	26.2	47.6	54.7	20.6	4.8	68.5	0.706	3413	26347
BH Genetics	BH 8690VIP3111	14	7.7	22.0	72.9	9.0	26.4	47.9	50.8	20.9	4.9	67.1	0.691	3289	25283
Bayer/Dekalb	DKC64-44	32	7.7	21.9	71.9	8.7	25.4	46.6	52.7	22.4	4.3	67.6	0.697	3338	25618
	Trial Mean		8.2	23.3	72.7	8.9	26.2	47.9	52.7	20.1	4.7	66.5	0.685	3254	26530
	LSD		0.5	1.5	1.4	0.6	2.0	2.6	1.5	3.0	NS	2.0	0.022	146	NS
	LSD P >		0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	CV		4.0	4.0	1.2	4.3	4.6	3.4	1.8	9.2	8.0	1.8	2.0	2.7	5.3
	F Test		0.0019	0.0019	<0.0001	<0.0001	0.0061	0.0002	<0.0001	<0.0001	0.1614	<0.0001	<0.0001	<0.0001	0.1550

PERFORMANCE OF GRAIN CORN VARIETIES

Investigators: B. Niece1, A. Mesbah1, A. Scott1

1 New Mexico State University, Agricultural Science Center at Clovis, NM

OBJECTIVE

To evaluate grain yield components of corn varieties submitted for testing in the New Mexico Corn and Sorghum Performance Trials.

MATERIALS AND METHODS

The grain corn variety trial was planted May 12, 2021, in 30-inch rows under center pivot irrigation. Soil type is an Olton silty clay loam and elevation is 4,435 feet. Individual plots consisted of two, 30-inch rows 20 feet long. There were three replications for each entry, planted in a randomized complete block. Individual plots were planted at a rate of 27,000 seeds/acre. Plots were planted with a John Deere Max Emerge planter fitted with cone metering units.

Before planting, the planting area was fertilized with 40 lb N/ac, 3 qt zinc and, 47 lb/ac of P2O5. Additional nitrogen was applied on May 13 (122 lb N/ac). Sulfur was applied on May 13 (22 lb/ac). Pre-plant herbicide applications included Panther, LV 6, and Glyphosate at rates of 2 oz/ac, 20 oz/ac, 32 oz/ac respectively. At plant herbicide applications included Atrazine (1 pt/ac), DiFlexx (16 oz/ac), Balance Flex (3 oz/ac) and Warrant (1.5 qt/ac). Diflexx and Warrant herbicides were applied on 1 July at 16 oz/ac and 1.5 qt/ac respectively. Onager miticide (16 oz/ac) was applied on 15 June. Two insecticides were applied on July 31 (Prevathon, 20 oz/ac; Oberon, 8 oz/ac).

The total irrigation amount for the trial was 21.3 inches. Amounts were applied during May, June, July, August, September, and October. Monthly amounts were 2.5, 2.2, 6.25, 7.9, 2.2, and 0.20 inches, respectively. Precipitation during the period after planting until the harvest of the irrigated plots was 5.7 inches.

The plots were harvested on October 6, 2021, with a WinterSteiger combine. Individual plot weights were recorded using a Harvest Master HM 800 Classic Grain Gage, which was also used to determine percent moisture and test weight (lb/bu). Reported yields are adjusted to standard 15.5% moisture and bushel weight of 56 pounds.

STATISTICAL ANALYSIS

All data were subjected to SAS® procedures for the test of significant differences between varieties. Mean separation procedures ((protected (P<0.05) least significant differences)) were used to determine where differences exist.

RESULTS AND DISCUSSION

Yield data for the 2021 grain corn trial are presented in Table 1, Grain yields, for the 12 varieties in the trial, ranging from 273.7 to 239.9 bushel/acre with a trial average of 254.6 bushel/acre.

Table 1. New Mexico 2021 Grain Corn Performance Test - Agricultural Science Center at Clovis

Brand/Company Name	Hybrid/Variety Name	Relative Maturity		Grain Yield	Grain Yield	Moisture at Harvest	Test Weight
				bu/a	lb/a	%	lb/bu
Dyna-Gro Seed	D52DC82	112	1	232.8	13037	11.3	53.8
Dyna-Gro Seed	D57TC29	117	7	229.8	12869	12.2	60.0
Dyna-Gro Seed	D54SS34	114	3	225.6	12635	11.7	63.2
Dyna-Gro Seed	D54SS74	114	4	223.4	12507	11.4	61.2
Dyna-Gro Seed	D55VC80	115	6	219.2	12274	11.7	59.8
Dyna-Gro Seed	D57VC17	117	8	218.1	12211	12.2	62.83
Dyna-Gro Seed	D54VC14	114	5	217.9	12204	11.4	61.4
Dyna-Gro Seed	D58VC65	118	9	210.8	11805	11.7	62.8
Dyna-Gro Seed	D53TC19	113	2	207.7	11628	11.2	61.1
		Trial Mean		220.6	12352	11.6	60.7
		LSD (P > 0.05)		NS	NS	0.4	NS
		CV		6.8	6.8	2.0	5.3
		F Test		0.5367	0.5363	0.0005	0.0674

PERFORMANCE OF IRRIGATED FORAGE SORGHUM VARIETIES

Investigators: B. Niece1, A. Mesbah1, A. Scott1

1 New Mexico State University, Agricultural Science Center at Clovis, NM

OBJECTIVE

To evaluate the dry matter and green forage yield and nutritive value of irrigated forage sorghums submitted for testing in the New Mexico Corn and Sorghum Performance Trials.

MATERIALS AND METHODS

All 18 forage sorghum entries were planted on May 19, 2021, into 30-in rows under center pivot irrigation. Soil type is an Olton clay loam and elevation is 4,435 ft. Individual plots consisted of two, 30-inch rows, 20 feet long. Plots were planted with a two-cone planter at a rate of 75,000 seeds/acre.

Before planting, the planting area was fertilized with a pre-plant mixture of 56 lb/ac, 35 lbs/ac, and 8.25 lb/ac of nitrogen, P_2O_5, and S respectively. Micronutrient zinc was applied pre-plant at rates of 2 qt/ac. Fertilizers were incorporated into the soil immediately after application.

The total irrigation amount was 13.7 inches applied from June to September at varying rates during the growing season. Atrazine, Panther, Glyphosate, and Dicamba herbicide were applied to plots for weed control before planting at a rate of 1 pt/acre, 1 oz/ac, 48 oz/ac, and 8 oz/ac respectively. Buccaneer, Atrazine, Sharpen and Warrant were applied on May 21 at 1 qt/ac, 1 pt/ac and 1.5 oz/ac, and 1.5 oz/ac respectively. Additionally, 90 lb/ac of nitrogen was applied on 21 May as well. Precipitation during the period after planting until the harvest of the plots was 6.2 in.

Plots were harvested on September 19, 2021, with a tractor-drawn commercial forage chopper and forage material was collected in a large basket where plot weight was determined. After plot weight was recorded, approximately 500 grams of freshly cut forage were placed in brown paper bags for later estimation of moisture content and nutritive value.

STATISTICAL ANALYSIS

Varieties/hybrids were assigned randomly to plots in a randomized complete block design with 3 replications. Data were subjected to SAS® procedures for the test of significance for differences ($P < 0.05$) among entries and mean separation procedures (protected least significant difference) were used to determine where differences occurred.

RESULTS AND DISCUSSION

Data for the forage sorghum performance trial are presented in Table 1. The highest yielding varieties exceeded 29.7 tons of green forage. Mean wet forage yields for the 18 varieties were 23.8 tons/acre, and varieties differed ($P < 0.05$) concerning yield. All forage quality parameters were significantly different among the varieties. Nutritional analysis results are pending.

Table 1. New Mexico 2021 Forage Corn Performance Test - Agricultural Science Center at Clovis

Brand/Company Name	Hybrid/Variety Name	Sorghum Type	Maturity Group	Brown Midrib		Dry Forage	Green Forage	Moisture at Harvest	CP	ADF	NDF	NDFD 30hr	Ash	TDN	NE_l	Milk/ Ton	Milk/ Acre
						t/a	t/a	%	%	%	%	%	%	%	Mcal/lb	lb/t	lb/a
Dyna-Gro Seed	5 Star	FS	ME	N	12	10.5	30.1	60.8	7.4	32.3	53.3	56.3	5.5	66.7	0.687	3285	34616
Sorghum Partners	SS402	FS	MF	N	2	10.3	29.3	65.1	7.2	34.4	57.5	52.0	4.8	65.9	0.678	3217	33041
Dyna-Gro Seed	Super Sile 20	FS	MF	N	20	9.7	27.6	64.7	7.5	31.9	53.2	53.5	5.6	66.0	0.679	3222	31156
Dyna-Gro Seed	Super Sile 30	FS	ME	N	15	9.6	27.5	63.8	7.0	32.6	54.7	53.5	5.6	65.0	0.668	3158	30404
Dyna-Gro Seed	F72FS05	FS	ME	N	13	9.4	26.9	61.0	7.6	31.2	52.9	55.2	4.7	68.0	0.701	3374	31713
Dyna-Gro Seed	F70FS91 BMR	FS	E	Y	10	9.0	25.8	54.0	8.0	28.9	48.5	59.1	5.5	70.1	0.725	3566	32234
Wilbur-Ellis	Integra 38F80	FS	ML	N	7	8.6	24.6	64.7	8.0	32.3	52.9	54.5	5.8	68.4	0.705	3409	29400
Mojo Seed	Opal	FS	ML	N	6	8.6	24.5	62.3	7.2	33.4	55.1	55.0	6.2	68.5	0.707	3425	29290
Dyna-Gro Seed	FX21842	FS	MF	N	22	8.5	24.2	65.5	7.9	32.2	53.2	54.7	5.9	68.0	0.701	3387	28739
Dyna-Gro Seed	Sweet Ton MS	FS	MF	N	19	8.4	24.1	66.5	7.3	29.4	49.8	57.2	5.4	65.5	0.673	3205	27031
Wilbur-Ellis	Integra 34F95	FS	ME	Y	9	8.3	23.8	64.9	8.2	27.8	48.8	60.7	4.9	68.4	0.706	3443	28585
Sorghum Partners	NK300	FS	ME	N	1	7.8	22.2	65.6	7.6	33.3	54.0	53.8	5.5	67.9	0.700	3370	26181
Sorghum Partners	SP 3905 BD BMR	FS	ME	Y	4	7.7	21.9	61.3	8.1	29.6	48.3	59.1	5.0	71.0	0.735	3635	27879
Wilbur-Ellis	Integra 33F70	FS	L	Y	8	7.2	20.4	64.8	8.2	31.4	51.6	55.8	5.8	69.4	0.717	3513	25197
Dyna-Gro Seed	F72FS25 BMR	FS	M	Y	16	7.1	20.2	68.6	8.1	33.2	53.5	56.8	6.5	68.7	0.709	3458	24389
Sorghum Partners	SP 3904 BD BMR	FS	MF	Y	3	6.6	19.0	66.6	8.5	31.3	50.8	57.5	6.5	68.6	0.708	3451	22910
Mojo Seed	Pearl	FS	M	N	5	6.6	19.0	70.5	8.8	31.3	54.4	53.2	4.9	66.1	0.680	3238	21488
Dyna-Gro Seed	FX21865	FS	MF	N	21	6.5	18.7	62.8	7.6	35.3	55.3	57.6	6.8	69.3	0.716	3511	22971
Dyna-Gro Seed	F74FS72 BMR	FS	MF	Y	18	5.7	16.3	70.6	9.1	32.4	52.2	54.3	6.4	68.4	0.706	3431	19561
Dyna-Gro Seed	F71FS72 BMR	FS	E	Y	11	5.7	16.2	65.7	7.8	31.6	51.3	57.4	5.8	69.8	0.721	3544	20069
Dyna-Gro Seed	F74FS23 BMR	FS	M	Y	17	5.6	16.0	69.0	6.6	32.3	51.1	57.6	6.6	68.6	0.708	3450	19355
Dyna-Gro Seed	FX21815	FS	ME	N	14	5.5	15.8	65.7	8.1	34.2	55.1	55.6	6.6	67.6	0.697	3370	18630
	Trial Mean					7.9	22.5	64.7	7.8	31.9	52.6	55.9	5.7	68.0	0.701	3394	26584
	LSD					0.9	2.7	2.0	0.9	NS	4.6	2.4	1.1	2.5	0.028	186	3753
	LSD P >					0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	CV					7.3	7.3	1.9	6.8	7.7	5.3	2.6	11.6	2.3	2.4	3.3	8.6
	F Test					<0.0001	<0.0001	<0.0001	0.0002	0.0816	0.0141	<0.0001	0.0030	0.0008	0.0008	0.0001	<0.0001

† Sorghum Type: FS=Forage Sorghum, BD = Brachytic Dwarf, SxS = Sorghum-Sudangrass Hybrid, HPM= Hybrid Pearl Millet

§Maturity Group: E = Early, M = Medium, F = Full, PS = Photoperiod Sensitive

Brown Midrib Trait: BMR = (Y) Brown Midrib, (N) Conv= Conventional

PERFORMANCE OF DRYLAND FORAGE SORGHUM VARIETIES

Investigators: B. Niece1, A. Mesbah1, A. Scott1

1 New Mexico State University, Agricultural Science Center at Clovis, NM

OBJECTIVE

To evaluate the dry matter and green forage yield and nutritive value of dryland forage sorghums submitted for testing in the New Mexico Corn and Sorghum Performance Trials.

MATERIALS AND METHODS

All 15 forage sorghum entries were planted on June 14, 2021, into 30-in rows under center pivot irrigation. Soil type is an Olton clay loam and elevation is 4,435 ft. Individual plots consisted of two, 30-inch rows, 20 feet long. Plots were planted with a two-cone planter at a rate of 50,000 seeds/acre.

On May 1, the planting area was fertilized with 60 lb N/ac, 9 lb/ac Sulphur, 30 lb/ac of P2O5, and 2 qt/ac of chelated Zinc. At plant herbicide applications included Atrazine (2.0 pt/ac),and Warrant (2 qt/ac).

Glyphosate, Atrazine, and Verdict herbicides were applied to plots for weed control before planting at rates of 32 oz/acre, 1.5 pt/ac, 10 oz/ac, respectively. Huskie, Atrazine, and Warrant were applied for weed control on July 10 at rates of 1 pt/ac, 1 pt/ac, and 1.5 qt/ac, respectively. Sivanto and Onager were applied on August 30 at rates of 10.5 oz/ac and 20 oz/ac. No irrigation was applied. Precipitation during the period after planting until the harvest was 6.7 inches.

Plots were harvested on September 21, 2021, with a tractor-drawn commercial forage chopper and forage material was collected in a large basket where plot weight was determined. After plot weight was recorded, approximately 500 grams of freshly cut forage were placed in brown paper bags for later estimation of moisture content and nutritive value. Samples were dried for 72 hours before dry matter determination.

STATISTICAL ANALYSIS

Varieties/hybrids were assigned randomly to plots in a randomized complete block design with 3 replications. Data were subjected to SAS® procedures for the test of significance for differences (P < 0.05) among entries and mean separation procedures (protected least significant difference) were used to determine where differences occurred.

RESULTS AND DISCUSSION

Data for the forage sorghum performance trial are presented in Table 1. The highest yielding varieties exceeded 8.5 tons of green forage. Mean wet forage yields for the 15 varieties were 8.5 tons/acre, the varieties differed (P < 0.05) concerning yield. Nutritional analysis results are pending.

Table 2. New Mexico 2021 Dryland Forage Sorghum Performance Test - Agricultural Science Center at Clovis

Brand/Company Name	Hybrid/Variety Name	Sorghum Type	Maturity Group	Brown Midrib		Dry Forage	Green Forage	Moisture at Harvest	CP	ADF	NDF	NDFD 30hr	Ash	TDN	NE	Milk/ Ton	Milk/ Acre
						t/a	t/a	%	%	%	%	%	%	%	Mcal/lb	lb/t	lb/a
Dyna-Gro Seed	Super Sile 30	FS	ME	N	7	5.5	15.8	68.1	8.4	28.2	50.7	55.8	6.6	64.9	0.667	3178	17547
Dyna-Gro Seed	5 Star	FS	ME	N	4	5.2	14.7	67.0	7.9	29.0	51.9	57.2	5.6	68.9	0.712	3456	17804
Dyna-Gro Seed	F70FS91 BMR	FS	E	Y	2	4.9	14.0	58.9	8.1	29.7	51.8	57.3	6.3	69.1	0.714	3491	17037
Dyna-Gro Seed	Super Sile 20	FS	MF	N	12	4.8	13.6	67.5	8.7	28.3	50.8	54.6	5.9	66.0	0.679	3245	15490
Dyna-Gro Seed	F72FS05	FS	ME	N	5	4.8	13.6	64.3	9.2	28.8	51.4	53.6	5.7	65.1	0.669	3174	15109
Dyna-Gro Seed	F71FS72 BMR	FS	E	Y	3	4.6	13.0	63.1	8.7	29.3	51.8	54.7	5.8	67.6	0.697	3358	15315
Dyna-Gro Seed	FX21842	FS	MF	N	14	4.5	12.9	67.1	8.9	30.0	53.0	55.3	6.3	68.5	0.707	3430	15468
Mojo Seed	Pearl	FS	M	N	1	4.5	12.8	65.8	9.2	32.0	52.2	55.9	5.8	67.0	0.691	3318	14910
Dyna-Gro Seed	F72FS25 BMR	FS	M	Y	8	4.4	12.6	67.9	9.1	27.5	49.7	58.1	4.7	70.9	0.734	3624	15959
Dyna-Gro Seed	F74FS72 BMR	FS	MF	Y	10	4.3	12.3	69.6	9.1	26.9	48.9	54.2	4.9	66.5	0.685	3280	14145
Dyna-Gro Seed	Sweet Ton MS	FS	MF	N	11	4.3	12.2	64.9	8.0	27.1	49.2	57.5	4.6	69.6	0.719	3502	14888
Dyna-Gro Seed	FX21865	FS	MF	N	13	4.1	11.7	65.6	9.6	27.7	49.7	57.3	5.9	69.3	0.716	3498	14237
Dyna-Gro Seed	F74FS23 BMR	FS	M	Y	9	3.7	10.7	66.4	8.8	27.2	48.1	55.3	5.7	66.8	0.688	3306	12389
Dyna-Gro Seed	FX21815	FS	ME	N	6	3.6	10.2	65.5	9.1	30.1	52.9	55.6	5.8	67.3	0.693	3330	11882
	Trial Mean					4.5	12.9	65.8	8.8	28.7	51.0	55.9	5.7	67.7	0.698	3371	15155
	LSD					0.5	1.4	1.2	NS	NS	NS	NS	NS	NS	NS	NS	1776
	LSD P >					0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	CV					6.6	6.6	1.0	8.9	8.1	4.4	4.0	14.3	3.6	3.9	5.5	7.0
	F Test					<0.0001	<0.0001	<0.0001	0.3112	0.3787	0.2263	0.3590	0.1622	0.1530	0.1518	0.1571	<0.0001

† Sorghum Type: FS=Forage Sorghum, BD = Brachytic Dwarf, SxS = Sorghum-Sudangrass Hybrid, HPM = Hybrid Pearl Millet

§Maturity Group: E = Early, M = Medium, F = Full, PS = Photoperiod Sensitive

Brown Midrib Trait: BMR = (Y) Brown Midrib, (N) Conv = Conventional

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 CO_2 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.

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16. David Okello – NaSARRI – Soroti, Uganda
17. Amade Muitia – IIAM – Mozambique

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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

2021 Report

Agricultural Science Center at Clovis

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