New Mexico State University

Agricultural Science Center at Clovis

2018

Annual Progress Report

New Mexico State University
Agricultural Science Center at Clovis
2346 State Road 288
Clovis, NM 88101

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ANNUAL PROGRESS REPORT

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Clovis Agricultural Science Center
2346 State Road 288
Clovis, NM 88101-9998

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NOTICE TO USERS OF THIS REPORT

This report has been prepared to aid Science Center Staff in analyzing 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.

Information in this report represents only one-year's research. The reader is cautioned against drawing conclusions or making recommendations as a result of data in this report. In many instances, data represents only one of several years' results that will constitute the final format. It should be pointed out, that 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 prior written approval of the New Mexico State University Agricultural Experiment Station.

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Acknowledgements

Several individuals and companies donated products and services the Clovis Agricultural Science Center during 2017. Appreciation is expressed to the following persons and organizations for their Contributions.

Clovis Agricultural Science Center Advisory Committee Members

Paul Stout, Chairman
Jim Chandler, Vice Chairman

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Wood Equipment	Davis, C

INTRODUCTION

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 34.60^{o} N, -103.22^{o} W, at an elevation of 4,435 feet above sea level. The Olton clay loam soil at the center is representative of a vast area of the High Plains of New Mexico and the Texas Panhandle. Research at the center began in 1948, originally as dryland field research. Irrigation studies were initiated in 1960, when an irrigation well was developed. Water for irrigation is derived from the Ogallala Aquifer. Since 2005, the center has improved its irrigation delivery by developing two center pivot irrigation systems and subsurface and surface drip irrigation systems.

Center Events and Activities

Advisory Committee Meeting: The Clovis Agricultural Science Center Advisory Committee met on March 8, 2018 at the Center Conference Room. Paul Stout, Chairman, called the meeting to order. Dr. Steve Loring gave update on the University and the recent legislative session. Abdel Mesbah, Superintendent gave an update on the Center and shared the 2017 progress report. After the updates, Abdel presented a drafted Advisory Committee Bylaw for discussion and approval.

Annual Field Day: The Center hosted its Annual Field Day on August 9, 2018, with 110 in attendance. The chancellor Dan Arvizu and the President John Floros were the keynote speakers. The following research topics were covered during the tour:

- On-Farm Soil Health and Resilience. Rajan Ghimire, Cropping System Specialist, NMSU.
- Cover Crops and Crop Rotation Management. Kelly Kettner, Grower, Muleshoe, TX.
- Peanut Phenotyping for Drought Stress. Naveen Puppala, Peanut Breeder, NMSU.
- Weed Management in Crops. Leslie Beck, Extension Weed Scientist, NMSU.
- Sugar Cane Aphid Management. Pat Porter, Extension Entomologist, TAMU.
- Sustainable Silage Corn Production. Sultan Begna, Research Scientist, NMSU.
- Dairy Extension Program and Industry Issues. Robert Hagevoort, Dairy Extension Specialist, NMSU.
- Developing Guar as a Stress Tolerant Crop. Sangu Angadi and John Idowu, Agronomists, NMSU.

Leadership Clovis: In collaboration with the Chamber of Commerce, the Clovis Ag. Science Center hosted the "Leadership Clovis". (22 Attendees).

Dairy Training: The Center hosted a tour for NMSU Extension Agent Dairy Training (November 2, 2018).

Forage and Cover Crops Field Day: Faculty at the Center organized a Forage and Cover Crops Field Day at the Heritage Dairy Farm (April 11, 2018).

Open House: The Clovis AS Center participated with six posters at the ACES Open House.

Ongoing Research Projects

- Bayer products for weed control in fallow. The objective of this study is to evaluate the long- term effect of several herbicides on weed control when applied at the fallow period. Abdel Mesbah, Bryan Niece & Aaron Scott.
- Huskie herbicide for weed control in Sorghum. The objective of this study is to evaluate weed control and sorghum response to Huskie herbicide applied alone or in combination with other herbicides. Abdel Mesbah, Bryan Niece & Aaron Scott.
- Pre/postemergence weed control in Corn. The objective of this study is to evaluate weed control and corn response to several pre emergence herbicides followed by post emergence herbicides. Abdel Mesbah, Bryan Niece & Aaron Scott.
- Forage Variety Trials. Evaluate the performance of several new, old, and improved varieties of corn, sorghum, and winter wheat grown under dry land and irrigated conditions. Abdel Mesbah, Bryan Niece & Aaron Scott.
- Grain Variety Trials. Evaluate the performance of several new, old, and improved varieties of corn, sorghum, and winter wheat grown under dry land and irrigated conditions. Abdel Mesbah, Bryan Niece & Aaron Scott.
- Antitransiparants effect on winter canola seed and oil yield formation. Sultan Begna, Sangu Angadi, and Micheal Stamm. Antitranspirants have the ability to increase water use efficiency and productivity of crops. This field research will assess their effect on winter canola productivity in the Southern High Plains.
- Temperature and germination relationship of available guar cultivars. Jagdeep Singh, Sangu Angadi, Sultan Begna. Colder soil limits early planting of guar and also limits how far north the crops can be grown. Understanding the relationship and variations among guar cultivars will help to assess potential guar area expansion.
- Winter canola variety trial. Sangu Angadi, Sultan Begna, Micheal Stamm and others. The trial focuses on developing well adopted, higher yielding winter canola cultivars for the region. Winter canola is a new crop in the US and this coordinated project aims to identify suitable cultivars for each region.
- Effect of seeding rate on seed yield of open pollinated and hybrid winter canola. Sultan Begna and Sangu Angadi. Hybrid winter canola are new to the United States and most of the cultivars are from European seed companies and seeds are expensive. Better understanding of response of both open pollinated and hybrid canola to management are needed to reduce inputs and related cost. The trial focused on wider row spacing and lower seed rate effect on winter canola yield formation.
- Winter canola pre-irrigation and critical stage based Irrigation Trial. Paramveer Singh, Sangu Angadi and Sultan Begna. Winter canola is becoming important alternative crop in the Southern Great Plains. The trial focuses on understanding winter canola growth and yield formation under critical stage based irrigation with or without soil moisture in the soil profile. It focuses on the ability of root system to relieve stress under critical stages by extracting soil moisture from deeper soil profile.
- Adopting DSSAT Crop Growth Simulation model to simulate winter canola growth and yield under range of water availabilities. Paramveer Singh, Sangu Angadi, Sultan Begna and Mike Stamm. The project assesses DSSAT crop growth model for simulation of winter canola under range of water availabilities.

- Nitrogen management in winter canola. Sangu Angadi, Sultan Begna, Rajan Ghimire and Murali Darapuneni. The project assesses best way to provide nitrogen to winter canola to reduce input cost and maximize productivity.
- Seasonal temperature at flowering and winter canola seed yield and oil formation in diverse winter canola cultivars. Sangu Angadi and Sultan Begna. Temperature at flowering is very critical for winter canola seed yield and oil formation. The trial uses inflorescence removal technique at bud and flowering stages to expose canola flowering to range of temperatures in ten diverse cultivars and assesses seed yield and flowering temperature relationships.
- Circles of perennial grass buffer strips in a center pivot for multiple benefits. Sangu Angadi, Sultan Begna, Rajan Ghimire and John Idowu. Due to declining well out puts and pumping restrictions, farmers are not able to irrigate their entire irrigated land in the Southern Great Plains. The project aims to assess multiple benefits of using the underutilized area in the partial pivot to rearrange them into multiple circles of perennial grasses to improve water cycle and improve crop microclimate.
- Guar: Deficit irrigation management study. Guar is a desert adopted alternative crop to improve bioeconomy of the South West. Jagdeep Singh, Sangu Angadi and Sultan Begna. With increasing demand for guar gum, we want to develop local guar supply to ensure the steady supply of quality gum for the industries. This will also develop a low input, highly heat and drought tolerant alternative crop for the region.
- Drought physiology of guar cultivars under range of water availabilities. Guar is a desert adopted alternative crop to improve bioeconomy of the South West. Sangu Angadi and Sultan Begna. With increasing demand for guar gum, we want to develop local guar supply to ensure the steady supply of quality gum for the industries. This will also develop a low input, highly heat and drought tolerant alternative crop for the region.
- Guar response to Rhizobium inoculation and Phosphorus fertilization. Idowu J. S.V. Angadi and S. Begna. This project assesses effectiveness of available rhizobium inoculum on nodulation and guar seed yield with or without phosphorous.
- Strategies for soil and water conservation and sustainable forage corn production system in New Mexico: Decreasing plant row spacing, increasing cutting height and forage quality considerations. Sultan Begna, Sangu Angadi, Rajan Ghimire, Abdel Mesbah and Zachary Cordel (a dairy producer and cooperator). This project is being conducted on producer’s field. The objective of this demonstration cum research project is to assess corn cutting height on corn forage production and forage quality. It also studies effect of different height stubble on soil quality, soil moisture content and wind dynamics.
- Forage Corn Variety, Cutting Height, Yield, Quality Relationships Trial. Sultan Begna, Sangu Angadi, Rajan Ghimire & Abdel Mesbah. The objective of this study is to evaluate five forage corn varieties response to four silage corn cutting heights on forage yield, quality, and economic profitability.
- Enhancing the Breeding Potential of Valencia Peanut for Drought and Disease resistance in New Mexico. Naveen Puppala. The objective of this research is to breed for drought and disease resistant peanut suitable for eastern New Mexico and west Texas that are high yielding, high oleic and disease resistant.
- Valencia Peanut Breeding for Drought Tolerance. Naveen Puppala and Paxton Payton. The long-term goal is to restore back the predominant position of New Mexico by providing the peanut growers the Valencia peanut cultivars that produces more with less water and at the same time possesses good seed quality meeting standards of the in-shell peanut trade

industry. Additionally, with the availability of high density genetic linkage map (based on intra-specific cross) and markers linked with agronomic and seed quality traits will go a long way assisting peanut breeders to select progenies with beneficial traits in peanut breeding.

- An Integrated Inter-Regional Approach to Breeding Valencia Market Class of Peanut for Enhanced Productivity and Sustainability under Water Deficit. M. Burrow, C.E. Simpson, M. Baring, N. Puppala, S. Tallury, J. Chagoya, P. Payton and J. Mahan. The specific objectives are to (i) evaluate diverse Valencia peanut germplasm for transpiration efficiency, harvest index and pod weight from 288 RILs from F8 generation developed from a cross between Valencia-C and JUG03, (ii) field screening for two years under irrigated and water deficit conditions for pod yield and grade, (iii) marker analysis under separate funding will be performed on the populations to identify QTL's for these traits as well as yield and grade based on data that will be obtained in this project.
- Valencia Seed Treatment Study. Naveen Puppala and Soum Sanogo. The objective of this research is to evaluate best organic seed treatment for Valencia Peanut.
- Arysta Fungicide Study. Naveen Puppala and Soum Sanogo. The objective of this research is to evaluate different Arysta Fungicide treatments during the growing season for pod yield and grade.
- Cotton Variety Evaluation. R. Flynn, J. Zhang, N. Puppala, J. Idowu and L. Lauriault. The objective is to evaluate commercial cotton cultivars for seed cotton yield, lint yield and fiber qualities.
- U.S. Dairy Education & Training Consortium. Robert Hagevoort, Armando Garcia & Shelly Spears
- Dairy Safety Training for dairy producers/employees in English & Spanish. Robert Hagevoort, Shelly Spears & Armando Garcia
- Safe Animal Handling & Stockmanship training for dairy producers/employees in English & Spanish. Robert Hagevoort, Shelly Spears & Armando Garcia
- Antibiotic Residue Prevention training for dairy producers/employees in English & Spanish. Robert Hagevoort & Armando Garcia
- Dairy Leadership Development program for middle managers and front line supervisors. David Douphrate & Robert Hagevoort
- International benchmarking of U.S. milk producing regions. Marin Bozic & Robert Hagevoort
- Maximizing voluntary compliance in antimicrobial stewardship programs: a critical factor for effective intervention. Armando Garcia & Robert Hagevoort
- Regional survey to better understand dairy worker history, association and understanding of TB in humans and cattle. Anabel Rodriguez, David Douphrate and Robert Hagevoort.
- Cover Crops in Limited Irrigation Wheat-Sorghum Fallow. Rajan Ghimire, Vesh Thapa, and Mark Marsalis. Evaluate the effects of diverse cover crops (single species vs mixtures) on (a) soil organic matter dynamics, (b) nutrient cycling, (c) soil water conservation, and (d) sustainable crop production.
- Sustaining Agriculture through Adaptive Management of the Ogallala Aquifer under a Climate Change. Rajan Ghimire, Mark Marsalis, Sangu Angadi, and Ram Acharya.
  Evaluate diverse crop and soil management strategies to improve soil health, soil water conservation, and economic viability of dryland and limited-irrigation agriculture in the Southern Ogallala Aquifer region. Winter cover crop-summer forage crop rotations for soil

health and forage quality. Rajan Ghimire, Abdelaziz Nilahyane, Mark Marsalis, and Abdel Mesbah. Evaluate the soil health and forage quality under diverse winter cover crops in a forage corn-sorghum rotation.

- Nitrogen management in dryland sorghum. Rajan Ghimire, Sk. Musfiq US Salehin, and Aaron Scott. Evaluate N dynamics and system N budget under different rates of N fertilizer and compost application.
- Monitoring Greenhouse gas emissions and climate change mitigation potential of diverse cropping systems in eastern New Mexico. Rajan Ghimire, Abdelaziz Nilahyane, and Amy Ganguli. Evaluate CO_2 and N_2O emissions from diverse crop and forage production systems and use DAYCENT Model to simulate effects of conservation systems on soil C sequestration and GHG mitigation.
- Soil profile C and N dynamics in cover crops. Rajan Ghimire, Pramod Acharya, Cho Young. Understanding soil C and nutrient dynamics under diverse cover cropping practices in eastern New Mexico.
- Spatiotemporal variability of soil properties on forage corn production system. Rajan Ghimire, Mikayla Allan, Sultan Begna, and Sangu Angadi. Evaluating spatial and temporal differences in response of selected soil health indictors in corn field.
- Improving soil health and ecosystem services through circular grass buffer strips, cover cropping, and crop diversification in New Mexico. Rajan Ghimire, Sultan Begna, Sangu Angadi and Abdel Mesbah. Quantify changes in soil health in ongoing cover crop and buffer strip projects and help NRCS to improve this soil health assessment matrices.
- Cover Crops in Dryland Crop Rotations – Demonstration. Rajan Ghimire and Aaron Scott. Demonstrate stand establishment and the performance of cover crops in dryland winter wheat-sorghum-fallow rotation.
- Vineyard soil health. William Giese and Rajan Ghimire. Evaluate effects of diverse cover crops and mixtures on soil health and grape quality in southern New Mexico.

Grants and Sponsored Activities

- Stamm, M. (KSU, PI), S.V. Angadi (Co-PI), S. Begna (Co-PI), and others (Multi-state). Development and management of canola in the Great Plains region, Sponsored by (United States Department of Agriculture- National Institute of Food and Agriculture-Supplemental and Alternative Crops (USDA-NIFA-SACC) (through Kansas State University), $29,640 (September 1, 2018 - August 31, 2019).
- Angadi, S.V. (Co-PI), Krishna Jagadish (Co-PI), and M. Stamm (PI), KSU. Heat and Drought Effects on the oil formation of southern Great Plains winter canola. Sponsored by South Central SunGrants (through Kansas State University), $42,500 (September 1, 2018 - March 31, 2019).
- Angadi, S. (Principal), Sponsored Research, "Diversifying Rainfed Cropping System in the Southern Great Plains to Improve Sustainability of Agriculture", Sponsoring Organization: US Department of Agriculture/Agricultural Research Service, Sponsoring Organization Is: Other, Research Credit: $34,430, PI Total Award: $34,430, Current Status: Funded. (August 1, 2018 - July 31, 2019).
- Begna, S. (PI), S. Angadi, R. Ghimire, and A.O. Mesbah. Strategies for soil and water conservation and sustainable forage corn production in New Mexico: cutting height, row

spacing and forage quality considerations. New Mexico Conservation Innovation Grant. 2017-2019: $75,000.

- Angadi, S.V. (Co-PI), K. Ogden (PI), D. Ray, M. Downes, J. Idowu, C. Brewer and others. Sustainable bioeconomy for arid regions. Sponsored by USDA-NIFA-Sustainable Bioenergy and Bioproducts (through University of Arizona), $350,000 (September 1, 2017 to August 31, 2022).
- Angadi, S.V. (Co-PI), Krishna Jagadish (Co-PI), and M. Stamm (PI), KSU. Heat and Drought Effects on the oil formation of southern Great Plains winter canola. Sponsored by South Central SunGrants (through Kansas State University), $38,000 (September 1, 2016 - August 31, 2018)
- Angadi, S.V. (PI), O. J. Idowu, (Co-PI), P. Gowda (Co-PI), C. West (Co-PI). Circles of live buffer strips in center pivot irrigation for multiple ecosystem services in the southern Great Plains. Sponsored by USDA-NIFA-Foundational Program, $ 145,205 (April 1, 2016 - March 31, 2018).
- Angadi, S.V. (Co-PI), S. Begna (Co-PI), M. Stamm, KSU, (PI), and others (Multi-state). Development and management of canola in the Great Plains region. Sponsored by USDA-NIFA-SACC (through Kansas State University), $ 28,229 (September 1, 2017 - August 31, 2018).
- Puppala, N. (PI). "Valencia Peanut Breeding for Drought Tolerance-Year 5". Sponsoring Organization: National Peanut Board, Sponsoring Organization Is: Other, Research Credit Total Award: $ 6,079 (January 1, 2018 - December 31, 2018).
- Puppala, N. (PI). An Integrated, Inter-Regional Approach to Breeding Valencia Market Class of Peanut for Enhanced Productivity and Sustainability under Water Deficit. Sponsoring Organization: NIFA – through Texas A&M University. Is: Other, Research Credit Total Award: $ 55,713 (March 15, 2017- March 14, 2020).
- Hagevoort, G.R. (Co-PI), Garcia-Buitrago, A. (Co-PI). Maximizing Voluntary Compliance in Antimicrobial Stewardship Programs: A Critical Factor for Effective Intervention. Sponsored by USDA-NIFA (through Texas A&M University), $40,513 (January 15, 2016 to January 14, 2019).
- G.R. (PI), Garcia-Buitrago, A. (Co-PI). Impact of NutriTek on Salmonella and Klebsiella in Dairy Cows. Sponsored by Diamond V. $30,000 (July 1, 2018 to December 31, 2018).
- Angadi, S.V. (Co-PI), Stamm, M. (KSU, PI), S. Begna (Co-PI), and others (Multi-state). Development and management of canola in the Great Plains region, Sponsored by (United States Department of Agriculture- National Institute of Food and Agriculture-Supplemental and Alternative Crops (USDA-NIFA-SACC) (through Kansas State University), $29,640 (September 1, 2017 - August 31, 2018).
- Marsalis, M.A. (PI), S. Angadi, R. Ghimire. Sustaining agriculture through adaptive management to preserve the Ogallala Aquifer under a changing climate. NMSU sub-award of USDA award# 2016-68007-25066, total funding: 15M. NMSU 2016-2020 budget: $151,795.
- Ghimire, R. (PI), A. Mesbah, J. Idowu. Soil conservation and sustainable crop production through reduced-tillage and crop diversification in drylands of the eastern New Mexico. NMSU Agricultural Experiment Station. 2016-2018: $48,000.
- Ghimire, R. (PI). Conservation tillage and cover crops for improving sustainability of semiarid dryland cropping systems in the south-western United States. USDA- National Institute of Food and Agriculture, Hatch project, 2016-2021.

- Ghimire, R. (PI), M. Marsalis, and A.O. Mesbah. Cover crops for improving soil health and forage production in eastern New Mexico. New Mexico NRCS, 2018-2023: $200,576.
- Ghimire, R. (PI), S. Begna, S. Angadi, and A.O. Mesbah. Improving soil health and ecosystem services through circular grass buffer strips, cover cropping, and crop diversification in New Mexico. New Mexico NRCS. 2018-2021: $49,000.
- Ganguli, A. (PI), R. Ghimire, D. Dubious, et al., Participatory approaches to agroecosystem resilience in times of drought (ARID): An example from the Southern Great Plains, PI:, USDA NIFA Resilient Agroecosystems, 2018-2022:$70,000.

Publications

Peer-reviewed journal papers

- Darapuneni, M. K., Idowu, O. J., Lauriault, L. M., Dodla, S., Pavuluri, K., Ale, S., Grover, K., Angadi, S. 2019. Tillage and nitrogen rate effects on corn production and residual soil characteristics. Agron. J. 111:1-9.
- Djaman, K., O'Neill, M. K., Owen, C., Smeal, D., West, M., Begay, D., Angadi, S., Koudahe, K., and Allen, A. 2018. Seed Yield and Water Productivity of Irrigated Winter Canola (Brassica napus L.) under Semiarid Climate and High Elevation. Agronomy 8:90.
- Umesh, M.R., T.S. Mallikarjun Swamy, N. Ananda, U.K. Shanwad, B.M. Chittapur, B.K. Desai and S. Angadi. 2018. Real time nitrogen application based on decision support tools to enhance productivity, nutrient use efficiency and quality of sweet corn (Zea mays L. cv. Saccharata). Indian J. Agron. 63:331-336.
- Manoj, K.N., M.R. Umesh, Y.M. Ramesh, S.R. Anand, and S. Angadi. 2018. Light interception, dry matter production and radiation use efficiency of pulses grown under different light levels in subtropical India. Bangladesh Journal of Botany. 48(1): in press.
- Ghimire, R., Ghimire, B., Mesbah, A., Idowu, O. J., O'Neill, M. K., Angadi, S., et al. 2018. Current status, opportunities, and challenges of cover cropping for sustainable dryland farming in the Southern Great Plains. Journal of Crop Improvement, 32, 579-598.
- Darapuneni, M. K., Angadi, S., Umesh, M., Contreras-Govea, F., Annadurai, K., Begna, S., Marsalis, M. A., Cole, A., Gowda, P., Hagevoort, G. R., Lauriault, L. M. 2018. Canopy development of annual legumes and forage sorghum intercrops and its relation to dry matter accumulation. Agronomy Journal, 110, 939-949.
- Katuwal K.B., S.V. Angadi, S. Singh, Y. Cho, S. Begna and M.R. Umesh. 2018. Growth stage based irrigation management on biomass, yield and yield attributes of spring canola in the Southern Great Plains. Crop Science 58:2623-2632.
- Umesh M.R., Mallesha, B.M. Chittapur, and S. Angadi. 2018. Alternate wetting and drying (AWD) irrigation for rice to enhance water productivity and sustainable production: A review. J. Farm Sci., 30:441-449.
- Manjonda, R.V., N. Vorasoot, N. Puppala, A. M. Muitia and S. Jogloy. 2018. Reproductive Efficiency and Yield Responses of Valencia Peanut Genotypes Under Terminal Drought Conditions. Khon Kaen Ag. J. 46(1)181-192.
- Carvalho, M.J., N. Vorasoot, N. Puppala, A. Muitia and S. Jogloy. 2018. Effects of Terminal Drought on Growth, Yield and Yield Components in Valencia Peanut Genotypes. SABRAO 49(3) 270-279.

- Chamberlin, K. D., and N. Puppala. 2018. Genotyping of the Valencia Peanut Core Collection with a Molecular Marker Associated with Sclerotinia blight Resistance. Peanut Science 45(1):12-18.
- Zurweller, B.A., A. Xavier, B.L. Tillman, J.R. Mahan, P.R. Payton, N. Puppala and D.L. Rowland. 2018. Pod Yield Performance and Stability of Peanut Genotypes Under Differing Soil Water and Regional Conditions. Journal of Crop Improvement. 32(4)532-551.
- Kavi Kishor, P.B., K. Venkatesh, P. Amareshwari, P. Hima Kumari, D.L. Punita, S. Anil Kumar, A. Roja Rani and N. Puppala. 2018. Genetic Engineering for Salt and Drought Stress Tolerance in Peanut (*Arachis hypogaea* L.). Ind J. Plant Physiol. 23(4):647-652.
- Renee Arias., Victor S Sobolev., Alicia N Massa., Valerie A Orner., Travis E Walk., Linda L Ballard., Sheron A Simpson., Naveen Puppala., Brian E. Scheffler., Francisco de Blas and Guillermo J. Seijo. 2018. New tools to screen wild peanut species for aflatoxin accumulation and genetic fingerprinting. BMC Plant Biology 18:170.
- Rodriguez, A., G.R. Hagevoort, D. Leal, L. Pompei, and D.I. Douphrate. Using mobile technology to increase safety awareness among dairy workers in the United States (2018). J. Agr. Medicine, 23(4): 315-326. DOI:10.1080/1059924X.2018.1502704
- Edrington, T.S., J.A. Garcia Buitrago, G.R. Hagevoort, G.H. Loneragan, D.M. Bricta-Harhay, T.R. Callaway, R.C. Anderson, D.J. Nisbet (2018). Effect of waste milk pasteurization on fecal shedding of Salmonella in pre-weaned calves. J. Dairy Sci. 101:9266-9274. DOI:10.3168/jds.2018-14668.
- Thapa, V.R., R. Ghimire, M. Mikha, J. Idowu, and M. Marsalis. 2018. Land use systems effects on soil health in drylands. Agricultural and Environmental Letters. Doi: 10.2134/ael2018.05.0022.
- Ghimire, R., J.B. Norton, and U. Norton. 2018. Soil organic matter dynamics under irrigated perennial forage-annual crop rotation systems. Grass and Forage Science. 73: 907-917.
- Wang, J., R. Ghimire, X. Fu, U.M. Sainju, and W. Liu. 2018. Straw mulching increases precipitation storage rather than water use efficiency and dryland winter wheat yield. Agricultural Water Management. 206: 95-101.
- Cano, A., A. Nunez, V. Acosta-Martinez, M. Schipanski, R. Ghimire, C. Rice, C. West. Current knowledge and future research directions of soil health and water conservation in the Ogallala Aquifer region. Geoderma. 238: 109-118.
- Duval B., R. Ghimire, M.D. Hartman, and M.A. Marsalis. 2018. Water and nitrogen management effects on semiarid sorghum production and soil trace gas flux under future climate. PlosOne 13(4): e0195782.
- Rijal, J.P., R. Regmi, R. Ghimire, K. Puri, S Gyawly, S. Poudel. 2018. Farmers' knowledge of pesticide safety and pest management: A case study of Vegetable Growers in Chitwan, Nepal. Agriculture, 8(1), 16. http://www.mdpi.com/2077-0472/8/1/16
- Ghimire, R., S. Machado, and P. Bista. 2018. Decline in soil organic carbon and nitrogen limits yield in wheat-fallow systems. Plant and Soil. https://doi.org/10.1007/s11104-017-3470-z.

- Ghimire, B. R. Ghimire, A.O. Mesbah, and D. VanLeeuwen. 2017. Cover crop residue inputs and quality effects on soil organic matter mineralization, Manuscript accepted in 'Sustainability'.

Book Chapters

- S. S. Gangurde, Rakesh Kumar, Arun K. Pandey, Mark Burow, Haydee E. Laza, Spurthi N. Nayak, Baozhu Guo, Boshou Liao, Ramesh S. Bhat, Naga Madhuri, S. Hemalatha, Hari K. Sudini, Pasupuleti Janila, Putta Latha, Hasan Khan, Babu N. Motagi, T. Radhakrishnan, Naveen Puppala, Rajeev K. Varshney and Manish K. Pandey. 2018. Climate-Smart Groundnuts for Achieving High Productivity and Improved Quality: Current Status, Challenges, and Opportunities. Genomic Designing of Climate-Smart Oilseed Crops. Springer Nature. 1-39. Book ISBN: 978-3-319-93535-5
- Varshney, R.K., M. Pandey and N. Puppala. 2018. The Peanut Genome. Compendium of Plant Genomes. Springer BOOK ISBN: 978-3-319-63935-2.

Extension/Outreach publications

- Angadi S., P.H. Gowda, H. Cutforth, R. Ghimire, S. Begna and J. Idowu. 2018. Circles of Hope: Circular Buffer Strip Schemes for Agriculture. Scientia 117:47-50.
- Angadi S. Conservation Matters, Soil and Water Conservation Society, Science and Policy Committee, Recorded video of Circular Buffer Strips of Perennial Grass Project to Share conservation science beyond our audience (July 30, 2018) (https://vimeo.com/313804865).
- N. Puppala, N.P. Goldberg, L. Beck, S. Sanogo, S. Thomas and C. Trostle. 2018. New Mexico Peanut Production. Circular 645. Extension Publication revised.
- Ghimire, R. (2018). In Kathy Wythe (Ed.). Mixing it up: In the Ogallala Aquifer region, one size (of farming) doesn't fit all. TxH2O Fall 2018.
- Ghimire, R. 2018. Sustainably feeding current and future generations. Scientia Global, https://www.scientia.global/dr-rajan-ghimire-sustainably-feeding-current-and-future-generations/.
- Marsalis, M.A., T. Blaine, R. Ghimire. 2018. Ogallala Summit White Paper: New Mexico. Ogallala Summit, April 2018. http://ogallalawater.org/ogallala-summit-april-2018-new-mexico-white-paper/.
- Cano, A., A. Nunez, V. Acosta-Martinez, M. Schipanski, R. Ghimire, and C. Rice. 2017. Linking soil health to water conservation in the Ogallala Aquifer region. Colorado Water, special issue – the Ogallala Water, November/December 2017.
- Idowu, J., S. Angadi, M.K. Darapuneni, and R. Ghimire. 2017. Reducing tillage in arid and semi-arid cropping systems. NMSU Cooperative Extension Services. Guide A-152. http://aces.nmsu.edu/pubs/_a/A152.pdf
- Ghimire R. and S. Machado. 2017. Soil acidification affects crop yield in a wheat – fallow system. Crop and Soil. 50:14-16.

Meeting abstracts and presentations

- Angadi S.V., S.H. Begna and M.R. Umesh. 2018. Crop diversification for sustainable soil and water resources use in semi-arid regions of USA. XXI Biennial National Symposium of Indian Society of Agronomy, Udaipur, India (October 24-26, 2018) (Keynote Presentation).

- Angadi S.V., S.H. Begna, S. Singh, K. Katuwal, J. Singh, P. Gowda, and R. Ghimire. 2018. Multiple Approaches to sustain Ogallala Aquifer in the Southern Great Plains of the United States of America. Agrosym 2018, Jahorina, Bosnia, (October 04-07, 2018).
- Angadi S.V., S.H. Begna, M.R. Umesh, K. Katuwal, S. Singh and Y. Cho. 2018. Growth Stage Based Irrigation Impact on Crop Performance and Oil Content of Safflower and Canola (Poster presentation). XXI Biennial National Symposium of Indian Society of Agronomy, Udaipur, India (October 24-26, 2018).
- Singh, P., S.V. Angadi, S.H., Begna and D. VanLeeuwen. 2018. Winter Canola Performance under Dormant and Growth-Stage Based Irrigation Strategies in the Southern High Plains of the USA (Poster presentation). The Western Sustainable Agriculture Conference (WSARE), University of New Mexico-Valencia Campus, Los Lunas, New Mexico (Dec. 12, 2018).
- Singh, J., S.V. Angadi and S. Begna (2018). Crop Growth Stage Based Deficit Irrigation Management in Guar Crop (Poster presentation). The Western Sustainable Agriculture Conference (WSARE), University of New Mexico-Valencia Campus, Los Lunas, New Mexico (Dec. 12, 2018).
- Singh, P., S.V. Angadi and S.H., Begna. 2018. Strategies to Reduce Irrigation Requirement of Winter Canola (Oral presentation). ASA-CSSA Annual Meeting, Baltimore, MD, (November 4-7, 2018).
- Begna S.H., R. Ghimire, S.V. Angadi, M. Allen, C. Brungard and A. Mesbah. 2018. Silage Corn Row Spacing and Cutting Height Effect on Yield, Quality and Wind Dynamics in New Mexico. (Oral presentation). ASA-CSSA Annual Meeting, Baltimore, MD, (November 4-7, 2018).
- Begna, S., S. Angadi, P. Singh, K. Katuwal, M. Stamm and A. Mesbah. 2018. Spring and Winter Canola Forage Yield and Nutritive Value during Early Reproductive Stage under Limited Irrigation and Dryland Conditions. (Poster presentation). ASA-CSSA Annual Meeting, Baltimore, MD, (November 4-7, 2018).
- Singh, P., S.V. Angadi and S.H., Begna. 2018. Water Use Efficiency of Winter Canola under Deficit Irrigation (Oral presentation). Soil and Water Conservation Society of America Annual Meeting, Albuquerque, NM, (July 29 – Aug 1, 2018).
- Begna, S. H, R. Ghimire, S. Angadi, M. Allan, C. Brungard, and A. Mesbah. 2018. Strategies for Soil and Water Conservation and Sustainable Forage Corn Production System in New Mexico: Cutting Height, Row Spacing, Forage Quality and Cover Crop Considerations (Oral and poster presentation). Soil and Water Conservation Society of America Annual Meeting, Albuquerque, NM, (July 29 – Aug 1, 2018).
- Angadi, S.V., R. Ghimire, S. H. Begna, P. Singh, O. J. Idowu, P.H. Gowda, G. W. Marek, and C. P. West. 2018. Circular buffer strips (CBS): An Innovative Way to Add Ecosystem Services to Irrigation Agriculture. (Oral presentation). Soil and Water Conservation Society of America Annual Meeting, Albuquerque, NM, (July 29 – Aug 1, 2018).
- Singh, P., S.V. Angadi and S.H., Begna. 2018. Strategies to Reduce Irrigation Requirement in Winter Canola (Oral presentation). Western Society of Crop Science Conference, Laramie, WY, (June 19-20, 2018). (Won third prize in student oral competition).
- Allan, M., Ghimire, R., Brungard, C. W., Begna, S. Angadi, S. 2018. Understanding soil spatial variability for sustainable forage corn production in Eastern New Mexico (Oral

presentation). Western Society of Crop Science, Laramie, WY, (June 19-20, 2018) (Won second prize in student oral competition).

- Singh J., S.V. Angadi and S. Begna. 2018.. Response of Guar Genotypes to Various Irrigation Management Practices. SBAR Annual Retreat, University of Arizona, Tucson, Arizona (Aug. 2, 2018).
- Angadi S.V., S.H. Begna, S. Singh, K. Katuwal, J. Singh, P. Gowda, and R. Ghimire. 2018. Multiple Approaches to sustain Ogallala Aquifer in the Southern Great Plains of the United States of America. Agrosym 2018, Jahorina, Bosnia, (October 04-07, 2018).
- Patil B.S., S.V. Angadi and S. Asseng. 2018. Modeling the Effect of Environmental Conditions on Health-promoting Compounds of Melons (Oral) AGMIP 7 Global Workshop, San Jose, Costa Rica (Apr 24-26, 2018).
- Angadi S.V., R. Ghimire, S. Begna, P. Gowda, P. Singh, G. Marek and C. West. 2018. Glimpses of Benefits of Circular Buffer Strips (CBS) of Perennial Grasses to Sustain Ogallala Aquifer in the Southern Great Plains. Ogallala Aquifer Program Annual Meeting, Lubbock, TX. (March 27-29, 2018)
- Angadi. S.V., Selecting Crop Alternatives for Challenging Climates, Guest lecture in AXED 400/500: The Diffusion and Adoption of Agricultural Innovations, (March 6, 2018)
- Angadi, S.V., UAV/UAS- A New Tool for Crop Research, Guest lecture in HORT/AGRO 315/515: Crop Physiology (March 6, 2018)
- Puppala, N., J.D. Mura, V. Vadez, J. Paspuleti, M. Pandey, R. K. Varshney. 2018. Intergrated Agronomy, Physiology and Plant Breeding Approaches to Improve Drought Tolerance Phenotyping in Peanut. American Peanut Research and Education Society, Williamsburg, VA, July 10-12, 2018.
- Chamberlin, K., N. Puppala, C.C. Holbrook, T.Isleib, J. Dunne and T. Grey. 2018. Examination of the High-Oleic Trait Effective Germination of Peanut Seed. American Peanut Research and Education Society, Williamsburg, VA, July 10-12, 2018.
- Sanchez-Dominguez, S and N. Puppala. 2018. Researching on Rhizobiology in Peanuts (Arachis hypogaea L.) American Peanut Research and Education Society, Williamsburg, VA, July 10-12, 2018.
- Puppala, N., J.D. Mura, V. Vadez, J. Paspuleti, M. Pandey, R. K. Varshney. 2018. Genetic Mapping of Yield Traits Using Ril Population Derived from Valencia-C X Jug-03 of Peanut (*Arachis hypogaea* L.). ASA, CSSA, Baltimore, Maryland, Nov 3 – 8, 2018.
- Taylor, E.A., E.R. Jordan, J.A. Garcia, G.R. Hagevoort, K.N. Norman, S.D. Lawhon, H.M. Scott. (2018). Effects of a two-dose ceftiofur treatment for metritis on levels of antimicrobial resistance among fecal Escherichia coli in Holstein-Friesian dairy cows at the time of slaughter-eligibility.
- Thapa V.R., R. Ghimire, V. Acosta-Martinez, and M. Marsalis. 2018. Reducing Tillage and Increasing Crop Diversity for Improving Soil Health and Agricultural Sustainability: Examples from Eastern New Mexico. NM Sustainable Agriculture Conference, Los Lunas, NM.
- Thapa V.R., R. Ghimire, V. Acosta-Martinez, and M. Marsalis. 2018. Conservation systems for improving soil health and resilience in the southern Ogallala region. Ogallala Water Project third annual meeting, Santa Fe, NM.

- Begna, S., R. Ghimire, S. Angadi, M. Allan, C. Brungard, and A.O. Mesbah. 2018. Silage corn row spacing and cutting height effect on yield, quality and wind dynamics in New Mexico. ASA-CSSA International Annual Meeting, Baltimore, MD.
- Angadi S.V., S.H. Begna, S. Singh, K. Katuwal, J. Singh, P. Gowda, and R. Ghimire. 2018. Multiple Approaches to sustain Ogallala Aquifer in the Southern Great Plains of the United States of America. Agrosym 2018, Jahorina, Bosnia.
- Ghimire, R., V.R. Thapa, and A.O. Mesbah. 2018. Tillage and cover crops effects on soil organic matter dynamics under dryland corn-sorghum rotation. ASA-CSSA International Annual Meeting, Baltimore, MD.
- Acharya, P., R. Ghimire, and C. Young. 2018. Soil health indicators under diverse cover crops in a winter wheat-sorghum-fallow rotation. Soil Health Institute third annual meeting, Albuquerque, NM.
- Ghimire, R., A.O. Mesbah, R.N. Acharya, and M.A. Marsalis. 2018. Cover crops in limited irrigated cropping systems: Opportunities and challenges for sustaining the Ogallala Aquifer. Western Society of Crop Science Annual Meeting, Laramie, WY.
- Allan, M.J., R. Ghimire, C. Brungard, and S. Begna. 2018. Understanding soil spatial variability for sustainable forage corn production in Eastern New Mexico. Western Society of Crop Science Annual Meeting, Laramie, WY (Second place in student oral competition).
- Ghimire, B., R. Ghimire, and A.O. Mesbah. 2018. Early responses of cover crops on limited-irrigated winter wheat-sorghum fallow. Global Food Security through Agricultural Transformation. Oklahoma City, OK.
- Thapa, V.R. and R. Ghimire. 2018. Tillage and cover cropping effects on soil organic matter components and wet aggregate stability in the semi-arid drylands. Global Food Security through Agricultural Transformation. Oklahoma City, OK.
- Begna, S. H, R. Ghimire, S. Angadi, M. Allan, C. Brungard, and A. Mesbah. 2018. Strategies for soil and water conservation and sustainable forage corn production system in New Mexico: Cutting height, row spacing, and forage quality and cover crop considerations. Soil and Water Conservation Society of America Annual Meeting, Albuquerque, NM.
- Angadi, S.V., R. Ghimire, S. H. Begna, P. Singh, O. J. Idowu, P.H. Gowda, G. W. Marek, and C. P. West. 2018. Circular buffer strips (CBS): An Innovative Way to Add Ecosystem Services to Irrigation Agriculture. Soil and Water Conservation Society of America Annual Meeting, Albuquerque, NM.
- Angadi, S.V., R. Ghimire, S. H. Begna, P. Singh, O. J. Idowu, P.H. Gowda, G. W. Marek, and C. P. West. 2018. Circular buffer strips (CBS) of perennial native grasses for sustaining Ogallala Aquifer in the Southern Great Plains. (Poster presentation). College of Agriculture Consumer and Environmental Sciences, Open House, Las Cruces, NM.
- Angadi. S.V., R. Ghimire, S. Begna, P. Gowda, P. Singh, G. Marek and C. West. 2018. Glimpses of Benefits of Circular Buffer Strips (CBS) of Perennial Grasses to Sustain Ogallala Aquifer in the Southern Great Plains. Ogallala Aquifer Program Annual Meeting, Lubbock, TX.
- Thapa, V.R. and R. Ghimire. 2018. Land use effects on soil organic matter pools and soil structure. NeSA 10th International Conference on Role of Diaspora for Sustainable Homeland, Las Cruces, NM.

Annual Weather Summary

Table 1. Historical monthly precipitation (in) for Agricultural Science Center at Clovis

	2011	2012	2013	2014	2015	2016	2017	2018
January	0.00	0.00	0.45	0.00	1.23	0.08	1.11	0.00
February	0.30	0.25	0.79	0.06	0.64	0.16	0.36	0.90
March	0.01	0.14	0.03	0.20	0.61	0.00	0.93	0.04
April	0.00	0.33	0.00	0.17	0.61	0.49	0.49	0.69
May	0.00	2.52	0.45	3.32	7.45	1.53	2.08	1.60
June	1.46	1.31	1.67	3.08	1.77	4.26	1.02	1.71
July	0.23	0.50	3.26	2.23	3.40	0.48	2.18	3.05
August	1.96	1.86	1.49	0.61	4.00	3.25	7.87	3.94
September	1.04	2.06	4.25	2.65	2.54	2.05	4.13	1.80
October	1.22	0.43	0.12	0.35	8.20	0.01	2.04	3.99
November	0.08	0.00	1.03	0.22	0.86	1.00	0.00	0.17
December	1.72	0.08	0.28	0.04	0.61	0.17	0.00	0.14
Total	8.02	9.48	13.82	12.93	31.92	13.48	22.21	18.03

Table 2. Historical average monthly temperatures (^{0}F) for Agricultural Science Center at Clovis

	2011	2012	2013	2014	2015	2016	2017	2018
January	35.8	40.6	35.3	35.1	31.1	35.8	36.5	35.2
February	36.5	39.1	38.0	38.4	38.8	42.8	45.8	40.3
March	51.2	51.4	46.9	45.1	46.0	49.3	51.7	49.4
April	58.1	59.9	52.4	53.6	54.2	53.6	55.5	52.8
May	64.4	65.6	63.8	62.9	59.3	59.9	61.4	69.4
June	77.9	75.9	74.7	73.2	72.2	72.8	74.1	76.1
July	80.3	77.4	73.8	75.2	75.7	78.9	77.0	76.5
August	80.2	76.0	75.3	75.1	74.8	72.7	71.1	74.5
September	69.1	68.7	68.8	66.9	72.6	67.3	66.8	68.5
October	58.3	57.1	55.1	60.0	58.2	61.8	56.4	56.0
November	45.3	50.4	42.5	40.7	44.7	49.5	50.1	43.0
December	32.5	40.4	34.9	37.5	38.9	35.5	38.1	37.5
Average	57.4	58.5	55.1	55.3	55.5	56.6	57.0	56.5

Table 3. Historical average monthly maximum temperatures (^{0}F) for Agricultural Science Center at Clovis

	2011	2012	2013	2014	2015	2016	2017	2018
January	52.3	56.4	50.4	52.0	41.2	48.5	49.1	51.5
February	52.3	52.7	53.5	55.0	53.3	59.7	62.2	58.0
March	68.8	69.2	64.6	63.6	60.5	66.7	70.3	66.5
April	76.0	77.3	71.5	72.6	70.9	70.4	71.6	71.0
May	80.4	82.3	82.6	78.2	72.8	75.8	78.3	86.5
June	94.8	92.5	91.5	87.6	85.8	87.7	91.1	92.2
July	95.3	92.8	88.1	88.0	89.3	95.3	91.7	91.0
August	94.9	91.6	91.6	88.9	89.1	86.6	82.3	88.0
September	84.3	84.4	83.6	77.8	86.6	80.4	80.0	82.0
October	74.1	74.0	72.9	74.4	69.6	78.3	71.0	68.0
November	61.0	69.4	56.8	55.7	59.2	63.6	65.7	56.0
December	41.7	57.2	50.2	51.5	51.8	49.8	53.5	51.0
Average	73.0	75.0	71.4	70.4	69.2	71.9	72.2	71.8

Table 4. Historical average monthly minimum temperatures. (^{0}F) for Agricultural Science Center at Clovis.

	2011	2012	2013	2014	2015	2016	2017	2018
January	19.2	24.8	20.2	18.1	21.0	23.0	23.9	18.8
February	20.7	25.4	22.5	21.8	24.2	25.8	29.3	22.5
March	33.5	33.5	29.2	26.6	31.4	31.9	33.1	32.1
April	40.1	42.4	33.2	34.5	73.4	36.8	39.4	34.5
May	48.3	48.8	45.0	47.5	45.8	43.9	44.5	52.3
June	60.9	59.3	57.8	58.7	58.5	57.9	57.1	59.9
July	65.2	62.0	59.5	62.4	62.0	62.4	62.2	62.0
August	65.4	60.4	58.9	61.2	60.5	58.7	59.8	61.0
September	53.8	52.9	54.0	56.0	58.6	54.2	53.6	55.0
October	42.4	40.2	37.2	45.6	46.8	45.3	41.8	44.2
November	29.5	31.3	28.1	25.6	30.2	35.3	34.4	30.6
December	23.3	23.5	19.6	23.4	26.0	21.1	22.7	24.0
Average	41.9	42.0	38.8	40.1	44.9	41.4	41.8	41.4

Table 1. NMSU Agricultural Science Center at Clovis, Approximate Operational Revenues and Expenditures (2017-18).

FY 17-18	Sales	Operations Enhancement	Indirect Cost	Start Up	Irrigation	Tractor Vehicle	Green House	Grants	Gift	Total
Revenue										
Appropriation	-	308,501	-	-	-	-	-	-	-	308,501
Carry Over FY 16-17	11,029	-	37,278	24,238	51,842	42,622	218	284,724	161,012	612,966
Grants & Gifts	-	-	-	-	-	-	-	168,443	13,912	182,355
Sales	30,136	-	-	-	-	-	-	-	-	30,136
Fees (Variety Trials)	42,336									42,336
Irrigation Usage	-	-	-	-	15,799	-	-	-	-	15,799
Tractor/Veh Usage	-	-	-	-	-	24,834	-	-	-	24,834
Green House Usage	-	-	-	-	-	-	900	-	-	900
Indirect Cost	-	-	11,870	-	-	-	-	-	-	11,870
TOTAL REVENUE	83,502	308,501	49,149	24,238	67,641	67,456	1,118	453,167	174,924	1,229,698
Travel Totals	432	66,154	96	1,020	-	-	-	31,190	-	98,895
Salary/Labor	4,562	57,276	-	-	-	-	-	123,540	-	185,378
Supplies										
Auto/Trt	-	1,468	-	-	-	1,682	-	414	-	3,565
Fuel	174	5,442	-	4	180	2,296	-	828	-	8,925
Office	-	1,695	-	-	-	-	-	39	-	1,735
Other	502	11,219	-	32	1,933	16	223	3,909	120	17,958
Linen	-	84	-	-	-	-	-	-	-	84
Lab Supplies	-	413	-	-	-	-	-	321	-	735
Computer	-	2,039	-	-	-	-	-	147	-	2,186
Cleaning	-	1,104	-	-	-	-	-	-	-	1,104
Photo	-	2,948	-	-	-	-	-	-	-	2,948
Safety	-	1,661	-	-	-	-	-	(84)	-	1,576
Seed/Fertz	7,934	14,341	-	-	-	-	-	8,968	-	31,243
Business Meals	96	3,125	104	-	-	-	-	-	3,015	6,342
Pub/Films	-	384	-	-	408	-	-	-	-	792
Books	-	259	-	-	-	-	-	-	-	259
Newspapers	-	175	-	-	-	-	-	-	-	175
Keys	-	103	-	-	-	-	-	-	-	103
Furnt/Eqpt lt5000	-	15,074	-	-	566	2,170	-	3,650	-	21,461
Parts R &M	-	5,064	-	-	-	-	-	-	-	5,064
Building R & M	-	-	-	-	-	-	-	-	-	-
Equip R & M	-	806	-	-	-	3,607	-	358	-	4,772
Computer R & M	-	-	-	-	-	-	-	-	-	-
Vehicle R & M	-	-	-	-	-	-	-	-	-	-
Supplies Totals	8,708	67,412	104	37	3,087	9,771	223	18,554	3,136	111,036

Table 1. (Continued) NMSU Agricultural Science Center at Clovis, Approximate Operational Revenues and Expenditures (2017-18).

FY 17-18	Sales	Operations Enhancement	Indirect Cost	Start Up	Irrigation	Tractor Vehicle	Green House	Grants	Gift	Total
Services										
Training	-	265	-	-	-	-	-	-	-	265
Postage	-	664	-	-	-	-	-	-	-	664
Phone/Cell Phone	-	5,157	-	-	-	-	-	-	-	5,157
Advertising	-	4,325	-	-	-	-	-	-	-	4,325
Insurance	-	1,017	-	-	-	1,466	-	-	-	2,484
Printing	-	1,182	-	50	-	-	-	4,743	-	5,976
General Rental	-	915	-	-	-	-	-	65	64	1,045
Hardware Equip	-	1,877	-	-	-	-	-	-	-	1,877
Non Building R & M	-	1,720	-	-	1,530	7,799	-	1,900	-	12,950
Building R & M	-	8,387	-	-	-	-	-	-	-	8,387
Electric	-	15,436	-	-	15,389	-	-	-	-	30,825
Trash	-	1,214.16	-	-	-	-	-	-	-	1,214
OFS Services	-	-	-	-	-	-	-	-	-	-
Dues, Fees, Tax	1	2,832	-	2	-	-	-	-	-	2,836
Memberships	-	2,383	-	-	-	-	-	-	-	2,383
NMGRT-NM	-	6	-	-	-	-	-	-	-	6
Profs Service	-	16,702	-	-	-	-	-	4,800	-	21,502
Legal Fees	-	-	-	-	-	-	-	-	-	-
Medical Fees	-	85	-	-	-	-	-	-	-	85
Lab Analysis	5,057	577	-	-	-	-	-	6,639	-	12,274
Farm & Ranch Services	14,228	9,952	-	437	-	-	-	16,637	-	41,255
Freight	91	1,475	-	-	-	22	-	72	-	1,661
Software	-	1,414	-	149	-	-	-	-	-	1,564
Grant Overrun	-	1,985	-	-	-	-	-	(1,985)	-	-
Service Totals	19,378	79,579	-	638	16,920	9,288	-	32,872	64	158,743
Enter Dept. Transfers		(320)	-	-	-	-	-	-	-	(320)
Sub Contract	-	-	63	-	-	-	-	7,025	-	7,088
Indirect Cost General	-	-	-	-	-	-	-	64,041	-	64,041
Non Mand Transfers	7,000	25,200	-	-	-	-	-	(709)	-	31,490
Funiture/Equip GT 5000	-	-	-	-	-	-	-	-	-	-
Enter Dept. Transfers Total	7,000	24,879	63	-	-	-	-	70,356	-	102,299
TOTAL REVENUE	83,502	308,501	49,149	24,238	67,641	67,456	1,118	453,167	174,924	1,229,698
Total Expenses	40,082	295,302	264	1,697	20,008	19,060	223	276,513	3,201	656,353
Difference	43,420	13,198	48,884	22,541	47,632	48,395	895	176,653	171,722	573,345

Irrigated and Dryland Wheat Variety Trial, 2017-2018

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Objective

Test the adaptability and yield performance of newly developed wheat varieties and selections grown under irrigated and dryland conditions at Clovis, New Mexico.

Materials and Methods

The irrigated winter wheat trial was planted October 23, 2017 into a conventionally tilled flat bed plots for center pivot irrigation. Soil type is an Olton clay loam and elevation is 4,435 feet. Individual plots consisted of 11 rows, 6.25 inches apart, 30 feet long. There were three replications for each entry, planted in a randomized complete block design. Individual plots were planted at a rate of 70 lb/ac irrigated and 30 lb/ac dryland. Plots were planted with a Great Plains solid stand plot drill (3600).

The irrigated planting area was fertilized with a pre-plant mixture of 150, and 30 lb/ac of nitrogen, and P_20_5 respectively and 40 lb/ac of Sulphur. Fertilizers were incorporated into soil immediately after application. Additional nitrogen was applied on February 20, 2018 at a rate of 64 lb/ac. Affinity, Lo-Vol6 (2,4-D), and Prowl H20 herbicides were applied at a rate of 0.6 oz/ac and 12 oz/ac, and 3 pt/ac respectively on February 5, 2018. Lorsban 4E (chlorpyrifos) insecticide was applied at a rate of 1 pt/ac on February 5, 2018.
Total irrigation amount for the trial was 17.6 inches. The amounts were applied during October, November, February, March, April, May and June. Precipitation during the period after planting until harvest of the irrigated plots was 6.2 inches.

Height, lodging, and date of bloom measurements were collected during the growing season. The trial was harvested on June 27, 2018 with a WinterSteiger combine. A Harvest Master HM 800 Classic Grain Gage was used to determine percent moisture and test weight (lb/bu).
The dryland trial was planted on October 11, 2017 in the same manner as described above, except at a seeding rate of 30 pounds/acre. The planting area was not furrowed. 36 lb/ac of nitrogen was applied pre-plant. Fertilizers applied on February 7, 2017 were 30 lb/ac, and 5.5 lb/ac of nitrogen and sulphur respectively. Herbicides applied on February 7, 2018 include Affinity BS, Lo-Vol6 (2,4-D), and Prowl H20 at a rate of 0.6 oz/ac and 12 oz/ac, and 3 pt/ac respectively. Precipitation during the period after planting until harvest was 5.7 inches.
Dryland plots were harvested on June 13, 2017 in the same manner as described above for the irrigated trial.

All data were analyzed using SAS® procedures and means were separated using protected least significant difference (LSD) at 5% probability level.

Results and Discussion

Yield data for 2017-2018 are presented in Tables 1 for the irrigated trial and Table 2 for the dryland trial. Grain yields for the irrigated trial averaged 78.8 bushel/acre. The dry land trial produced an average yield of 17.2 bushel/acre.

Table 1. Irrigated Wheat Variety Trial, NMSU-Agricultural Science Center at Clovis.

Variety Name	Grain Yield[1]	Bushel Weight	Harvest Moisture	Plant Height	Lodging	Head Date
	bu/a	lb/bu	%	in	%	date
Winterhawk	86.75	61.1	9.8	30.0	0	20-Apr
TAM 113	86.53	60.7	10.6	29.0	0	19-Apr
CROPLAN EXP 09-17	86.22	59.9	9.5	27.5	0	26-Apr
WB Grainfield	84.76	60.1	9.5	29.2	0	27-Apr
Long Branch	84.60	58.9	9.0	28.5	0	30-Apr
CROPLAN EXP 69-16	83.34	60.3	9.1	28.5	0	1-May
SY Grit	83.09	59.6	9.3	31.1	0	17-Apr
LCS Chrome	82.59	59.8	9.2	31.0	0	1-May
TAM 111	82.03	61.3	10.4	30.7	0	25-Apr
TAM 304RS	81.69	58.2	8.3	27.7	0	26-Apr
Iba	80.45	61.3	10.2	29.5	0	19-Apr
T158	80.35	60.7	9.9	29.6	0	24-Apr
TX12V7415	79.82	61.4	10.8	31.2	0	30-Apr
SY Rugged	79.76	58.3	9.1	27.1	0	24-Apr
SY Monument	79.71	59.4	9.1	29.7	0	29-Apr
TAM 112	79.67	61.3	9.9	28.1	0	13-Apr
TAM 114ET	79.60	62.4	11.0	28.5	0	28-Apr
TAM 304	77.97	57.6	8.4	28.7	0	29-Apr
WB4418	77.85	57.8	8.7	27.3	0	25-Apr
TAM 204	77.01	55.0	8.2	30.4	0	2-May
TAM 114	76.57	61.5	10.4	28.2	0	27-Apr
WB4458	76.33	57.7	8.8	30.2	0	27-Apr
TX11A001295	76.17	62.1	10.4	30.6	0	22-Apr
CROPLAN EXP 56-17	75.70	61.2	10.4	26.5	0	20-Apr
LCS Pistol	74.33	59.2	9.2	29.1	0	22-Apr
WB4303	73.41	55.6	7.8	28.2	0	20-Apr
SY Flint	70.79	57.9	9.2	29.8	0	30-Apr
TAM W-101	69.80	57.8	8.9	29.4	0	29-Apr
TX13M5625	69.09	58.5	8.4	29.3	0	29-Apr
TAM 305	68.81	58.6	8.9	28.3	0	16-Apr
Trial Mean	78.8	59.5	9.4	29.1	0.0	25-Apr
LSD (P> 0.05)	9.5	1.7	0.7	2.7	0.0	5.24
CV	7.4	1.7	4.7	5.7	0	2.76
F Test	0.0	<.0001	<.0001	0.0	0.0	<.0001

[1]Yields adjusted to 60 lb standard bushel weight and 13.5 % moisture.

Table 2. Dryland Wheat Variety Trial, NMSU-Agricultural Science Center at Clovis.

Variety Name	Grain Yield[1]	Bushel Weight	Harvest Moisture	Plant Height	Lodging	Head Date
	bu/a	lb/bu	%	in	%	date
PlainsGold Denali	23.2	51.4	10.7	22.6	3	4/30
LCS Mint	21.9	57.7	10.7	23.3	2	4/29
Long Branch	21.8	58.8	10.3	21.1	7	4/27
CROPLAN EXP 69-16	20.0	57.0	10.1	20.6	9	4/25
PlainsGold Avery	19.8	57.1	10.7	20.0	30	4/23
T158	19.7	55.4	9.9	19.3	3	4/22
WB4721	19.4	56.4	10.2	18.8	8	4/26
TAM 204	18.7	54.5	9.9	17.5	2	4/25
WB Grainfield	18.7	53.0	10.2	20.6	3	4/25
TAM 113	18.4	53.9	10.7	20.6	17	4/25
Iba	18.1	58.5	10.3	21.0	2	4/29
Winterhawk	17.7	54.1	9.6	21.0	16	4/25
TX11A001295	17.7	59.2	10.6	22.3	3	4/30
WB4462	17.7	54.2	10.4	23.1	18	4/23
CROPLAN EXP 09-17	17.4	56.0	10.4	20.4	7	4/23
TX12V7415	16.8	56.7	10.4	19.4	11	4/21
TAM 304RS	16.6	56.0	9.8	19.2	9	4/23
TAM 112	16.1	57.9	10.8	19.3	22	4/22
TAM 114	16.1	56.4	10.2	20.5	4	4/25
TAM 111	15.8	58.6	11.2	22.9	27	4/27
TAM 304	15.8	53.6	10.1	18.9	16	4/23
Plains Gold Langin	15.7	57.3	10.6	19.8	23	4/23
TAM W-101	15.0	52.2	10.2	18.8	18	4/20
LCS Pistol	14.7	56.4	10.4	17.7	11	4/22
TAM 112ET	13.9	56.9	10.2	18.9	22	4/21
CROPLAN EXP 56-17	13.2	56.2	10.3	17.0	2	4/27
LCS Chrome	13.1	46.0	10.3	17.5	0	4/28
TAM 114ET	12.4	56.8	10.6	18.6	10	4/27
TX13M5625	12.0	56.0	10.3	15.5	2	4/28
Trial Mean	17.2	55.6	6.4	19.9	10.4	4/25
LSD (P> 0.05)	6.1	8.3	0.9	2.6	18.1	3.38
CV	21.8	9.1	8.6	7.9	106.0	1.77
F Test	0.0	0.7	0.4	<.0001	0.3	<.0001

[1]Yields adjusted to 60 lb standard bushel weight and 13.5 % moisture.

Small Grain Winter Forage Variety Testing, 2017-2018

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Objective

To evaluate ensilage production potential through dry matter harvests and nutritive value of cool-season, small grain varieties submitted for testing at the Ag. Science Center at Clovis.

Materials and Methods

This variety trial was planted on October 23, 2017. All 37 entries were planted into conventionally tilled flat bed plots. Soil type is an Olton clay loam and elevation is 4,435 ft. Individual plots consisted of 11 rows, 6.25 inches apart and 8 feet long. Plots were planted at a rate of 100 lb/acre with a plot drill. One entry of Ultimate triticale was planted at 110 lb/acre and two entries were planted at 120 lb/ac (Table 1).

On February 2, 2018, the planting area was fertilized with a pre-plant mixture of 64, and 12 lbs/acre of Nitrogen, and Sulphur respectively. All fertilizer applications were based on soil test results and recommendations. Herbicides applied during the study period included Affinity BroadSpec (0.6 oz/ac), Lo-Vol 6 (12 oz/ac), Govern (1pt/ac), and Prowl H2O (3pts/ac) on February 5, 2018.

Plots were center pivot irrigated throughout the season. October and November irrigation consisted of 2.5 inches of water to aid in establishment. Inadequate precipitation through the fall and early winter required additional irrigation; and 16.6 inches of water was applied after the post-planting watering event. These irrigations occurred in February (1.7 in.), March (3.6 in.), April (5.6 in.), and May (3.2 in.).

These small grains were managed for a one-cut, silage oriented harvest in spring of 2018 (Table 1). Harvests began on April 18, 2018 with the earliest maturing species (rye and triticale) and continued through May 11. Plants were harvested at boot stage (Feekes scale: 10.0-10.3; Zadoks scale: 45-53) for maximum forage quality. Although yield is maximized at later growth stages, cutting earlier at boot to early head stages allows for a balance of good yields and optimum nutritive value. Considering the high nutritional needs of dairy cattle in the region and the common practice of double cropping with corn or sorghum, an early cutting of forages was deemed most appropriate for the area. All plots were harvested with a sickle bar mower set at a height of 2 inches, and total plot weights were obtained to estimate yield on both a green forage and dry matter basis. Canopy height and lodging data were collected at harvest.

All data were analyzed using SAS® procedures and means were separated using protected least significant difference (LSD) at 5% probability level.

Results and Discussion

Yield data are presented in Table 2. Total precipitation and irrigation amounts were less in 2017-2018 (19.51 in.) than in the previous year (21.47 in.). Yields from the 2017-2018 season were slightly higher than 2016-2017 and averaged 21.8 tons/acre for green forage. The Small Grain Winter Forage tests at Clovis were harvested and fresh weights were obtained. However, a drying oven fire consumed all the subsamples used for estimating dry matter and nutritive value parameters. Hence, no DM yield or quality results are reported for these tests.

Table 1. Winter Annual Small Grain Forage Trial, NMSU-Agricultural Science Center at Clovis.

Company Name	Variety Name	Species†	Harvest Date	Dry Forage	Moisture Forage	Harvest Moisture
				T/ac	T/ac	%
Ehmke Seed	Thunder Tall II	T	11-May	7.6	21.8	75.7
UNL Husker Genetics	NE 96T441	T	11-May	7.1	20.3	77.3
TriCal Superior Forage	Exp. 17201	T	7-May	7.1	20.2	75.3
Ehmke Seed	Thunder Tall	T	11-May	6.9	19.8	77.0
Agricultural Developmant	Ulitmate" Triticale	T	11-May	6.8	19.4	77.0
Watley Seed	SlickTrit II	T	11-May	6.8	19.3	77.3
Ehmke Seed	Thunder Green	R	30-Apr	6.5	18.6	80.3
TriCal Superior Forage	Trical 348	T	7-May	6.5	18.5	77.3
TriCal Superior Forage	Exp. 16T2018	T	4-May	6.0	17.2	79.3
TriCal Superior Forage	Trical 813	T	4-May	6.0	17.2	80.3
UNL Husker Genetics	NT 13416	T	27-Apr	6.0	17.2	76.0
TriCal Superior Forage	Flex 719	T	4-May	3.0	17.2	78.7
Sharp Brothers Seed Co.	Triticale 718	T	4-May	6.0	17.2	77.3
TriCal Superior Forage	SY TF 131	T	27-Apr	5.9	17.0	76.3
Ehmke Seed	Thunder Cale F	T	30-Apr	5.9	16.8	75.7
Chromatin	KWS Progas	R	27-Apr	5.7	16.1	81.3
UNL Husker Genetics	NT 13443	T	4-May	5.6	16.1	78.0
UNL Husker Genetics	NT 09404	T	27-Apr	5.4	15.5	77.3
UNL Husker Genetics	NT 09423	T	30-Apr	5.4	15.4	76.3
Agri Pro	SY Monument	W	4-May	5.3	15.2	76.0
UNL Husker Genetics	NT 11406	T	27-Apr	5.3	15.2	77.3
Ehmke Seed	Thunder Cale V	T	27-Apr	5.3	15.2	78.7
TriCal Superior Forage	Exp. 1331412	T	27-Apr	5.2	14.9	76.3
UNL Husker Genetics	NT 12414	T	27-Apr	5.2	14.8	77.3
UNL Husker Genetics	NT 11428	T	27-Apr	5.2	14.8	77.3
UNL Husker Genetics	NT 12434	T	4-May	5.1	14.7	81.3
UNL Husker Genetics	NT 12403	T	23-Apr	4.8	13.7	78.0
AGSECO	Triticale 135	T	23-Apr	4.8	13.6	77.0
Ehmke Seed	Shortbeard Thunder	T	23-Apr	4.6	13.1	78.3
TriCal Superior Forage	Exp. 103126	T	18-Apr	4.5	12.9	77.3
TriCal Superior Forage	Exp. 1331319	T	23-Apr	4.5	12.9	77.3
Watley Seed	TAM 204	T	27-Apr	4.4	12.7	71.0
TriCal Superior Forage	Exp. 30412	T	18-Apr	4.3	12.4	77.7
TriCal Superior Forage	Trical Gainer 154	T	18-Apr	4.2	12.0	78.0
Ehmke Seed	Thunder Cale	T	18-Apr	4.2	12.0	77.3
Agri Pro	SY Grit	W	23-Apr	4.1	11.7	71.3
UNL Husker Genetics	NT 07403	T	18-Apr	3.9	11.3	75.3
	Trial Mean			5.5	15.8	77.2
	LSD (0.05)			0.9	2.5	0.02
	CV			9.9	9.9	1.3
	F Test			<.0001	<.0001	<.0001

†B=barley; T=triticale; W=wheat, R=Rye

Plots were harvested at Feekes stage 10.0-10.3; 10.0=sheath of flag leaf completely grown out, ear not visible; 10.3= half of heading process complete.

Performance of Grain Corn Varieties, 2018

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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 17, 2018 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 random 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.

On February 16, the planting area was fertilized with 18 lb N/ac, 3 qt zinc and, 60 lb/ac of P_2O_5. Additional nitrogen was applied pre-plant (122 lb N/ac) and May 17 (30 lb N/ac). Sulphur was applied at plant (22 lb/ac) and May 17, (5.5 lb/ac). Pre-plant herbicide applications included Atrazine (1 pt/ac), Balance Flex (3 oz/ac), Diflex (5 oz/ac) and, Glyphosate (40 oz/ac). Diflex and Brawl herbicides were applied on 20 June at 8 oz/ac and 16 oz/ac respectively. Onager miticide (16 oz/ac) was applied on 20 June. Insecticide and Miticide was applied on August 1 (Prevathon, 20 oz/ac; Oberon, 8 oz/ac)

Total irrigation amount for the trial was 16.0 inches. Amounts were applied during May, June, July, August and, September. Monthly amounts were 1.4, 3.2, 5.3, 4.4, and 1.7 inches, respectively. Precipitation during the period after planting until harvest of the irrigated plots was 15.9 inches.

The plots were harvested on November 5, 2018 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.

All data were analyzed using SAS® procedures and means were separated using protected least significant difference (LSD) at 5% probability level.

Results and Discussion
Yield data for the 2017 grain corn trial are presented in Table 1, Grain yields, for the 16 varieties in the trial, ranged from 289.6 to 245.0 bushel/acre with a trial average of 268.0 bushel/acre.

Table 1. Grain Corn Variety Trial, NMSU-Agricultural Science Center at Clovis.

Company Name	Variety Name	Grain Yield	Harvest Moisture	Test Weight	Plant Height	Ear Height	Silk Date
		bu/a	%	lb/bu	in	in	
LG Seeds	LG 66C32 STX	289.6	18.33	60.60	101.0	42.1	23-Jul
Golden Harvest Seeds	G18D87-3111	283.9	18.56	59.70	109.7	48.4	20-Jul
Dyna-Gro Seeds	D57VC51	281.8	18.06	56.43	108.3	46.6	21-Jul
LG Seeds	ES 7667 VT2 PRO	277.8	18.66	59.30	102.7	44.6	21-Jul
Golden Harvest Seeds	G11B63-3010A	271.5	16.83	58.40	103.0	43.0	23-Jul
Dyna-Gro Seeds	D58VC65	270.4	16.93	60.03	100.0	43.0	21-Jul
Golden Harvest Seeds	G13Z50-3110	269.0	16.20	58.73	95.0	44.1	25-Jul
Dyna-Gro Seeds	D54VC14	265.3	16.56	60.00	94.7	42.8	24-Jul
Dyna-Gro Seeds	D55VC45	261.8	16.30	60.46	94.3	42.4	25-Jul
Dyna-Gro Seeds	D54DC94	261.7	17.13	57.80	100.3	45.5	24-Jul
Dyna-Gro Seeds	D52VC63	261.6	15.36	59.80	100.3	47.5	21-Jul
Golden Harvest Seeds	G13T43-3010	249.0	17.46	55.13	97.7	41.3	21-Jul
Dyna-Gro Seeds	D52VC91	240.5	16.96	59.56	97.0	43.8	24-Jul
	Trial Mean	268.0	17.2	58.9	100.3	44.3	22-Jul
	LSD (P > 0.05)	27.9	1.16	4.49	6.0	3.7	3.1
	CV	6.17	4.03	4.52	3.52	5.02	0.88
	F Test	0.0623	<.0001	0.3956	<.0001	<.0001	0.0168

Performance of Forage Corn Varieties, 2018

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Objective

To evaluate 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 34 corn entries were planted on May 17, 2018 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).

On February 16, the planting area was fertilized with 18 lb N/ac, 3 qt zinc and, 60 lb/ac of P_2O_5. Additional nitrogen was applied pre-plant (122 lb N/ac) and May 17 (30 lb N/ac). Sulphur was applied pre-plant (22 lb/ac) and May 17 (5.5 lb/ac). At plant herbicide applications included Atrazine (1 pt/ac), Balance Flex (3 oz/ac), Diflex (5 oz/ac) and, Glyphosate (40 oz/ac). Diflex and Brawl herbicides were applied on 20 June at 8 oz/ac and 16 oz/ac respectively. Onager miticide (16 oz/ac) was applied on 20 June. Two insecticides were applied on August 1 (Prevathon, 20 oz/ac; Oberon, 8 oz/ac)

Total irrigation amount was 14.3 inches applied from May to August at varying rates during the growing season. Monthly amounts were 1.4, 3.2, 5.3, and 4.4 inches for May, June, July, and August, respectively. Precipitation during the period after planting until harvest was 11.0 inches.

Plots were harvested on September 6, 2018 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 was placed in brown paper bags for later estimation of moisture content and nutritive value. Samples were dried for 72 hours prior to 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.

All data were analyzed using SAS® procedures and means were separated using protected least significant difference (LSD) at 5% probability level.

Results and Discussion

Data for the forage corn performance trial are presented in Table 2. Highest dry matter yields were above 10.00 tons/ac for the trial. Average dry matter yield was 8.7 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. Forage Corn Variety Trial, NMSU-Agricultural Science Center at Clovis.

Brand/Company Name	Hybrid/Variety Name	Dry Forage	Green Forage	Harvest Moisture	CP	NDF	NDFD Starch	Ash	TDN	NE_l	Milk/ Ton	Milk/ Acre
		t/a	t/a	%	%	%	%	%	%	Mcal/lb	lb/t	lb/a
Wilbur-Ellis Company	INT6709 VT3PRO	10.4	29.8	64.9	9.1	42.5	31.4	4.1	66.2	0.681	3181	33204
Wilbur-Ellis Company	INT9678 VT2PRO	9.5	26.9	64.5	9.4	42.4	31.3	3.8	65.5	0.673	3102	29575
Golden Harvest Seeds	G18D87-3111	9.5	27.8	65.7	8.9	42.1	31.4	4.1	67.2	0.693	3277	31213
Wilbur-Ellis Company	INT STP6498R	9.4	29.0	67.8	9.1	44.5	28.5	4.1	66.8	0.688	3246	30351
Dyna-Gro Seeds	D58RR70	9.3	27.0	65.4	9.2	42.9	31.2	4.1	66.6	0.685	3224	30045
Wilbur-Ellis Company	INT 6474 DGVT2PRIB	9.2	26.1	64.6	9.0	40.8	33.2	4.2	67.2	0.692	3267	30153
Golden Harvest Seeds	G14H66-3010A	9.2	26.0	64.5	8.9	40.8	32.7	4.0	67.4	0.695	3286	30337
Wilbur-Ellis Company	INT9684 VT2PRO	9.1	27.6	67.2	9.3	44.3	28.4	4.3	65.0	0.667	3085	28017
Dyna-Gro Seeds	D58SS65	9.0	26.7	66.3	9.2	40.9	33.8	4.0	66.2	0.681	3172	28531
Golden Harvest Seeds	G18H82-3111	8.9	23.8	62.4	8.4	37.9	38.1	3.5	67.8	0.698	3306	29566
Wilbur-Ellis Company	CX618118-VT2PRIB	8.9	24.7	63.9	8.8	40.6	32.7	3.8	67.6	0.696	3291	29335
Blue River Organic Seed	70A47	8.8	25.7	65.6	9.5	39.9	34.8	4.6	66.1	0.679	3168	27972
Golden Harvest Seeds	NK1860-3111	8.8	23.7	62.8	9.0	37.3	35.2	4.2	69.0	0.712	3423	30172
Masters Choice	MCT6653	8.8	24.5	64.0	9.1	41.7	33.1	3.9	66.8	0.688	3235	28469
Dyna-Gro Seeds	D55VC77	8.8	25.8	66.0	9.2	44.0	31.0	4.3	64.2	0.659	3011	26340
Wilbur-Ellis Company	CX801115 DGVT2PRO	8.8	25.2	65.3	8.9	39.6	35.0	4.3	66.5	0.684	3205	28040
Masters Choice	EXP 671T	8.7	23.9	63.5	8.6	41.7	32.4	4.0	66.8	0.688	3240	28286
Masters Choice	EXP 672T	8.7	24.7	65.0	8.7	41.4	33.1	4.3	66.7	0.687	3232	28052
Golden Acres Genetics	LG 68C88 VT2PRO	8.7	24.1	64.1	9.0	44.2	27.8	3.8	66.6	0.685	3214	27776
Blue River Organic Seed	66G25	8.6	24.5	64.8	9.0	42.5	31.3	4.2	67.0	0.689	3252	28107
Golden Harvest Seeds	G16K01-3111	8.6	25.7	66.4	8.4	41.9	32.9	3.9	66.6	0.685	3212	27779
Golden Acres Genetics	ES 7667 VT2PRO	8.5	24.4	65.2	9.1	42.1	31.6	4.1	67.0	0.689	3247	27572
Masters Choice	EXP 621T	8.4	24.2	65.1	8.6	41.9	32.7	4.4	66.4	0.683	3202	26928
Wilbur-Ellis Company	CX711118-3110	8.4	25.6	67.1	9.5	43.0	28.5	4.1	65.9	0.677	3150	26559
Wilbur-Ellis Company	CX801117 SS	8.4	23.1	63.6	8.8	40.2	33.9	3.8	67.2	0.692	3251	27360
Wilbur-Ellis Company	CX842118-3110	8.4	24.0	65.2	8.9	41.3	32.3	4.2	67.0	0.690	3255	27275
Wilbur-Ellis Company	CX841118-3110	8.3	24.6	66.0	8.6	43.7	31.2	4.3	66.4	0.683	3208	26744
Dyna-Gro Seeds	D55SS45	8.3	23.5	64.6	9.3	39.8	32.6	4.1	68.4	0.706	3374	28055
Blue River Organic Seed	62G22	8.2	24.1	66.0	9.3	43.0	31.5	4.4	66.2	0.681	3187	26234
Masters Choice	MCT6733	8.2	22.8	64.1	8.7	42.2	32.5	3.8	67.2	0.691	3265	26708
Dyna-Gro Seeds	D52VC15	8.2	21.0	61.0	8.4	39.7	36.6	4.0	67.1	0.691	3259	26623
Masters Choice	MCT6552	8.1	24.0	66.2	8.9	40.5	33.2	4.2	67.7	0.697	3307	26717
Golden Acres Genetics	LG 68C22 VTPRO	8.1	22.1	63.6	9.1	42.1	31.3	3.8	66.7	0.687	3215	25884
Wilbur-Ellis Company	CX851110SS	7.4	21.6	65.6	9.3	40.4	31.7	4.6	67.8	0.698	3321	24661
	Trial Mean	8.7	24.9	64.9	9.0	41.6	32.3	4.09	66.8	0.681	3231	28195
	LSD	1.0	2.7	0.02	0.58	3.3	4.71	0.61	2.09	0.023	177	3573
	LSD P >	0.1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.050	0	0.05
	CV	7.2	6.7	2.3	4.0	4.9	9.0	9.2	1.9	2.083	3	7.8
	F Test	0.0	0.0001	0.0003	0.0028	0.005	0.0274	0.2370	0.0872	0.090	0.0725	0.0132

Performance of Dryland Grain Sorghum Varieties, 2018

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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 11, 2018 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 random 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 February 19, the planting area was fertilized with 30 lb N/ac, 4 lb/ac sulphur and, 20 lb/ac of P_2O_5. Additional nitrogen was applied at plant (75 lb N/ac). At plant herbicide applications included Atrazine (1.0 pt/ac), Sharpen (1.5 oz/ac), Starane (6.4 oz/ac) and, Glyphosate (40 oz/ac). Brawl herbicide was applied on 12 June at 1.3 pt/ac. Two insecticides were applied, Sivanto, at 10.5 oz/ac, and Prevathon at 20 oz/ac on August 15. An additional application of Sivanto was made on September 24, at 10.5 oz/ac.

No irrigation was applied. Precipitation during the period after planting until harvest was 13.3 inches.

The plots were harvested on November 8, 2017 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.

Results and Discussion
Yield data for the 2017 grain sorghum trial are presented in Table 1, Grain yields, for the 22 varieties in the trial, ranged from 113.0 to 59.5 bushel/acre with a trial average of 94.1 bushel/acre.

Table 1. Dryland Grain Sorghum Variety Trial, NMSU-Agricultural Science Center at Clovis.

Brand/Company Name	Hybrid/Variety Name	Grain Yield	Harvest Moisture	Test Weight	Plant Height	Head Exertion	Lodging	Heading Date
		bu/a	%	lb/bu	in	in	%	
Dyna-Gro Seeds	GX17948	113.0	14.6	58.5	21.7	5.0	0	8-Aug
Advanta Seeds	ADV XG602	112.9	14.2	56.9	20.7	7.3	0	16-Aug
Golden Acres	2620C	112.7	12.9	56.6	16.0	7.7	0	11-Aug
Golden Acres	2730B	109.1	13.5	58.2	16.7	7.0	0	15-Aug
Dyna-Gro Seeds	M69GR88	107.5	15.1	56.5	21.0	4.3	0	12-Aug
Browning Seed, Inc.	Phoenix	105.3	13.8	58.3	18.7	8.7	0	16-Aug
Dyna-Gro Seeds	M74GB17	103.7	14.8	57.4	19.0	6.3	0	16-Aug
Advanta Seeds	ADV XG001	102.9	14.5	58.5	15.0	7.3	0	17-Aug
Dyna-Gro Seeds	M60GB31	99.2	13.9	57.6	17.3	6.3	0	17-Aug
Dyna-Gro Seeds	GX17968	97.6	14.1	57.2	20.0	7.7	0	7-Aug
Dyna-Gro Seeds	GX17962	97.2	14.0	58.6	16.3	5.0	0	10-Aug
Dyna-Gro Seeds	M60GB88	93.2	12.9	58.0	17.0	5.7	0	17-Aug
Advanta Seeds	AG 1203	91.4	13.8	57.9	18.7	6.0	0	12-Aug
Dyna-Gro Seeds	M68GR41	89.8	15.5	54.8	17.3	2.3	0	9-Aug
Browning Seed, Inc.	775 W	89.1	13.3	57.6	15.7	6.0	0	14-Aug
Dyna-Gro Seeds	GX17379	84.7	15.3	51.5	16.7	1.3	0	18-Aug
Dyna-Gro Seeds	GX16833	84.6	15.3	54.7	24.3	2.3	0	23-Aug
Advanta Seeds	AG 1201	82.8	13.0	56.4	16.3	5.0	0	15-Aug
Advanta Seeds	ADV XG629	78.9	13.1	57.6	17.7	5.0	0	13-Aug
Browning Seed, Inc.	Blaze	78.1	14.2	58.0	16.0	5.7	0	12-Aug
Browning Seed, Inc.	Challenger BMX	77.3	14.5	51.0	21.0	5.7	0	8-Aug
Dyna-Gro Seeds	M73GR55	59.5	17.0	35.8	22.7	2.3	0	11-Aug
	Trial Mean	94.1	14.2	55.8	13.3	5.5	0.0	13-Aug
	LSD (P > 0.05)	50.2	0.8	7.5	4.0	2.2	0.0	3.2
	CV	32.3	3.4	8.1	13.3	24.3	0.0	0.9
	F Test	0.8661	<0.0001	0.0002	0.0006	<0.0001	<0.0001	<0.0001

Weed Management in Grain Corn

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Objective:
Evaluate Red Root Pigweed control and corn response to several herbicides applied as post-emergence or pre-plant followed by post-emergence.

Materials and Methods

Plots were established under limited sprinkler irrigation at the Clovis Agricultural Science Center, NM. Plots were three rows wide and 30 ft. long with three replications arranged in a randomized complete block design. Corn (var. Pioneer 1151) was seeded at the rate of 22,000 seeds/A in 30" rows on June 1, 2018. Soil at the experimental site is Olton clay loam with 1.6% organic matter and pH 7.9. Herbicide treatments were applied broadcast with a CO_2 pressurized knapsack sprayer delivering 15 gpa. at 40 psi. Pre-emergence treatments (A) were applied on June 1, 2018 (air temperature 82F, relative humidity 13%, wind north east at 7 mph., sky clear, and soil temperature at 0-inch 92F, 2-inch 70F, and 4-inch 70F). Post-emergence treatments (B) were applied broadcast on June 21, 2018 (air temperature 90F, relative humidity 19%, wind south west at 5-7 mph., sky partly cloudy, and soil temperature at 0-inch 94F, 2-inch 83F, and 4-inch 80F). Plots were evaluated for herbicides injuries twice on June 21 and 28. Red root pigweed infestation was uniform throughout the experimental site. Weed control evaluation was done visually on June 21 and July 5.

The middle row of each plot (20ft) was harvested by hand on October 30, and thrashed on November 8, 2018. 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 were adjusted to standard 15.5% moisture and bushel weight of 56 pounds.

All data were analyzed using SAS® procedures and means were separated using protected least significant difference (LSD) at 5% probability level.

Results and Discussion

In the post-emergence trial (Table 1), no injury was recorded with any of the treatments. Red root pigweed control was good to excellent (95 to 100%) with all treatments except for Laudis+Liberty the control was around (73%). Corn yield ranged from 168 to 192 bu/A. Yields were 74 to 104 bu/ac higher in herbicide treated plots, compared to the weedy check plots (94 bu/A). In general, corn yields were closely related to weed control.

In the pre-plant followed by post-emergence treatment trial (Table 2), no injury was recorded with any of the treatments. Redroot pigweed control was good to excellent (97 to 100%) with all the treatments. Yields were 46 to 58 bu/ac higher in herbicide treated plots, compared to the weedy check plots (124 bu/A). In general, corn yields were closely related to weed control.

Table 1. Weed control and corn response to postemergence treatments, NMSU-Agricultural Science Center at Clovis.

	Treatments[1]	Appli.	Rate[2]	R. Root Pigweed	Corn Response	
				Control	Injury	Yield
			(oz/A)	(%)	(%)	(bu/A)
1	Check	--	--	--	0	94
2	DiflexxDuo+RoundupWM+Aatrex	Post	32+32+16	100	0	178
3	DiflexxDuo+RoundupWM+Aatrex	Post	24+32+16	100	0	176
4	DiflexxDuo+Liberty 280+Aatrex	Post	24+32+16	98	0	182
5	Capreno+RoundupWM+Aatrex	Post	3+32+16	98	0	192
6	Halex GT+Aatrex+Nis	Post	57+16	98	0	188
7	Armeson Pro+RoundupWM+Aatrex	Post	16+32+16	98	0	198
8	Armeson+Status+RoundupWM+Aatrex	Post	0.6+3+32+16	96	0	176
9	Laudis+RoundupWM	Post	3+32	95	0	178
10	Laudis+Liberty 280	Post	3+32	73	0	168

[1] All treatments included AMS; ammonium sulfate (17 lb/100 gal). Nis; preference (0.25% v/v).
[2] Herbicide rate expressed on oz of product/A.

Table 2. Weed control and corn response to pre-plant followed by post-emergence treatments, NMSU-Agricultural Science Center at Clovis.

	Treatments[1]	Applic	Rate[2]	R. Root Pigweed	Corn Response	
				Control	Injury	Yield
			(oz/A)	(%)	(%)	(bu/A)
1	Check	--	--	--	0	124
2	Corvus+Atrazine	PPI	5.6+32			
	DiflexxDuo+Atrazine+RoundupPM	Post	24+32+16	100	0	182
3	Balance Flexx+Atrazing	PPI	3+32			
	Capreno+Atrazine+RoundupPM	Post	3+32+16	100	0	176
4	Balance Flexx+Atrazing	PPI	3+32			
	Laudis+Diflexx+RoundupPM+AMS	Post	3+8+32	100	0	178
5	Balance Flexx+Atrazing	PPI	3+32			
	Laudis+Diflexx+Liberty 280+AMS	Post	3+8+22	97	0	170

[1] AMS; ammonium sulfate 17 lb/100 gal.
[2] Herbicide rate expressed on oz of product/A.

Strategies for Soil and Water Conservation and Sustainable Forage Corn Production in New Mexico: Increasing Cutting Height, Decreasing Row Spacing and Forage Quality Considerations

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Rational:
Dairy industry's contribution to New Mexico's agricultural revenues is huge (~40%, $1.3 billion) and vital for state's economy. Forage corn is the main row crop for dairy industry, but production system removes most of the vegetation out of field living soil exposed to wind and water erosion. With wide row spacing of 30", 3 to 6" silage cutting height and long fallow period, the system is inefficient to conserve soil and water resources and hence corn silage system is unsustainable. Recent observations are also suggesting that bottom portion of the stem in corn is of lower quality and it lowers overall quality of forage. We hypothesized that increasing corn cutting height and decreasing row spacing has the potential to conserve soil and water and also improve forage quality without affecting forage yield significantly.

Objective:
On-farm **demonstration/**research to evaluate effect of increased forage corn cutting height (6 vs. 21") and reduced row spacing (15 vs. 30") on forage yield, forage quality, soil quality (soil organic matter components), soil moisture, wind dynamics and economics.

Materials and Methods
The second year of the project was established in spring of 2018 in dairy producer's (co-operator, Heritage Dairy Farm) field near Clovis, NM in a half-circle of a center pivot (6o acres). The field has seven spans encompassing two corn row spacing, two forage corn (silage) cutting height. The experimental design is a split-plot design with four replications (span 4, 5, 6 and 7); row spacing and silage cutting height as main and sub-plots, respectively. Corn was planted on May 12 and 17, in 2017 and 2018 respectively. In 2017 corn was planted into no-tilled field (previous crop canola), while in 2018 was into previous corn field using commercial planter (model DB60, John Deer Planter, Moline IL, USA). The corn variety '9678VT3P' was selected for the trial for both years. It was planted at 22,000 seeds ac^{-1} in both years. Liquid fertilizer blend (32-0-0) was pumped through sprinkler at a rate of 5.35, 6.58 and 5.59 tons in June 16, 24 and July 27, 2018 resulting in total equivalent of 187 lbs ac-1 of nitrogen. Herbicide Glyphosate and Keystone nxt at 32oz and 1.4 qt ac-1 in May 13 and Glyphosate and Status at 32 oz and 2 oz qt ac-1 in June 24, 2017 were applied for weed control.
The field operation follows producer's management practices. Crop was irrigated although the availability of irrigation water was limited (13 inches in total). Soil samples were taken in May 18, 2017 before fertilizer application and after final harvest in fall of both years. Samples were taken by a graduate student (partially funded by this grant) guided by supervisor (Co-PI) with the GPS grid mapping approach prepared earlier. Samples processing/analysis for soil organic matter components (such as mineralizable carbon, nitrogen, available phosphorus, and inorganic N (NH4 and NO3) taken in October of 2017 and 2018 after forage harvest. Soil quality, forage

yield and quality were assessed each year. A strip of 20 ft wide in the center of each plots of varying length depending on the span size (ranging from 1983 ft to 3680 ft) was harvested using producer's commercial forage chopper and collected in a separate truck. Plot weights were determined by weighing the truck with and without forage from the plot. Two samples of about 500 grams were collected from each plot harvest and placed in paper bags and plastic bags for estimation of moisture content and nutritive value. After fresh weights were recorded, samples were dried to a constant weight at 65˚C. Dried and fresh weights were used to estimate forage biomass production per acre. The dried samples were ground to pass through a 1-mm screen using a Wiley Mill (Thomas Manufacturing) and submitted to the certified Laboratory in University of Wisconsin to estimate nutritive values using near-infrared spectroscopy and Milk 2000 technology.

A cover cropping (Rye-winter pea mixture, variety Elbon and Austrian, respectively) treatment was also added in the section of the field (span 1, 2 and 3) in conjunction with short cut/stubble height and narrower spacing after forage harvest for comparisons with other treatments mentioned above. The rye-pea mixture (65:35 %) was planted at 41 lbs ac-1 rate. Cover crop was planted in November of 2017. Once cover crop was established sensors were set for wind and soil moisture dynamics monitoring.

Sensors (wind and soil temperature) for microclimate observations were set in December of 2017 and 2018 and monitoring of wind, temperature and periodical soil moisture readings (with portable soil moisture reader) under the different corn cutting/stubble height-row spacing combination treatments including cover crop treatment is underway.

Since the project is being conducted in producer's field it involves a lot of coordination. Collection of production records (such as seeding rate, seed type, irrigation events, and nutrient and pesticide applications) is going on and a process to continue until the middle of 2019 the time most of the data and information will be compiled and analyzed for publication.

Data Analysis

Forage yield and quality data were analyzed using SAS procedure on combined two years' data (SAS 9.3, SAS Institute Inc.). Statistical analysis was performed on the basis of split-plot design (row spacing as main and silage cutting height as sub-plot factors). To detect differences between row spacing treatments and their interactions with silage cutting heights types, PROC GLM procedures were used. Significance was considered at $P < 0.05$, and Fisher's protected LSD was used to separate means.

Results and Discussion

Forage yield and quality results involving row spacing and silage cutting heights are presented in Table 1. Significant difference was detected between 15" than 30" row spacing for dry and green forage yield, moisture at harvest, starch content and milk production per acre (Table 1). The two row spacings, however, were not significantly different for the other measured parameters.

Dry forage yield was higher with 15 than 30” row spacing (7.7 vs. 6.0 t/ac) which was also reflected in milk production per acre (25179 vs. 19720 lbs/ac; an increase in milk by 22%). Similarly, significant differences were detected between 6” than 21” silage cutting heights for dry and green forage yield and moisture at harvest and milk production per acre. Dry forage yield production per acre were reduced by 20 % with silage cutting height of 21” compared to the 6” (6.2 vs. 7.6 t/ac). This was also reflected in milk production per acre as well. However, cutting height had no significance effect on milk production per ton. In general, a significant improvement in forage quality was observed with increasing silage cutting height (reduction in fiber by 6 to 8%, increase in starch by 11% and reduction in nitrate by 39%). In a separate trial conducted at NMSU-Agricultural Science Center at Clovis in 2017 involving three silage cutting heights (6, 13, 21”) and five corn varieties revealed similar reduction in dry forage yield with the highest silage cutting height. However, yield reduction with 13” cutting height was only 5% suggesting the possibility of raising cutting height to 13” with minimum yield loss. In the long run, tall stubble (with higher silage cutting heights) in conjunction with narrow row spacing is expected to leave more plant residue in field potentially resulting in better soil coverage, improvement in soil conservation and moisture retention, carbon sequestration, and in overall improvement and sustainability of forage corn production and hence dairy farming systems and rural economies in New Mexico.

Table 1. Effects of corn row spacing and silage cutting height on forage yield and quality on producer’s field near Clovis

Row Spacing (inch)	Green Forage (t/ac)	Dry Forage (t/ac)	Harvest moisture	CP	ADF	NDF (%)	Starch	Ash	TDN	Nitrate (ppm)	NEl (Mcal/lb)	Milk (lb/t)	Milk (lb/ac)
15	18.3a[+]	7.7a	59.9b	9.4a	22.6a	41.8a	29.6a	4.1a	67.2a	41.6a	0.716a	3266a	25179a
30	14.7b	6.0b	60.9a	9.6a	23.2a	42.1a	27.7b	4.6a	67.3a	56.2a	0.718a	3281a	19720b
Silage cutting height (in)													
6	18.3a	7.6a	62.3a	9.5a	23.9a	43.3a	27.0b	4.4a	66.6b	60.8a	0.707a	3229a	24279a
21	14.6b	6.2b	58.5b	9.5a	21.9b	40.6a	30.2a	4.1b	67.8a	37.0a	0.727a	3318a	20620b

Crud protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF), total digestible nutrient (TDN), net energy for lactation (NEl)
[+]Values within a column followed by the same letter are not significantly different at P<0.05

Crop Growth Stage Based Deficit Irrigation Management in Guar Crop

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Objective

To examine the effect of critical stage based deficit irrigation on in season biomass, seed yield under pre-irrigation and no pre-irrigation conditions.

Material and Methods

Experiment location during 2018 was NMSU Agricultural Science Center in Clovis NM (340 35' N, 103° 12' W and elevation of 1348 m above mean sea level).

Design: Strip plot with split-split arrangement.
Treatments:

Main plot: Pre-irrigation and No pre-irrigation.

Sub plot: Four irrigation treatments [Fully irrigated (FI), Irrigation water stress at vegetative stage (Vstss), Irrigation water stress at reproductive stage (Rstss) and Rainfed irrigated]

Sub-Sub plot: Guar cultivars: Kinman (branching) and Monument(less branching)

Date of sowing: July 3, 2018.

Spacing: Row to row distance was 30 inches.

Seed rate: 8 lbs/acre.

Replications: 4 (Four replication of each treatment)

Results and Discussion

Seed yield under pre-irrigation treatment recorded 23% more than seed yield under no pre-irrigation treatment (Table1). Pre-Irrigation treatment increased seed yield in all in season irrigation treatment. The highest percentage seed yield increase (27%) was obtained under Rstss treatment with pre-irrigation as compared to Rstss treatment without pre-irrigation. Thus skipping irrigation during reproductive growth stage and applying a pre-irrigation to guar crop is beneficial with a seed yield loss of 3.8% as compare to fully irrigated treatment which was pre-irrigated before. (Table2).

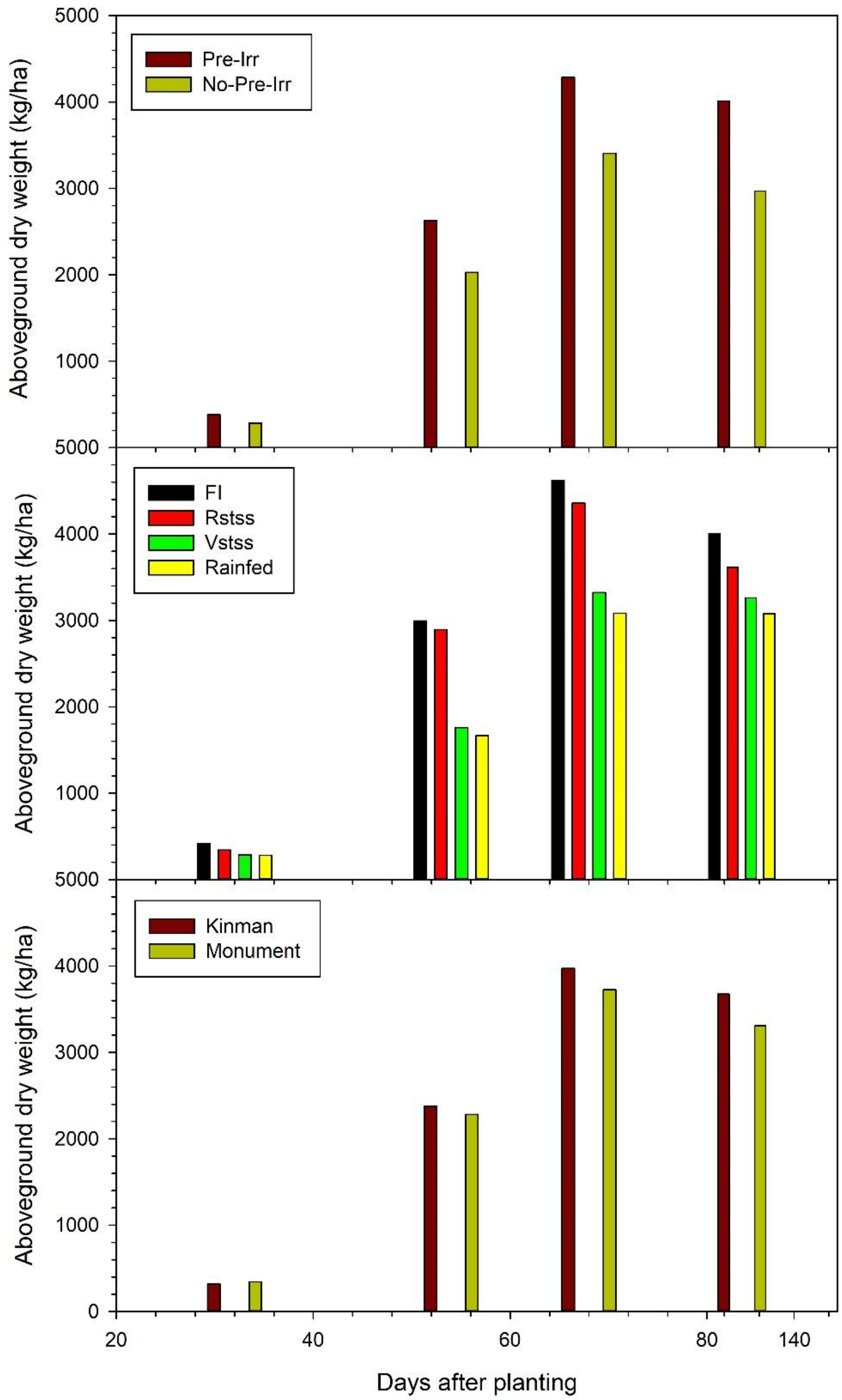
The effect of pre-irrigation was also observed in other in season irrigation treatments as seed yield increased (26.12%) under Vstss treatment with pre-irrigation as compared to Vstss treatment with no pre-irrigation and 26.03% seed yield increased was recorded under Rainfed with pre-irrigation as compare to Rainfed without any pre-irrigation. Least seed yield increase (14.39%) was observed under fully irrigated with pre-irrigation as compare to fully irrigation without any pre-irrigation. Among the cultivars, Kinman performed better than Monument cultivar and making a yield difference of 10.33%. Pre-irrigation had effect on sesonal pattern of biomass production as well. Aboveground dry biomass increased during initial growth and then started decreasing in the later growth of guar crop (Fig.1). During initial crop growth (32 DAP) in season aboveground dry weight under Rstss was 19.23% higher than Vstss and during late crop growth this difference further increased to 32.2%. This indicates that guar crop needs irrigation during its early growth for better biomass production and seed yield.

Table 1. Seed yield under main plot treatment

Pre-season Irrigation	Seed Yield (Kg ha^{-1})	HI (%)
Pre-irrigation	1011	25.71
No-Pre-irrigation	823	27.92

Table 2. Seed yield under different irrigation treatments

Pre-season Irrigation	Critical Stage Based irrigation	Seed Yield (Kg ha^{-1})	HI (%)
Pre-irrigation	FI	1137	26.68
	Vstss	927	24.96
	Rstss	1095	26.09
	Rainfed	886	25.10
No-Pre-irrigation	FI	994	27.25
	Vstss	735	26.95
	Rstss	861	29.18
	Rainfed	703	28.33


Pre-Irr
No-Pre-Irr
FI
Rstss
Vstss
Rainfed
Kinman
Monument
Aboveground dry weight (kg/ha)
Days after planting
0
1000
2000
3000
4000
5000
20
40
60
80
140

Row Spacing Effect on Seed Yield of Guar Varieties

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Objective:
The objective of this demonstration plot study was to evaluate row spacing effect on seed yield of three guar varieties

Materials and Methods:
The study was conducted at NMSU-Agricultural Science Center at Clovis in 2018. The soil type was an Olton clay loam (fine, mixed, superactive, thermic Aridic Paleustolls). Based on soil test results no fertilizer was recommended for the crop. Guar was planted in June 7 but because of herbicide drift damage of the plan, crop was re-replanted in July 2, 2018 in a conventionally tilled seedbed using a commercial field drill (Model 2010HD, Great Plains Drill) under limited center pivot irrigation. Herbicide Treflan was applied at the rate of 1.5 pints ac-1 before planting for weed control. Hand weeding was also done as needed. All varieties were planted at seeding rate of 8 lbs ac^{-1}.
The experimental design was a randomized complete block with a split-split plot arrangements with four replications. Main plot involved variety (Kinman, Monument and Jud) while row spacing (30, 20 and 6 inches) was the sub-sub-plot. At plant maturity a large area of 115 ft2 was harvested in mid-December of 2018 using a plot combine (Model Elite Plot 2001, Wintersteiger, Ried, Austria) from center two rows of each plot for seed yield determination. Seed yield was adjusted to a standard seed moisture content of 12.5%.

Data Analysis:
Statistical analysis was performed on the basis of a split-plot design (variety as main and row spacing as sub plot factors). To detect differences between the factors and their interactions, PROC GLM procedures were used (SAS 9.3, SAS Institute Inc.). Significance was considered at $P < 0.05$, and Fisher's protected LSD was used to separate means.

Results and Discussion
The interaction of variety × row spacing effect was not significant on seed yield. However, variety and row spacing had significant effect on seed yield. Seed yield of variety Jud was significantly higher (by 26% and 39%) than seed yield of Kinman and Monument, respectively (Table 1) indicating its high yielding potential over the other varieties. However, Kinman and Monumnet were not significantly different for seed yield. On the other hand, row spacing of 6" produced the lowest seed yield compared to 20 and 30" row spacing (Table 1). Results suggests that similar yield can be achieved with both 20 and 30" row spacing potentially giving growers to choose spacing that fits their operations. The trial will be repeated in 2019 and using two years results a recommendation can be made to growers.

Table 1. Effects of row spacing on seed yield of guar varieties at NMSU-Agricultural Science Center Clovis, NM 2018

Variety	Grain yield (lbs/ac)	**Row Spacing (inch)**	Grain yield (lbs/ac)
Kinman	547b[†]	30	794a
Monument	661b	20	768a
Jud	894a	6	539b

[†]Values within variety and within row spacing column with different letters are significantly different at ($P<0.05$).

Identifying Best Open Pollinated and Hybrid Winter Canola Varieties for Semiarid Southern High Plains (2017-18)

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Objective:
This study focuses on testing diverse open pollinated and hybrid winter canola varieties that can be used for developing a high yielding, well-adapted winter canola variety for the region. Winter canola is a new crop in the US and this Nationally coordinated project aims at identifying suitable varieties for each region. Efforts to introduce hybrid winter canola in to North America is new and mostly European hybrids are being assessed for adoptions and yield performance.

Materials and Methods:
The study was conducted at NMSU-Agricultural Science Center at Clovis in 2017-18 growing seasons. The soil type at the site was an Olton clay loam (fine, mixed, superactive, thermic Aridic Paleustolls). Based on soil test results, recommended fertilizer of 125–0–20–35 lbs ac^{-1} (N–P–K–S) in 2017 was pre-plant incorporated into soil. Planting was on September 20, 2017 into a conventionally tilled seedbed using a plot drill (Model 3P600, Great Plains Drill) under center pivot irrigation. Seeding rate was 5 and 4 lbs ac^{-1} for open pollinated and hybrid varieties. Limited irrigation was provided as needed (11 inches in total). Treflan herbicide at 1.5 pints ac^{-1} was applied for weed control before planting. This is a good and commonly used herbicide for weed control in canola. Some hand weeding was also done as needed. Insecticides were applied as needed for insect control.
The experimental design was a randomized complete block arrangement with three replications. The trial was composed of open pollinated and hybrid variety groups. Open pollinated and hybrid varieties were kept separate with buffer strip. The trial involved 39 varieties representing both hybrid (21) and open pollinated (18) varieties coming from diverse seed companies (such as DuPont Pioneer, Croplan Genetics, DL Seeds Inc/Rubisco Seeds LLC, Monsanto, Kansas State University). Fall plant stand, winter survival rating, flowering (50% bloom) dates were recorded for each plot. Before final harvest, plant height was measured from soil surface to the tip of the plant. A 115 ft^2 area in the middle of each plot was harvested for seed yield using a plot combine (Model Elite Plot 2001, Wintersteiger). Seed yield was adjusted to 10% moisture.

Data Analysis:
Statistical analysis was performed on data on the basis of randomized complete block design for open pollinated and hybrid groups separately. Analysis followed PROC GLM procedures (SAS 9.3, SAS Institute Inc.). Significance was considered at $P < 0.05$, and Fisher's protected LSD was used to separate means.

Results and Discussion:
The most important measured variables in 2017-18 growing season are shown in Table 1. Based on nine years of data, crop establishment and winter survival has been excellent (Table 2)

indicating its easy adaptability to the growing conditions of the region and hence acceptance by farmers.
There were significant differences among canola varieties within open pollinated and hybrid types for measured variables. Days required for 50% bloom in hybrids ranged from 91 (variety: MH 15HIB002) to 102 (variety: QUARTZ) days while in open pollinated varieties it ranged from 94 (varieties: KS4670 and KS4675) to 100 (variety: Riley) days. Plant height of hybrids ranged from 38 to 45 inches, while in open pollinated varieties height ranged from 36 to 40 inches (Table 1). Averaged over varieties, test weight of hybrid was slightly higher (50 lbs/Bu) than that of open pollinated (48 lbs/Bu) reflecting hybrids inherent bigger seed size.

Seed yield was significantly different among varieties within canola types (hybrids and open pollinated). Seed yield of hybrids ranged from 2851 (variety: MH 15HIB002) to 3713 (variety: Mercedes) lbs ac^{-1}, while seed yield in open pollinated varieties ranged from 1995 (Star 915W) to 3208 (variety: Riley) lbs ac^{-1}. Averaged over varieties, seed yield of open pollinated was 84% of hybrid's yield indicating the continuous improvement in yield of open pollinated varieties. Thus, open pollinated varieties producing comparable seed yield to hybrid varieties suggest that they have potential to be used by growers with less cost associated with seeds. Canola seed yields of 2017-18 growing season is within the range achieved in the past nine years of variety trials (Table 2) conducted at NMSU-Agricultural Science Center at Clovis; and this is with limited irrigation (less than 15 inches).

Planting date of early-to late-September (Table 2) is a wide window and has worked well. This is a very important agronomic information that growers need for canola production in our area. Thus, if a grower misses early September planting he/she can still plant the crop even in late September and still get good crop. However, the earlier the planting date the higher yield potential of the crop can be realized if growing condition is favorable. Seed yield produced by canola in very dry years (Table 2) clearly shows that canola has potential to produce at least 3000 lbs ac^{-1} with less than 15 inches of irrigation. Again, this is key and important information for an area with rapidly declining underground irrigation source. The results of 2017-18 and previous multi years variety testing suggest that canola not only is a potential, less water requiring alternative crop (with some varieties yielding more than 4000 lbs ac^{-1}) but also adaptable to the growing conditions of the region to become a cash and rotational break crop in the region dominated by cereal mono-cropping systems.

Table 1. Results of National Winter Canola Variety Trial at NMSU-Ag Science Center Clovis (2017-18)-Hybrids & Open pollinated.

	Hybrid					**Open pollinated**			
	50% Bloom Date	Plant Height	Test Weight	Seed Yield		50% Bloom Date	Plant Height	Test Weight	Seed Yield
Variety	(days)	(in)	(lbs/Bu)	(lbs/ac)	**Variety**	(days)	(in)	(lbs/Bu)	(lbs/ac)
Wichita	98	41	50	2957	KS4670	94	39	49	2977
QUARTZ	102	43	50	3440	KS4675	95	39	47	2930
HIDYLLE	99	44	51	3560	KSR4723	99	39	48	2561
HAMOUR	100	44	51	3364	KSR4724S	94	39	48	2806
MH 15HIB001	93	43	49	3688	KSUR1211	97	39	49	3100
MH 15HIB002	91	41	49	2851	Riley	100	40	46	3208
MH 15AY085	99	45	51	3302	Sumner	96	39	47	3136
MH 15HT229	98	43	49	3363	Wichita	99	41	46	2679
Edimax CL	97	44	51	3238	Torrington	96	39	49	3016
Inspiration	95	45	50	3511	QUARTZ	102	42	47	2373
Mercedes	100	40	51	3713	HyCLASS115W	97	39	47	2821
Popular	94	41	51	3605	HyCLASS225W	96	41	48	2844
Atora	98	44	51	3314	HyCLASS320W	98	41	49	2947
Event	99	43	50	3451	Star 915W	96	38	48	1995
Phoenix CL	98	43	50	3295	Star 930W	96	41	48	2904
Plurax CL	94	42	50	3428	DKW44-10	97	38	48	3295
Temptation	99	44	50	3571	DKW45-25	98	39	48	2531
DK Imiron CL	98	43	50	3013	DKW46-15	98	36	48	2809
DK Imistar CL	98	41	52	3292					
DK Sensei	99	43	51	3396					
DK Severnyi	99	38	51	3357					
Means	**98**	**43**	**50**	**3367**	**Means**	**97**	**39**	**48**	**2830**
LSD $_{(0.05)}$	1.8	5.1	1.5	449.8	LSD $_{(0.05)}$	2.2	3.7	3.0	868.7
CV (%)	1.1	7.3	1.8	8.1	CV (%)	1.4	5.7	3.8	18.5

Table 2. Results of multi years National Winter Canola Variety Trial at NMSU-Ag Science Center Clovis

Growing Seasons	Number of varieties	Seeding date	(Winter survival)†	Irrigation (I)	Precip (P)	(I + P)	Seeds	Seed Yield range	Avg. Seed Yield
					(inch)		(lbs/in)	(lbs/ac)	
2009-10	16	Sep 15	98	11.8	14.6	26.3	138.4	(3162-3799)	3643
2010-11	44	Sep 20	94	16.3	2.8	19.0	91.1	(608-2418)	1759
2011-12	45	Sep 22	97	17.9	6.6	24.5	111.1	(1563-3930)	2724
2012-13	50	Sep 6	98	20.4	8.0	28.4	95.4	(1680-3494)	2707
2013-14	47	Sep 4	97	14.0	12.5	26.5	48.1	(807-2061)	1271
2014-15	54	Sep 11	98	12.2	15.0	26.8	142.2	(2666-4641)	3811
2015-16	48	Sep 4	98	11.0	18.1	29.1	121.9	(1777-4477)	3548
2016-17	36	Sep 13	73	11.7	5.8	17.6	71.6	(671-1887)	1263
2017-18	39	Sep 20	95	11.3	9.9	21.3	145.8	(1995-3713)	3098

† Winter survival rating of established plants (0, no survival and 90-100 % excellent survival). Seed oil content ranges from 37 to 42%. Canola can be planted any time in September (this can be considered as a wide window of panting opportunity) but the earlier planting is the better for achieving optimum fall stand, winter survival and seed yield.

Circles of Perennial Grass Buffer Strips (CBS) in a Center Pivot to Improve Water Cycle and other Ecosystem Services

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RATIONALE:

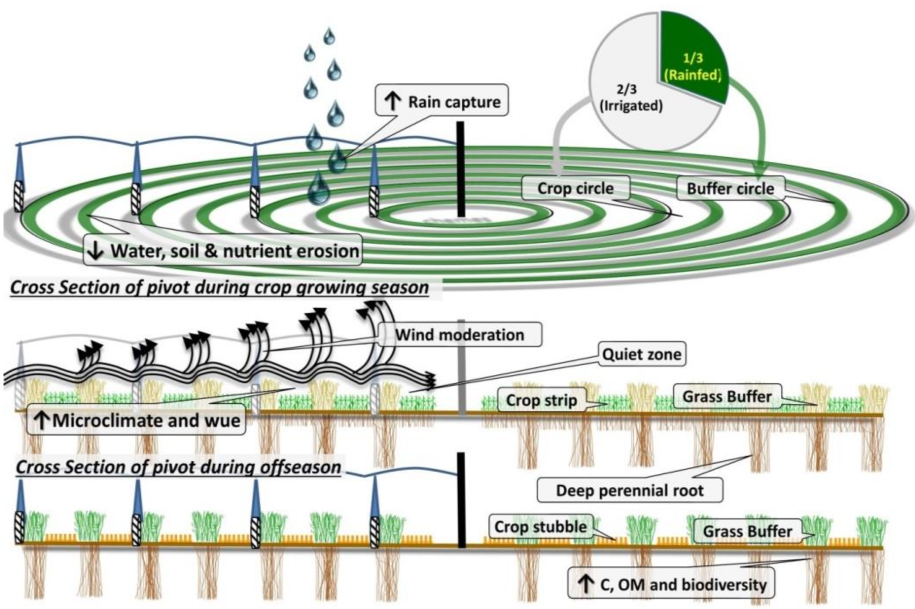
Rearranging underutilized/unirrigated part of pivots in to multiple circles of perennial grass buffer strips can improve long term sustainability and profitability of irrigated agriculture in the region, while reversing the degraded soil quality and ecosystem over time.

POTENTIAL BENEFITS: Each component of the design, perennial grass, buffer strip, circular design and multiple circles, add or improve benefits to the system. Benefits include Agronomic, Environmental, Economic and Quality of Life. Main benefits anticipated include.1. Improve water cycle and water use efficiency (capture more precipitation and reduce losses) 2. Protect soil and crop (reduce wind, soil abrasion injury) 3. Increase biodiversity (microbial, plants and wildlife) 4. Improve carbon sequestration (deeper root, longer growing season, and higher productivity) 5. Circular rings trap agrochemicals, water and soil moving in any direction (improve efficiency) 6. Better quality of life (reduced pollution, improved air quality, diverse wildlife) 7. Practical benefits (well pressure, pivot tire, wiper irrigation)

Objectives:

To assess the effect of circular buffer strips of native perennial grasses on microclimate of center pivot irrigated corn
To characterize effect of CBS on corn biomass and seed yield productivity in center pivot irrigated corn

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). Assuming a center pivot not having irrigation water to irrigate one third of the pivot was used for the project. One third of the pivot was rearranged as circular buffer strips (Fig 1). A mixture of native warm season and cool season grasses (seven species) were planted on August 8, 2016 to establish CBS. Outer most strip in the pivot was 30 ft wide grass strip, which alternated with 60 ft wide crop strips. Grass strips were periodically watered during the first year to establish. During 2017 and 2018, we used grain corn for crop strip. Grass strip was allowed establish during 2017. In 2018, when the corn was grown above grass height (when the benefit of CBS is minimum on corn), grass was swathed and baled in August and allowed to regrow rest of the season. It was proposed not to irrigate grass strips in the CBS pivot to reduce irrigation water use. However, we watered them to establish and also to initiate growth in extremely dry year of 2018. But, it did not receive water during corn growing season.
Observations focused on microclimate, crop growth and seed yield. The purpose was to compare with or without buffer strips on corn performance and microclimate. We also assessed distance to which buffer strip benefits were observed. The effect of multiple buffer strips was also assessed to a limited level. Visual observations in 2018 indicated that corn emergence was



(Angadi et al., 2016)

Figure. 1. Rearranging unirrigated portion of a partial pivot into circular buffer strips (top). An example of a partial pivot with 1/3 area not irrigated is used. During the crop growing season (middle) grass buffer strip doesn't receive any irrigation water. It is protecting the young crop. Once the crop is harvested, grass can be stimulated to grow and protect the soil in the early spring (bottom).

quicker and more uniform in CBS pivot compared to control pivot. Similarly, early growth showed significant differences between CBS and control pivots. Moderating wind close to soil surface might have contributed for the benefits. We will characterize these differences by taking relevant observation in 2019. To characterize microclimate, wind anemometers (sonic and cup) were installed close to the ground (2 inches) to characterize incoming, in buffer strip, in crop strip close to buffer and in the center of crop strip. Due limited availability of sensors, only outer most buffer and crop strip was focused. Limited soil and air temperature, relative humidity were also measured at a limited location.

Aboveground biomass samples were collected couple of times during the growing season. They were taken at different distance from the border or from buffer strips to assess edge effect. For biomass sampling 10 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 a constant dry weight were obtained after drying for three days. At harvest, biomass and seed yield from different rows were harvested. To assess effect on large plots and integrate effects on different locations in the edge, a few passes of 8 rows wide were harvested at different locations in CBS pivot and control pivot. The seed yield was adjusted to a standard seed moisture content. We also used an ET system in outermost and third buffer and crop strips and assessed effect of CBS on microclimate or ET were assessed. This basically integrates buffer strip effect on corn and grass performance.

Results and Discussion

Preliminary observations in 2017 on microclimate improvements and corn crop performance strongly supported CBS over control pivot (Fig. 2). In general, emergence of corn was quicker and more uniform with CBS compared to control pivots. Due to limited funds, most of our observations were focused on outer grass strip and were in select locations. During seedling stage of corn, grass

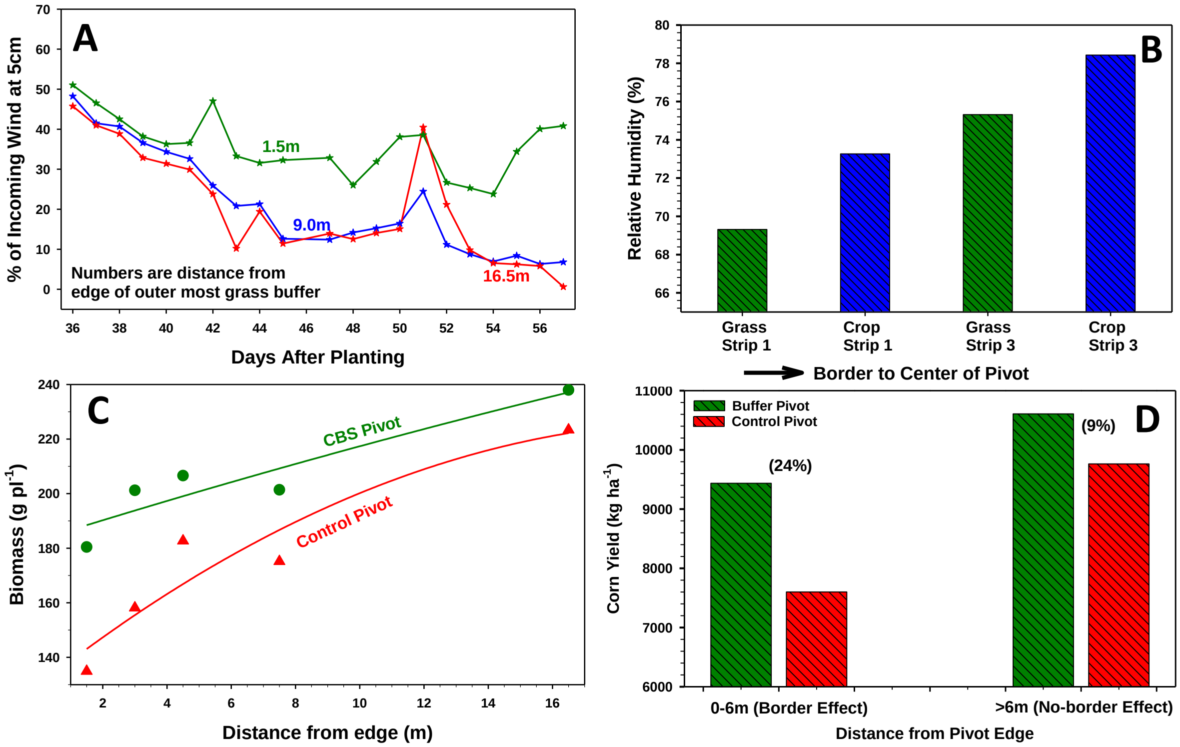


Figure 2. Preliminary results from Circular buffer Strip trial at Agricultural Science Center at Clovis. A). Wind moderation by grass buffers at three distances from first buffer from the edge of pivot. B). Relative humidity as we move from edge to inside of CBS pivot (effect of 1st and 3rd grass strip). C). Difference in relationships between corn plant biomass during middle of the season and distance from edge in CBS pivot and control pivot. D). Effect of CBS on corn yield (combine data; 8 row entire strips) in the outer 6 m from the edge (next to first grass buffer in CBS and outer edge in control pivot showing border effect) and mean of 3 random passes up to 51 m inside pivot.

buffers reduced wind speed by more than 50% at 1.5m from the inside edge of first grass strip (Fig. 2A). The benefit was also seen in the middle and end of the first crop strip (9.0 m and 16.5 m). Relative humidity measured with ET tower (Fig. 2B) showed that CBS improved microclimate for crop growth (eg. higher RH) as we moved from edge of the pivot to center of the pivot (eg. crop strips 1 vs 3). In response to improved microclimate, the relationship between corn biomass production in the middle of the season and distance from outer edge (either from inside edge of first grass strip or from pivot edge) showed significant improvement in CBS compared to control pivot (Fig. 2C). The final harvest with a combine, which integrates all benefits of CBS over traditional practice, showed 24% seed yield increase with grass buffer strips in the outer 6 m and the average benefit was 9% in three 6m wide random passes in side pivot (up to 51 m). Thus, limited observations prove CBS benefits beyond edge effect, which needs to be studied in depth to realize the benefits in SGP and beyond. Understanding effects of CBS on FEW components and their interactions will help us in developing models, which can be used for adoption of the technology in diverse situations in SGP.

WINTER CANOLA NITROGEN MANAGEMENT STUDY

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Objective:
To study the effects of nitrogen application time on seasonal biomass production, nitrogen allocation, seed oil and protein content and seed yield of winter canola under limited irrigation.

Materials and Methods:
The study was conducted at NMSU-Agricultural Science Center at Clovis. Soil type at the site was an Olton clay loam (fine, mixed, superactive, thermic Aridic Paleustolls). Based on soil test results, recommended fertilizer of 120–0–25–17 lbs ac^{-1} (N–P–K–S) was applied in October 20, 2017 as full rate, fall time nitrogen (N) application. We consider this as 100% rate-fall application: N1. Canola was planted on September 20, 2017 into a conventionally tilled seedbed using a plot drill (Model 3P600, Great Plains Drill) under center pivot irrigation. Seeding rate were 6 and 4 lbs ac^{-1} for Riley (open pollinated) and 46W94 (hybrid) varieties, respectively. Limited irrigation was provided as needed (11inches in total). Treflan herbicide at the rate of 1.5 pints ac^{-1} was soil incorporated before planting for weed control. This is a good and commonly used herbicide for weed control in canola. Some hand weeding was also done as needed. Insecticides were applied as needed for insect control.

The study used a randomized complete block design with a split plot arrangement of eight treatments with four replications. Nitrogen application rate-time was the main plot while variety was sub-plot. The main plot factor had four nitrogen application rate-time treatments (100% rate-fall: N1; 100% spring: N2; split application with 50% fall and 50% spring: N3; 25 + 25 + 25% fall and spring with spring before bolting and at flowering: N4). Nitrogen was applied in early-spring (February 2, 2017) for spring application treatments, while application for part of N4 treatment was done during canola flowering stage (April 10, 2017). The sub-plot involved two canola varieties (46W94 and Riley).

Aboveground biomass of canola was estimated from two 0.5 m^2 harvests of each plot at different harvest times (December 15, 2016: late-fall; and February 13, 2018: mid-winter). The mid-winter harvest was done before spring nitrogen application. After the harvested fresh weight was recorded, a subsample of known weight was dried to a constant weight at 65°C. Dried and fresh weights were used to estimate forage biomass production per acre. The dried subsamples were ground to pass through a 1-mm screen using a Wiley Mill (Thomas Manufacturing) and submitted to Ward Laboratories, (Kearney, NE) to estimate crude protein (CP) values using near-infrared spectroscopy. This value was used to calculate crude protein production per acre. A 115 ft^2 area in the middle of each plot was harvested for seed yield using a plot combine (Model Elite Plot 2001, Wintersteiger). Seed samples were submitted to the Brassica Breeding and Research Laboratory (University of Idaho) for seed oil and protein content analysis. Value were used to calculate oil yield and crude protein production per acre.

Data Analysis:
Statistical analysis was performed on data using split-plot design (nitrogen application time as the main plot and canola varieties as sub-plots). To detect differences between nitrogen application time treatments and their interactions with variety types, PROC GLM procedures

were used (SAS 9.3, SAS Institute Inc.). Significance was considered at $P < 0.05$, and Fisher's protected LSD was used for mean separation.

Results and Discussion:

There were significant differences among nitrogen treatments for most of the measured variables. However, varieties were not significantly different for variables measured. Canola dry mater accumulation of late-fall harvest was the lowest (Table 1) with spring nitrogen application time alone (N2-spring) compared to the other treatments reflecting low nitrogen availability in the soil because of no nitrogen was applied for this treatment in the fall. However, the other nitrogen application time treatments (N1, N3 and N4) were not significantly different in dry matter accumulation with late-fall harvest. Canola dry matter accumulation of late-fall harvest ranged from 1990 to 2957 lbs ac^{-1}. Similar trend was observed among nitrogen application time treatments for crude protein accumulation in above ground plant tissues confirming plant's usage of the available nitrogen in the soil. The trend in canola dry matter and crude protein accumulation in above ground plant tissues with mid-winter harvest was similar as late-fall harvest among nitrogen application time treatments.

Seed oil content, seed and oil yield are the most important variables in canola production. Seed yield was significantly affected by time of nitrogen application. The lowest seed yield was measured with fall-application (N1) treatment while the highest was measured with 50% fall and 50% spring-application (N3) treatment (Table 1). This translates into 15% more seed yield with split nitrogen (N3) application compared to full rate fall only nitrogen application suggesting the advantage of split nitrogen application over fall application (N1). This can help producers manage nitrogen more efficiently and have a successful canola production with split application of nitrogen. Interestingly, nitrogen treatments those applied at least half of nitrogen in spring (N2, N3 and N4) were not significantly different for seed yield (Table 1). This suggests that nitrogen need for winter canola seed yield formation is in the spring. Unlike winter wheat, most of the fall foliage of winter canola is lost by winter kill. So excessive nitrogen use in the fall may not be converted into seed yield. However, minimum vegetative growth in the fall is required for surviving winter. It was interesting to see that nitrogen application in three splits and reducing total N application by 25% (N4) had no significant effect on canola seed yield. Since pumping additional nitrogen through center pivot irrigation is relatively easy and cost effective, keeping the option of applying additional nitrogen from bolting to flowering, depending on the seasonal growing condition will help canola productivity greatly. Seed oil content (avg. 38%) was not significantly different among the nitrogen treatments suggesting seed oil content is stable and is not affected by the time of nitrogen application. Oil yield is the product of seed yield and seed oil content. Since there was no significant difference among the nitrogen treatment for seed oil content, seed yield was the main driver of winter canola oil yield. Therefore, oil yield followed the same pattern as seed yield in relation to nitrogen treatments. Nitrogen treatments were not significantly different for seed protein content, mirroring seed oil content response to nitrogen application time treatments.

The trial is planted again in the 2018-19 season at two locations (second location is Tucumcari, ASC). Two year data will provide insight into nitrogen management (timing, in particular) for winter canola under limited irrigation in New Mexico. Canola is a relatively new, potential alternative less water requiring crop for diversifying the cropping systems of New Mexico. Thus, developing a nitrogen management guide for producers is critical for successful canola production and sustainable agriculture with limited irrigation in the region.

Table 1. Effects of nitrogen application time on winter canola dry matter accumulation, crude protein, seed oil and protein content and yield at NMSU-Ag Science Center Clovis in 2017-18.

Nitrogen application time				**Nitrogen application time**			
N1-Fall	N2-Spring	N3-Fall & Spring	N4-Fall & Spring	N1-Fall	N2-Spring	N3-Fall & Spring	N4-Fall & Spring
Dry matter (lbs ac^{-1})$^{+}$				Crude protein in plant tissues (lbs ac^{-1})			
2769a	1990b	2957a	2853a	729a	442b	750a	727a
Dry matter (lbs ac^{-1})$^{++}$				Crude protein in plant tissues (lbs ac^{-1})			
3045a	2574a	3056a	2813a	683a	500b	660a	601ab
Seed yield (lbs ac^{-1})				Seed oil content (%)			
2328b	2631a	2736a	2585a	37.79a	38.06a	37.30a	37.20a
Oil yield (lbs ac^{-1})				Seed protein content (%)			
833b	952a	967a	913ab	28.55ab	28.47b	28.98ab	29.40a

Late-Fall (12/15/2017)$^{+}$ and mid-Winter (02/13/2018)$^{++}$ harvest. Nitrogen application: N1 (fall-100%) & N2 (spring-100%), N3 (50% + 50%: fall and spring); N4 (25 + 25 + 25 %: fall and spring with spring before bolting and at flowering application). 100% Nitrogen (N) rate= 120 lbs ac^{-1}. Means followed by same latter within a row are not significantly different at P<0.05.

Exposing Winter Canola Flowering to Different Environment by Removing Inflorescence and its Effect on Seed and Oil formation

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Objective:

The objective of this project is to assess effect of delaying flowering by mechanically removing inflorescence from diverse open pollinated and hybrid varieties of winter canola on biomass, seed and oil formation in semiarid conditions of the Southern High Plains.

Materials and Methods:

The study was conducted at NMSU-Agricultural Science Center at Clovis in 2016-17 and 2017-18 growing seasons. The soil type at the site was an Olton clay loam (fine, mixed, superactive, thermic Aridic Paleustolls). Based on soil test results, recommended fertilizer of 120–0–35–28 and 125–0–20–35 lbs ac^{-1} (N–P–K–S) in 2016 and 2017, respectively was pre-plant incorporated into soil. Crop was planted on September 20, and 18 in 2016 and 2017 respectively into a conventionally tilled seedbed using a plot drill (Model 3P600, Great Plains Drill) under center pivot irrigation. Seeding rate was 4 lbs ac^{-1} in both years. Limited irrigation was provided as needed (11 inches in total in both years). Treflan herbicide at 1.5 pints ac^{-1} was applied in both years for weed control before planting. This is a good and commonly used herbicide for weed control in canola. Some hand weeding was also done as needed. Insecticides were applied as needed for insect control.

The experimental design was a randomized complete block with a split-plot arrangement with four replications. Stress treatments imposed through cutting (mechanical removal) of inflorescence at different stages (none/control, at bolting and at full- bloom) were the main plots and winter canola varieties (hybrid and open pollinated) were sub-plots. The trial involves 10 varieties representing both hybrid (5 varieties) and open pollinated (5 varieties) coming from diverse seed companies (such as DuPont Pioneer, Croplan Genetics, DL Seeds Inc/Rubisco Seeds LLC, Monsanto, Kansas State University). Stress treatment imposed through cutting of inflorescence at different stages was done on April 3 (2017 and 2018: bolting stage with 7 inches cutting height) and on April 12 (2017 and 2018: full- bloom stage with 14 inches cutting height). Flowering (beginning, 50% and ending) dates were recorded for each plot. Seed yield and biomass were determined on samples of canola hand harvested (in mid-June both in 2017 and 2108) at ground level from an area of 1 m^2 from each plot. Plant samples were dried to a constant weight at 65°C before threshing with a plot combine (Elite Plot 2001, Wintersteiger). Yield components were determined on five randomly harvested plant samples for each plot. Harvest index, calculated as the ratio of grain to total biomass (grain plus aboveground dry matter), was also determined for each plot. Seed samples from each plot was analyzed using near-infrared spectroscopy to determine oil content (Brassica Breeding and Research Laboratory, University of Idaho).

Data Analysis:
Statistical analysis was performed on combined 2 years' data on the basis of split-plot design (stress treatment as main and canola variety as sub-plot factors). To detect differences between stress treatments and their interactions with variety types, PROC GLM procedures were used (SAS 9.3, SAS Institute Inc.). Significance was considered at $P < 0.05$, and Fisher's protected LSD was used to separate means.

Results and Discussion:
The main assumption in this trial was that if we remove the inflorescence at bud formation or flowering stage, canola plant will regrow from auxiliary buds and produce inflorescence at a later stage. Typically, daytime temperatures increase in the region during March to May months. Thus, delayed flowering in inflorescence stress imposed treatments will be exposed to higher temperature stress which will significantly affect seed and oil formation.
Crop established well and reached to the recommended stage (6-8 leaf stage) for good winter survival before the first killing frost, which is critical for successful winter canola production. Results of the most important variables measured: pod numbers, 1000 seeds weight, seed oil content, seed and oil yield and biomass are presented in Tables 1 and 2. Calculated flowering duration based on beginning and ending flowering dates are included in the table.
There was significant difference among inflorescence removal (cutting) treatments for all measured variables. Averaged over varieties, seed yields were 1999, 1363 and 1121 lbs ac^{-1} for control (no cutting), cutting at bolting, and cutting at full-bloom treatments, respectively (Table 1). Imposing stress through mechanical removal of inflorescence at flowering reduced seed yield by 44 % while cutting at bolting reduced seed yield by 32 % compared to the control (no cutting) treatment. Yield components (pods per plant and 1000 seeds weight) were reduced by removal of inflorescence and more so at flowering than bolting stage compared to control treatment. The reduction in seed yield resulted from not only form reduction in pods formation per plant and 1000 seeds weight but also reduced flowering duration (Table 1) which could be linked to higher temperatures occurred during reproductive growth stage. Seed oil content and oil yield were significantly affected by inflorescence removal at bolting and flowering stages compared to control treatment. Highest seed oil content was recorded with control while lowest value was recorded with stress imposed at flowering treatment. There was no difference between bolting and full-bloom treatments in pods per plant and biomass production suggesting enough time for plants even with stress imposed at flowering to recover and produce similar biomass as bolting stressed treatment (Table 1). However, plants stressed at full bloom treatment was the least efficient in harvest index reaching just 14%, which was 33% and 18% lower compared to control and stressed at bolting treatments, respectively. Nevertheless, these result suggest that canola's sensitivity to stress at both stages to result in significant yield reduction but more so when stress occurs at flowering than bolting stages.
Averaged over variety types, hybrids produced more seed yield than open pollinated (by 8%). Seed yield ranged from 1321 to 1695 lbs ac^{-1}. The highest yield was produced by Hekip (hybrid) while lowest yield was achieved by DKW46-15 (open pollinated). Nevertheless, half of the open pollinated varieties produced similar seed yield as hybrids suggesting their potential to be used by growers with less cost associated with seeds. Stress imposed through cutting at bolting and flowering had a less pronounced effect on biomass than on seed yield. These results suggest that plants stressed through cutting at bolting and flowering were limited more by sink (less pods and

seeds) than source (biomass) since sufficient source was produced by the plants with cutting treatments at both stages. Seed oil content was different between inflorescence removal treatments. Inflorescence removal at flowering produced seed with lowest seed oil content compared to control (no cutting of inflorescence treatment) but similar seed oil content to that of inflorescence removal at flowering treatment. Oil yield response of canola in relation to stress imposed through cutting of inflorescence followed same pattern as seed oil content. Both seed yield and seed oil content are major oil yield determining factor.

Table 1. Effects of stress imposed through inflorescence removal at different stages of winter canola on flowering duration, yield components, seed and oil yield and biomass at NMSU-Agricultural Science Center Clovis.

Plant stage and stress treatment†	Flowering duration (days)	Pods/ plant	1000 seed weight (g)	Seed Yield (lbs/ac)	Oil yield (lbs/ac)	Seed oil cont. (%)	Biomass (lbs/ac)	Harvest index
None	40a††	170a	4.17a	1999a	724a	40.0a	9474a	0.21a
Bolting	32b	140b	3.99a	1363b	367b	37.2ab	7781b	0.17b
Full-bloom	27c	136b	3.63b	1121c	258b	35.5b	7514b	0.14c

†Stress imposed through inflorescence removal at bolting and full-bloom stages. one (without stress).
††Values within column with different letters are significantly different at (P<0.05).

Table 2. Effects of stress imposed through inflorescence removal at different stages on winter canola flowering duration, yield components seed and oil yield and biomass at NMSU-Agricultural Science Center Clovis in 2016-18

Variety	Flowering duration (days)	Pods/ plant	1000 seed weight (g)	Seed yield (lbsac)	Oil yield (lbs/ac)	Seed oil cont. (%)	Biomass (lbs/ac)	Harvest index
46W94†	31.7c††	153a	4.07ab	1544ab	459a	37.0abc	8223b	0.18ab
EdimaxCL	31.7d	135a	4.18a	1533ab	446a	37.abc	8176b	0.18abc
Hekip	32.7b	164a	3.97ab	1695a	496a	35.8c	9140a	0.18abc
Mercedes	31.3e	149a	3.98ab	1531ab	489a	38.3a	8126b	0.18abc
Popular	32.7b	149a	3.80b	1470bc	441ab	37.9a	8365b	0.17bc
DKW44-10	33.0a	138a	3.74b	1404bc	416ab	36.2c	8354b	0.16c
DKW46-15	31.7c	154a	3.78b	1321c	337b	37.1abc	7805b	0.16c
HyCLASS225W	32.3c	148a	4.00ab	1396bc	425ab	37.9a	8033b	0.17abc
Riley	31.7d	145a	3.91ab	1523ab	506a	37.6ab	8120b	0.19a
Wichita	31.7d	150a	3.87ab	1530ab	481a	37.5ab	8221b	0.18ab

†The first five varieties are hybrid and the rest represent open pollinated. ††Values within column with different letters are significantly different at (P<0.05).

Forage Corn Vertical Biomass Distribution and Quality Relationships

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Objective:

To assess the relationships between forage corn vertical biomass distribution and forage quality of diverse corn varieties. This information can be useful for developing optimum silage corn harvesting height recommendations that could be used as a strategy/tool for farmers to harvest silage corn sustainably, conserve soil and water resources.

Materials and Methods

The study was conducted at NMSU-Agricultural Science Center at Clovis in 2018. Based on soil test results recommended fertilizer was applied at rate of 18 (N), 60 (P_2O_5) lbs ac^{-1}, 3qt ac^{-1} (Zn) in February16 and 122 (N), 22 (S) lbs ac^{-1} as pre-plant and 30 (N) and 5.5 (S) lbs ac^{-1} at plant. Herbicide mixture Atrazine, Balance Flex, Diflex, Glyphosate was applied pre-plant at 1 pint, 3 oz, 5 oz, and 40 oz ac^{-1}, respectively. Additional herbicide mixture of Diflex and Brawl at 8 oz and 1.3 pint ac^{-1} was applied for weed control in June 20, 2018. Insecticides Onager (16 oz ac^{-1}) in June 20 and Prevathon (20 oz ac^{-1}) and Oberon (8 oz ac^{-1}) in August 1, 2018 were applied for insect control.

The experimental design followed a randomized complete block design with three replications. The study involved five corn varieties [9678VT3P, 1151AQ, D58QC72, P1449xr (brown mid rib, BMR) and 1197P]. Corn was planted in May 19, 2018 at the seeding rate of 27,000 seeds ac^{-1}. For plant portions/sections contribution to biomass yield and quality determination, a 1m length of row of whole plant samples were harvested at 6” height from soil surface for each plot of each variety. Whole plant samples were then brought indoor and cut/partitioned into four portions (H7, H16, H32, and AE) for each plot and variety. Besides these four portions, ear/cobs were kept separate and considered as additional plant portion. Plant portions H7, H16 and H32 represents below ear and AE represents above the ear portion of the plan. Forage sample were harvested in September, typical time period when silage corn is commonly harvested. After fresh weight were recorded, sample portions were chopped and a subsample of known weight from each sample was dried to a constant weight at 65°C. Dry and fresh weights were used to estimate plant portions biomass and contributions to total forage biomass yield per acre. Dry subsamples were ground to pass through a 1-mm screen using a Wiley Mill (Thomas Manufacturing) and submitted to a certified laboratory (Ward Laboratories, Kearney, NE) to estimate forage quality using near-infrared spectroscopy

Data Analysis

Forage (dry- and green-biomass) yield and quality data of the different plant portions were analyzed using SAS procedure. To detect differences between variety and their interactions with plant portions, PROC GLM procedures were used (SAS 9.3, SAS Institute Inc.). Significance was considered at $P < 0.05$, and Fisher’s protected LSD was used to separate means.

Results and Discussion

Forage (dry- and green-biomass) yield and quality results involving plant portion and variety are presented in Tables 1. Plant portion× variety interaction effect was not significant for forage yield, quality and milk production. Varieties were not significantly different for most of the measured parameters. However, significant difference was detected between the different plant portions for forage yield, quality characteristics, and milk production (Table 1). Corn ear/cob contributed the highest (58%) to total forage yield (10.8 t/ac) while the least contribution (5%) came from the bottom H7 plant portion. This was also reflected in milk production (Table 1). Moisture content in plant parts was the lowest in ear/cob while the highest moisture content was recorded in plant portion H32 followed by H16 and H7 (Table 1).

Forage quality of ear/cob and above the ear plant portions were significantly higher than below ear plant portions indicating the significant importance of ear and above ear plant portions in the overall corn forage quality and hence feed value in animal feed ration. Similarly, fiber and nitrate content of plant portions of below the ear are significantly lower than corn ear/cob and above the ear plant portions further enforcing the insignificant importance of this plant portions in animal feed value. This suggests that raising silage corn cutting height to as high as H7 to H13 (5 to 11 % reduction in yield) can be used as a strategy to sustainably harvest silage corn with minimum forage yield loss and improved forage quality that can and potentially conserve soil and water resources in forage corn production systems. In the long run, tall stubble (with higher silage cutting heights of at least 13") in conjunction with a corn variety of producer's choice is expected to leave more plant residue in the field potentially resulting in better soil coverage, improvement in soil conservation and moisture retention, carbon sequestration, and in overall improvement and sustainability of forage corn production and hence dairy farming systems in New Mexico. The study will be repeated in 2019.

Table 1. Forage corn biomass yield, quality and milk production of the different plant parts at NMSU-Agricultural Science Center, Clovis 2018.

	Corn plant parts					
Variables	H7	H16	H32	Ear/cob	Above the ear	Total
Green Forage (t/ac)	2.1e	2.6d	4.4c	12.1a	9.0b	30.1
Moisture at harvest (%)	75ab	77ab	78a	47.9c	73b	
Dry Forage (t/ac)	0.5d	0.6cd	1.0c	6.3a	2.4b	10.8
CP (%)	4.9e	5.4d	6.1c	8.b	9.4a	
Starch (%)	8.8bc	8.2bc	6.7c	52.4a	9.5b	
ADF (%)	39.5a	38.5a	38.0a	11.7c	32.7b	
NDF (%)	56.4c	59.1b	58.8b	65.2a	60.0b	
Nitrate (ppm)	412a	200ab	64b	22b	27b	
NE_l (Mcal/lb)	0.51d	0.54c	0.55c	0.84a	0.60a	
Milk/Ton (lbs/t)	2291d	2459c	2462c	3682a	2675b	
Milk/ac (lbs/ac)	1210c	1464c	2372c	23221a	6526b	

Plant parts H7, H16 and H32 represents portions from the bottom up 6 to 13”, 13 to 22” and 22 to 32’” cuttings.

Effect of Rhizobium Inoculation and Phosphorus application on Guar Biomass and Seed Yield

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Objective:
The objective of this study was to assess guar responses to rhizobium inoculation and phosphorus application on biomass and seed yield production

Materials and Methods:
The study was conducted at NMSU-Agricultural Science Center at Clovis in 2018. The soil type was an Olton clay loam (fine, mixed, superactive, thermic Aridic Paleustolls). Guar was planted in June 7 but because of herbicide drift damage, crop was re-replanted in July 2, 2018 in a conventionally tilled seedbed using a commercial field drill (Model 2010HD, Great Plains Drill) under center pivot irrigation. Herbicide Treflan was applied at the rate of 1.5 pints ac-1 before planting for weed control. Hand weeding was also done as needed. All varieties were planted at seeding rate of 8 lbs ac^{-1}.
The experimental design was a randomized complete block with a split-split plot arrangements with four replications. Main plot involved rhizobium inoculation (with or without; for plots with rhizobium 0.2lb of inoculant for an acre of planting seeds was applied) while five phosphorus rate (0, 22, 45, and 67 and 89 lbs/ac) was the sub-sub-plot. After a crop was planted, a furrow was created next to the crop row and the different phosphorus rate was applied manually. At plant maturity plant samples from center of each plot in a 2m length was harvested for biomass and seed yield determination. Plant samples were dried to a constant weight at 65°C. After dry weights were recorded samples were threshed using a plot combine (Model Elite Plot 2001, Wintersteiger, Ried, Austria). Seed yield was adjusted to a standard seed moisture content of 12.5%.

Data Analysis:
Statistical analysis was performed on the basis of a split-plot design (Rhizobium as main and phosphorus rate as sub plot factors) procedures. To detect differences between the factors and their interactions, PROC GLM procedures were used (SAS 9.3, SAS Institute Inc.). Significance was considered at $P < 0.05$, and Fisher's protected LSD was used to separate means.

Results and Discussion:
The interaction of rhizobium inoculant × phosphorus rate effect was not significant on biomass and seed yield production. Treatment with inoculant and without inoculant were significantly different for seed yield but not biomass production. Interestingly no-inoculant treatment had greater seed yield than treatment with inoculant by 17% (Table 1). On the other hand, phosphorus application had no effect on both biomass and seed yield production. The trial will be repeated in 2019 and using two years results a conclusion and recommendation can be.

Table 1. Effects of rhizobium inoculant and phosphorus rate on guar biomass and seed yield at NMSU-Agricultural Science Center Clovis, NM 2018

Treatments		
Rhizobium inoculant	Biomass (lbs/ac)	Grain yield (lbs/ac)
Yes	3577a†	888b
No	3835a	1067a
Phosphorus rate (lbs/ac)		
0	3923a	977a
22	3621a	968a
45	3667a	977a
67	3579a	998a
89	3740a	947a

†Values within rhizobium inoculant and within phosphorus rate column with different letters are significantly different at ($P<0.05$).

Winter Canola under Dormant Period and Growth-Stage Based on Irrigation Strategies in the Southern High Plains of the USA

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Objective

Evaluate the effect of dormant period irrigation on growth and yield of winter canola.
Assess the impact of water stress at different growth stages on growth and yield.

Materials and Methods

A two-year field study was conducted during 2016-17 and 2017-18 growing season at the New Mexico State University Agricultural Science Center, Clovis (34.60˚N, 103.22˚W, elevation 1331m). Three cultivars of winter canola (*Brassica napus* L.) were planted under a center-pivot irrigation system with wheat as previous crop. Before planting, the field was disked and ploughed to incorporate wheat residue. Experimental plots were planted on 20th September 2016 and 12th September 2017, using an Eleven Row Plot Planter with one seed cone (John Deer Maximizer). The plot size was 9.1 m × 1.7 m with one pass per plot. Crop was planted at 15 cm row spacings at a 4.5 Kg ha^{-1} seed rate. Based on soil test recommendations, 150 kg N ha^{-1}, 28 kg P_2O_5 ha^{-1} and 28 kg S ha^{-1} were applied in 2016. A total of 140 kg N ha^{-1}, 22 kg P_2O_5 ha^{-1} and 40 kg S ha^{-1} was applied in 2017. In both years, Treflan® HFPA (a,a,a-trifluoro- 2,6-dinitro-N,N-dipropyl-p-toluidine, Dow AgroSciences), a pre-plant herbicide was incorporated at the 2.5 L ha^{-1} for weed control. Strip-plot design with split-split arrangement was used with four replications.
Main-Plot factor: Two levels of dormant period irrigation (Yes - applied, No - not applied).
Sub-Plot factor: Growth-Stage Based irrigation (Irr – fully irrigated, VStss – no irrigation during vegetative growth, RStss – no irrigation during reproductive period, RD - rainfed)
Sub-sub Plot factor: Three winter canola cultivars (Riley, Hekip, and DKW-46-15)
Aboveground biomass samples were collected several times during the growing season. An area of 0.25 m^2 was hand harvested and oven dried at 65˚C for 72 h. Dry biomass weight was recorded when a constant dry weight was obtained after drying for three days. Five random plants were selected, and hand harvested at maturity to calculate yield components. Number of pods per plant, number of seeds per pod, 1000 seed weight and number of branches were calculated as an average of five selected plants. An area of 1 m^2 was harvested separately at maturity for harvest index. Dry plant biomass was obtained, and samples were threshed using a plot combine (Model Elite Plot 2001, Wintersteiger, Reid, Austria) to obtain seed yield. Harvest index was calculated as the ratio of seed yield to total dry plant biomass. For final seed yield, plot area of 9.2 m^2 was harvested using the above-mentioned plot combine. The seed yield was adjusted to a standard 10% seed moisture.

Results and Discussion

Applying irrigation during dormant period significantly increased aboveground biomass in both years (Table 2). This increased canola’s capacity to intercept photosynthetic active radiation (PAR), as a strong relationship between PAR and aboveground biomass has been reported in canola. Crop recovered from an early VStss and produced 8% (2016-17) and 11% (2017-18) more final biomass than RStss. Refilling of soil profile during dormant period increased seed yield by

41% (2016-17) and 31% (2017-18). Because of increased supply of assimilates and extended reproductive period by dormant period irrigation, canola produced more flowers and eventually formed more pods. Reproductive period was more susceptible to water stress than the vegetative period. RStss reported higher yield loss than VStss. Oil content (OC) was significantly increased by applying dormant period irrigation in 2016-17. But no such effect was observed in 2017-18. Pods per plant influenced seed yield more than other yield components. Hekip and Riley performed similarly in both years. Relatively lower biomass and shorter reproductive phase of DKW46-15 resulted in lower yield as compared to Hekip and Riley.

Table 1. Amount of irrigation applied for winter canola establishment and to each irrigation treatment during 2016-17 and 2017-18 season at Clovis, NM.

			Treatments					
Year	Month	Establishment (mm)	Dormant period irrigation (mm)		Growth stage-based irrigation (mm)			
			Yes	No	Irr	VStss	RStss	RD
2016-17	September	31	0	0	0	0	0	0
	October	68	0	0	0	0	0	0
	November	0	0	0	0	0	0	0
	December	0	38	0	0	0	0	0
	January	0	76	0	0	0	0	0
	February	0	25	0	0	0	0	0
	March	0	0	0	107	0	107	0
	April	0	0	0	86	86	0	0
	May	0	0	0	0	0	0	0
	June	0	0	0	0	0	0	0
	Total	99	140	0	193	86	107	0
2017-18	September	33	0	0	0	0	0	0
	October	0	0	0	0	0	0	0
	November	0	0	0	0	0	0	0
	December	0	0	0	0	0	0	0
	January	0	152	0	0	0	0	0
	February	0	0	0	0	0	0	0
	March	0	0	0	102	0	102	0
	April	0	0	0	86	61	25	0
	May	0	0	0	51	51	0	0
	June	0	0	0	0	0	0	0
	Total	33	152	0	229	112	127	0

Irr: Fully irrigated, VStss: No irrigation during vegetative stage, RStss: No irrigation during reproductive stage, RD: Rainfed

Table 2. Final biomass (BM), seed yield (SY), and oil content (OC) of three winter canola cultivars under different irrigation treatments in 2016-17 and 2017-18 at Clovis, NM.

Treatments	2016-17			2017-18		
	BM (kg ha^{-1})	SY (kg ha^{-1})	OC (%)	BM (kg ha^{-1})	SY (kg ha^{-1})	OC (%)
Dormant period irrigation (D)						
Applied	8975 a †	1635 a	38.52 a	10826 a	2025 a	35.34 a
Not applied	7267 b	1154 a	37.72 b	9270 b	1626 b	35.67 a
Growth stage-based irrigation (I)						
Fully irrigated	9143 a	1951 a	39.45 a	12199 a	2489 a	37.10 a
Stress at vegetative stage	8486 ab	1638 a	38.17 b	10596 b	1992 b	35.55 b
Stress at reproductive stage	7950 bc	1179 b	38.12 b	9791 b	1730 c	35.10 bc
Rainfed	6905 c	809 c	36.75 c	7605 c	1091 d	34.86 c
Cultivars (C)						
Hekip	8910 a	1429 a	37.41 c	9926 ab	1966 a	35.11 b
DKW46-15	7309 c	1316 a	39.13 a	9759 b	1569 b	36.06 a
Riley	8143 b	1438 a	37.83 b	10458 a	1941 a	35.35 b

†Values within a column followed by same the letter are not significant different at P≤0.05.

Soil Health Status of Diverse Land Use Systems
In Eastern New Mexico

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Objective

To evaluate the effects of diverse land uses on soil organic matter components as indicators of soil health at the surface (0–0.2 m) and subsurface (0.2–0.4 m) depths in eastern New Mexico.

Materials and Methods

The study was conducted at the New Mexico State University Agricultural Science Center (ASC) at Clovis, NM (34°35' N, 103°12' W, 1348 m elevation), and nearby farmers' fields. Land use systems compared included grazed native pasture (GNP), cropland converted to grassland (CCG), conventional-tilled winter grazed cropland (CTGC), and strip-tilled cropland (STC) and no-tilled cropland (NTC) with no grazing. The GNP and CCG were farmers' field with more than 50 years under native grasses. The CTGC was also an on-farm plot maintained with dryland sorghum-based rotation and occasional winter grazing. The STC and NTC fields were under corn-sorghum rotation since 2013 and under winter wheat-sorghum-fallow before. Soil samples were collected from 0–8 inch and 8-16 inch depths of each plot in the summer of 2017 using a tractor-mounted Giddings hydraulic probe (Giddings Machine Company Inc., Windsor, CO) fitted with 1.77-inch diameter plastic liner tubes. From each sample, approximately 50-g subsamples were air dried and sieved through a 0.16-inch sieve for particulate organic matter (POM), while the remaining samples were air dried and gently ground to pass through a 0.08-inch sieve for soil pH, electrical conductivity (EC), soil organic carbon (SOC), and potassium permanganate oxidizable carbon (POXC) analyses. Soil pH and EC were determined in 1:5 soil to water suspension and measured using electrodes. Soil bulk density was determined by core method and SOC content was determined in a LECO CHNS analyzer (LECO Corporation, St. Joseph, MI). Soil inorganic carbon content was removed by treating soils with a 6 mole L^{-1} HCl solution. The POM content was determined by a procedure outlined by sieving, and POXC content by potassium permanganate extraction. Soil inorganic N was determined by measuring nitrate (NO_3^-) and ammonium (NH_4^+) ions in an automated flow injection N analyzer (Timberline Instruments, LLC, Boulder, CO).

The data were statistically analyzed using the PROC GLM procedure in the SAS (v 9.4, SAS Institute, Cary, NC) for completely randomized experiments. All the comparisons were made at the significant probability level $P<0.05$ unless otherwise stated.

Results

Soil pH was significantly lower at surface (pH = 6.7) than subsurface (pH = 7.8) depth, while it was not significantly different between land uses or land uses × sampling depths interaction. Soil EC was not significantly different between land uses, sampling depths, and their interaction. Soil bulk density was significantly lower at surface than subsurface depth and did not differ among land uses (Table 1).

The SOC content was significantly different between land uses, sampling depths, and land uses × sampling depths interaction. Averaged across land uses, the SOC content was greater at surface than subsurface depth. At surface depth, the SOC content was not significantly different between GNP and CCG. However, the grasslands stored approximately 36.9% more SOC than croplands (CTGC, NTC, and STC). Within croplands, SOC content under CTGC was significantly greater than under STC, while the SOC under NTC was not significantly different from CTGC nor from STC. No differences in SOC content were observed among land uses at subsurface depth.

Soil POM content also differed significantly between land uses, sampling depths, and land uses × sampling depths interaction. Soil POM at the surface depth was approximately 11.4 ton/acre with the GNP system, which was significantly greater than all other land uses (Table 1). No differences in soil POM content were observed between the croplands at surface depth. Soil POM content in croplands was in between GNP and CCG as CCG had the lowest POM content. Soil POM content was not influenced by the land uses at the subsurface depth. Land uses, sampling depths, and land uses × sampling depths interaction did not affect soil POXC content at any depth.

Soil inorganic N content was significantly different between land uses, sampling depths, and land uses × sampling depths interaction. Though the soil inorganic N content at surface was greatest under NTC, it was not significantly different from CTGC and STC (Table 1). Soil inorganic N content was significantly lower in grasslands than in croplands at surface depth, while it did not differ significantly between GNP and CCG and among land uses at subsurface depth.

Summary

Healthy soils are integral to the sustainable agriculture because they provide multiple ecological functions such as soil organic matter formation and stabilization, nutrient cycling, and environmental quality improvement. The CTGS that integrate livestock in cropping system maintained higher or at least equivalent amount of SOC suggesting that light grazing may improve SOC and soil health status in semiarid drylands.

Acknowledgements

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Table 1. Soil organic carbon (SOC), particulate organic matter (POM), potassium permanganate oxidizable carbon (POXC), and soil inorganic N as influenced by various land uses in soil surface (0–8 inch) and sub-surface (8–16 inch).

Land use	**SOC**			**POM**			**POXC**			**Inorganic N**		
	ton/ac									(lbs/ac)		
	0–8”	8-16”	0-16"	0–8”	8-16”	0-16"	0–8”	8-16”	0-16"	0–8”	8-16”	0-16"
CTGC	9.50	7.49	17.0	6.83	2.25	9.08	0.37	0.41	0.79	24.4	7.33	31.7
NTC	8.34	7.41	15.8	4.73	1.12	5.84	0.40	0.41	0.82	26.2	5.79	31.9
STC	7.27	6.87	14.1	3.80	1.08	4.88	0.42	0.42	0.85	19.1	6.65	25.7
GNP	12.2	7.90	20.1	11.4	1.65	13.1	0.41	0.41	0.83	6.35	3.11	9.45
CCG	10.7	7.94	18.6	3.64	1.15	4.78	0.39	0.39	0.79	10.9	4.92	15.8

CTGC = conventional-tilled grazed cropland, NTC = no-tilled cropland, STC = strip-tilled cropland, GNP = grazed native pasture, CCG = cropland converted to grassland.

Feasibility of Cover Cropping For Economic And Environmental Benefits

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Objective

To evaluate the feasibility of using cover crops as a means to enhance soil organic matter, rainwater absorption and retention capacity of the soil, weed suppression, crop yield, and thereby farm profitability.

Materials and Methods

We use experimental data from the Agriculture Science Center-Clovis, NM and estimated costs for different farming related activities, revenue generated from each system and risks associated with each practice. The experiment had eight treatments including seven different combinations of cover crops and a fallow treatment as a control. The cover crop treatments included a fallow (no cover crop), three sole cover crops (pea, oat, canola), and four cover crop mixtures [pea + oat (POM), pea + canola (PCM), pea + oat + canola (POCM), and six species mixtures (SSM) of pea + oat + canola + hairy vetch + forage radish + barley]. The experiment was designed using a randomized complete block design, with three replications and eight treatments. The economic analysis used data from last two crop years (2016-2017). The data from the first year are used for establishing the baseline yield. The data from the second year are used for calculating the net returns by treatment.
The analysis involved preparing an enterprise crop budget for each treatment to generate net returns and identify potential stochastic variables. We used experimental yield data and market prices for outputs and production inputs to set up the budgets and used @Risk software to simulate the results. We incorporate the indirect benefit of the cover crop by accounting for the reduced soil erosion (15 tons/acres*imputed price of $2/ton as indicated in the literature).

Results

The enterprise crop budgets for seven different cover crop treatments are reported in Table 1 below. Although identical cultivation practices used for each treatment, the crop budget differ in terms of seed cost. The crop budgets include indirect benefits of reduced soil erosion. Moreover, the cover crop can also be harvested or grazed over for a fee and generate additional revenue. However, it was terminated by using herbicide and does not yield revenue.
The values reported in table 1 are on per acre basis. From table 1 we can see that the treatment with six species mixture of cover crops (SSM) has the highest cost, whereas canola is the least cost option. Cover crops also have an alternative use as livestock feed that adds revenue. Economically, SSM come out to be the prominent alternatives for the New Mexico farmers. Highest probable mean return to risk for SSM is 422 dollars per acre. In statically and economic terms, those data sets which have the higher variations through observations are considered risky, canola being the opposite is the safest.

We used Monte Carlo simulation to evaluate the potential benefits of using cover crop in Eastern New Mexico to enhance soil organic matter and farm profitability. The results from the Monte Carlo simulations show that a cover crop treatment that includes a mixture of six crops (SSM) yields highest net return, while treatment with only canola provides a least profitable option. Whereas SSM (highest) and POCM are the preferred treatments in various risk attitudes, and Pea and Canola are less preferred. The SSM has also the highest expected income. These results have significant policy and investment implication for growers in the Clovis and surrounding area. In particular, cover crop in general yield higher returns because of its potential to reduce soil erosion (i.e., it has an added value of $30/acre). Moreover, adoption of the most profitable cover crop (e.g. SSM) would further enhance farm profitability and help in reducing soil erosion. These results also indicate that further research is needed to identify other cover crop options that may yield additional benefits of adding nitrogen, weed control, enhanced water retention capacity particularly in arid regions where the incidence of wind erosion is high.

Summary

Cover crop selection affects farm profitability and risks associated with it. While adoption of the most profitable cover crop (e.g. SSM) would further enhance farm profitability and help in reducing soil erosion, the most profitable cover cropping option is associated with highest risk. Canola as a cover crop appears to be least risky option.

Table 1 Crop budgets for seven cover crop treatments used in the study

	SSM	POCM	Canola	Pea	Oat	POM	PCM
Primary Yield	0	0	0	0	0	0	0
Primacy Price	0	0	0	0	0	0	0
Secondary Income (erosion)	30	30	30	30	30	30	30
Gross return	30	30	30	30	30	30	30
Operating expenses							
Seed	22.3	17.33	9	25	18	21.5	17
Fertilizer	0	0	0	0	0	0	0
Chemicals	2.54	2.54	2.54	2.54	2.54	2.54	2.54
Crop insurance	0	0	0	0	0	0	0
Other Inputs	0	0	0	0	0	0	0
Fuel, oil and lubricants	3	2.9	2.7	2.7	2.7	2.8	2.8
Repairs	1.15	1.1	0.9	0.9	0.9	1	1
Custom Charges	4.05	4	3.8	3.8	3.8	3.9	3.9
Land Taxes	14.4	14.4	14.4	14.4	14.4	14.4	14.4
Other expenses	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Total expenses	50.94	45.77	36.84	52.84	45.84	49.64	45.14
Return over operating expenses	-20.9	-15.7	-6.84	-22.84	-15.8	-19.6	-15.1
Fixed costs	5.53	5.53	5.53	5.53	5.53	5.53	5.53
Total costs	56.47	51.3	42.37	58.37	51.37	55.17	50.67
Net farm income	-26.4	-21.3	-12.3	-28.3	-21.3	-25.1	-20.6
Labor/Management costs	1.5	1.45	1.3	1.3	1.3	1.4	1.4
Net operating profits	-27.9	-22.7	-13.6	-29.67	-22.6	-26.5	-22.0
Capital costs							
Interest on operating capital	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Interest on equipment	2.09	2.09	2.09	2.09	2.09	2.09	2.09
Total capital costs	2.29	2.29	2.29	2.29	2.29	2.29	2.29
Return to land and risk	**-30.2**	**-25.0**	**-15.9**	**-31.96**	**-24.9**	**-28.8**	**-24.3**

Budget format source: New Mexico State University, Extension Budget, by Hawkes et al.

Understanding Spatial Variability of Soil Health Indicators In A Forage Corn Production System

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Objective

The main objective of the research was to evaluate the field-scale spatial variability of selected soil health indicators and assess the effects of cutting heights, row spacing, and cover crop treatments on these indicators.

Materials and Methods

This study was conducted at Heritage Dairy Farm (HDF) near Clovis, NM. Soils in the study site are an Amarillo fine sandy loam. The study was conducted on a 60-acre field under a half-circle of an irrigation pivot (Fig. 1). The study had five large plot treatments and four replications. The treatments included two (15-inch and 30-inch) corn row spacing, two corn silage cutting height [6-inch short stubble (SS) and 18-inch tall stubble (TS)], and a cover crop [cereal rye and Austrian winter pea mixture] with narrow row spacing and short silage cutting height (15-SS-CC). Spans 1-3 had 15-SS-CC treatment, while spans 4 and 6 had a narrow row spacing and spans 5 and 7 had a wide row spacing treatments (Fig. 1).
The study was established in May 2017. Corn was planted at 53340 seeds ha^{-1} in the second week of May. The '9678VT3P' corn variety was used in both years of the study. A liquid blended urea and ammonium nitrate fertilizer (32-0-0) was pumped through the sprinkler at a rate of 4.85, 5.97, and 5.07 metric tons on June 16, 24, and July 27, 2017, respectively. The cereal rye and Austrian winter pea cover crop mixture (70% rye+30% pea) was planted on October 23, 2017 and terminated on April 12, 2018 in the cover crop treatment. The study area was divided into 80 experimental units (grids) of approximately 0.3 ha area within each grid. Each treatment represented 16-grids and sampling points within each grid was georeferenced with GaiaGPS for repeated measurement throughout the study. Soil samples were collected on May 17, 2017, October 2, 2017, and May 21, 2018 and they were stored in a 4ºC refrigerator after each sampling event prior to laboratory analysis, which was done within a week of sampling. Laboratory analysis included inorganic N, potentially mineralizable C (PMC), and potentially mineralizable N (PMN). Geostatistical analysis was done on the data using RStudio.

Results

Semi-variograms were created for all soil properties for BP 2017 and 2018 to illustrate and understand the spatial changes that took place within the one year growing season (Fig. 1). The amount of short-range spatial autocorrelation can be seen in all of the BP '18 semi-variograms; meaning there is a high amount of short-range spatial uncertainty in 2018 as compared to 2017. Kriging results were initially interpolated through predictions, followed by the standard deviation of predictions for BP 2017 and 2018. Because spatial changes were being observed for one year, AH 2017 was not reported. For all measured soil properties (inorganic N, PMC) there were visual fluctuations of spatial autocorrelation through time. Inorganic N shows an increase in spatial continuity, while PMC show a decrease for the one year growing season (Fig. 1, 2). This is quantified in the range values for each semivariogram. Although the range values are high, the scale for some of the measured parameters has a very short range.

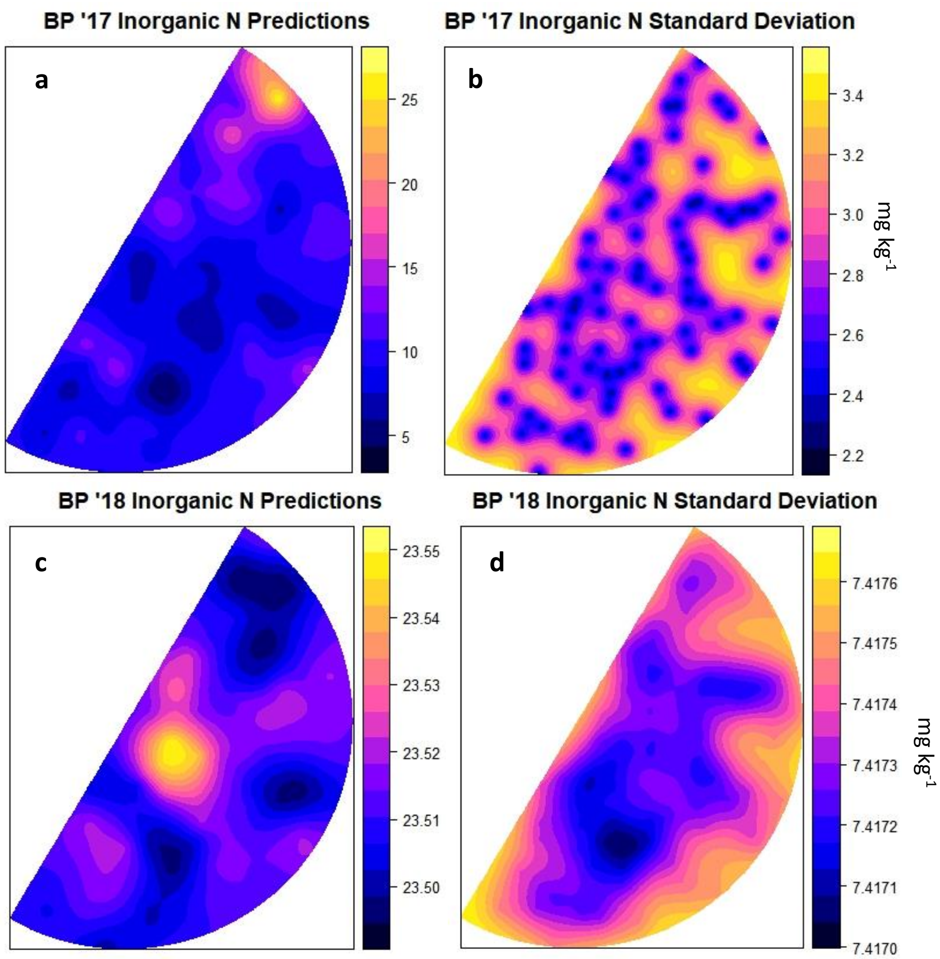

Figure 1. Kriging maps of a) BP 2017 inorganic N predictions, b) BP 2017 inorganic N standard deviation, c) BP 2018 inorganic N predictions, and d) BP 2018 inorganic N standard deviation. All units are mg kg^{-1}, but ranges depend on measured values.

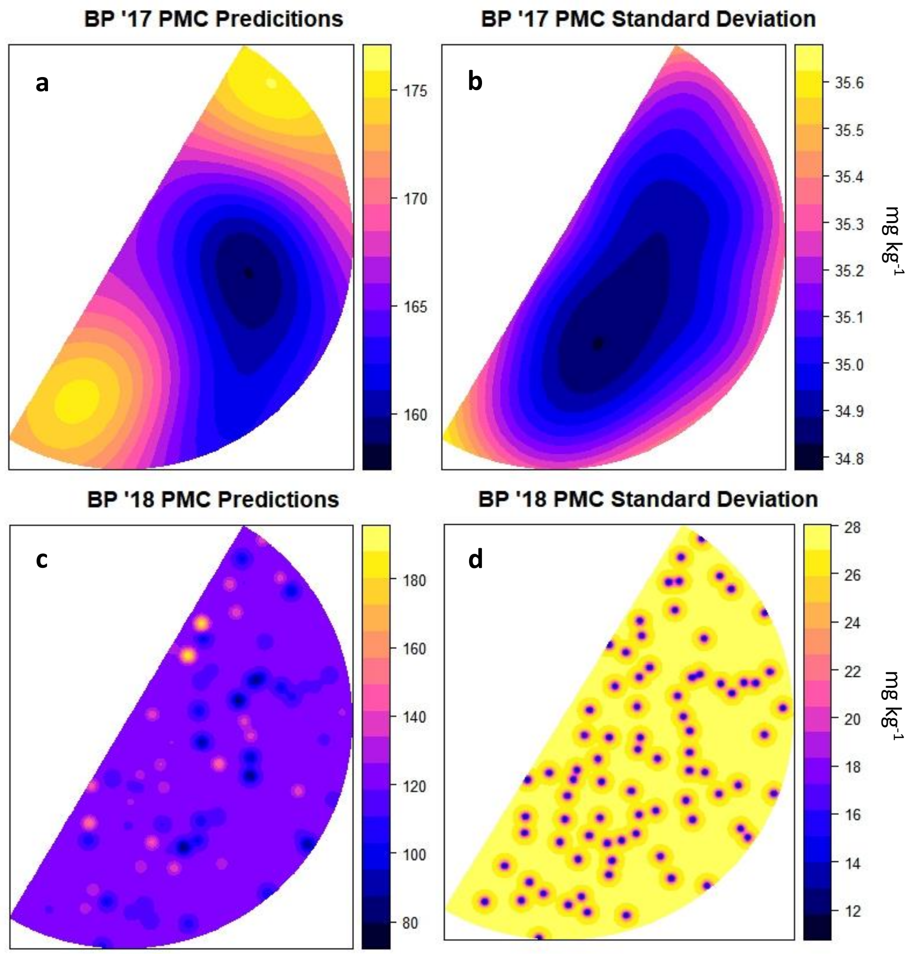

Figure 2. Potentially mineralizable carbon (PMC) kriging results of a) BP 2017 PMC predictions, b) BP 2017 PMC standard deviation, c) BP 2018 PMC predictions, and d) BP 2018 standard deviation. Brighter colors indicate a greater standard deviation than the darker colors. All units are mg kg^{-1} but ranges depend on measured value.

Summary

Understanding how C and N dynamics in agroecosystems function is crucial in improving soil health and sustainable agroecosystems. Understanding how crop management effects the spatial variability and autocorrelation helps in selection of the best management practices for eastern New Mexico.

Acknowledgements

We thank Heritage Dairy Farm for collaboration on this project.

Valencia Peanut Breeding – Advanced Breeding Lines

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Objective

To develop a variety that can yield high, produce 3 or more kernels per pods, resistant to diseases, maintain red skin and taste of Valencia with high oleic chemistry.

Material and Methods

Field studies were conducted at Morton in Texas on a producers farms in 2018. The experimental trial was planted on May 10, 2018 under center pivot irrigation. Soil type is an Amarillo-Acuff-Olton and elevation is 3760 feet. Individual plots consisted of two rows, 40-inch rows with 1000 feet long. 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.

Total irrigation amount was 5.1 inch applied over the growing period. Precipitation received during the growing period was 17.0 inches. The plots were dug with a Pearman digger on September 25, 2018. The peanuts were left for a ten to dry and thrashed on October 5, 2018 with a Lilliston 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 1. Peanut quality, as measured by Total Sound Mature Kernels (TSMK) was graded using 500 samples of pods. The details of the breeding lines and the cross details are provided in Table 1 along with the yield and grade.

Results and Discussion

The average yield that was recorded by the grower was 3300 lb/ac for half the center pivot area that was planted with peanuts. The variety that was grown was H&W-101. All the seven advance breeding materials performed better than the growers check variety H&W 101. The top three lines were CR-101 (5351 lb/ac); CR-55B (5322 lb/ac) and CR-27 (4666 lb/ac). The grade (TSMK) was highest for growers check variety H&W-101 and CR-101 (72%) followed by improved Valencia-C variety (71%). No major diseases were noticed during the growing season. We will be evaluating these material for three different diseases namely pod rot, Sclerotinia and Southern Stem rot in 2019 under sick plot conditions. Net return was highest for CR-101 ($ 963) and CR-27 ($ 957) breeding lines, an increase of $ 370 over the check variety. All these advanced breeding lines are high oleic and can help the processors in extending the shelf life by at least six months compared to the existing commercial varieties that are grown currently in eastern New Mexico and west Texas.

Table 1. High Oleic Valencia Advance Breeding Materials Tested at Mortan, Texas in 2018

S.No	Name of the Cross or Line	Pod Yield (lb/ac)	Grade (TSMK)	Net Return¶
1	CR-27 (309 x Hart)	4666	68.0	839.5
2	CR-47 (308 X Perry)	3595	65.0	646.8
3	CR-19 (308 X Serenut 5R)	4185	68.0	752.8
4	CR-79 (309 X Serenut 6T)	3728	68.0	670.7
5	CR-50 (308 X Perry)	4717	70.0	848.5
6	CR- 55B (308 X Perry)	5322	68.0	957.4
7	CR-101 (M3 X 309-2)	5351	72.0	962.6
8	Valencia – C (Improved)	4435	71.0	797.9
9	Check (Growers field)	3300	72.0	593.4

¶Net return calculated based on Valencia-type peanuts 5.398 per percent or $ 359.80 per ton https://www.fsa.usda.gov/news-room/news-releases/2018/nr_2018_0625_rel_0107

Organic Seed Treatment Study in Valencia Peanut

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Objective
To evaluate commercially available organic seed treatment products.

Materials and Methods
The experimental trial was planted on July 1, 2018 in 40-inch rows under center pivot irrigation. Soil type is an Amarillo-Acuff-Olton and elevation is 3760 feet. Individual plots consisted of two rows, 40-inch rows with 12 feet long. There were four replications for each entry, planted in a random complete 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.

The details of the seed treatments are provided in Table 1 along with the application type (seed treatment or liquid) and rate of application. After planting pre-plant soil incorporated herbicide Prowl 3.3 EC @ 2.4 pt/ac was applied for the control of annual grasses and small seeded broadleaf weeds such as pigweed. About 100 pounds of nitrogen was applied in split application. The experimental plots received 60 pounds of nitrogen in April and another 40 pounds through irrigation water in mid-August (45 DAP).

Irrigation amount was roughly 1.5 inches per week except at planting it received 3 inches of water. Total irrigation amount including precipitation received during the growing season was 30 inches. Due to late planting peanuts were dug on October 27, 2018 and were thrashed the same day 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.

Statistical Analysis
All data were subjected to SAS® procedures for test of significance 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 2018 seed treatment study are presented in Table 2. Average pod yield was higher for the chemical check Dynasty (3328 lb/ac) which was significantly not different from the organic seed treatments Neem oil (3227 lb/ac), AKX 612 (3025 lb/ac), Thyme Guard (2824 lb/ac), AKX-602 (2823 lb/ac), Mycostop-5.0 (2703 lb/ac) and combination of AKX-602 and AKX-612 (2622 lb/ac). The average pod yield for the trial was 2669 lb./ac. By treating the Valencia peanut seeds with organic products a grower can benefit anywhere from $ 156 with Thyme Guard to $ 254 with Neem oil compared to the Untreated Check (1956 lb/ac). Estimated net result will give a true picture based on the cost of the product and the rate of application. We plan to repeat this study again in 2019 growing season.

Table 1. List of organic seed treatments applied to experimental plots in a Valencia peanut field in Mortan, Texas.

S.No	Company	Product Name	Product Description	Application Type	Application Rate
# 1	Untreated Check	Untreated Check	Raw Peanut Seed	N/A	N/A
#2	Syngenta	Dynasty PD	Standard Check (Fungicide)	Seed Treatment	3 Oz/cwt
# 3	AgriEnergy Resources	Bac Pac	BioStimulant & Protectant	Seed Treatment	4 Oz/cwt
#4	AgriEnergy Resources	Thyme Guard	BioFungicide	Liquid IF	20 oz/cwt
# 5	AgriEnergy Resources	Neem Oil	BioFungicide	Liquid IF	12 oz/cwt
# 6	Agro-K	AKX-602	BioStimulant	Liquid IF	1 qt/ac
# 7	Agro-K	AKX-612	BioStimulant	Liquid IF	1 pt/ac
# 8	Agro-K	AKX-602 + AKX-612	BioStimulant	Liquid IF	1 qt/ac + 1 pt/ac
# 9	BASF	Integral	BioFungicide	Liquid IF	0.51 fl oz/Gal of H2O
# 10	BASF	Serefel	BioFungicide	Liquid IF	0.21 fl oz/Gal of H2O
# 11	Verdera	MycoStop	BioFungicide	Seed Treatment	2.5g/kg seed
# 12	Verdera	MycoStop	BioFungicide	Seed Treatment	5.0g/kg seed

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

S.No	Company	Product Name	Pod Yield	Grade (TSMK)	Net Return¶	Ranking
			lb/a		$/a	
1	Check	Control	1956 e±	64.3 ab±	339 d±	12
2	Syngenta	Dynasty PD (Chemical check)	3328 a	69.2 ab	620 a	1
3	AgriEnergy	Bac Pac	2239 de	65.0 b	393 cd	11
4	AgriEnergy	Thyme Guard	2824 abcd	64.8 b	495 abc	6
5	AgriEnergy	Neem Oil	3227 a	68.1 ab	593 a	2
6	Agro-K	AKX-602	2823 abcd	66.5 b	506 abc	4
7	Agro-K	AKX-612	3025 abc	66.5 b	543 ab	3
8	Agro-K	AKX-602 + AKX-612	2622 bcde	64.2 b	454 bcd	8
9	BASF	Integral	2561 bcde	66.1 b	456 bcd	7
10	BASF	Serefel	2420 cde	64.4 b	425 bcd	10
11	Verdera	MycoStop 2.5 g/kg seed	2299 de	72.3 b	448 bcd	9
12	Verdera	MycoStop 5.0 g/kg seed	2703 abcd	68.1 b	495 abc	5
		Mean	2669	66.6	481.0	
		CV	17.65	5.92	18.34	
		LSD 0.05	677.71	5.67	126.86	
		Pr>F	0.0139	0.2388	0.0074	

± Means followed by the same letter are not different at th *p*=0.05 level of probability

¶Net return calculated based on Valencia-type peanuts 5.398 per percent or $ 359.80 per ton https://www.fsa.usda.gov/news-room/news-releases/2018/nr_2018_0625_rel_0107

Rhizobium Innoculation Study in Valencia Peanut

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Objective
To evaluate commercially available rhizobium innoculants on peanut yield and grade.

Materials and Methods
The experimental trial was planted on July 1, 2018 in 40-inch rows under center pivot irrigation. Soil type is an Amarillo-Acuff-Olton and elevation is 3760 feet. Individual plots consisted of two rows, 40-inch rows with 12 feet long. There were four replications for each entry, planted in a random complete 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.

The details of the rhizobium inoculants are provided in Table 1 along with the application type (granular or liquid treatment) and rate of application. After planting pre-plant soil incorporated herbicide Prowl 3.3 EC @ 2.4 pt/ac was applied for the control of annual grasses and small seeded broadleaf weeds such as pigweed. About 60 pounds of nitrogen was applied in split application. The experimental plots received 30 pounds of nitrogen in April and another 30 pounds through irrigation water in mid-August (45 DAP).

Irrigation amount was roughly 1.5 inches per week except at planting it received 3 inches of water. Total irrigation amount including precipitation received during the growing season was 30 inches. Due to late planting peanuts were dug on October 27, 2018 and were thrashed the same day 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.

Statistical Analysis
All data were subjected to SAS® procedures for test of significance 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 2018 rhizobium treatment study are presented in Table 2. Average pod yield was higher when the seeds were treated with rhizobium inoculant Verdesian (3630 lb/ac) which was significantly not different with the check (3328 lb/ac). The average pod yield for the trial was 3041 lb/ac. By treating the Valencia peanut seeds with Visjon Biologics resulted in significantly higher grade (69 %). Estimated net result was higher with Primo GX2 inoculant. We plan to repeat this study again in 2019 growing season.

Table 1. Details of rhizobium inoculants used in the study.

S.No	Company	Product name	Application type	Application rate
1	Untreated Check	Untreated check	None	N/A
2	Monsanto	Tag Team + Active Powder	Liquid IF	15 oz/ac + 5.7 g/ac
3	Monsanto	Optimize	Liquid IF	15 oz/ac
4	Verdesian	Primo Power	Liquid IF	7.5 oz/ac
5	BASF	Vault	Liquid IF	17.7 oz/a + 10.6 mL/ac
6	Visjon Biologics	Biological Exceed	Liquid IF	15 oz/ac
7	Verdesian	Primo GX2	Granular	5.4 lb/ac
8	Abound	Chemical	Liquid IF	18.5 oz/ac

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

S.No	Company	Pod Yield (lb/ac)	Grade (TSMK)	Net Return ($)
1	Check	3328 ab	65.0 cd	586.0 abc
2	Monsanto	2813 cd	65.8 bcd	500.0 cd
3	Monsanto	2934 bc	68.3 ab	540.0 abcd
4	Verdesian	2789 cd	61.3 ef	461.0 d
5	BASF	3267 abc	67.8 abc	598.0 ab
6	Visjon Biologics	2426 d	69.0 a	453.0 d
7	Verdesian	3630 a	63.5 de	622.0 a
8	Abound	3146 abc	60.3 f	512.0 bcd
	Mean	3041	65.13	481.0
	CV	11.20	2.62	18.34
	LSD 0.05	500.79	2.51	89.40
	Pr>F	0.0021	<0.0001	0.0125

± Means followed by the same letter are not different at th p=0.05 level of probability

¶Net return calculated based on Valencia-type peanuts 5.398 per percent or $ 359.80 per ton https://www.fsa.usda.gov/news-room/news-releases/2018/nr_2018_0625_rel_0107

Seed Treatment Study in Valencia Peanut Using Chemical Fungicides

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Objective

To minimize soil borne pathogen by treating Valencia seeds with chemical fungicides.

Materials and Methods

The experimental trial was planted on May 10, 2018 in 40-inch rows under center pivot irrigation. Soil type is an Amarillo-Acuff-Olton and elevation is 3760 feet. Individual plots consisted of two rows, 40-inch rows with 50 feet long. There were four replications for each entry, planted in a random complete 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.

The details of the seed treatments are provided in Table 1 along with the application type (seed treatment or liquid) and rate of application.

Total irrigation amount was 5.1 inch applied over the growing period. Precipitation received during the growing period was 17.0 inches. The plots were dug with a Pearman digger on September 25, 2018. The peanuts were left for a ten to dry and thrashed on October 5, 2018 with a Lilliston 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 samples of pods.

Statistical Analysis

All data were subjected to SAS® procedures for test of significance 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 2018 seed treatment study are presented in Table 2. Average pod yield was higher (5323 lb/ac) when seeds were treated with chemical fungicide Rancona that was applied along with Tepra fungicide in-furrow at planting followed by one application of Evito fungicide that was applied on 60 days after planting. This treatment resulted in an increase of 31% higher pod yield compared to untreated control (4054 lb/ac). The second best treatment resulted in an increase of 20% higher pod yield when fungicide Racona was applied along with fungicide Tepra in furrow at planting which was similar to the same treatment along with one application of Evito fungicide on 60 days after planting. Application of fungicide Rancona alone at planting resulted in 19% higher pod yield compared to control check. Application of Dimilin insecticide along with fungicides Rancona, Evito and Tepra did show an increase in pod yield by 16% compared to control treatment.

Table 1. Peanut seed treatments along with rate and time of application.

S.No	Treatment
1.	Rancona 4oz/cwt at planting.
2.	Rancona 4oz/cwt + Tepra in-furrow (4.2 fl.oz/ac) at planting.
3.	Untreated control
4.	Rancona 4oz/cwt + Tepra in-furrow (4.2 fl.oz/ac) at planting + Evito (5.7 fl./oz/ac @ 60 days after planting
5.	Rancona 4oz/cwt + Tepra in-furrow (4.2 fl.oz/ac) at planting + Evito (5.7 fl./oz/ac @ 60 days after planting
6.	Rancona 4oz/cwt + Tepra in-furrow (4.2 fl.oz/ac) at planting + Evito (5.7 fl./oz/ac @ 60 days after planting+ + Evito (5.7 fl.oz/ac @90 days after planting.

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

S.No	Treatment detail	Pod Yield lb/a	Grade	Net Return[¶] $/a	% increase over control
1	Rancona at planting	4824 cd	67.7 bc	768	18.9
2	Rancona + Tepra at planting	4947 bc	71.1 a	891	22.0
3	Untreated control	4054 e	68.9 b	-	-
4	Racona + Tepra at planting followed by Evito on 60 DAP	4983 b	70.4 a	927	22.9
5	Racona + Tepra at planting followed by Evito on both 60 DAP and 90 DAP	5323 a	68.7 b	1267	31.2
6	Racona + Tepra at planting followed by Evito on 60 DAP; followed by Evito along with Dimilin on 90 DAP	4718 d	66.9 c	662	16.3
	Mean	4808	69.0	903	
	CV	1.81	1.46	2.92	
	LSD 0.05	131.05	1.52	32.21	
	Pr>F				

± Means followed by the same letter are not different at th *p*=0.05 level of probability

[¶]Net return calculated based on Valencia-type peanuts 5.398 per percent or $ 359.80 per ton https://www.fsa.usda.gov/news-room/news-releases/2018/nr_2018_0625_rel_0107

Performance of Cotton Varieties, 2018

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Objective

To evaluate commercial cotton varieties suitable for eastern New Mexico.

Materials and Methods

The cotton variety trial was planted April 27, 2018 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 single, 30-inch rows 30 feet long. There were four replications for each entry, planted in a random complete 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 18, the planting area was treated with herbicide Prowl H2O @ 3.0 pt/ac as pre-plant application. After planting Roundup (60 Oz/ac), Brawl (12 Oz/ac) and Caparol (1.6 pt/ac) were sprayed and irrigated. Fertilizer applied was 28-0-0-5 N:P:K + Sulphur at the rate of 30 gallons per acre. Growth regulators applied were, Prevathon 20 Oz/ac, Pix 24 Oz/ac, Prep @ 20 Oz/ac and Def 6 2 pt/ac.

Total irrigation amount was 5.1 inch applied over the growing period. Precipitation received during the growing period was 17.0 inches. The plots were harvested on November 27, 2018 with a cotton stripper. Individual plot weights were recorded. For fiber quality each individual plot was hand harvested with 25 bolls randomly picked within a plot. The fiber samples were sent to Louisiana State University ginning lab after calculating the lint percent from 25 boll samples.

Statistical Analysis

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

Results and Discussion

Yield data along with quality traits for the 2018 cotton trial are presented in Table 1, lint yield for the 16 varieties in the trial, ranged from 1343 to 1715 lb/ac with a trial average of 1402 lb/ac. Estimated net return was $ 865 for FM 2574 followed by $ 795 for PHY300 W3FE. The average net return was $ 676

Table 1. New Mexico 2018 Cotton Variety Performance Test

Company Name	**Variety Name**	**Seed cotton lb/ac**	**Lint Yield lb/ac**	**Bales per a**	**Lint %**	**Boll wt g**	**Length**	**Uni.**	**SFI**	**Strength**	**Elon**	**MIC**	**Mat**	**Loan Value cents/lb**	**Est net ret. $/a**	**Rank**
Stoneville	ST 4946	3623	1495	3.1	41.2	5.9	1.22	84.3	8.0	30.6	6.2	3.9	80.0	56.7	747.5	3
Fibermax	BX 1972 GLTP	3071	1231	2.6	40.1	4.7	1.20	82.1	9.8	28.6	6.2	3.1	78.0	50.6	536.8	15
Fibermax	BX 1971 GLTP	2621	1238	2.6	47.3	6.0	1.21	84.7	8.0	28.0	4.9	4.1	81.3	54.6	604.0	13
Bayer	FM 2498 GLT	3027	1357	2.8	44.9	6.0	1.21	82.7	9.2	25.7	4.6	3.8	80.5	52.2	623.5	12
Bayer	FM 2574 GLT	3543	1677	3.5	47.3	5.2	1.24	81.8	9.4	28.1	4.3	3.7	80.8	57.3	865.8	1
Bayer	FM 2334 GLT	2294	1022	2.1	44.6	4.8	1.25	83.8	8.5	28.2	4.6	3.9	80.7	57.1	521.8	16
Monsanto	DP 1845 B3XF	3071	1360	2.8	44.4	5.0	1.25	83.0	9.0	29.7	6.5	3.5	78.8	53.7	642.0	10
Monsanto	DP 1612 B2XF	3739	1557	3.2	41.5	5.2	1.19	82.2	9.5	29.7	7.4	3.9	78.8	53.9	739.0	4
Monsanto	DP 1646 B2XF	2817	1348	2.8	47.6	4.5	1.22	82.3	9.5	26.8	6.7	3.7	78.5	52.2	624.3	11
Monsanto	DP 1820 B3XF	2962	1389	2.9	46.9	4.5	1.22	82.4	9.3	30.2	4.3	3.9	81.3	56.6	705.5	6
Phytogen	PHY 300 W3FE	3986	1715	3.6	43.0	4.3	1.16	82.3	10.3	29.6	5.8	3.4	78.8	53.1	795.3	2
Phytogen	PHY 320 W3FE	3238	1343	2.8	41.5	4.8	1.16	83.3	9.2	29.7	6.2	3.4	78.5	51.5	602.5	14
Phytogen	PHY 350 W3FE	3499	1396	2.9	39.7	5.3	1.22	85.1	7.8	29.5	6.3	3.9	79.5	56.4	689.5	8
Phytogen	PHY 210 W3FE	3216	1372	2.9	42.7	5.4	1.19	83.6	8.0	30.9	5.0	3.5	79.8	56.5	686.0	9
Phytogen	PHY 250 W3BF	3405	1415	2.9	41.5	5.0	1.21	84.1	8.0	30.0	4.8	3.5	79.8	56.2	701.3	7
Phytogen	PX 2B04 W3FE	3601	1512	3.2	42.0	5.0	1.23	83.0	8.8	30.3	5.2	3.3	79.0	54.6	724.5	5
	Trial Mean	**3232**	**1402**	**2.9**	**43.5**	**5.1**	**1.21**	**83.2**	**8.9**	**29.1**	**5.6**	3.64	**79.6**	**54.6**	**676.0**	
	CV	15.9	17.1	17.1	2.63	8.2	2.28	1.41	10.7	4.64	11	7	0.99	5.04	17.2	
	LSD0.05	732.62	340.41	0.72	1.63	0.60	0.04	1.67	1.35	1.92	0.87	0.34	1.12	3.92	0.007	
	Pr>F	0.0011	0.0153	0.0133	<0.0001	<0.0001	0.0003	0.0070	0.0164	0.0001	<0.0001	<0.0001	<0.0001	0.0156	0.4	

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, center to the success of the program, fully recognize and support the unique value, freely allowing students access and insight to 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 positon, 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 opportunities for expansion are being considered to in addition to the open-lots of the Southwest, add learning experiences in the barns of the Midwest and the free-stall operations of the West. All with the goal to provide the next generation of dairy owners and managers with excellent educational opportunities.

FUNDING: CES funds, USDA NIFA funding , and allied industry contributions.

Development and implementation of a dairy safety awareness program

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. A large majority of dairy employees have or had little or no experience working in agriculture or with large animals or large equipment. Agriculture, Forestry and Fishing AFF) ranks among the most dangerous industrial sectors with an incident rate of 5.7 non-fatal occupational injuries per 100 FTE's and a rate of 23.2 fatal work injuries per 100,000 FTE's (BLS). In addition, about one-fifth of fatalities in 2016 were to foreign-born workers and roughly two-thirds of fatal work injuries were foreign-born Latino or Hispanic workers. Effective training and education of both ***current and future dairy employees*** is imperative for both safety and performance. However, limited educational opportunities exist to train and certify a skilled and able dairy workforce.

WHAT HAS BEEN DONE: Beginning in 2011-12 with the development of two dairy safety awareness training DVD's in English and Spanish to accomplish multiple goals: 1. being able to document employees are trained on dairy safety issues, 2. improve job performance through understanding the "why" of work- and safety-procedures and 3. to prevent safety incidents through heightened safety awareness. To date approximately 6,000 copies have been distributed worldwide, and the International Rescue Committee (IRC) subsequently translated the DVD's into a number of other languages for placement of refugees on dairies. The remaining question: what is the training effectiveness of viewing a DVD? Delivery of training content became center in training effectiveness evaluation. In collaboration with Dr. David Douphrate, UT School of Public Health, San Antonio Campus, small interactive video/audio vignettes were created in Articulate 360 and subsequently loaded on an IPad for individualized training purposes (m-learning).

REACH: As part of two DOL Susan Harwood projects a total of 2,090 dairy employees in 7 states on 60+ farms were trained using mobile technology on iPads. The large majority of trainees were foreign-born with the majority from Mexico (52.4%), and 27.4% from Guatemala, Honduras and El Salvador. About 88% male and 12% female. Average age 34.4 ± 12.0. About 6% had not received any education, 28% had attended (some) elementary school, 24% (some) middle school, 29% (some) high school, and 13% had received (some) higher education. As anticipated, reading comprehension was a challenge, making the video/audio delivery method critical. We realized soon that many of the Central American trainees didn't speak any English or Spanish, but communicated in a Mayan language (K'iche). Training effectiveness evaluation (Kirkpatrick Four-Level Training Evaluation) analysis suggests that participants rated the m-learning training favorably (level-1). Pre-test to post-test scores changed from a 74.2% to a 92.5% (level-2). Interview results at about 3-6 months post-training (level-3) indicate workers were applying the knowledge gained from the training in their work activities, as well as reporting safety hazards when identified. Findings suggest the utilization of m-learning techniques is an effective means to deliver safety awareness training content to dairy workers in remote and challenging work environments.

IMPACT: NMSU Dairy Extension has now provided safety awareness training to about one-third of the NM dairy workforce. We have added safe animal handling with live demonstration to our

training tools, training which is picking up traction. In 2016 as a result of a several highly publicized dairy fatalities in the Northwest, Idaho Dairymen's Association (IDA) took the lead in adopting our program with significant processor and co-op support. We were asked to help recruit and prepare a dairy safety specialist for IDA. The person was hired in July of 2017, and is currently providing safety awareness training for Idaho dairy producers. Recognizing we were missing about 1 out of 3-4 workers due to language issues, we just completed full translation and voiceover of all video materials into K'iche, a menu option to be added to the iPad library. As part of the NMPF FARM – Workforce development effort we have been charged with the development of a Dairy Safety Manual, which is at the date of this writing (Feb 2019) is nearing completion.
Sparked by consumer questions, National Milk Producers Federation representing the majority of the U.S. milk supply formed (Nov. 2017) a Dairy Safety Task Force looking at national adaptation and implementation of the program. Continued content development: safe feeds and feeding (2018) , safe young stock handling, safe hospital care and safe maternity care are the next items on our list. In Feb. 2018 a 5-yr. leadership development project was initiated, addressing the needs of frontline supervisors and middle managers to learn more about managing people vs. managing cows. In two separate groups, approximate 50 middle managers have now completed the 13-week training program of this project.

NEXT: Another project to be initiated in March 2019 is geared to evaluate the understanding of dairy workers of TB as a zoonosis, with the goal to develop appropriate educational tools for dairy workers. TB has been a reoccurring issue in the NM-West TX dairy shed over the last decade or so and even though most of the DNA seems to trace back to Mexican feeder steers, there is the potential of transmission, a persistent health risk both for humans and cows.

FUNDING: DOL Susan Harwood funding and allied industry contributions.

Maximizing voluntary compliance in antimicrobial stewardship programs: a critical factor for effective intervention

ISSUE: Antimicrobial resistance has risen over the past few decades leading to the reduced effectiveness in the treatment of some infectious diseases. Each year in the United States, 2 million people are infected with antimicrobial resistant organisms resulting in 23,000 deaths and 70 billion dollars in medical costs. As resistance becomes more common, cost is expected to continue to rise in order to fight infections. To combat resistance, the Obama administration generated The National Action Plan for Combating Antibiotic-Resistant Bacteria aimed at better surveillance of antimicrobial resistance, better diagnostic testing, and the development of new vaccines and antibiotics, among other things.
Antimicrobial drug resistance is of great concern for both animal and human health. Using antimicrobials to treat illness is a key element used by veterinarians and physicians alike to combat bacterial diseases. The Food and Drug Administration (FDA) is charged with evaluating both the effectiveness and safety of these compounds. During the process of approving new animal drugs, a slaughter withdrawal period is established for each drug. The slaughter withdrawal time is the number of days between the last time an animal is treated and when the animal can be slaughtered for meat to go into the human food supply. To date, the slaughter withdrawal time has been based upon the duration of time when a drug is still in the animal tissue. There has been little to no consideration as to what management practices might be needed to minimize the risk of antimicrobial drug resistance.

WHAT HAS BEEN DONE: This research project is to evaluate whether a voluntary extended withdrawal time could potentially reduce the level of bacteria resistant to an antibiotic (the specific antibiotic used for this study will be ceftiofur) that are being shed at time of slaughter. The ultimate goal of the project is to identify viable management options for producers to reduce the potential exposure of consumers to resistant bacteria and to develop strategies that result in voluntary adoption of those management options. Overall, the goal is to ensure cattle are released to slaughter with levels of antibiotic resistant microbial populations comparable to their resistance level before being given an antibiotic. A decision-making tool will subsequently be created and made available for dairy farmers and veterinarians to use for the development of antimicrobial stewardship programs. Additionally, developing a stewardship protocol beneficial to farmers, ranchers, and veterinarians is important for food safety.

REACH: Lab work and data analysis has been completed and manuscripts have been submitted for publication. Expectations are we will be able to present take-home messages to producers in the spring of 2019.

FUNDING: USDA NIFA Funding through Texas A&M University.