2014

Annual Progress Report

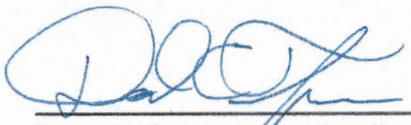
Agricultural Science Center at Tucumcari
6502 Quay Road AM.5
Tucumcari, NM 88401

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 formal report. 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 are authorized for release or publication, without the written prior approval of the New Mexico Agricultural Experiment Station.



Dr. David Thompson, Associate Dean and
Director Agricultural Experiment Station

2014

ANNUAL PROGRESS REPORT

New Mexico State University
Agricultural Science Center at Tucumcari
6502 Quay Road AM.5
Tucumcari, NM 88401-9661

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Acknowledgements

Several individuals and companies donated products and services to the Agricultural Science Center at Tucumcari during 2014. Appreciation is expressed to the following persons and organizations for their contributions.

Agricultural Science Center Advisory Committee

Mr. Phillip Box, Chairman
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Arch Hurley Conservancy District – Franklin McCasland
Tucumcari, NM ..... Field Day Meal

Blair L. Waldron – USDA-ARS Forage and Range Research Lab
Logan, UT……..……...Perennial forage Kochia seed

Box Insurance Agency – Phillip Box
Tucumcari, NM ..... Field Day Meal

Box Irrigation – Phillip Box
Tucumcari, NM ..... Field Day Meal

Canadian River SWCD – Tommy Wallace
Tucumcari, NM ..... Field Day Meal

Citizen's Bank – Cooper Glover
Tucumcari, NM ..... Field Day Meal

Kristi Schraufnagel
Deer Creek Seed ..... 50 lbs. Austrian winter peas and inoculant

Dickinson Implement- Dwight Haller
Tucumcari, NM ..... Field Day Meal

Everyone's Federal Credit Union – Andi Baum
Tucumcari, NM ..... Field Day Meal

Farm Credit Services – Will Cantrell
Tucumcari, NM ..... Field Day Meal

Farmers' Electric Cooperative, Inc. – Lance Adkins
Clovis, NM ..... Field Day Meal

First Title Service LLC – Rex & Cyndie Kirksey
Tucumcari, NM ..... Field Day Meal

Green Cover Seed Company
Bladen, NE .....5 lbs. of pre-inoculated Berseem clover seed

Plateau – Tom Phelps, CEO
Clovis, NM ..... Field Day Meal

Quay County Farmer's Union – Tim Clark
Tucumcari, NM ..... Field Day Meal

Surya N. Acharya – Agriculture and Agri-Food Canada
Lethbridge, Alberta, Canada……Perennial cereal rye seed

Tucumcari/Quay County Chamber of Commerce – Patsy Gresham
Tucumcari, NM ..... Bottled water for Field Day

Tucumcari Federal Savings & Loan – Bobby Alarcon
Tucumcari, NM ..... Field Day Meal

Tucumcari General Insurance – C.J. Wiegel
Tucumcari, NM ..... Field Day Meal

Watkins Products – Kathleen Box
Tucumcari, NM ..... Field Day Meal

Wells Fargo Bank NA – Cindy Lingle
Tucumcari, NM ..... Field Day Meal

Introduction

The New Mexico State University Agricultural Science Center at Tucumcari is located on U.S. Highway 54 three miles northeast of Tucumcari and Interstate 40, Exit 333. The center consists of 464 acres, with 170.9 acres having Arch Hurley Conservancy District water rights. In operation since 1912, the center is New Mexico State University's oldest continuously operating off-campus research facility. Home of the annual Tucumcari Bull Test, which helps producers improve their beef herds, the center's mission also includes developing forage and grazing systems for irrigated lands in the western USA and the evaluation of crops and cropping systems for local adaptation. Prior to conducting research in irrigated agriculture, the center evaluated dryland cropping systems and trees for windbreak and farmstead plantings The tree research led to the establishment of over 50 species of trees and shrubs on the center grounds, making it an oasis of trees in a sea of native grassland.

Significant events at the Agricultural Science Center in 2014 included: (1) the hiring of Murali Darapuneni, PhD, as an Assistant Professor in the Plant and Environmental Sciences Department to work on semiarid cropping issues including limited irrigation and dryland production and (2) completion of the first Tucumcari Bull Test with enlarged pens. These and other activities hosted or participated in by the staff at the Agricultural Science Center at Tucumcari are described in this publication along with the ongoing projects.

Outreach Events, Productivity and Activities

Bull Performance Testing

The 53rd Annual Tucumcari Bull Test ended with the Performance Tested Bull Sale at the center on Saturday, March 8th, 2014. This was the first test using pens that were expanded the previous summer. The 37 bulls completing the test gained an average of 3.12 pounds per day and represented three breeds (Angus, Charolais, and Hereford) entered by 9 cooperators. Average sale price was $3216 ($2490 for Herefords, $3100 for Charolais, and $3369 for Angus), with a range of $2300 to $4300. The sale also included 45 registered and commercial yearling heifers.

The 2014-15 Tucumcari Bull Test began on October 25th, 2014, with the delivery of 107 bulls representing the same three breeds entered by 13 cooperators. The test will conclude with the Annual Performance Tested Bull Sale on Saturday, March 8, 2014. Information on the bull testing program is available from the NMSU Cooperative Extension Service's Bull Session publication, on the Internet (http://aces.nmsu.edu/beefperformancetest), and from Dr. Marcy Ward.

Field Day

The center hosted its Annual Field Day on August 7th, 2014. The program, held in the Bull Test Sale Barn for the first time, included dinner catered by Del's Restaurant, preceded by a presentation by NMSU President, Dr. Garrey Carruthers, who was introduced by Dr. Dave Thompson, Associate Dean of the College of Agricultural, Consumer and Environmental Sciences and Director of the Agricultural Experiment Station. The University Provost, Dr. Dan Howard also was in attendance.

The field tour was cancelled and presentations inside were precluded by the sound of rain on the tin roof. Presentations would have been made by:

- Leah Schmitz, M.S. graduate student in the Animal and Range Sciences Department, on the heifer development grazing studies (articles on page 20 and 23 with a cover photo);
- Dr. Jane Breen-Pierce, Entomologist in the Extension Plant Sciences Department, regarding glandless cotton (cotton performance report on page 40);
- Dr. Murali Darapuneni, Assistant Professor in the Plant and Environmental Sciences Department, located at the Agricultural Science Center, on dryland cropping (page 35); and
- Leonard Lauriault, regarding ongoing alfalfa research (multiple articles contained herein).

Dinner and refreshments were sponsored by the local businesses listed on page iii and despite the rain, attendees lingered in the Bull Test Sale Barn and enjoyed the sound of the rain on the tin roof.

Other Public Programs

In addition to the Field Day, the center hosted other activities described below.

Over 90 students and 15 adults from 21 school districts throughout eastern and central New Mexico participated in the 2014 Tucumcari Invitation FFA Livestock Judging Evaluation at the center on March 22nd. Leonard Lauriault assisted with that program as a Tucumcari FFA parent.

The center also hosted a Quay County Fair steer and heifer tagging day on March 28th.

An Earth Day community service project was held on April 24th for members of Tucumcari High School Class of 2014. The center also remained open for tours of the Eastern New Mexico Outdoor Arboretum. More details about these activities are given elsewhere in this report.

The center hosted a Farm Day event for the Tucumcari Elementary School fourth and fifth grades on September 25th. Presentations topics included:

- Types of farm equipment (Jason Box, Farm Manager at the Agricultural Science Center)
- 4-H (T.J. Riddle, 4-H Sponsor/Volunteer)
- Chickens (Relissa Nials, NRCS)
- Animal feedstuffs (Jason Lamb, Quay County Cooperative Extension Service)
- Soil texture classes (Murali Darapuneni, Assistant Professor at the Agricultural Science Center)
- Salt cedar beetles and other biological controls (Leonard Lauriault)

Quay County Cotton Boll Weevil Control District

The Agricultural Science Center at Tucumcari continued to assist the Quay County Cotton Boll Weevil Control District (QCCBWCD) with its activities in 2014. While about 1500 acres of cotton were planted in Quay County, hail storms in early June destroyed all fields. Only about 163 acres were replanted and. Jason Lamb, Quay County Cooperative Extension Service Agent for Agriculture, scouted for boll weevil and pink bollworm using traps. Activities by QCCBWCD were mostly limited to maintaining an active organization so as to maintain a record of boll weevil activity in the area, in preparation for future cotton production in the area.

Advisory Committee

The Advisory Committee to the Agricultural Science Center at Tucumcari March 21st, 2014. Minutes of the meeting are available upon request at the center's office.

At that meeting, Dr. Steve Loring, Associate Director of the Agricultural Experiment Station and Chair of the Semiarid Cropping Systems Faculty Search Committee gave an update on the search. Leonard Lauriault gave an update on the wastewater reuse project, current research projects at the center, and the enhancement initiative, including the $75,000 in Capital Outlay funding secured by District 67 Rep. Dennis Roch. Dr. Loring, on behalf of Dr. David Thompson, Associate Dean and Director of the Agricultural Experiment Station (AES), thanked the committee for their legislative support. As usual, AES did not get all that it asked for, but more funding was received.

Personnel and Facilities

Personnel

Although it was not mentioned in the 2013 report, Calvin Henson resigned as Laborer, Sr. effective December 1st, 2013. The position was advertised and Jared Jennings was the successful candidate and resigned as Laborer with a seamless transition to Laborer, Sr. on January 28th, 2014. Due to these transitions, funding became available to upgrade the Laborer position to a Laborer, Sr. level and Hubert Eugene "Geno" Roberts began on April 10th, 2014, in that position.

After screening a pool of 24 mostly qualified applicants, Murali Darapuneni was hired as an Assistant Professor in the Plant and Environmental Sciences Department to conduct semiarid cropping systems research at the Agricultural Science Center. He reported for work on July 16th, 2014. Dr. Darapuneni had

received his M.S. from West Texas A&M, Canyon, TX, and his PhD from Texas A&M, College Station, TX, and was in a post-doctoral position at the University of Nebraska when he was hired.

A list of temporary employees at the center in 2014 is shown below:

Name	Job Title	Dates of Employment
Alice Johnson	Custodian	01/01/2014 – 12/31/2014
Ashley Brown	Laborer	06/16/2014 – 06/30/2014

Several College of Agricultural, Consumer and Environmental Sciences personnel from other locations worked cooperatively with staff at the Tucumcari center in 2014. These individuals included: Sangu Angadi, Jamshid Ashigh, Sultan Begna, Jane Breen-Pierce, Owen Burney, Shad Cox, Tom Dominguez, David DuBois, Manny Encinias, Robert Flynn, Tessa Grasswitz, Kulbhushan Grover, Steve Guldan, Paul Gutierrez, Robert Hagevoort, Mike Hubbert, John Idowu, Jason Lamb, Bernd Leinauer, Clint Loest, Steve Loring, Mark Marsalis, John Mexal, Mick O'Neill, Curtis Owen, Chris Pierce, Tom Place, Gino Picchioni, Rich Pratt, Naveen Puppala, Ian Ray, Aaron Scott, Eric Scholljegerdes, Brian Schutte, Manoj Shukla, Angela Simental, Sergio Soto-Navarro, Carol Sutherland, Dave Thompson, April Ulery, Marcy Ward, Shengrui Yao, and Jinfa Zhang.

Individuals from outside the NMSU College of Agricultural, Consumer and Environmental Sciences, who worked cooperatively with center staff in 2013 were:

USA:
City of Tucumcari: Jared Langenegger, Doug Powers, City Commission, and Calvin Henson
NMDA: Cary Hamilton
Quay County Government: County Commission, Larry Moore, and Richard Primrose
Quay County Sun: Thomas Garcia and Steve Hansen
Tucumcari Public Schools: Christina Fleming and Tonya Hodges
Missouri Botanical Garden, Saint Louis: Jennifer Kleeschulte
Texas AgriLife Research and Extension: Jerry Michels (Amarillo), G. Ray Smith (Overton), and Calvin Trostle (Lubbock)
Texas Boll Weevil Eradication Foundation: Lyn Vandiver
University of Nebraska, Scottsbluff: Gary Hergert and Cody Creech
University of Wisconsin – Madison: Francisco Contreras-Govea
USDA: Kenneth Alcon (NRCS, Las Vegas, NM) N.A. Cole and Prasanna Gowda (ARS, Bushland, TX), David Dreesen (NRCS PMC Los Lunas, NM), Aaron Miller (APHIS, Abilene, TX), and Blair Waldron (ARS, Logan, UT)
West Texas A&M University, Canyon: Bob Stewart

Italy:
University of Padova, Legnaro, Padova, Italy: Stefano Macolino, Filippo Rimi, and Umberto Ziliotto

Mexico
INIFAP, Sonora: Alejandro Suárez and Luis Tamayo
SENASICA: Mexico City: Gustavo Torres
Universidad Autónoma de Baja California: Leonel Avendaño-Reyes, David Calderon-Mendoza, Francisco Loya-Olguín, and Rafael Villa-Angulo

Pakistan:
University of Agriculture, Faisalabad: Muhammad Ibrahim, Muhammad Ayub, Muhammad Mudassar Maqbool, Sajid Mahmood Nadeem, Tanveer ul Haq,and Safdar Hussain
University College of Agriculture, University of Sargodha, Sargodha: Amjed Ali

Buildings, Grounds, and Facilities

The Eastern New Mexico Outdoor Arboretum at the Agricultural Science Center at Tucumcari remained relatively unchanged in 2014. Several older trees, including nearly all of the ponderosa pines; several Siberian elms, Austrian pines, Rocky Mountain junipers, and Arizona cypresses; most of the eastern redcedar windbreak west of the superintendent's residence, and the hackberry in front of the superintendent's residence had perished due to drought, insect infestation, and disease. These were

removed during the first quarter of 2014 and stored at the brush dump for firewood cutting. Once that removal project is complete, future plantings will be evaluated in light of current and future needs at the center. The honeylocust in the right-of-way on the north side of US 54 that was saved from removal New Mexico Highway and Transportation Department and trimmed of dead limbs by center staff in 2013 filled in fairly well in 2014.

For the Earth Day community service project on April 24th, the Tucumcari High School Seniors cleaned out the flower beds in front of the office, removed dead material from the pollinator project, and picked up trash along both sides of the center's road frontage on US 54.

Other alterations and improvements to the grounds and facilities included replacement of the transformer and installation of an electrical plug for electric fencing and maintenance operations at the holding pond for the west center pivot, rebuilding gates and removal of additional concrete irrigation ditching and a livestock drinker from the field along US 54 on the west side of the driveway, removing a portion of the old concrete irrigation pipeline at the North Farm, removing a concrete barbecue pit and pond from the old orchard behind the superintendent's residence to reduce mosquito habitat, and constructing additional steps for use on wagon tours in addition to the tree removal and trimming, in addition to the Bull Test pen expansion already described.

Irrigation Water

The annual Arch Hurley Conservancy District assessment for 2014 was $12.00 per water right acre. The total allocation for 2014 was 15 in/ac, or 213.63 acre-feet for the center, 76.78 acre-feet of which was delivered at $10/acre-foot. Water was first released into the canal on April 22nd and turned off on November 3rd. The center retained a credit of $519.26 for pre-paid water from previous years.

Delivery of treated wastewater from the City of Tucumcari Wastewater Treatment Facility for irrigation was continuous in 2014 and total of 131.9 acre-feet were applied from January through December through the three center pivots. The total amount paid by the center to the City for that water was $15,896.28, including $9,000 for the water and $6,896.28 in electricity for pumping and labor to read the meters. Net returns from commercial hay production in 2014 that was possible due to the availability of this water was sufficient to cover the cost of this water. Every six months a semi-annual report is submitted to NMED showing monthly water use, meter inspection, and amount of nitrogen applied to the water use area.

Sustainability and Environmental Stewardship

Continuing with sustainability through recycling in 2014, staff at the Agricultural Science Center at Tucumcari recycled 96.6 lb plastic; 140 lb tin cans; 109.2 lb glass; 39 ink or toner cartridges; 7 CFL's; and 590.6 lb paper and other fiber products. Purchased paper totaled 249 lb for 2014. Additionally, 33 gal of petroleum lubricants (motor oil, transmission fluid, and hydraulic fluid) were recycled, while 60 gal were purchased.

Productivity

Peer Reviewed Journal Articles

Darapuneni, M. K., Morgan, G., Ibrahim, A., Duncan, R., Bean, B., Grichar, J., et al. (2014). The evaluation of cool-season crops for yield and adaptation in Texas: An approach for selection of efficient biofuel feedstock. *International Journal of Agronomy and Agricultural Research, 5*, 62-74.

Darapuneni, M. K., Morgan, G. D., Ibrahim, A. M.H., Duncan, R. W. (2014). Evaluation of flax genotypes for cold tolerance in Southeast Texas. *Journal of Agronomy and Crop Science*, DOI: 10.1111/jac.12097.

Ibrahim, M., Ayub, M., Maqbool, M. M., Nadeem, S. M., ul Haq, T., Hussain, S., Ali, A., **Lauriault, L. M.*** (2014). Forage yield components of irrigated maize-legume mixtures at varied seed ratios. *Field Crops Research, 169*, 140-144.

Rimi, F., Macolino, S., Leinauer, B., **Lauriault, L. M.**, Ziliotto, U. (2014). Fall dormancy and harvest stage effects on alfalfa persistence and characteristic of taproot and crown. *Agronomy Journal, 106*, 1258-1266.

Conference Proceedings and Abstracts

Lauriault, L. M. (2014). *Experiences (and some speculation) about biological control of field bindweed in New Mexico*. Obregon, Sonora: Junta Local de Sanidad Vegetal of Yaqui Valley. http://www.jlsvyaqui.org.mx/MemoriasSimposio.htm

Schmidtz, L., Scholljegerdes, E. J., **Lauriault, L. M.**, et al. (2014). In Shad Cox and Eric Scholljegerdes (Ed.), *Evaluating the use of irrigated annual forages in the pre- and post-breeding period for replacement beef heifers* (pp. 37-39). Corona, NM: Corona Range and Livestock Research Center.

Lauriault, L. M. (2014). *Abstract - Alfalfa planting date effects*. Madison, WI: CSSA. https://scisoc.confex.com/scisoc/wscs2014/webprogram/Paper85399.html

Experiment Station Publications

Lauriault, L. M., Ray, I., Pierce, C., Burney, O., Flynn, R. P., Marsalis, M. A., O'Neill, M. K., Owen, C. *The 2014 New Mexico Alfalfa Variety Test Report*. Las Cruces, NM: Agricultural Experiment Station and Cooperative Extension Service, New Mexico State University. http://aces.nmsu.edu/pubs/variety_trials/2013AlfalfaVarietyReport.pdf

Marsalis, M. A., Flynn, R. P., **Lauriault, L. M.**, Mesbah, A., O'Neill, M. K. (2014). *New Mexico 2013 corn and sorghum performance tests*. Las Cruces, NM: Agricultural Experiment Station and Cooperative Extension Service, New Mexico State University. http://aces.nmsu.edu/pubs/variety_trials/13CornSorghum.pdf

Extension Publications

Marsalis, M. A., **Lauriault, L. M.** (2014). Forage research program update - Pushing on. In Mark Marsalis (Ed.), *Alfalfa Market News* (1st ed., vol. 133). Las Cruces, NM: Agricultural Experiment Station and Cooperative Extension Service, New Mexico State University. http://aces.nmsu.edu/pubs/haymarketreports/docs/2014/May_2014.pdf

Ashigh, J., **Lauriault, L. M.**, Marsalis, M. A., Schutte, B. J., Hamilton, C. (2014). *Guide A-340, Integrated weed management in irrigated permanent grass pastures and hayfields in New Mexico*. Las Cruces, NM: Agricultural Experiment Station and Cooperative Extension Service, New Mexico State University. http://aces.nmsu.edu/pubs/_a/A340.pdf

Press Releases and Newspaper Articles

Simental, A., Leinauer, B., Sevostianova, E., **Lauriault, L. M.** (2014). *Is effluent water the future? NMSU scientists invited to discuss issue in Rome*. Las Cruces, NM: New Mexico State University Communications and Marketing. ttp://newscenter.nmsu.edu/Articles/view/10830/is-effluent-water-the-future-nmsu-scientists-invited-to-discuss-issue-in-rome (quotes from a previous press release were reused in this article (December 16, 2014).

Fox, D., **Lauriault, L. M.** (2014). *Roundup Ready Alfalfa Cross Pollination is a Concern* (pp. 3). Los Lunas, NM: News-Bulletin (August 6, 2014).

Fox, D., **Lauriault, L. M.** (2014). *Roundup Ready Alfalfa* (pp. 4). Los Lunas, NM: News-Bulletin. http://www.news-bulletin.com/2014/07/30/news/roundup-ready-alfalfa-2.html (July 30, 2014).

Fox, D., **Lauriault, L. M.** (2014). *Roundup Ready Alfalfa* (pp. 4). Los Lunas, NM: News-Bulletin. http://www.news-bulletin.com/2014/07/23/news/roundup-ready-alfalfa.html (July 23, 2014).

Garcia, T., **Lauriault, L. M.** (2014). *Storms bring hail, rain* (pp. 1, 5). Tucumcari, NM: Quay County Sun (June 11, 2014).

Hansen, S., **Darapuneni, M. K.** (2014). *Semi-arid cropping specialist joins Ag center staff*. Tucumcari, New Mexico: Quay County Sun (September 24, 2014).

Hansen, S., **Lauriault, L. M.** (2014). *Rainfall benefits county*. Tucumcari, NM: Quay County Sun (May 28, 2014).

Simental, A., **Lauriault, L. M.** (2014). *Tortoise keeper's interest in teff hay sparks interest for future NMSU research* (pp. C-2). Las Cruces, NM: Las Cruces Sun News (May 11, 2014).

Holin, F., Marsalis, M. A., **Lauriault, L. M.**, Mussi, N. (2014). *Teff delivers market flexibility* (pp. 16-18). Minneapolis, MN: Hay and Forage Grower (March 2014).

Other Publications

Lauriault, L. M. (2014). In Joanie Quinn (Ed.), *Managing Nitrates and Prussic Acid in Frosted Sorghum Forages* (9th ed., vol. 14, pp. page 7). Las Cruces, NM: New Mexico Department of Agriculture Organic Program (December 2014).

Lauriault, L. M. (2014). *Fall/winter harvest/grazing management of sorghum forages*. Self-published email (October 21, 2014).

Lauriault, L. M. (2014). *What I learned at the World Dairy Expo and another event in Madison, Wisconsin*. Self-published email (October 2, 2014).

Lauriault, L. M. (2014). *What I learned at the Western Society of Crop Science meeting this week*. Self-published email (July 7, 2014).

Presentations at Public Conferences or Meetings

Lauriault, L. M., Angadi, S., Grover, K., 6th Annual Northeastern New Mexico Prairie Partners Meeting, El Llano Estacado RC&D, Tucumcari, "New and Alternative Crops for Northeastern New Mexico", Invited. (December 3, 2014).

Lauriault, L. M., Forage Growers Workshop, NMSU Valencia County Cooperative Extension Service, Los Lunas, "Using Gall Mites for Field Bindweed Control in Pastures and Other Forage Crops", Invited. (December 2, 2014).

Darapuneni, M. K., ASA, CSSA, SSSA Annual Meeting, Long Beach, "Effect of precipitated calcium carbonate on soil characteristics and sugarbeet yield and quality", (November 4, 2014).

Lauriault, L. M., Employee protection from chemical exposure, Tucumcari Municipal Schools, Tucumcari, NM, "Employee protection from chemical exposure", Invited. (October 10, 2014).

Darapuneni, M. K., Farm Day for Tucumcari's 4th & 5th Graders, NMSU Agricultural Science Center, Tucumcari, NM, "Soil texture classes", (September 25, 2014).

Lauriault, L. M., Farm Day for Tucumcari's 4th & 5th Graders, NMSU Agricultural Science Center, Tucumcari, NM, "Biological controls for bindweed and saltcedar", (September 25, 2014).

Lauriault, L. M., Symposium on Integrated Pest Management of Field Bindweed in the Yaqui Valley, Local Board of Yaqui Valley Plant Health, Cd. Obregon, Sonora, Mexico, "Experiences (and Some Speculation) about Biological Control of Field Bindweed in New Mexico", Invited. (September 23, 2014).

Lauriault, L. M., New Mexico Pueblo and Community Agriculture Conference, NM CES, USDA, Santa Fe, "Forage Production", Invited. (August 15, 2014).

Darapuneni, M. K., Field Day, NMSU Agricultural Science Center, Tucumcari, NM, "The importance of semiarid cropping systems", (August 7, 2014).

Lauriault, L. M., Field Day, NMSU Agricultural Science Center, Tucumcari, NM, "Alfalfa research in the Tucumcari Irrigation Project", (August 7, 2014).

Lauriault, L. M., Field Day, NMSU Agricultural Science Center, Tucumcari, NM, "Welcome and Announcements", (August 7, 2014).

Lauriault, L. M., Field Day, NMSU Agricultural Science Center, Farmington, NM, "Alfalfa variety selection, planting dates, and irrigation", Invited. (July 25, 2014).

Schmitz, L., Scholljegerdes, E. J., **Lauriault, L. M.** (Poster), 4th Triennial Research Field Day, Corona Range and Livestock Research Center, Corona, NM, "Evaluating the use of irrigated annual forages in the pre- and post-breeding period for replacement beef heifers", published in proceedings. (July 19, 2014).

Lauriault, L. M., Annual Meeting of the Western Society of Crop Science, Western Society of Crop Science, Bozeman, MT, "Alfalfa planting date effects", published in proceedings. (July 8, 2014).

Lauriault, L. M., Bindweed mite workshop, Socorro County Cooperative Extension Service, Socorro, NM, "Got Bindweed?", Scope: Regional, Invited or Accepted? Invited. (May 8, 2014).

Lauriault, L. M., Guadalupe County Soil and Water Conservation District Annual Meeting, Guadalupe County Soil and Water Conservation District, Santa Rosa, NM, "Basic Alfalfa Management for the Upper to Middle Pecos River Valley in New Mexico", Invited. (March 19, 2014).

Lauriault, L. M., Marsalis, M. A., NM Organic Farming Conference, NMDA/NM Farm to Table/NMSU CES, Albuquerque, NM, "Teff management options for organic farmers", Invited. (February 14, 2014).

Lauriault, L. M., 4th Annual Forage Growers' Workshop, NMSU CES/Small Farm and Ranch Task Force, Los Lunas, "Irrigated cool-season pasture management", Invited. (January 31, 2014).

Grant and Contracts

Funded: None

Not Funded

Darapuneni, M. K. (Principal), Angadi, S. (Co-Principal), **Lauriault, L. M.** (Co-Principal), "Water Use Efficiency and Nitrogen Dynamics of Various Grain Legume Crops under Semi-Arid Environments", CGIAR Consortium Office, Research Credit: $5,068.55, PI Total Award: $101,371.00, (October 1, 2014).

Schutte, B. J. (Principal), Ashigh, J. (Co-Principal), Marsalis, M. A. (Co-Principal), Picchioni, G. (Co-Principal), **Lauriault, L. M.** (Co-Principal), "Determining Wastewater-Induced Changes in Vegetation to Improve Forage Crop Weed Management Strategies in the U.S. Southwest", USDA/NIFA/AFRI, Research Credit: $7,322.35, PI Total Award: $146,447.00, (July 1, 2014).

Pending: None

In development

Shukla, M. (Co-Principal), **Lauriault, L. M. (Co-Principal)**, **Darapuneni, M. K. (Co-Principal)**, Angadi, S. (Co-Principle), Picchioni, G. (Co-Principle), Schutte, B. (Co-Principle), Xu, P. (Co-Principle), Sims, G. (Co-Principle), Carroll, K. (Co-Principle), Ulery, A. (Co-Principle), Idowu, J. (Co-Principle), Grover, K. (Co-Principle), "Water conservation innovation for improving food security and ecosystem sustainability and diversity", EPSCoR Track II (to be submitted January 15, 2015).

Other

"Capital Outlay for Equipment Purchases," 2014 New Mexico Legislature (Rep. Dennis Roch), $75,000.00.

"Fee-based alfalfa variety testing, 2014," Multiple seed companies, $5,250.00, Description: Entry fees for alfalfa varieties planted in one year and compared for the next three years at various NMSU locations across the state.

"Fee-based cotton performance evaluations, 2014," Multiple seed companies, $750.00, Description: Entry fees for cotton cultivars compared in 2014 at Tucumcari.

"Fee-based sorghum grain and forage performance evaluations, 2014," Multiple seed companies, $1,495.00, Description: Entry fees for grain and forage sorghum hybrids compared in 2014 at Tucumcari.

"Invasiveness of Selected Brassicaceae Plants on Wastewater-Treated Rangelands in New Mexico: Is Sodium a Causal Element?," NMAES Rangeland Ecosystem Program, 2013, $13,000.00.

Other Activities

Murali Darapuneni

Visited ICRISAT, Hyderabad, Telangana, India, to establish collaboratons (December 4, 2014).

Made numerous contacts to develop collaboration with ARS-USDA, Bushland, Texas.

Leonard Lauriault

Responded to over 90 miscellaneous questions from New Mexico residents, including NMSU NRCS, and FSA personnel, as well as residents and extension personnel in other states.

Coordinated NMSU's statewide alfalfa variety testing program.

New Mexico Beef Cattle Performance Association. Assisted with the Tucumcari Bull Test weigh days and sale.

Continued program to distribute forage nitrate toxicity screening test kits to all interested AES and CES personnel in New Mexico.

Distributed bindweed gall mites as a biological control for field bindweed to interested parties throughout New Mexico.

Canadian River Soil and Water Conservation District: Attended and participated in monthly meetings whenever possible as an interested party; supervised maintenance and handled reservations for two seed drills and a tree-planter owned by the District for use by producers.
Reviewed manuscripts for: Agronomy Journal (1) and The Philippian Agricultural Scientist (1).
Set up booth display about the activities of the Agricultural Science Center at the Quay County Fair (Tucumcari, August 13-16, 2014), as well as at the center's Field Day.
Provided letter of support for Dr. Mark Murphy and Mr. Jack Chatfield regarding an NMED funding application for watershed-based non-point-source pollution planning the Eastern New Mexico Ute Watershed Authority and Canadian River Riparian Restoration Project. (June 4, 2014).
Member of Northeastern New Mexico Regional Water Plan Steering Committee.
Member of AOSCA C655.4 National Alfalfa & Misc. Legumes Review Board.
Member of Plant and Environmental Sciences Department and College of Agricultural, Consumer and Environmental Sciences Promotion and Tenure Committees.

Jason Box
Arch Hurley Conservancy District: Attended and participated in monthly meetings whenever possible as an interested party.
New Mexico Environmental Department: Maintained and submitted semi-annual reports for wastewater use at station including total water usage, nitrogen fertilizer applications, and septic tank conditions.

Professional Development Activities and Other Meetings Attended Not Previously Mentioned

Leonard Lauriault
Continuing Education, "6th Annual Northeastern New Mexico Prairie Partners Meeting", El Llano Estacado RC&D, Tucumcari, NM, USA (December 3, 2014).
Continuing Education, "Forage Growers Workshop", NMSU Valencia County Cooperative Extension Service, Los Lunas, NM, USA (December 2, 2014).
Continuing Education, "Mills Canyon Tour", Canadian River Soil and Water Conservation District and Canadian River Riparian Restoration Project, Mills Canyon, NM, USA (October 29, 2014).
Continuing Education, "Pesticide Applicator Workshop", NMSU Cooperative Extension Service, Tucumcari, NM, USA (October 15, 2014).
Continuing Education, "World Dairy Expo", Multiple, Madison, WI, USA (October 1, 2014).
Continuing Education, "Alforex Seed Product Announcement", Alforex Seeds, Madison, WI, USA (September 30, 2014 - October 1, 2014).
Continuing Education, "Field Day", NMSU Agricultural Science Center at Farmington, Farmington, NM, USA (July 24, 2014).
Continuing Education, "Southwest Hay and Forage Conference", New Mexico Hay Association, Ruidoso, NM, USA (January 16, 2014 - January 17, 2014).

Murali Darapuneni
Continuing Education, " Field Day", NMSU Agricultural Science Center at Artesia, Artesia, New Mexico, USA (September 11, 2014).

Jason Box
Continuing Education, "Amarillo Farm and Ranch Show", Amarillo, TX (December 2, 2014).
Continuing Education, "Southwest Turfgrass Conference", Albuquerque, NM (October 28-29, 2014).
Continuing Education, "Quay County Pesticide CEU Workshop", Tucumcari, NM, (October 15, 2014).
Continuing Education, "Panhandle Ranch Management", Amarillo, TX (August 18, 2014).
Continuing Education, "Texas Panhandle Scout School". Amarillo, TX (May 9, 2014).
Continuing Education, "Mesquite Management Webinar". Tucumcari, NM (April 3, 2014).
Continuing Education, "Ag Apps for Tablets and Smart Phones". Amarillo, TX (March 4, 2014).
Continuing Education, NM AgExpo. Portales, NM (February 18, 2014).
Continuing Education, "Llano Estacado Cotton Conference, Muleshoe, TX, (January 24, 2014).
Continuing Education, "High Plains Irrigation Conference". Amarillo, TX (January 16, 2014).
Continuing Education, "Texas Southern Panhandle Crop Clinic", Farwell, TX (January 9, 2014).

Memberships

Murali Darapuneni
Crop Science Society of America, Scope: International.
American Society of Agronomy, Scope: International.

Soil Science Society of America, Scope: International.
The Association of Agricultural Scientists of Indian Origin, Scope: International.

Leonard Lauriault
Western Society of Crop Science, Secretary-treasurer; President-elect; President; Past President, Scope: International
Crop Science Society of America, Scope: International.
American Society of Agronomy, Scope: International.
New Mexico Hay Association, Ex-officio Director, Scope: State.
American Forage and Grassland Council, Scope: National.

Certifications for All Faculty and Professional Staff:
HAZMAT, Troxler Electronic Laboratories, Inc. (Murali Darapuneni only).
Nuclear Gauge Safety Certification, Troxler Electronic Laboratories, Inc. (Murali Darapuneni only).
New Mexico Beef Quality Assurance Trained Producer, New Mexico Livestock Board.
Preparing Communities for Animal, Plant, and Food Incidents: An Introduction, National Center for Biomedical Research and Training Academy of Counter-Terrorist.
Certified Forage and Grassland Professional, American Forage and Grassland Council (through December 31, 2015; Leonard Lauriault only).
First Detector Certification, National Plant Diagnostic Network (Jason Box only).
Public Pesticide Applicator's License (Leonard Lauriault and Jason Box).
Private Pesticide Applicator's License for Rodent Control (Jason Box and Leonard Lauriault).
NMSU Assurance of Actual Training, IACUC.
Worker Protection Standard, Pesticide Handlers.
Forklift Certification, Farm Crew

Faculty and Staff Awards and Recognitions:
Shane Jennings: NMSU 5 Year Service Award (Anniversary: September 16, 2008; Recognized: April 11th, 2014).
Leonard Lauriault: Charles Tharp Farms Distinguished Service Award (Recognized: April 11, 2014).
Leonard Lauriault: Constancia por excelente exposicion, Junta Local de Sanidad Vegetal of Yaqui Valley, MX. For presentation about the field bindweed mite. (Recognized: September 23, 2014).

Annual Weather Summary

The first documented weather observations in the Tucumcari area were from a weather station near the Tucumcari Post Office. That station was operational from December 1904 through February 1913. The Agricultural Science Center at Tucumcari began recording daily precipitation in January 1912. Air temperatures were first recorded on May 26 of that year. The weather station at the center has remained in continuous operation since its establishment in 1912. An updated historical summary of weather observations at the Agricultural Science Center at Tucumcari was published as an Agricultural Experiment Station Research Report in early 2003. This report contains summary information relative to weather conditions at the center through 2002. The report is available from the Agricultural Science Center office or online at: http://aces.nmsu.edu/pubs/research/weather_climate/RR751.pdf.

In addition to the precipitation and weather records, the center has maintained records on wind movement since 1918. Above ground pan evaporation has been measured since 1953. Maximum and minimum soil temperatures, at a four-inch depth, have been recorded since 1977. Maximum and minimum water temperatures in the evaporation pan were first recorded in 1981.

Total precipitation for 2014 was 13.92 inches, 2.50 inches less than the long-term average of 16.42 inches (Table 1). There were above average amounts of precipitation recorded in 2014. Record high and low amounts of precipitation, by month, are shown in Table 2. No precipitation records were set in 2014.

The mean maximum temperature for 2014 was 71ºF, which 3ºF higher than the long-term average and was 7ºF less than 2012 when the record was set (Table 3). Mean monthly maximum temperatures were above normal for the months of January, March, April, May, August, October, and December. The monthly mean maximum temperatures for June and July tied the long-term averages. Mean minimum temperature for 2014 was 44ºF, which ties the long-term average of 44ºF. Mean monthly minimum temperatures were above normal for the months of June, August, September, and October. Mean minimum temperatures tied with the long term average for April, May, and December. The mean annual temperature for 2014 was 59ºF.

The lowest recorded temperature in 2014 of 4ºF was recorded on January 28th. The highest temperature, 105ºF, was recorded on July 1st. Highest and lowest recorded temperatures and mean temperature extremes are shown in Table 4. A record high was tied on July 1st. (105ºF). Record lows were recorded on November 17th. (9 ºF) and November 18th. (12ºF). A record low was tied on May 13th (35 ºF).

The last spring temperature of 32ºF in 2014 was recorded on April 15th (Table 5). The first temperature of 32ºF in fall was recorded on November 11th. Normal last spring and first fall freeze dates are April 4th and October 14th, respectively. The 2014 growing season was 210 days, 37 days longer than the long-term average of 173 days. The longest and shortest growing seasons on record are 222 and 136 days, which were recorded in 1989 and 1945, respectively.

The last snowfall in spring 2014 was recorded on April 14th. The first snowfall in winter 2014 was recorded on November 13th. Total snowfall in 2014 was 13.91 inches. The last snowfall in spring has occurred as late as May 18th in 1935 and 1980. The first snowfall in winter has been recorded as early as October 8th in 1970.

Summaries of pan evaporation and wind run at the center are shown in Table 6. Daily evaporation was near the long-term average, but somewhat less than recent years and season total was well below the record set in 2012 (91.48 inches). Wind speeds were above average, but well below the record of 7.7 mph set in 1918 (contrary to recent annual reports stating that this record had been broken). April and May were considerably windier than average. May was the windiest for that month since 1933 (7.9 mph), but well below the 1918 record of 10.0 mph.

Table 1. Summary of monthly precipitation amounts (inches) recorded at the NMSU Agricultural Science Center at Tucumcari, 1905-2014.

Month	2014	2013	2012	2011	2010	Average
January	0.01	0.40	0.00	0.00	0.99	0.38
February	0.03	0.88	0.22	0.39	0.96	0.49
March	0.22	0.00	0.09	0.73	1.27	0.77
April	0.21	0.01	0.18	0.10	0.63	1.14
May	2.42	0.82	1.51	0.03	0.30	1.94
June	4.00	1.13	0.93	0.18	1.26	1.97
July	2.54	1.23	0.33	1.42	3.93	2.72
August	0.82	0.92	0.97	1.21	2.42	2.80
September	2.73	4.28	1.42	2.71	0.93	1.62
October	0.19	0.26	0.38	0.81	0.94	1.32
November	0.37	0.43	0.00	0.01	0.12	0.66
December	0.38	0.11	0.50	1.81	0.27	0.61
Total	13.92	10.47	6.53	9.40	14.02	16.42

Table 2. Highest and lowest monthly precipitation amounts recorded at the NMSU Agricultural Science Center at Tucumcari 1905-2014.

Month	Maximum	Year	Minimum	Year
	(inches)		(inches)	
January	1.68	1999	0.00	2012
February	2.40	1912	0.00	2000
March	3.69	1919	0.00	2013
April	4.89	1997	0.00	1996
May	8.72	1921	0.00	1927
June	6.39	1919	0.00	1947
July	11.28	1950	0.24	1987
August	8.38	1933	0.12	1951
September	7.23	1941	0.00	1948
October	7.51	1923	0.00	1975
November	4.00	1905	0.00	2012
December	4.27	1959	0.00	1976
Total	70.44		0.36	

Note: Where minimum records are shared by more than one year, only the most recent year is listed.

Table 3. Summary of mean monthly temperatures at the NMSU Agricultural Science Center at Tucumcari , 1905-2014.

Date	2014	2013	2012	2011	2010	Average 1905-2014
			Mean Maximum Temperature (°F)			
January	56	52	60	57	57	52
February	56	57	57	55	46	57
March	66	57	71	70	62	64
April	75	71	81	77	75	73
May	82	81	86	84	78	81
June	91	96	98	99	97	91
July	93	94	97	101	93	93
August	93	95	96	100	94	92 *
September	82	85	88	86	92	85 *
October	79	74	75	77	78	75 **
November	61	60	70	64	65	62 **
December	55	51	58	45	60	53 *
Annual	71	73	78	76	75	68 **
			Mean Minimum Temperature (°F)			
January	22	24	28	22	22	24
February	26	28	29	23	23	27
March	32	31	39	35	34	33
April	42	38	48	42	45	42
May	51	52	55	47	49	51
June	62	64	65	64	66	61
July	64	66	69	68	67	65
August	64	66	66	67	65	63
September	58	61	57	55	60	56
October	47	42	44	41	47	44 *
November	30	34	36	32	32	33 *
December	25	24	27	24	31	25
Annual	44	44	47	43	45	44
			Mean Temperature (°F)			
January	39	38	44	39	39	38
February	42	43	43	39	35	42
March	49	44	55	53	48	49
April	58	54	64	60	60	57
May	66	66	70	65	63	66
June	76	80	82	81	82	75
July	79	80	83	85	80	79
August	79	80	81	84	79	77 *
September	70	73	72	70	76	70 *
October	63	58	59	59	63	60 **
November	45	47	53	48	49	47 **
December	40	38	43	35	45	39
Annual	59	58	62	60	60	58 *

Note: *Indicates 1 year of missing data
**Indicates 2 years of missing data
Some records from previous years have been corrected.

Table 4. Highest and lowest recorded temperatures (°F) and mean temperatures (°F), by month, at the NMSU Agricultural Science Center at Tucumcari, 1905-2014.

	Daily Record Extremes (1913-2014)				Monthly Mean Extremes (1905-2014)			
	Highest		Lowest		Highest		Lowest	
Month	Temp	Year	Temp	Year	Max	Year	Min	Year
January	80	1974	-22	1963	62	2006	12	1963
February	83	2002	-16	1933	67	1976	17	1929
March	92	1989	-3	1948	75	1974	24	1965
April	97	2012	12	1920	81	2012	37	1983
May	103	2000	25	1917	90	1996	46	1983
June	109	2013	37	1919	99	2011	55	1983
July	107	2011	52	1995	101	2011	61	1967
August	108	2007	49	1988	100	2011	57	1965
September	105	2011	30	1970	92	2010	51	2006
October	97	2000	12	1993	82	1979	39	2009
November	90	2006	-2	1976	71	1999	26	1929
December	82	1980	-18	1918	66	1980	17	1983
Annual					79	2011	41	1963

Note: Where records are shared by more than one year, only the most recent year is listed.

Table 5. Summary of last spring and first fall temperature of 32°F and 28°F and growing season at the NMSU Agricultural Science Center at Tucumcari 1913-2014.

						Average 1913-	Record Extremes			
	2014	2013	2012	2011	2010	2014	Earliest	Year	Latest	Year
32°F or less										
Last in Spring	15-Apr	24-Apr	4-Apr	2-May	8-Apr	29-Mar	24-Mar	1943	15-May	1945
First in Fall	11-Nov	19-Oct	27-Oct	18-Oct	28-Oct	7-Oct	17-Sep	1965	19-Nov	1989
Growing Season (Days)	210	169	207	169	203	192	136	1945	222	1989
28°F or less (Killing Frost)										
Last in Spring	15-Apr	3-May	4-Apr	2-May	25-Mar	4-Apr	6-Mar	1935	6-May	1917
First in Fall	11-Nov	6-Nov	27-Oct	18-Oct	2-Nov	17-Oct	8-Oct	1970	27-Nov	2001*
Number of Killing Frost Free Days	210	187	206	169	217	211	169	1917	256	2001

*Also in 1965 & 1923

Table 6. Summary of pan evaporation (inches) and wind run (average miles per hour) at the NMSU Agricultural Science Center at Tucumcari, 1918-2014.

	Pan Evaporation				Wind Run	
	2014		1953 - 2014		2014	1918-2014
Month	Total	Daily Average	Monthly Average	Daily Average	Daily Average	Daily Average
	……inches……				mph	mph
April	13.54	0.45	9.56	0.45	6.1	5.5
May	15.11	0.48	11.30	0.50	7.0	4.9
June	16.80	0.56	12.72	0.56	4.8	4.5
July	14.87	0.47	12.45	0.50	4.0	3.7
August	12.80	0.41	10.81	0.43	3.3	3.3
September	8.36	0.26	8.57	0.28	4.0	3.6
	81.48	0.44	65.21	0.45	4.87	4.25

Operational Revenues and Expenditures

The Agricultural Science Center at Tucumcari received $56,242 in operational funds in FY 2013-2014. (Table1). An additional $29,000.00 was received from the 2005 SB190. Carry-over funds from the previous year totaled $71, 784.00.

The center billed itself $29,333.00 for vehicle and equipment use based on established mileage rates and hourly charges for vehicles, tractors, and other equipment.

The alfalfa variety testing program generated $4,725.00, the sorghum variety test generated $1,890.00, and the cotton variety test generated $750.00 in FY 2013-2014.

The center's operational expenditures in fiscal year 2013-2014 totaled $152,121.00 (Table 1). Tractor and Vehicle use was the largest expenditure ($29,333.00). Although Tractor/Vehicle Use is in the expenditure category of Table 1, it is a revenue source for the Tractor/Vehicle Index (101507). The second largest expenditure was for Irrigation Services ($22,792.00), which included payments to the City of Tucumcari and the Arch Hurley Conservancy District. Furniture and repairs or upgrades. Equipment <$5,000 in the amount of $14,844.00 was the third largest expenditure of 2013-2014 (Table 1). Fuel and Lubricants totaled $10,841.00.

Expenditures for Non-office Supplies totaled $3,820.00 in FY 2013-2014, which was $4,651.00 lower than the previous year. Total for chemicals purchased is $8,320.00, which included $937.00 spent for herbicides, $6,639.00 for fertilizer, $610.00 for insecticides, $27.00 for pest control supplies, and $107.00 for adjuvants.

Major purchases during the 2013-2014 Fiscal Year include a computer for Leonard ($963.78), Tar River 60" rototiller ($2,095.95), a trencher attachment for the Bobcat ($2,095.95), a DR Chipper ($3,999.00). a Tar River 50" rototiller ($1,850.00), and a transformer and electrical outlet at the holding pond for the west center pivot ($1,729.83). Annual charge for the effluent treated wastewater, including electricity to deliver effluent wastewater and payment for a city meter reader totaled $14,931.02 while payments to the Arch Hurley Conservancy District for the annual assessment and water delivery totaled $2725.79. These major purchases are listed in Table 2.

The Hail Damage Index (113834 in Table 1) had little or no activity since its initiation in FY2007-08. Consequently, at the end of FY 2013-2014 its funds were distributed to another use by the University.

A Capital Outlay request of $175,000 to purchase a telehandler forklift, hay equipment, a rototiller, self-contained fuel tanks, and a limb chipper was made through Representative Dennis Roch. Of that, $75,000 was approved. The rototiller and limb chipper were purchased using other funds, as was a trencher attachment, which was included in a future priority. The fuel tanks were deemed to not be a high priority were removed from the list of priorities. These purchases will allow funds received from the 2014 Legislature to be utilized to acquire the higher priced forklift and/or hay equipment.

Table 1. NMSU Agricultural Science Center at Tucumcari, Approximate Expenditures by Index and Account Codes FY 2013-2014.

Item	Admin Plan 121851	Station Sales 120435	Forage Mgmt. 121771	Managing Change 121887	Tucumcari Pastures 123736	Tractor/ Vehicle 101507	Renewal & Replacement 107346	2005 Appropriation 121852	Field Day 902395	Irrigation 120592	Hail Damage 113834	Grand Total
REVENUE												
Appropriation	37,472		10,000	8,500			0	29,000				84,972
2012-2013 Carryover		7,518			47	14,605			1,458	307	47,849	71,783
Sales/Fees Generated		49,606			4,805	2,884				12,946		70,241
Private Gifts									1,525			1,525
Vehicle/Tractor Usage						30,083						30,083
Transfer of Funds												0
TOTAL REVENUES	37,472	57,124	10,000	8,500	4,852	47,572	0	29,000	2,983	13,253	47,849	258,604
EXPENDITURES												
Personnel												0
Temporary Salary	4,541							173				4,714
Fringes	790							30				820
TRAVEL	174	277	3,159		5.51	-176		1,035	62			4,536
Out of State/Local Seminar	55		380					192				627
SUPPLIES												
Automotive Supplies						620						620
Tires & Batteries						538						538
Fuels & Lubricants	76					10,642		123				10,841
Tractor/Hvy Equip. Supplies						338						338
Office Supplies	767		488					1,442				2,696
Computer Supplies			80									80
Non Office Supplies	15	746	273		50	89		2,253	380	15		3,820
Pest Control Supplies								27				27
Irrigation Supplies						56				192		248
Lab Supplies												0
Cleaning/Janitorial Supplies	21		54					95				170
Safety Supplies								274				274
Feed/Seed/Grain		3,697	123	274	243			266				4,603
Other Concentrate			8					99				107
Herbicide		338	29					570				937
Insecticide	402			84				124				610
Fertilizer		2,757	80		619			941				4,397
Business Meals/Food Items	17							206	254			476
Dues/Fees/Taxes		20	479	35		1,118		80		1,880		3,612
Books/Publications								29				29
Furn/Office Equip<=$5000	134		3,060	8,053		1,850		1,747				14,844
Small Tools	210	9	10					646				876
Bldg. Repair & Maint Parts												0

Table 1. (continued) NMSU Agricultural Science Center at Tucumcari, Approximate Expenditures by Index and Account Codes, FY 2013-2014.

Item	Admin Plan 121851	Station Sales 120435	Forage Mgmt. 121771	Managing Change 121887	Tucumcari Pastures 123736	Tractor/ Vehicle 101507	Renewal & Replacement 107346	2005 Appropriation 121852	Field Day 902395	Irrigation 120592	Hail Damage 113834	Grand Total
Painting Supplies												0
Plumbing Supplies	55				26			148				229
Scientific Equipment												0
Heating/Cooling Supplies								336				336
Equip. Repair/Maintenance	31					7,425		248		1,998		9,702
Electrical Supplies								13				13
Veh. Repair/Maint. Parts												0
Irrigation Supplies								18				18
TOTAL SUPPLIES & MATERIALS	7,288	7,843	8,223	8,446	943	22,499	0	11,115	695	4,085	0	71,137
												0
SERVICES												0
Postage	52	15	89	15	14			385				571
Telephone	966							360				1,327
Cellular Expense	875											875
Internet	1,292							431				1,723
Printing/Reproduction			180					160				340
Rental												0
Repair/Maint. Bldg												0
Repair/Maint.Equipment								217				217
Utilities - Electric	11,665							145		1,171		12,981
Utilities - Fuel	1,466							191				1,656
Trash Hauling	493											493
Catering									1,350			1,350
Advertising	212	116						303	340			970
Magazine Subscriptions	60											60
Sales Tax												0
Prof/Contract Services	435				22			532				989
Lab Analysis		1,985	39	**38.56**	112			18		45		2,236
Farm/Ranch Services					714							714
Tractor & Vehicle Usage	3,375	10,097	819					15,042				29,333
Irrigation Services	9,000	10,061	280		2,446			159		846		22,792
Freight		294	12			-14		44		19		354

Table 1. (continued) NMSU Agricultural Science Center at Tucumcari, Approximate Expenditures by Index and Account Codes, FY 2013-2014.

Item	Admin Plan 121851	Station Sales 120435	Forage Mgmt. 121771	Managing Change 121887	Clayton Pastures 123736	Tractor/ Vehicle 101507	Renewal & Replacement 107346	2005 Appropriation 121852	Field Day 902395	Irrigation 120592	Hail Damage 113834	Grand Total
UPS/FedEx								-183				-183
Computer Software	78		50					69				197
TOTAL SERVICES	29,968	22,567	1,469	54	3,307	-14	0	17,873	1,690	2,080	0	78,995
Equip. & Capital Outlay												0
Furn/Equip>$1000												0
TOTAL EQUIP. & CAP.												0
OUTLAY												0
TOTAL EXPENSES	37,256	30,410	9,692	8,500	4,251	22,485	0	28,988	2,385	6,165	0	150,132
ENDING BALANCE	216	26,713	308	0	601	25,087	0	12	598	7,088	47,849	108,472

Table 2. Listing of major purchases paid for during FY 2013-2014, NMSU Agricultural Science Center at Tucumcari.

Index	Description	Cost
101507	Wood Equipment 50" Tar River Rototiller	$1,850.00
121771	Wood Equipment 60" Tar River Rototiller	$2,095.95
121851	Arch Hurley Conservancy District Irrigation assessment, water delivery	$2,725.79
121851	City of Tucumcari Treated wastewater, electricity, meter reading	$14,931.02
121852	Ag Services Construction Inc. Transformer & electrical outlet at holding pond for west pivot	$1,729.83
121887	Attachments Direct Trencher attachment for the Bobcat	$4,050.00
121887	Proffit's Lawn & Leisure DR Chipper	$3,999.00
	Total	$31,381.59

Evaluation of Winter Pastures for Beef Heifer Development

Investigator(s):

E.J. Scholljegerdes[1], L. H. Schmitz[1], L.M. Lauriault[2], P.L. Cooksey[2], J. Box[2], C. Henson[2], J. Jennings[2], and S. Jennings[2]

[1]New Mexico State University, Department of Animal and Range Sciences, Las Cruces, NM 88003

[2]New Mexico State University, Agricultural Science Center at Tucumcari, NM 88401

Method(s):

During the winters of 2012-13 and 2013-14, triticale (avg 23.3% CP and 45.7% NDF, DM basis) was compared to supplemented rangeland (dormant perennial warm-season grasses (avg 8.8% CP, 69.9% NDF, DM basis) for winter pasture in a completely randomized design with two replicates to determine if the onset of puberty and initial breeding of beef heifers would be affected. Range pastures had not been grazed for several years. The triticale pastures were planted into a conventionally tilled seedbed on November 9, 2012, and October 1, 2013, and irrigated with treated municipal wastewater (Class 1B) applying 6.9 inches throughout the pre-grazing and grazing period of the first year and 15.2 inches in the second year. The triticale seeding rate was 100 lb/ac. Nitrogen (46 lb N/ac) was applied to the triticale pastures on December 5, 2012, to supplement 10 lb of soil residual N. In the second year, 52 lb N/ac were applied to supplement 30 lb/ac of residual N. Fertilizer applications were based on soil test recommendations.

Pastures were unequally sized by treatment (approximately 6 acres each for triticale and 13 to 40 acres for range). Consequently, animals were assigned to pastures by initial body weight (482 ± 50 lb in 2012 and 491 ± 38 lb in 2013) to provide for approximately 50% utilization during the anticipated grazing season (30 d in 2012-13 and 84 d in 2013-14). Three 16 ft^2 exclosures were uniformly distributed in each pasture prior to grazing. Grazing was initiated on February 13, 2013, and ended on March 20, 2013, for the first year and for the second year grazing took place from December 20, 2013, through March 14, 2014. Mineral (Hi-Pro Beef Range Mineral) was supplied *ad libitum* in all pastures and protein (Producers Pride 24% Protein Tub) was provided *ad libitum* in the range pastures. In the second year, minerals were supplemented with Sendero Range Beef Mineral in all pastures and Hi-Pro 20% Southwest Breeder cubes were used to supplement protein in the range pastures. In 2013-14, forage became limiting in both initial range pastures. Consequently, those animals were moved, one group in January and one in February, to other pastures with similar species composition.

Heifers were weighed before grazing began and every 28 days until grazing ended. Standing forage near each exclosure was hand-clipped to ground level coincidental to heifer weigh days. After grazing ended, standing forage within exclosures was clipped. Clipped material was collected and dried in a forced-air oven at 140°F for 48 hours to determine dry matter yield and held for subsequent nutrient value analysis.

After the conclusion of grazing each winter, heifers were transported to NMSU's Corona Range and Livestock Research Center for additional data collection and breeding. Heifers were synchronized on May 14, 2013, and May 16, 2014, and subjected to timed artificial insemination and immediately turned out with clean-up bulls for 60 days. After a breeding period from May 21 to June 20, 2013, and May 25 to June 24, 2014, and pregnancy testing, bred heifers were shipped back to Tucumcari and turned onto annual warm-season pastures for a study described in an article beginning on page 23 of this annual report.

Because of the change in range pastures in the second year and differences in the length of grazing seasons, forage yield data was not uniform enough for statistical analysis. Animal gain data were analyzed using SAS Proc MIXED to compare pasture type (triticale or range) and year, and their interaction. A $P < 0.05$ was considered significant and $0.05 < P < 0.10$ was considered a trend.

Results:

Data is presented in Table 1 and 2 for years one and two, respectively. Range pastures had been allowed to accumulate; however, due to the ongoing drought, initial availability was relatively low yet within the amount required not to limit forage intake as described by Allison (1985). In the first year of the study, initial heifer BW did not differ (P = 0.77). Similarly, final BW did not differ (P = 0.16) between the treatment groups. Average daily gain, did not differ between treatments (P = 0.21) despite the numerical differences between the two groups observed, with heifers in the triticale group having greater ADG compared to the rangeland treatment. This discrepancy in performance between treatments is likely due to the high variation in compressed block consumption between native range replicates (0.07 and 0.53 lb^{-1}•hd^{-1}•d^{-1}). Heifers in one pasture consumed 0.46 lb^{-1}•hd^{-1}•d^{-1} more protein supplement when compared to heifers assigned to the other native range pasture. Interestingly enough, these heifers also had the lowest utilization of available forages based on forage production of these pastures, determined by clippings taken at the beginning and end of the study. This contrasts results obtained by McCollum and Galyean (1985), who indicated that improved animal production may be the result of increased consumption of low-quality forage, as an effect of protein supplementation. However our results in this first year are similar to Rittenhouse et al. (1970), who reported that grazing responses to supplemental protein can be variable; however, in contrast to our study, they attributed this variation to forage quality and quantity. Additionally, we may be able to speculate that poor block consumption may have had an impact on animal performance, this being the reason that protein supplement source changed in yr 2.

The results of the second year were more closely aligned with original expectations. Heifer initial BW did not differ (P = 0.95). Final BW differed (P = 0.08), with heifers assigned to the triticale group weighing 69 lb more than those allocated to the native range pastures. Average daily gain was greater (P = 0.03) for triticale compared to heifers grazing native range plus supplement. These results are substantiated by reports (Smoliak and Slen, 1974; Hoveland et al., 1978; Wilkinson and Stuedemann, 1983; McCartney et al., 2008), that grazing annual forages offers producers the opportunity to improve animal gains relative to gains expected from cattle grazing dormant forages. Over the course of the two year study, first service conception rates did not differ (P = 0.91) and were 57.9 and 59.4% for native and triticale, respectively. Overall pregnancy rates tended (P = 0.09) to be greater for heifers grazing triticale (93.3%) when compared to heifers grazing native range (87.8%).

Annual forages are generally higher in quality when compared to native dormant forages (McCartor and Rouquettte, 1977), and may allow grazing heifers to overcome any deficiencies that may be experienced while grazing native forages. However, to adequately decide the best system for heifer growth, producers must determine the costs associated with grazing native pastures, supplements, and labor and compare that to the costs of producing irrigated annual forages. Likewise, one must consider the additional performance garnered by grazing annuals in the cost analysis (Table 3). We can see that, while triticale had greater input costs, additional gains of those heifers covered the initial cost. However, cost of planting and the potential of annual precipitation influence on native pasture forage quality as well as the amount of supplement needed can vary from year to year. Additionally, transportation costs may negate any cost advantages that annual forages provide, depending on proximity of the irrigated pastures. In order to obtain a better grasp on how using irrigated annual forages can fit into heifer management strategies, this experiment will be conducted over the next several years.

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Table 1. Effects of irrigated annual forage in comparison to native rangeland with the addition of supplement on body weight and average daily gain of beef heifers (yr. 1)

	Treatments			
Item	Native	Triticale	SEM[1]	*P*-value
BW, lb				
Initial	475	479	7.28	0.77
Final	484	502	2.72	0.16
ADG, lb/d				
Total	0.20	0.59	0.15	0.21

[2]n = 2 pastures per treatment

Table 2. Effects of irrigated annual forage in comparison to native rangeland with the addition of supplement on body weight and average daily gain of beef heifers (yr. 2)

	Treatments			
Item	Native	Triticale	SEM[1]	*P*-value
BW, lb				
Initial	491	491	4.40	0.95
Final	565	634	6.43	0.08
ADG, lb/d				
Total	0.92	1.67	0.08	0.03

[2]n = 2 pastures per treatment

Table 3. Sample cost analysis for native range and triticale pastures (yr 2)

Item	Native Range	Triticale
Cost, $		
Pasture (rental/input), $/hd[1]	21.00	36.00
Supplementation, $/hd	53.00	-
Transportation, $/hd	11.00	11.00
Total Cost, $$^{-1}$•pd^{-1}•hd^{-1}	85.00	47.00
Value Added, $		
Total Gain, lb	75	145
Market Price, $/lb	2.85	2.85
Added Value, $	213.00	414.00
Total Profit, $	128.00	367.00

[1]Pasture rental is calculated for the entire grazing period.

Evaluation of Summer Pastures for Bred Beef Heifer Development

Investigator(s):

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Method(s):

Sorghum x sudangrass (SxS) pasture was compared to pearl millet (PM) in a completely randomized design with two replicates in each of 2013 and 2014 to determine their relative effect (pasture type) on growth and development of bred beef heifers. Pastures were planted into a conventionally tilled seedbed on June 28, 2013, and June 16, 2014, and sprinkler-irrigated with treated municipal wastewater (Class 1B) applying 13.2 and 19.8 inches throughout the pre-grazing and grazing periods of 2013 and 2014, respectively. The seeding rate was 35 and 20 lb/ac for SxS and PM, respectively. Me-Too-Lachlor herbicide (1.33 pt/ac) was applied to the SxS pastures on July 10, 2013 and June 19, 2014, and Detonate herbicide (8 oz/ac) was applied to all pastures on July 23, 2013. Nitrogen was applied on July 16, 2013 (17 lb N/ac) to supplement 66 lb of residual soil N. In 2014, 26 lb N/ac was applied on July 11 to supplement 9 lb/ac of residual N. Phosphorus (19 lb P_2O_5/ac) also was applied that day. All fertilizer applications were based on soil test recommendations.

Pastures were of the same size each year (approximately 4.5 acres each) and three 16 ft^2 exclosures were uniformly distributed in each pasture prior to grazing. Six animals were assigned to each pasture by initial body weight (644 ± 59 lb in 2013 and 730 ± 92 lb in 2014) to have the same stocking density. Grazing was initiated on August 13, 2013, and September 10, 2014. Minerals (Hi-Pro Beef Range Mineral) were supplied *ad libitum* in each pasture. Every 28 days, heifers were weighed and standing forage was harvested near each exclosure leaving a 2-inch stubble using a self-propelled forage plot harvester equipped with a weighing system. After grazing was ended, standing forage within exclosures was harvested to estimate single-cut hay production in the absence of grazing. Since the SxS pastures had been sampled less than a week before grazing was terminated, no additional grazed sample was collected. A subsample of each harvested sample was collected and dried in a forced-air oven at 140°F for 48 hours to determine dry matter percentage and yield and held for subsequent nutrient value analysis.

Grazing of the SxS pasture ended on October 22, 2013, and November 11, 2014, due to anticipated hard freeze or frost, and those heifers were weighed and removed to a non-experimental pasture. Grazing was ended on the PM pasture on November 5, 2013, December 4, 2014, which were the next scheduled weigh days each year and because it was anticipated that forage would soon become limiting. Those heifers also were turned in to graze a non-experimental pasture. Data were analyzed using SAS Proc MIXED to compare pasture type (SxS or PM), measurement period, year, and their interactions. When differences were significant ($P < 0.05$) lsmeans were separated using least significant differences.

Results:

Data and results of statistical analyses including both years are presented in Table 1. The pasture type x year interaction was significant for grazed forage because SxS had higher initial yields than PM in 2014 (Table 1) and the rate of subsequent growth and removal by the animals was consistent across pasture types, measurement periods, and years, as indicated by a lack of significance for other interactions

involving measurement period. There was no difference in estimate single-cut hay yield, which averaged 9220 lb/ac across pasture types.

Season-long animal gains differed between pasture types with PM having higher gains than SxS. This partially due to the longer grazing season afforded by PM after the freeze (Table 1; grazing days were not statistically analyzed). There also was a trend ($0.05 < P < 0.10$) in season-long animal gain that may be attributable to a difference in forage quality between pasture types. In 2013, grazing was initiated barely 1.5 months after planting. At that time the PM was more finely-stemmed and leafier than the SxS, which was in the boot stage. Grazing would have kept the PM in a more vegetative state than the SxS. In 2014, grazing was initiated nearly 2.5 months after planting and both pasture types were much more mature and had begun seed production. Forage quality analysis had not been conducted on any samples at the time of this report.

Table 1. Forage yields (lb/ac) and animal gains (lb/d and lb/animal/yr) by measurement period or year (when the interaction of forage type with or year is significant)[1].

	Pasture Type	
Date	**Haygrazer**	**Millet**
Grazed forage yield, lb DM/ac (Pasture type x year, P < 0.0003)[2]		
2013	1790 C	1883 C
2014	8706 A	5013 B
Grazing days		
2013	70	84
2014	62	85
Season long gain, lb/animal/yr (Pasture type x year, P < 0.0556)		
2013	128 B	207 A
2014	116 B	131 B
Season long gain, lb/animal/yr (Pasture type, P < 0.0369)		
Mean	122 B	169 A

[1]lb, ac, d, yr, and DM signify pounds, acre, day, year, and dry matter, respectively.
[2]P-values indicate the probability that a difference does not exist between pasture types or within an interaction. That is, for P < 0.0003, there is less than a 0.03% chance that the pasture type x year interaction is not significant.
[3]Ungrazed forage yield was harvested when animals were removed from the pasture type and represents single-cut hay yield potential.

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Alfalfa Planting Date Evaluation

Investigator(s):

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Method(s):

The Advisory Committee to the Agricultural Science Center at Tucumcari requested an evaluation of the effects of earlier than recommended planting due to first delivery of water in mid- to late May and the availability of Roundup Ready® varieties as a summer weed control option during establishment. Consequently, WL 454HQ.RR alfalfa was planted on June 5 & 26, July 17, August 7 & 28, and September 18 in 2013 and 2014 in adjacent studies under the highway center pivot irrigation system, in the field fronting US 54. The test area (Redona/Canez fine sandy loam) was conventionally tilled and formed into a flat seedbed for each study. Plots were sown using a disk drill fitted with a seed-metering cone at 20 lb inoculated seed/acre in a Randomized Complete Block design with 3 replications. It was assumed that slight cultivation by the disks on the planter would be sufficient to freshen the seedbed on subsequent planting dates. After the first planting, irrigations with Class 1B treated municipal wastewater were applied approximately twice weekly to the test area, including plots not yet planted for a total of 28.8 inches in 2014, to supplement precipitation. On Feb. 12, 2014, 20 lb N and 94 lb P/ac were applied to the entire study area, including both tests.

Plots for the 2013 planting were 5 ft x 30 ft of which the center 5 ft x 25 ft were harvested for yield using a self-propelled forage plot harvester equipped with a weighing system. In 2014, plots were 5 ft x 20 ft of which the center 5 ft x 15 ft were harvested. For each study, in the seeding year, the first harvest was taken as soon as possible after 80 days after planting with any subsequent harvest approximately 35 days after that, unless that interfered with a 42 day rest period between planting and the anticipated first hard freeze (about November 5) to allow for root carbohydrate storage or it was estimated that yields did not produce feasibly harvestable hay yields. Harvest dates in the seedling year varied by treatment as did irrigation amounts after planting. Irrigation prior to planting was considered to have a negligible effect on establishment and yield as the oil was well-drained and maintained at field capacity. In the seeding year of each study, the first two planting dates were harvested twice, the middle two harvest dates were harvested once just prior to the anticipated hard freeze, and the last two planting dates fell within or past the recommended late summer/autumn planting window and were not harvested at all, which also is recommended to maintain topgrowth for winter protection. The 2013 planting was harvested on May 29, June 25, July 17, Aug. 14, Sep. 16, and Oct. 27 in 2014.

Total seeding year yields of both studies and first production year total annual yields and the two year total yields for the 2013 planting were subjected to SAS Mixed procedures for tests of significance and means separation using an alpha level of $P < 0.05$ when a significant difference was found.

Results:

Planting date rankings for first year yields were not different between the two studies leading to a nonsignificant year x date interaction (Table 1). In the first production year (2014) of the 2013 study, there was a stratification of yields forming two groupings of the first three and the second three planting dates such that, there was no difference between the June 5 & 26 and Aug. 7 planting dates, but there were yield reductions across each grouping (Table 1).

Table 1. Planting date effects on alfalfa yield (tons/acre) in the seeding and first production years at NMSU's Agricultural Science Center at Tucumcari.

	2013 Study			2014 Study
Planting date	**Seeding year**	**First production year**	**2-Yr total**	**Seeding year**
5-Jun	2.09 A	6.22 A	8.36 A	1.71 A
26-Jun	1.13 B	4.79 AB	5.96 B	1.63 A
17-Jul	0.53 BC	3.93 BC	4.50 BC	0.43 B
7-Aug	0.62 BC	4.90 AB	5.57 B	0.37 B
28-Aug	0.00 C	3.57 BC	3.61 BC	0.00 C
18-Sep	0.00 C	2.30 C	2.34 C	0.00 C
Prob>F	0.0002	0.0085	0.0027	0.0001

Yields within a column followed by the same letter are not significantly different based on the 5% LSD. The seeding year (2013 or 2014) x planting date interaction was not significant ($P < 0.2833$).

When comparing the first production year yield of June 5 planting date with those of the Aug. 28 planting date, which falls in the middle of the currently recommended planting window of mid-August to mid-September, there was a 2.65 ton/ac yield difference. For the 2-year total of the 2013 test, there was a 2.40 ton/ac difference between the earliest planting date (June 5) and the next highest numeric yield (June 26), which was significantly lower. The difference between the first planting date and the Aug. 28 planting date was a 4.75 ton/ac, which was numerically higher than the 2-year total yield of the Aug. 28 planting, which, as mentioned, falls in the middle of the currently recommended planting window for the region.

Consequently, producers could plant on June 5 instead of August 28 and harvest twice in the seeding year to increase yields in the first production year by nearly as much as the total for the Aug. 28 planting. Alternatively, if production costs for planting in early June are so high as to not be recovered by a nearly 3 ton/ac yield difference in the seeding year and first production year (June 5 2-year yield – Aug. 7 2-year yield in Table 1), planting could be done in early August with the opportunity to harvest higher yields than a later planting in the first production year to help recover establishment costs. If yields of an early August planting are not great enough to mechanically harvest in the seeding year, grazing would not be recommended; however, the stand could be harvested at first flower in the following spring rather than at 25% bloom as is recommended for later plantings.

Alfalfa Winter Irrigation Demonstration

Investigator(s):

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Method(s):

The Advisory Committee to the Agricultural Science Center at Tucumcari requested an evaluation of the effects of winter irrigation on alfalfa yields. Consequently, in an area of WL 454HQ.RR alfalfa established in late summer 2012 under the highway center pivot irrigation system, in the field fronting US 54. The test area (Canez fine sandy loam) was conventionally tilled and formed into a flat seedbed. The demonstration area included the entire inside span of the east half of the pivot (see the picture to the right, taken in late winter 2013-2014) with the outer half of that span irrigated throughout the winter when the ground was not frozen and the inner half irrigated only when water was available from the Arch Hurley Conservancy District (AHCD; April 22nd until Nov. 3rd). All irrigations were with Class 1B treated municipal wastewater applied approximately twice weekly. Note that when AHCD is referred from this point forward in this article as an irrigation scheduling treatment, it does not refer to the water source because treated municipal wastewater was always the source. Rather, it refers to the time period during which AHCD water is typically available. When approximately 30 inches of water had been applied to the winter irrigated portion, irrigation was terminated on the north half of the demonstration area. This occurred after the fourth harvest (Aug. 14; limited irrigation). The south half of the demonstration area continued to be irrigated with the inner part of the span terminated when water was no longer available from AHCD (full irrigation). Consequently, the fully winter-irrigated section received 36 inches of irrigation, while the limited winter irrigation, full AHCD, and limited AHCD received 31, 30, and 26 inches, respectively. On Feb. 12, 2014, 20 lb N and 94 lb P/ac were applied to the entire demonstration area.

Immediately prior to swathing the whole field, 3 replications (5 ft x measured length) were harvested from each of the four areas of the demonstration (Picture) for yield using a self-propelled forage plot harvester equipped with a weighing system. The harvest dates were May 29, June 25, July 17, Aug. 14, Sep. 16, and Oct. 27 in 2014. Drainage from upslope into the innermost portion of the span led to the exclusion of that area from measurements (Picture).

Individual harvest and total yield data were subjected to SAS Mixed procedures as a strip plot with 3 replications for tests of significance and means separation using an alpha level of $P < 0.05$ when a significant difference was found. Rep x treatment (winter irrigated or AHCD, full or limited irrigation) was

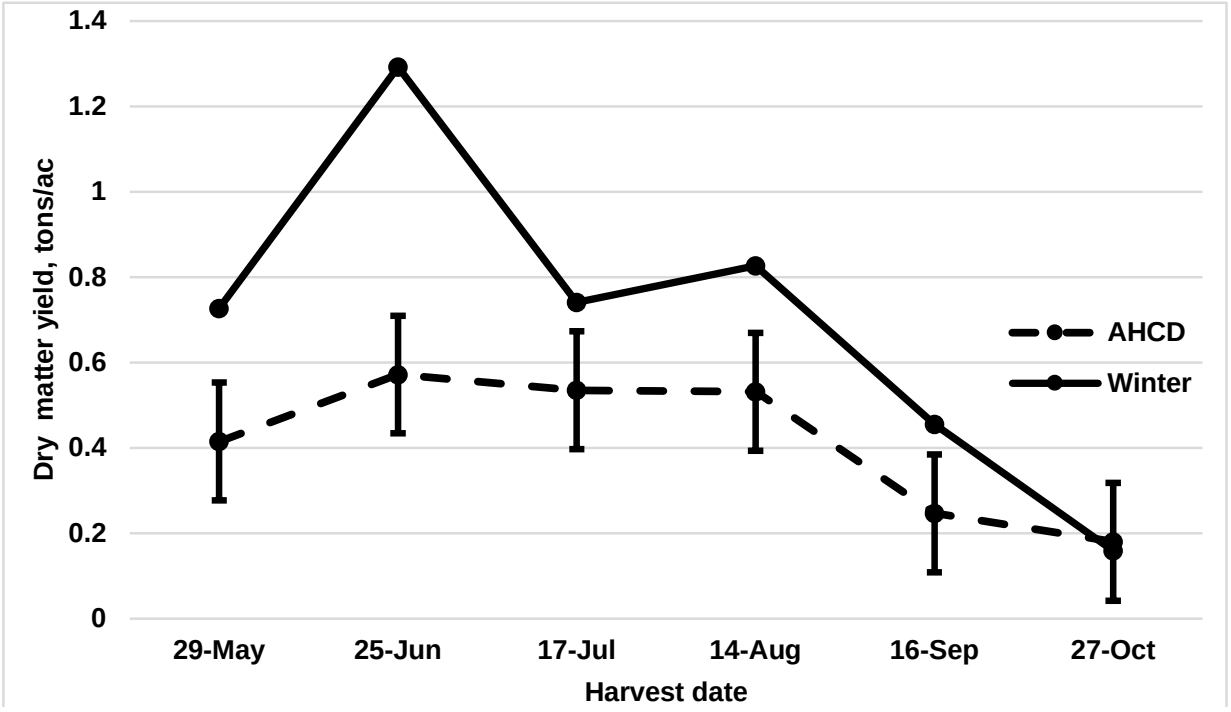
considered random and used as the denominator for tests of significance. Harvest data were evaluated as repeated measurements.

Results:

The main effect of irrigation schedule (winter vs. AHCD season) was significant for season total yield in 2014 (4.20 vs. 2.48 tons/ac, respectively) and the irrigation timing effect (season long vs. terminated after August 14) was significant (3.60 vs. 3.08 tons/ac, respectively), but the interaction between the two main effects was not (4.44, 3.95, 2.75, and 2.21 tons/ac for winter season long, winter terminated after August 14, AHCD season long, and AHCD terminated after August 14, respectively, $P < 0.8839$).

The irrigation schedule x harvest date interaction was significant because irrigating in winter increased yields over AHCD for every harvest except the final one (Fig. 1). Low first harvest and season long yields are attributed to the late summer seeding of a fall dormancy 7 alfalfa variety in this region (see the article on alfalfa planting dates beginning on page ?? of this annual report, which used the same variety).

Figure 1. The effect of irrigation schedule (winter: throughout the winter and either season long or terminated after August 14 vs. AHCD: only when canal water became available in the spring and either season long or terminated after August 14) on dry matter yields of alfalfa. Data are the lsmeans of 3 replicates within each of the four irrigation schedule x termination treatments. The irrigation schedule x harvest date interaction shown in this figure was significant at P < 0.0001. Bars indicate the 5% LSD value. When the bar does not cross both treatment yield lines, the yields for that harvest are different.



The irrigation timing (season long or terminated) x harvest date interaction was not significant, but there was a trend ($P < 0.0704$) such that yields were reduced for harvests taken after irrigation was terminated (data not shown).

Hence, it is beneficial to irrigate whenever possible and feasible throughout the winter using sprinkler irrigation and to not terminate irrigation. Therefore, if irrigation was available from the Arch Hurley Conservancy District in winter, producers should consider whether it would be more profitable to irrigate

fewer acres of alfalfa when the supply is limited, but available until the end of the growing season, or to fully irrigate more acres throughout the winter and terminate when the water is depleted, or irrigate more acres when only when water is traditionally available from the Arch Hurley C

Evaluation of Perennial Cereal Rye as Winter Forage in the Tucumcari Irrigation Project

Investigator(s):

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Method(s):

To evaluate local adaptation of perennial cereal rye (PCR) for grazing and hay in New Mexico, tests were planted in 2013 and 2014 at NMSU's Agricultural Science Centers at Tucumcari and Los Lunas. Due to low seed quality of the perennial cereal rye (15% germination), poor stands established at both locations and limited data were collected. After the 2013-14 winter growing season, the 2013 tests were abandoned and new tests were planted in 2014 using acceptable quality seed. Only information about the Tucumcari tests are presented in this report.

The test area for each study (Canez fine sandy loam) was conventionally tilled and formed into a flat seedbed under the sprinkler at the North Farm. Each test has a strip-split plot treatment arrangement with irrigation management (irrigated year round or minimally irrigated in winter and irrigation terminated in summer), harvest management (simulated grazing with multiple cuts, or single-cut hay at the boot stage), was the subplot, and cereal species (winter wheat, cereal rye, and triticale, all of which are annuals, and perennial cereal rye) as the sub-subplot in a randomized complete block design with 4 replications. Subplots (4 ft x 25 ft) were sown on October 25, 2013, and 4 ft x 20 ft in September 18, 2014, using a disk drill fitted with a seed-metering cone at 100 lb seed/acre. Before planting, the test area was irrigated with Class 1B treated municipal wastewater to bring it to field capacity and to facilitate land preparation. After planting, irrigations with the same water source were applied approximately twice weekly to the test area. In 2014, the 2013 planting received 17.0 inches after 10.5 inches had been applied from July through December 2013. The 2014 planting received 23.4 inches during the second half of the year. For the 2013 test, there had been 30 lb residual soil N/ac prior to planting. Another 62 lb N/ac was applied on March 17, 2014. The 2014 planting area had 36 lb residual soil N with no additional fertilizer applied in 2014. Fertilizer applications were based on soil test recommendations.

Harvests of the 2013 test subplots were taken by species when either the simulated grazing treatment reached 6 inches or the hay treatment was at the boot stage and 28 days later for both harvest management treatments, if there was sufficient regrowth. For each harvest, the center 4 ft x 20 ft was collected using a sickle-type, self-propelled forage plot harvester equipped with a weighing system. A subsample of harvested material from each plot was collected and dried to determine dry matter concentration and yield and then ground to pass a 1-mm screen for nutritive value analysis. After harvest, stand percentage as an estimate of planted row, was rated. Because the perennial cereal rye had a poor germination rate, yields were adjusted to estimate what might have been the case if the seed had been of suitable quality.

Unadjusted and adjusted dry matter yield and nutritive value data from the single-cut treatment of the 2013 test were analyzed using SAS Proc MIXED to compare cereal species and their interaction. When interactions were significant ($P < 0.05$) lsmeans were separated using least significant differences. Because the 2013 test was abandoned after the first winter growing season, irrigation treatments had not been applied. Consequently, there were 8 replications instead of 4.

No data was collected from the 2014 seeding in that year; however, all species established excellent stands and survived through the end of the year. There was significant predation of topgrowth by jackrabbits, deer, and geese throughout the winter.

Results:

Results of analysis of yield components are presented in Table 1. Harvest date (boot stage) varied widely among the entries. The timing for the annuals (rye, triticale, and wheat) was not surprising. The lateness of the perennial cereal rye (PCR) was not as expected since it is should be more closely related to the annual cereal rye. Stands of the perennial cereal rye averaged 75% fill of row (60% stand shown in the picture to the right), while the annuals were at or near 100%. The unadjusted and adjusted yields also were different. It was apparent that a poor choice of wheat variety was used. Consequently, a more suitable variety was used in the 2014 planting. Additionally, two different triticale varieties were used for the second planting.

Table 1. Yield components of cereal forages harvested at boot stage in 2014 at Tucumcari.

Cereal	Harvest date	Stand	Unadjusted yield	Adjusted yield	Dry matter
		%	lb/ac	lb/ac	%
PCR[1]	29-May	75 B	2339 B	2966 B	18.81 C
Rye	17-Apr	100 A	3719 A	3727 A	25.32 B
Triticale	7-May	100 A	3439 A	3447 AB	35.32 A
Wheat	14-May	96 A	1615 C	1697 C	33.78 A
Prob>F		0.0001	0.0001	0.0001	0.0001

[1]PCR signifies perennial cereal rye.

For nutritive value components (Table 2), PCR generally had higher crude protein and NDF digestibility, which may related to the lower lignin. Nonetheless, it was higher in ADF and NDF, which also impacted digestibility and energy. It also had higher ash content. Despite having slightly lower digestibility than the annual cereals, its digestibility is more than suitable for dairy quality forage at the boot stage.

With more uniform stands of all cereals established in late summer 2014, it is anticipated that the perennial cereal rye will be evaluated for suitability for grazing, initially using a simulated grazing harvest regime every 28 days, along with a determination of perenniality in the region

Table 2. Nutritive value components of cereal forages harvested at boot stage in 2014 at Tucumcari.

Cereal	Crude protein (CP)	Acid detergent fiber (ADF)	Neutral detergent fiber (NDF)	NDF digestibility (NDFD)	lignin	In vitro true dry matter digestibility (IVTDMD)	Total digestible nutrients (TDN)	Net energy for lactation (NE_l)	Ash
	%	%	%	% of NDF	%	%	%	Mcal/lb	%
PCR[1]	20.01 A	26.33 A	54.72 A	72.47 A	2.21 C	80.14 A	72.57 C	0.7534 C	6.29 A
Rye	19.13 AB	23.32 BC	49.95 C	67.84 B	2.50 B	80.97 A	75.98 AB	0.7914 AB	5.27 B
Triticale	18.16 B	24.44 B	52.37 B	63.84 C	3.23 A	78.17 B	74.69 B	0.7772 B	5.01 B
Wheat	15.43 C	22.74 C	48.44 C	63.34 C	2.37 C B	81.29 A	76.60 A	0.7987 A	4.63 B
Prob>F	0.0001	0.0001	0.0001	0.0001	0.0001	0.0021	0.0001	0.0001	0.0005

[1]PCR signifies perennial cereal rye.

Kochia Variety, Site, and Planting Evaluation

Investigator(s):

B. Waldron[1], L.M. Lauriault[2], P.L. Cooksey[2], J. Box[2], J. Jennings[2], and S. Jennings[2]

[1]USDA-ARS Forage and Range Lab, Logan, UT 84322
[2]New Mexico State University, Agricultural Science Center at Tucumcari, NM 88401

Method(s):

The Advisory Committee to the Agricultural Science Center at Tucumcari requested a local evaluation of perennial forage Kochia (*Kochia prostrata*). Consequently, four entries [subsp. *virescens* "Immigrant" (late maturing and high winter forage value) and "PustC2" (early maturing experimental) and subsp. *grisea* "Snowstorm" (late maturing and tall enhanced winter forage value) and ", KZ6xC2" (early maturing and salt tolerant experimental)] were acquired from the USDA-ARS Forage and Range Lab. Immigrant is the long-time standard and the only available variety until 2013. Snowstorm was released by the USDA in 2013.

The test is a strip (site: cropland irrigated with Class 1B treated municipal wastewater or rainfed range) – split (planting date: a winter seeding accompanied by snow and a spring seeding accompanied by rain) – split (variety) plot treatment arrangement with four randomized complete blocks within each site. The soil at both sites was Canez fine sandy loam having approximately 12 lb residual N/ac. The range area was a very thin stand of perennial warm-season native grasses that had been encroached by Russian thistle. The irrigated area had a winter cereal rye cover crop with about 6 inches of growth. Due to dry and extremely windy conditions, the February seeding was delayed until March 19, 2014. Plots were 9 x 20 ft of which the center 8 x 20 ft was disturbed with a rototiller set to till the surface 2 inches immediately prior to planting. After tilling tilled plots were rolled to firm the seedbed. The seeding rate was 41 PLS ft^{-2}, which represents 2.5 lb PLS ac^{-1} for all varieties except Snowstorm for which it represents 3.2 lb PLS ac^{-1}. Seed was mixed with corn grit at a 1:2 ratio to increase volume and sown using an EarthWay EV-N-SPRED hand broadcast spreader set at 2.5. The spreader operator's gait was calibrated to apply most of the seed in two passes and the spreader was held at a height to cover approximately 8 ft. Seed of Snowstorm was considerably fluffier than the other entries and 3-4 passes were needed to distribute the seed mixture for that entry. Seed mixture remnants after broadcasting were nearly negligible and were cast over the plot to empty the seeder. After the winter seeding, the range area was irrigated with ground water to solidify the seedbed and promote germination because precipitation was not strongly forecast within the next 14 days. The irrigated area was not watered until the following day to maximize desiccation of the cover crop residue. Both areas were treated with 25 glyphosate on March 25 to destroy existing vegetation for soil moisture conservation in the native grass area and to terminate the cover crop in the irrigated area. Because of the delay in the timing of the winter seeding, the spring seeding took place on May 22. The irrigated site received 20.8 inches of irrigation during 2014 to supplement 13.9 inches of precipitation.

Because 2014 was considered the establishment year, no herbicides were applied, but both areas were rotary mowed as needed to control competition by weeds.

Results:

Although no data were collected in 2014 and faculty were inexperienced in identification, some plants were observed that were likely perennial forage Kochia as shown in the picture to the right taken September 26, 2014. There might be a variety effect on adaptation or establishment.

Alternative Crops in Winter Wheat Based Cropping Systems

Investigator(s):

M. Darapuneni[1], L.M. Lauriault[1], A. Cunnigham[1], P.L. Cooksey[1], J. Box[1], J. Jennings[1], S. Jennings[1], and Hubert Roberts[1]

[1]New Mexico State University, Agricultural Science Center at Tucumcari, NM 88401

Method(s):

Under dryland conditions of the Southern Great Plains, the production capacity of traditional winter wheat cropping systems has stagnated. The scope of crop intensification in the rotation to improve the overall productivity of dryland cropping systems is extremely limited by the availability of soil moisture in the growing season. Considering the unpredictable weather and erratic precipitation patterns, supplementing nitrogen and other inputs under rain-fed conditions is often a risky and unprofitable management decision for most of the existing winter wheat cropping systems. In addition, the peak summer fallow period of the traditional winter wheat cropping system allows considerable amount of nutrient loss from the top soil due to lack of cover. Keeping the disadvantages of existing cropping system in view, devising a new strategy is necessary for efficient utilization of stored soil moisture and to conserve the finite resources of soil while maintaining the production sustainability.

In reality, the replacement of fallow period in wheat-fallow rotation with any alternative crop will affect the soil water content and yields of the following cash crop. At the same time, leaving fallow in the rotation will inevitably result in unproductive evaporation losses of soil moisture, making the system more vulnerable and inefficient. Nonetheless, introducing an alternative crop in the fallow period will have several advantages in terms of productivity per each drop of water, soil quality, and sustainability. Optimizing crop rotation benefits in traditional winter wheat systems by introducing diversity is necessary for sustainable crop production in semi-arid environments. The effects of alternative crops in the rotation sequence in terms of productivity, water availability, and nutrient use efficiency should be evaluated before making any practical recommendations to producers.

A test was initiated in the fall of 2014 with 6 rotation treatments. The experiment is a randomized block design with 3 replications in which plots are 30 x 40 feet. To maximize the data generation capacity, each rotation will be continually planted in three sequential segments during spring/fall seasons until one cycle of rotation is completed. The crop rotation options with winter wheat include chickpea, berseem clover, winter Austrian pea, pearl millet, winter canola, and grain sorghum. Winter wheat, winter canola, berseem clover, and winter Austrian pea are winter crops; whereas chickpea, pearl millet, and grain sorghum are summer-grown crops. The soil type is Canez fine sandy loam having residual nitrogen of 15 lb/ac with few exceptions. Initial incremental soil sampling was conducted on the profile to a depth of 36 inches to determine the nutrient status and moisture content. The soil moisture content at the time of planting was about 7%. The experiment was established on a 15-year old no-till area covered predominantly with warm-season grasses. The fall crops were planted on September 26, 2014. The seeding rates for various crops were: winter wheat 40 lb/ac, winter canola 5 lb/ac, berseem clover 20 lb/ac, and winter Austrian pea 80 lb/ac. A germination test was conducted to ensure the seed quality for each crop species. The test was planted with a no-till Tye drill with appropriate seedboxes and planting adjustments for the seeding rate for each crop provided by the manufacturing company. The planting depths for winter wheat, winter canola, berseem clover, and winter Austrian pea were 0.5, 0.25, 0.25, and 0.5 inch, respectively. The experiment was maintained under rainfed conditions. The stand counts were taken at the end of seed emergence in each crop.

Results:

The survival rate of all tested species was adversely affected by the soil compaction from undisturbed no-till conditions and chilling injury from the advent of freezing temperatures at the early stages of plant growth. The emergence rates were poor in all crop species except winter canola (Fig. 1). The emergence

rates for berseem clover, winter Austrian pea, and winter wheat were ranged from 20 to 30%. The emergence rate for canola was about 85%. Chilling injury in the early growth stages severely impacted the stand counts of canola and the mortality rate was almost 100%. Due to the problems in establishment of crops, other measurements were not taken in the fall of 2014. Although no data were collected in 2014, the fall trial helped the researcher to identify and understand the various environmental and management factors influencing the crop production at the experimental site and potential remedies to be taken to prevent the further crop losses in coming years. The test will be continued for at least 3 years to evaluate the production capacity, input-use efficiency, and sustainability of six winter wheat based cropping systems.

Fig.1. Emergence of winter canola, winter Austrian pea, winter wheat, and berseem clover (left to right) three weeks after planting during fall of 2014.

Alfalfa Variety Testing in the Tucumcari Irrigation Project

Investigator(s):

L.M. Lauriault[1], P.L. Cooksey[1], J. Box[1], J. Jennings[1], S. Jennings[1], and H. Roberts[1]

[1]New Mexico State University, Agricultural Science Center at Tucumcari, NM 88401

Method(s):

With the availability of treated wastewater for irrigation in 2012, a standard alfalfa variety test and a Roundup Ready® variety test, each with 19 entries, were planted September 26, 2012, in the field fronting US 54. The test area (Redona fine sandy loam) was conventionally tilled and formed into a flat seedbed for sprinkler irrigation. Plots were sown using a disk drill fitted with a seed-metering cone at 20 lb inoculated seed/acre in a Randomized Complete Block design with 4 replications set up for nearest neighbor analysis. Plots are 5 ft x 30 ft of which the center 5 ft x 16 ft were harvested for yield six times in 2014 after 14-ft borders were swathed and baled. The 2012 Annual Report of the Agricultural Science Center at Tucumcari (http://tucumcarisc.nmsu.edu/documents/2012-annual-report.pdf) provides more details about establishment. Prior to the last harvest, irrigations with treated municipal wastewater were applied approximately twice weekly for total of 36.7 inches to supplement 13.7 inches of pre-growing season and growing season precipitation. In 2014, 180 lb/ac of 11-52-0 were broadcast on February 12th. Velpar L (3 qt/ac) was applied on February 13th and 1 qt/ac of Prowl H2O was applied on July 31st. The Roundup Ready® study also was treated with a 2% glyphosate solution on July 31st. No insecticides were applied in 2014.

Results:

Yield data were detrended using the nearest neighbor analysis and subjected to SAS GLM procedures for tests of significance and means separation and are presented in Table 1 for the standard test and Table 2 for the Roundup Ready® test with varieties arranged in each table by descending total yield.

Reports giving results from statewide testing in 2014 and previous years are available at the New Mexico State University College of Agricultural, Consumer and Environmental Sciences' Publications and Videos Variety Test Reports webpage (http://aces.nmsu.edu/pubs/variety_trials/welcome.html#alfalfa) as well as from the Agricultural Science Center at Tucumcari and county Cooperative Extension Service offices.

Table 1. Dry matter yields (tons/acre) of alfalfa varieties sown September 26, 2012, at NMSU's Agricultural Science Center at Tucumcari and sprinkler-irrigated twice per week with treated municipal wastewater†.

	2013	2014 Harvests						2014	2-yr
Variety Name	Total	21-May	1-Jul	21-Jul	19-Aug	16-Sep	31-Oct	Total	Average
Malone	3.90**	1.01	1.68*	0.94*	1.03**	1.04**	0.57*	6.26*	5.08**
NuMex Bill Melton	3.45*	1.27*	1.66*	0.85*	1.01*	0.87	0.63*	6.28**	4.87*
56S82	3.90**	1.15	1.71*	0.89*	0.80	0.75	0.52	5.82*	4.86*
Roadrunner	3.52*	1.60**	1.65*	0.87*	0.90*	0.68	0.37	6.06*	4.79*
WL 454HQ.RR	3.23	1.01	1.62*	0.86*	0.88*	0.92*	0.58*	5.87*	4.55*
African Common	3.18	0.96	1.55*	0.84*	1.01*	0.90*	0.66**	5.92*	4.55*
NM Common	3.20	0.97	1.53*	0.78*	0.94*	0.96*	0.63*	5.80*	4.50*
Integra 8400	3.00	1.35*	1.74*	0.92*	0.75	0.76	0.46	5.98*	4.49*
Mallard	3.26	1.25*	1.62*	0.78*	0.85	0.71	0.42	5.62*	4.44*
Bluejay HR	2.88	1.52*	1.68*	0.75	0.88*	0.76	0.27	5.86*	4.37
54QR04	3.12	1.06	1.77*	0.78*	0.85	0.79	0.32	5.57*	4.34
55Q27	2.93	1.14	1.63*	0.77	0.88*	0.72	0.40	5.53*	4.23
Meadowlark	2.67	1.23*	1.76*	0.74	0.84	0.84	0.33	5.73*	4.20
6422Q	2.72	1.03	1.89**	0.77	0.82	0.81	0.35	5.66*	4.19
Dona Ana	3.28	0.70	1.16*	0.70	0.87*	0.88	0.56*	4.87	4.07
Wilson	2.95	0.77	1.39*	0.72	0.84	0.80	0.48	4.98	3.97
54VR03	2.52	0.94	1.51*	0.76	0.78	0.71	0.31	5.00	3.76
Bluejay 2	2.76	0.91	1.59*	0.58	0.74	0.62	0.22	4.66	3.71
HybriForce-2400	2.27	1.10	1.60*	0.60	0.79	0.68	0.26	5.04	3.65
Mean	3.09	1.10	1.62	0.78	0.86	0.80	0.44	5.60	4.35
LSD (0.05)	0.60	0.39	NS	0.17	0.17	0.16	0.11	0.91	0.65
CV%	13.69	25.07	18.18	15.32	13.67	14.21	17.27	11.40	14.84

†Data were detrended using nearest neighbor analysis, and analyzed using analysis of variance.
2013 Harvest dates 5-Jun, 25-Jun, 1-Aug, 23-Sep, and 6-Nov.
**Highest numerical value in the column.
*Not significantly different from the highest numerical value in the column based on the 5% LSD.
NS means that there were no significant differences between the varieties within that column at the 5% level.

Table 2. Dry matter yields (tons/acre) of Roundup Ready® alfalfa varieties sown September 26, 2012, at NMSU's Agricultural Science Center at Tucumcari and sprinkler-irrigated twice per week with treated municipal wastewater†.

	2013	2014 Harvests						2014	2-yr
Variety Name	Total	21-May	1-Jul	21-Jul	19-Aug	16-Sep	31-Oct	Total	Average
R77T729	4.00**	2.06**	1.82*	1.22*	1.35*	1.22	1.12*	8.78**	6.39**
R65BD278	3.77*	1.65*	2.08*	1.36*	1.22*	1.31*	1.04*	8.66*	6.21*
R66BX312	3.81*	1.81*	1.84*	1.22*	1.27*	1.17	0.97	8.28*	6.04*
R66BX320	3.45*	1.53*	1.96*	1.29*	1.36*	1.32*	1.14**	8.60*	6.03*
R78T823	3.72*	1.54*	1.92*	1.32*	1.19*	1.20	1.07*	8.24*	5.98*
R58HG236	3.22	1.70*	2.19**	1.31*	1.21*	1.18	1.00*	8.59*	5.90*
RR57K337	3.43*	1.57*	1.98*	1.36*	1.37**	1.07	0.78	8.12*	5.77*
R57K138	2.96	1.79*	2.00*	1.20*	1.23*	1.41**	0.97	8.59*	5.77*
R57A136	3.39*	1.63*	1.99*	1.22*	1.29*	1.13	0.77	8.04*	5.71*
R57W213	2.77	1.61*	2.15*	1.36*	1.25*	1.19	0.95	8.50*	5.63
R57OK217	2.71	1.67*	2.15*	1.30*	1.27*	1.22	0.95	8.56*	5.63
R66BX311	3.29	1.54*	1.83*	1.02*	1.22*	1.23	1.13*	7.97*	5.63
R57OK216	2.64	1.67*	2.18*	1.49**	1.18*	1.07	0.87	8.46*	5.55
R65BD277	3.18	1.21*	1.83*	1.41*	1.34*	1.15	0.95	7.89*	5.54
R65BD279	2.94	1.38*	1.82*	1.31*	1.19*	1.12	1.09*	7.90*	5.42
54QR04	2.57	1.78*	2.03*	1.34*	1.23*	1.07	0.82	8.26*	5.42
R86X214	2.24	1.49*	1.95*	1.28*	1.25*	1.16	0.89	8.01*	5.12
54VR03	2.81	1.32*	2.04*	1.16*	1.09	0.95	0.70	7.27	5.04
Mean	3.07	1.59	1.98	1.29	1.22	1.16	0.94	8.18	5.63
LSD (0.05)	0.71	NS	NS	NS	0.28	0.18	0.16	1.06	0.73
CV%	16.31	20.03	10.22	13.79	16.21	10.92	11.99	9.14	12.97

†Data were detrended using nearest neighbor analysis, and analyzed using analysis of variance.
2013 Harvest dates 5-Jun, 25-Jun, 1-Aug, 23-Sep, and 6-Nov.
**Highest numerical value in the column.
*Not significantly different from the highest numerical value in the column based on the 5% LSD.
NS means that there were no significant differences between the varieties within that column at the 5% level.

Commercial Cotton Performance Evaluations in the Tucumcari Irrigation Project

Investigator(s):

L.M. Lauriault[1], R.P. Flynn[2], J. Zhang[3], J. Idowu[4], P.L. Cooksey[1], J. Box[1], J. Jennings[1], S. Jennings[1], and H. Roberts, and A. Cunningham[1]

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[4]New Mexico State University, Extension Plant Sciences Department, Las Cruces, NM 88003

Objective(s):

To evaluate the local performance of varieties submitted by proprietors and NMSU's breeder.

Method(s):

A cotton variety test was initially planted in the field fronting US 54 (Canez fine sandy loam) on May 28, 2014, using a row crop planter with a seed-metering cone on each planting unit. The seedbed was conventionally tilled flat. Plots were two rows 30 inches apart x 25 ft long with a 10-ft unplanted alley between plots to facilitate harvesting. The seeding rate was 5 seed/ft in a randomized complete block design with 4 replications. Varieties and lines tested were commercial cultivars and experimental lines developed at NMSU (NM designation), as well as glandless entries (GLS designation). The soil moisture profile was excellent at planting due to precipitation and no preplant irrigation was needed. Emergence was good for all entries; however, hail on June 6th, 7th, and 8th destroyed the stand. Replanting took place on June 11th after which the test was sprinkler-irrigated using Class 1B treated municipal wastewater to promote germination. Emergence from the replanting was variable. Fertilizer (65 lb N + 35 lb P/ac) was applied on July 9th, based on soil test recommendations, and 1 pt/ac of Brawl was applied on June 4th. Acephate 97 (2.5 oz/ac) was applied on July 18th for control of thrips. Irrigations were applied approximately twice weekly until the end of October for a growing season total of 18.6 inches to supplement 10.4 inches of precipitation through harvest time. Two-row borders surrounding the test were stripped prior to harvesting the plots. Harvesting took place on December 22, 2014, using a John Deere model 484 cotton stripper modified to harvest two rows and to catch harvested material in a mesh bag. Prior to harvest, 25 bolls were collected, plants were counted, and the total length of skips (>12 inches) in the planted row was estimated for each plot. Boll samples were shipped to NMSU's Agricultural Science at Artesia for ginning and turnout calculations after which lint samples were sent to a lab at Louisiana State University for fiber quality analysis. Individual plot weights were adjusted to lint yields based on the average seedcotton to trash ratio of ginned samples of the harvested material from each of the borders. Lint yield and quality data were analyzed by SAS Proc GLM with means separated by protected 5% LSD.

Results:

While emergence was uniform for the initial planting that germinated on precipitation, variable emergence of cotton irrigated up using treated municipal wastewater either by pre- or post-planting application was also experienced in 2013. In the 2014 test, there were significant yield differences among varieties (Table 1) as well as differences in fiber quality (Table 2). Low yields compared to 2013 may be attributed to the later planting, which may have affected both plant populations and the ability of some entries to produce mature bolls as indicated by differences in the percent of open bolls among entries. Cotton growers should be aware that cultivars that perform well in full season plantings might not have the same yield potential when planted after the optimum planting date. For information about how several of these commercially available varieties would perform comparatively to each other when planted within the optimum planting window, see the 2013 Annual Progress Report of the Agricultural Science Center at Tucumcari (http://tucumcarisc.nmsu.edu/documents/2013-annual-report.pdf).

Table 1. Lint yield data from the late-planted (June 11), wastewater-irrigated cotton performance test at NMSU's Agricultural Science Center at Tucumcari in 2014.

Brand/Company	Hybrid/Variety	Population	seed-cotton	Lint		Turnout	Boll weight
		Plants/ac	lb/a	lb/a	bales/a	%	g
Cotton, Inc.	Acala GLS	21867	1119	414	0.86	37.38	6.70
NMSU	Acala1517-08	15246	1588	582	1.21	36.50	6.58
USDA Stoneville	JACO GLS	22129	817	269	0.56	32.25	5.95
Americot	NG1511B2RF	17511	772	333	0.70	43.25	6.18
Americot	NG3306B2RF	10890	872	333	0.69	37.63	5.53
NMSU, Exp.	NM12Y1002	18818	1289	391	0.82	30.33	5.79
NMSU, Exp.	NM12Y1004	13242	633	253	0.52	40.33	6.02
NMSU, Exp.	NM12Y1005	21490	836	312	0.65	37.50	5.81
NMSU, Exp.	NM13G1007	25207	2638	1020	2.12	38.50	6.39
NMSU, Exp.	NM13G1018	16379	1447	575	1.20	39.67	6.00
NMSU, Exp.	NM13G1019	21606	1726	636	1.32	36.50	6.22
NMSU, Exp.	NM13G1029	20793	2100	887	1.85	42.50	5.86
NMSU, Exp.	NM13W1012	19631	1078	392	0.82	35.17	5.89
Phytogen	PHY222WRF	13707	1467	545	1.14	37.17	5.92
Phytogen	PHY333WRF	13591	1360	491	1.02	36.83	6.25
Phytogen	PHY339WRF	8828	881	313	0.65	34.67	5.89
Phytogen	PHY367WRF	11848	270	106	0.22	39.00	5.59
Phytogen	PHY375WRF	8974	581	233	0.49	37.50	5.71
USDA Stoneville	STV GLS	17685	1864	568	1.19	30.75	5.69
	LSD, 0.05	5556	872	318	0.66	2.71	0.5
	Prob>F	0.0001	0.0053	0.0029	0.0029	0.0001	0.0006

Table 2. Cotton quality and economic data from the late-planted (June 11), wastewater-irrigated performance test at NMSU's Agricultural Science Center at Tucumcari in 2014.

Hybrid/Variety	Length	Unif	SFI	Str	Elg	Mic	Maturity
Acala GLS	1.19	85.7	6.3	36.3	6.3	3.7	79.8
Acala1517-08	1.17	85.0	6.7	35.3	6.7	4.1	80.5
JACO GLS	1.14	82.9	8.4	28.6	6.4	3.3	78.3
NG1511B2RF	1.09	85.1	7.4	31.6	8.5	4.7	80.5
NG3306B2RF	1.17	85.6	6.9	32.4	7.6	4.4	80.3
NM12Y1002	1.11	84.0	8.0	30.2	8.8	3.6	77.7
NM12Y1004	1.08	84.1	7.7	28.8	7.0	4.1	79.7
NM12Y1005	1.06	84.1	8.1	27.7	8.0	4.2	79.3
NM13G1007	1.18	85.9	6.3	32.6	7.9	4.0	79.0
NM13G1018	1.14	84.4	7.4	30.5	6.9	3.8	79.3
NM13G1019	1.18	85.2	6.7	32.6	7.4	4.1	80.0
NM13G1029	1.20	84.6	7.0	32.0	7.0	4.1	80.0
NM13W1012	1.13	84.4	7.2	32.6	7.5	3.9	79.0
PHY222WRF	1.09	84.3	7.5	30.8	9.6	4.0	78.0
PHY333WRF	1.12	84.2	8.0	28.5	7.9	3.7	78.3
PHY339WRF	1.11	85.0	6.9	31.2	8.0	3.5	78.0
PHY367WRF	1.11	84.6	7.7	31.0	7.5	4.0	79.3
PHY375WRF	1.10	83.9	8.0	29.2	6.9	3.8	79.3
STV GLS	1.09	83.1	9.1	27.1	7.2	3.4	77.8
LSD, 0.05	0.03	1.4	0.9	1.6	1.1	0.3	0.9
Prob>F	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

Performance of Treated Municipal Wastewater-Irrigated (Full & Limited Irrigation) Grain Sorghum in the Tucumcari Irrigation Project

Investigator(s):

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Method(s):

To evaluate grain yield of grain sorghum varieties under full irrigation and irrigated only at planting, if necessary, to bring the soil to field capacity, tests were planted into a conventionally tilled flat seedbeds in areas designated for full irrigation applications and dryland cropping. Each test was a Randomized Complete Block design with 4 replicates. Individual plots were 20 x 5 ft (two 30-inch rows), all of which were to be harvested after sorghum x sudangrass borders surrounding each test were swathed. Plots were planted May 28, 2014, using a small plot row crop planter with a seed-metering cone on each planter unit. The seeding rate for the fully irrigated test was 85,000 seeds/a and for the limited irrigation test it was 29,000 seeds/a. Carryover N was 12 lb/a. Fertilizer (100 lb N/ac for fully irrigated and 24 lb N/a for dryland) was applied on July 9th, based on soil test recommendations, and 1 pt/ac of Brawl was applied on June 4th. The dryland test received 4.50 inches of treated municipal wastewater (Class 1B) pre-planting to bring the upper 3 ft of soil to field capacity. Otherwise, irrigations with treated municipal wastewater were applied approximately twice weekly to the fully irrigated test and the surrounding area for a May through October total of 20.8 inches. Irrigations supplemented 13.2 inches of pre-growing season and growing season precipitation.

Immediately after surrounding sorghum x sudangrass borders were swathed, all plots of the fully irrigated test were combined and individually bagged on October 24, 2014, using an Allis-Chalmers Model 66 All Crop B series harvester. Immediately prior to combining, plots were rated for predation (deer and birds) damage and immature heads (those not having any grain), both as percentages. Harvest weights were recorded and an aliquot was evaluated for test weight (lb/bu) and then dried for 72 h at 65ºC and reweighed to calculate % moisture. Grain yields (lb/ac) were adjusted to 14% moisture.

Adjusted grain yield, harvest moisture, test weight, and immature head data were analyzed using SAS PROC GLM procedures to determine where differences between varieties existed. Means were separated by protected least significant difference ($P < 0.05$).

Results and Discussion:

Good stands established for both tests; however, rainfed sorghum x sudangrass borders surrounding the dryland test were not sufficient to deter predation by deer while the irrigated borders of the same width for the full irrigation study were. All grain in the dryland test was consumed. Consequently, no data were collected from that test. Future dryland tests will have a wider border, some of which will be irrigated.

Results of statistical analysis for data from the fully irrigated test are presented in Table 1. Reports giving results from statewide testing in 2014 and previous years are available at the New Mexico State University College of Agricultural, Consumer and Environmental Sciences' Publications and Videos Variety Test Reports webpage (http://aces.nmsu.edu/pubs/variety_trials/welcome.html#corn) as well as from the Agricultural Science Center at Tucumcari and county Cooperative Extension Service offices.

Table 1. Grain yield components from the wastewater-irrigated grain sorghum at NMSU's Agricultural Science Center at Tucumcari in 2014.

Brand/Company Name	Hybrid/ Variety Name	Adjusted Grain Yield	Harvest Moisture	Test Weight	Immature Heads
		lb/a	%	lb/bu	%
Chromatin, Inc./Sorghum Partners	NK5418	4371	8.22	59.0	3.25
Chromatin, Inc./Sorghum Partners	X445	3712	8.96	57.9	5.25
Chromatin, Inc./Sorghum Partners	K35-Y5	3689	8.35	59.1	10.00
Chromatin, Inc./Sorghum Partners	NK7829	3556	9.40	58.3	0.00
Chromatin, Inc./Sorghum Partners	KS585	3466	8.69	62.0	7.50
Chromatin, Inc./Sorghum Partners	KS310	3104	9.33	59.6	37.50
Warner Seeds, Inc.	W-7012	2848	9.25	58.3	0.50
Chromatin, Inc./Sorghum Partners	K73-J6	2570	9.46	58.6	2.50
Chromatin, Inc./Sorghum Partners	SP3303	2370	9.27	58.8	47.50
	Trial Mean	3298	8.99	59.1	12.67
	LSD, 0.05[1]	997	NS[2]	2.4	17.5
	CV	20.7	6.8	2.7	94.5
	F Test	0.0095	0.0536	0.0414	0.0001

[1]LSD and CV signify the least significant difference and the coefficient of variation.

[2]NS signifies that there were no significant differences among means in the column based on an F Test probability of <0.0500 at the bottom of the column. Consequently, no LSD value is published for that column.

Performance of Irrigated Forage Sorghum & Sorghum x Sudangrass Under a Single-cut Silage System in the Tucumcari Irrigation Project

Investigator(s):

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Method(s):

To evaluate yield and nutritive value of forage sorghum for silage, a test was planted into a conventionally tilled flat seedbed in the field fronting US 54. Plots were planted May 28, 2014, using a small plot row crop planter with a seed-metering cone on each planter unit at a seeding rate of 90,000 seed/a and a row spacing of 30 inches. Sorghum x sudangrass was sown around the test as a border. Brawl (1 pt/a) was applied on June 4th. There were 12 lb N/a of carryover nitrogen. Fertilizer (100-35-00 lb N-P-K/a) was applied on July 9th. Individual plots were 20 x 5 ft (two rows), all of which were harvested. A 5-ft unplanted alley was left between plots to facilitate harvesting. The test was a Randomized Complete Block design with 4 replicates. Irrigations with treated municipal wastewater were applied approximately twice weekly for a May through October total of 20.8 inches to supplement 13.2 inches of pre-growing season and growing season precipitation.

After the surrounding sorghum x sudangrass hay was swathed, standing forage from each plot was harvested on October 28th with a Case-IH model 8750 forage harvester with a row-crop head, leaving 6-inch stubble. Chopped material from individual plots was collected in a garbage can and immediately weighed. Prior to dumping the garbage can, a sample from each plot was placed in a labeled paper bag and sealed in a plastic bag. Immediately after harvesting was complete these samples were weighed, removed from the plastic bag, dried at 150°F for 48 hours, and reweighed to determine harvest moisture and to convert field weights to dry matter yield.

Dried samples were ground to pass through a 1-mm screen and submitted to the University of Wisconsin Forage Lab for forage nutritive value analysis by wet chemistry for crude protein (CP), neutral detergent fiber (NDF), 48-h neutral detergent fiber digestibility (NDFD), starch, ash, total digestible nutrients (TDN), and net energy for lactation (NE_l). Milk per ton and milk per acre were calculated by the lab.

Dry and green forage yield, harvest moisture, and nutritive value data were analyzed using SAS PROC GLM procedures to determine where differences between varieties existed. Means were separated by protected least significant difference ($P < 0.05$).

Results and Discussion:

Results of statistical analysis for yield and nutritive value data are presented in Table 1. Reports giving results from statewide testing in 2014 and previous years are available at the New Mexico State University College of Agricultural, Consumer and Environmental Sciences' Publications and Videos Variety Test Reports webpage (http://aces.nmsu.edu/pubs/variety_trials/welcome.html#corn) as well as from the Agricultural Science Center at Tucumcari and county Cooperative Extension Service offices.

Table 1. Forage yield and nutritive value data from the wastewater-irrigated forage sorghum and sorghum x sudangrass under 1-cut silage management at NMSU's Agricultural Science Center at Tucumcari in 2014.

Brand/Company Name	Hybrid/Variety Name	Type[1]	Dry Forage	Green Forage	Harvest Moisture	CP[2]	NDF	NDFD 48hr	Starch	Ash	TDN	NE_l	Milk/ Ton	Milk/ Acre
			t/a	t/a	%	%	%	%	%	%	%	Mcal/lb	lb/t	lb/a
DuPont Pioneer	841F	FS	6.8	17.3	60.3	10.9	52.3	74.5	2.8	5.6	60.2	0.614	2865	19655
DuPont Pioneer	849F	FS	6.5	17.2	62.7	10.9	54.4	72.4	2.4	5.8	59.9	0.611	2829	18180
Advanta US	AF7101	FS	4.4	11.1	60.4	11.1	55.0	72.0	2.1	5.9	60.3	0.616	2856	12554
Advanta US	AF7102	FS	4.2	11.5	64.3	10.1	54.4	72.4	2.9	5.1	59.7	0.609	2816	11733
Advanta US	AF7202	FS	4.3	11.7	63.5	10.2	54.8	72.1	2.4	5.6	59.3	0.605	2788	11933
Advanta US	AF7401	FS	5.3	17.3	69.0	10.3	52.6	74.7	3.0	5.5	59.9	0.611	2842	15103
Advanta US	AS6401	SxS	7.3	22.2	67.0	10.5	54.3	75.4	2.4	6.0	60.9	0.622	2923	21409
Advanta US	AS6402	SxS	4.6	13.1	64.7	9.3	55.3	68.7	2.3	4.6	56.4	0.573	2551	11700
Advanta US	AS6501	SxS	8.0	25.6	68.7	10.3	53.0	73.8	3.1	5.4	59.6	0.608	2819	22556
		Trial Mean	57.0	16.3	64.5	10.4	54.0	72.9	2.6	5.5	59.6	0.608	2816	16092
		LSD[3], 0.05	1.4	3.3	3.4	NS[4]	NS	NS	NS	1.0	2.1	0.024	108	4026
		CV	17.0	13.7	3.6	8.2	4.8	4.9	38.6	12.8	2.4	2.6	4.4	17.4
		F Test	0.0001	0.0001	0.0001	0.1616	0.6738	0.3183	0.8274	0.2016	0.0159	0.0156	0.0223	0.0001

[1]FS and SxS signify forage sorghum and sorghum x sudangrass, respectively

[2]CP, NDF, NDFD, TDN, and NE_l signify crude protein, neutral detergent fiber, NDF digestibility, and total digestible nutrients, respectively.

[3]LSD and CV signify the least significant difference and the coefficient of variation.

[4]NS signifies that there were no significant differences among means in the column based on an F Test probability of <0.0500 at the bottom of the column. Consequently, no LSD value is published for that column.

Performance of Irrigated Sorghum x Sudangrass Hybrids & Forage Sorghum Under a Multiple-cut Hay System in the Tucumcari Irrigation Project

Investigator(s):

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Method(s):

To evaluate yield and nutritive value of sorghum x sudangrass and forage sorghum in a two-cut system for hay, a test was planted into a conventionally tilled flat seedbed in the field fronting US 54 and managed as a drilled hay crop. Plots were planted June 3rd, 2014, using a small plot drill with a seed-metering cone at a seeding rate of 25 lb/ac with a row spacing of 6 inches. Sorghum x sudangrass was sown around the test as a border. Brawl (1 pt/a) was applied on June 4th. Carryover nitrogen totaled 12 lb/ac. Fertilizer (65-35-00 lb N-P-K/a) was applied on July 9th. Individual plots were 20 x 5 ft, of which 20 x 4 ft were planted and harvested. A 5-ft alley was left unplanted between plots to facilitate harvesting. The test was a Randomized Complete Block design with 4 replicates Irrigations with treated municipal wastewater were applied approximately twice weekly for a May through October total of 18.6 inches to supplement 13.2 inches of pre-growing season and growing season precipitation.

After the surrounding sorghum x sudangrass hay was swathed, standing forage from each plot was harvested on August 20th and October 27th using a small plot forage harvester equipped with a non-electronic weighing system, leaving 4-inch stubble. Subsamples from individual plots were chopped with a limb chipper and placed in a labeled paper bag and sealed in a plastic bag. Immediately after harvesting was complete these samples were weighed, removed from the plastic bag, dried at 150°F for 48 hours, and reweighed to determine harvest moisture and to convert field weights to dry matter yield.

Dried samples were ground to pass through a 1-mm screen and submitted to the University of Wisconsin Forage Lab for forage nutritive value analysis by wet chemistry for crude protein (CP), neutral detergent fiber (NDF), 48-h neutral detergent fiber digestibility (NDFD), starch, ash, total digestible nutrients (TDN), and net energy for lactation (NE_l). Milk per ton and milk per acre were calculated by the lab.

Dry and green forage yield, harvest moisture, and nutritive value data were analyzed using SAS PROC GLM procedures to determine where differences between varieties existed. Means were separated by protected least significant difference ($P < 0.05$).

Results and Discussion:

Results of statistical analysis for yield and nutritive value data are presented in Table 1. Unlike previous years, differences were detected for any variable in 2014. Reports giving results from statewide testing in 2014 and previous years are available at the New Mexico State University College of Agricultural, Consumer and Environmental Sciences' Publications and Videos Variety Test Reports webpage (http://aces.nmsu.edu/pubs/variety_trials/welcome.html#corn) as well as from the Agricultural Science Center at Tucumcari and county Cooperative Extension Service offices.

Table 1. Forage yield and nutritive value data from the wastewater-irrigated sorghum x sudangrass and forage sorghum under 2-cut hay management at NMSU's Agricultural Science Center at Tucumcari in 2014.

Brand/Company Name	Hybrid / Variety Name	Type[1]	Harvest 1					Harvest 2					Total	
			Dry Forage	Green Forage	Harvest Moisture	Milk/ Ton	Milk/ Acre	Dry Forage	Green Forage	Harvest Moisture	Milk/ Ton	Milk/ Acre	Dry Forage	Milk/ Acre
			t/a	t/a	%	lb/t	lb/a	t/a	t/a	%	lb/t	lb/a	t/a	lb/a
DuPont Pioneer	841F	FS	3.4	15.7	78.0	2764	9522	2.0	10.3	79.9	2863	5847	5.5	15368
DuPont Pioneer	849F	FS	4.1	18.5	77.9	2676	10877	1.8	9.6	80.6	2844	5170	5.9	16047
Advanta US	AF7101	FS	3.3	15.1	78.0	2703	8909	1.8	9.1	80.0	2909	5192	5.1	14101
Advanta US	AF7102	FS	4.2	20.0	78.7	2757	11675	1.6	7.8	78.8	2940	4830	5.9	16505
Advanta US	AF7202	FS	3.7	14.8	75.1	2772	10223	1.6	8.1	79.5	2772	4542	5.3	14764
Advanta US	AF7401	FS	3.5	14.9	76.8	2612	9040	1.6	8.2	80.1	2796	4569	5.1	13608
Advanta US	AS6401	SxS	3.8	16.8	78.0	2775	10698	1.7	8.8	80.1	2760	4820	5.5	15518
Advanta US	AS6402	SxS	3.9	16.4	76.0	2720	10689	1.8	9.1	80.4	2799	5002	5.7	15691
Advanta US	AS6501	SxS	3.7	16.2	77.2	2758	10181	1.6	7.9	79.6	2947	4711	5.3	14892
		Trial Mean	3.7	16.5	77.3	2727	10202	1.7	8.8	79.9	2847	4964	5.5	15166
		LSD 0.05[2]	NS[3]	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
		CV	18.3	16.4	3.0	5.4	18.8	24.3	25.6	1.7	4.5	24.7	16.3	16.3
						0.785					0.318			0.799
		F Test	0.0631	0.1518	0.4729	3	0.5369	0.8996	0.7761	0.7778	9	0.8866	0.8782	7

[1]FS and SxS signify forage sorghum and sorghum x sudangrass, respectively

[2]LSD and CV signify the least significant difference and the coefficient of variation.

[3]NS signifies that there were no significant differences among means in the column based on an F Test probability of <0.0500 at the bottom of the column. Consequently, no LSD value is published for that column.

Table 1 (cont.). Forage yield and nutritive value data from the wastewater-irrigated sorghum forages under 2-cut hay management at NMSU's Agricultural Science Center at Tucumcari in 2014.

Hybrid/ Variety Name	Harvest 1							Harvest 2						
	CP[2]	NDF	NDFD 48hr	Starch	Ash	TDN	NE_l	CP	NDF	NDFD 48hr	Starch	Ash	TDN	NE_l
	%	%	%	%	%	%	Mcal/lb	%	%	%	%	%	%	Mcal/lb
841F	13.2	50.6	70.4	2.6	7.1	59.2	0.603	8.7	50.7	68.0	10.5	5.3	60.9	0.622
849F	13.5	51.2	67.6	2.6	6.8	58.3	0.593	8.5	48.5	68.6	11.9	5.1	60.5	0.618
AF7101	12.5	50.4	69.9	3.4	6.7	58.4	0.595	8.8	46.3	64.7	17.3	4.7	61.8	0.633
AF7102	12.8	50.7	69.5	3.5	7.2	59.2	0.604	8.5	48.7	67.4	14.2	4.8	62.0	0.634
AF7202	13.5	49.1	71.3	3.1	7.3	59.2	0.604	8.4	50.2	65.0	12.6	4.8	59.9	0.611
AF7401	12.8	49.8	68.7	2.7	6.6	57.3	0.582	8.7	47.6	67.0	12.8	4.8	60.0	0.613
AS6401	12.4	51.7	70.0	3.3	6.6	59.4	0.606	8.8	48.1	65.3	12.7	4.8	59.7	0.609
AS6402	13.5	50.4	69.3	2.7	6.9	58.7	0.598	8.8	48.3	67.6	11.6	5.1	60.0	0.612
AS6501	13.4	51.3	69.5	2.8	7.1	59.4	0.605	8.6	48.9	68.3	13.9	5.0	62.0	0.634
Trial Mean	13.1	50.5	69.6	3.0	6.9	58.8	0.599	8.6	48.6	66.9	13.0	4.9	60.7	0.621
LSD, 0.05[3]	NS[4]	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV	10.2	5.1	4.6	34.5	9.9	3.0	3.3	6.8	5.8	5.2	30.6	12.8	2.8	3.1
	0.891				0.816			0.958	0.578			0.928		
F Test	0	0.9319	0.8913	0.8174	6	0.7333	0.7408	9	2	0.6761	0.4811	2	0.3253	0.3291

[1]FS and SxS signify forage sorghum and sorghum x sudangrass, respectively

[2]CP, NDF, NDFD, TDN, and NE_l signify crude protein, neutral detergent fiber, NDF digestibility, and total digestible nutrients, respectively.

[3]LSD and CV signify the least significant difference and the coefficient of variation.

[4]NS signifies that there were no significant differences among means in the column based on an F Test probability of <0.0500 at the bottom of the column. Consequently, no LSD value is published for that column.

Tepary Beans Evaluation for Grain and Forage in the Tucumcari Irrigation Project

Investigator(s):

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Introduction:

Heat and drought-tolerant tepary beans are a relative of common dry beans (e.g. pinto beans) that were selected by early farmers before the arrival of European settlers. They were cultivated from as far south as Central America to as far north as the Four Corners area of the United States. Tepary beans are commercially produced on a small scale and have the potential to become a more important crop in hot, dry environments. Selections arising from the northern area of cultivation (Arizona; Maricopa selections), and from the southern area (Chiapas, Mexico) were chosen to compare with modern varieties recently released by Colorado State University and by the USDA/ARS Tropical Agriculture Research Station in Puerto Rico (TARS 22 and TARS 32). The objective was to evaluate the relative performance of these varieties in southern New Mexico (Las Cruces) and in northern New Mexico. Additionally, their potential as a forage crop was evaluated at Tucumcari.

Method(s):

To evaluate the local performance of tepary bean varieties at Tucumcari as part of the multi-location study, a test with 8 entries was planted June 30, 2014, under the highway center pivot irrigation system in the field fronting US 54. The test area (Redona/Canez fine sandy loam) was conventionally tilled and formed into a flat seedbed. Brawl herbicide (1 pt/ac) was applied pre-plant incorporated on June 4. Plots (5 ft x 15 ft with a 5-ft alley) were arranged in a Randomized Complete Block design with 2 replications. Uninoculated seed were sown by hand spaced 6 in apart in a single row down the center of the plot. Irrigations with treated municipal wastewater were applied twice weekly at 0.5 inch per application for a May through October total of 18.9 inches to supplement precipitation. No fertilizer was applied, but there were 12 lb of carryover N/ac. Nodulation was not verified in this study.

On August 29, when all entries were in the early pod stage, a section from the end of each plot was cut to ground level and dried in a forced-air oven at 140°F for 48 hours to determine dry matter (DM) concentration and yield. These dried samples were ground to pass through a 1-mm screen and submitted to the lab for forage nutritive value analysis by near infrared spectroscopy to estimate crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF), 48-h neutral detergent fiber digestibility (NDFD), lignin, *in vitro* true dry matter digestibility (IVTDMD), total digestible nutrients (TDN), net energy for lactation (NE_l), calcium (Ca), phosphorus (P), and ash.

All aboveground biomass from a measured section in the center of the remaining portion of each plot was cut and bagged on October 17, 2014, for grain yield evaluation. Seed shattering was minimal compared to 2014, but shattered seeds were collected and included in the bag. It was estimated that >95% of shattered seeds were collected. Harvested material was forced-air-dried for 14 days because some entries still had green pods and leaves at the time of harvest.

Forage DM yield and nutritive value components were subjected to SAS Mixed procedures for tests of significance to compare varieties and means separation using least significant difference (LSD) at an alpha level of $P < 0.05$ when a significant difference was found. Grain yield data had not been summarized at the time of this report.

Results:

Dry matter concentration and dry matter yield were not different among varieties (19.5 ± 1.9% dry matter and 844 ± 377 lb DM/ac). The lack of difference in DM concentration indicates the similarity in stage of maturity among the varieties. The lack of difference in DM yield and the low yield levels are likely due to the small area collected for evaluation and low replication, both of which would increase variability, and because these plots were not planted as a typical forage crop would be planted in a more dense stand with a closer row spacing.

Nutritive value is less impacted by stand density of a monoculture and the similarity of stage of maturity of the material harvested in this study makes for valid comparisons of nutritive value. The nutritive value variables associated with fiber, calcium, and phosphorus were not different among varieties (24.3 ± 3.6% ADF, 26.7 ± 4.1% NDF, 50.5 ± 1.4% NDFD, 3.4 ± 0.4% lignin, 89.4 ± 3.0% IVTDMD, 72.7 ± 3.7 TDN, 0.7549 ± .04 Mcal/lb NE_l, and 2.54 ± 0.21% Ca, 0.29 ± 0.02% P). Results of analyses of crude protein and ash, for which differences were observed, are presented in Table 1.

Table 1. Crude protein and ash contents of tepary beans harvested for forage at the early pod stage at Tucumcari in 2014.

Variety	Crude protein, %	Ash, %
CSU Tep 148	24.46 ABCD	13.51 AB
Chiapas mottled	26.66 A	13.36 AB
Maricopa black	25.86 AB	12.72 B
Maricopa brown	23.36 CD	11.46 C
Maricopa white	23.81 BCD	12.54 BC
Select yellow	25.36 ABC	12.83 B
TARS Tep 22	22.81 D	11.36 C
TARS Tep 32	26.81 A	14.17 A
Prob>F	0.0312	0.0112

Means followed by the same letter are not significantly different based on the 5% LSD.

Fiber components (ADF and NDF) and lignin were low enough in this study to be of little concern as indicated by high estimates of digestibility (IVTDMD, TDN, and NE_l). The calcium:phosphorus ratio is of concern because it is 8.75:1, on average. Generally, because the Ca:P ratio in the body is about 2:1, the diet should closely match that, although there is a broad range of 1.5:1 to 8:1 in which no ill effects have been observed. When the ratio is >8:1, supplementation with phosphorus or a product having a 1:1 ratio is recommended to bring the total ration into a safer range. Consequently, it is likely that tepary bean forage should not be the sole component of any feed ration for any lengthy period of time. The crude protein concentration of the tepary beans in this study was high for most forage crops (Table 1). This may be attributed to this species' leafiness and fine stems, along with the development of pods as a protein sink. Ash content also is high for forage crops (Table 1). This normally would impact digestibility, although as already mentioned this forage has the potential to be highly digestible.

Since the biomass in this study was planted in widely-spaced rows and clipped to ground level such that no regrowth was observed, the ability to truly evaluate tepary beans for forage was hampered, except for the nutritive value analysis. Because nutritive value is high, further investigations are needed to adequately evaluate yield and regrowth potential as well as for verification of nodulation with or without inoculation.

Variation in Precipitation During the Growing Season at the Agricultural Science Center at Tucumcari

Investigator(s):

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Method(s):

Precipitation was measured at three locations distributed throughout the Agricultural Science Center property to evaluate variation in precipitation (Figure 1). Location 1 was the National Weather Service station, location 2 was east of the North Farm area (see the 2012 Annual Report for changes in designation names and locations), and location 3 was at the western end of North Farm area. Precipitation was collected and measured at each location using an 8-inch US Weather Bureau Non-Recording Rain and Snow Gage.

Precipitation events were measured daily at approximately 8 am at location 1. At the other locations it was measured Monday through Friday at approximately 8 am or as soon after precipitation had ended and roads were passable. It was always measured at approximately 8 am on Monday. Consequently, weekly total precipitation for each location was tallied as of Monday morning. Data were collected from the week preceding April 7 until November 3, 2014.

Weekly and season total precipitation data from each location were averaged and a standard deviation was generated to illustrate variation between the locations and differences in variation across locations within weeks and for the season total. The standard deviation also was divided by the weekly or total average and converted to a percent (100*standard deviation/mean, percentage of variation) to compare standard deviations associated with low or high precipitation weeks.

Results and Discussion:

Weekly and season total precipitation for April through October 2014 and their statistics (mean and standard deviation) are presented in Table 1 of this article. Precipitation throughout the 2014 growing season was slightly below the long-term average of 13.51 inches average (calculated from Table 1 on page 11. Weekly total precipitation ranged from 0.00 inches across all locations for several weeks to 2.67 inches at location 3 during the week preceding May 26th. As in recent years, precipitation gradients were not consistent within weeks, but the season averages and totals were nearly equal between locations 2 and 3 (Table 1). Excluding weeks with no precipitation, weekly variation between locations ranged from 0.000inches to 0.179. The maximum in the range remained intermediate to the preceding three years, which have been considerably less than 2010 when the maximum was 0.275 inches.

The percentage of variation (100*standard deviation/mean) continues to be equal for season mean weekly precipitation and for season total precipitation indicating the value of using this statistic to compare the standard deviations of large and small means (Table 1). The standard deviation as a percent of the mean for specific weeks ranged from 0 to 173%, as it has since 2009, and there appeared to be little correlation between this value and precipitation amounts, although it was always observed when precipitation occurred only at one location (Table 1).

Figure 1. Locations of precipitation gages at the Agricultural Science Center at Tucumcari (1 inch = ~¼ mile). Location 1 was the National Weather Service station, south of the office building, location 2 was east of the North Farm area, and location 3 was at the western end of North Farm area.

Table 1. Precipitation at three locations at the Agricultural Science Center at Tucumcari from April through October 2014.

		Locations[1]					
Year	Week	1	2	3	Mean	Std. Dev.	100*Std. Dev/Mean[2]
2014	7-Apr	0.16	0.15	0.15	0.15	0.006	4
2014	14-Apr	0.02	0.00	0.00	0.01	0.012	173
2014	21-Apr	0.02	0.00	0.00	0.01	0.012	173
2014	28-Apr	0.01	0.00	0.00	0.00	0.006	173
2014	5-May	0.00	0.00	0.00	.	.	.
2014	12-May	0.00	0.00	0.00	.	.	.
2014	19-May	0.02	0.01	0.00	0.01	0.010	100
2014	26-May	2.37	2.38	2.67	2.47	0.170	7
2014	2-Jun	0.02	0.02	0.02	0.02	0.000	0
2014	9-Jun	2.38	2.52	2.28	2.39	0.121	5
2014	16-Jun	0.28	0.58	0.60	0.49	0.179	37
2014	23-Jun	0.01	0.00	0.00	0.00	0.006	173
2014	30-Jun	0.79	0.87	0.97	0.88	0.090	10
2014	7-Jul	0.16	0.10	0.13	0.13	0.030	23
2014	14-Jul	0.00	0.00	0.00	.	.	.
2014	21-Jul	1.49	1.50	1.50	1.50	0.006	0
2014	28-Jul	0.31	0.31	0.31	0.31	0.000	0
2014	4-Aug	0.58	0.54	0.61	0.58	0.035	6
2014	11-Aug	0.43	0.48	0.40	0.44	0.040	9
2014	18-Aug	0.08	0.02	0.05	0.05	0.030	60
2014	25-Aug	0.00	0.00	0.00	.	.	.
2014	1-Sep	0.31	0.28	0.20	0.26	0.057	22
2014	8-Sep	0.52	0.56	0.68	0.59	0.083	14
2014	15-Sep	1.34	1.34	1.34	1.34	0.000	0
2014	22-Sep	0.55	0.55	0.47	0.52	0.046	9
2014	29-Sep	0.05	0.00	0.00	0.02	0.029	173
2014	6-Oct	0.24	0.20	0.21	0.22	0.021	10
2014	13-Oct	0.14	0.15	0.09	0.13	0.032	25
2014	20-Oct	0.01	0.02	0.00	0.01	0.010	100
2014	27-Oct	0.00	0.00	0.00	.	.	.
2014	3-Nov	0.13	0.15	0.14	0.14	0.010	7
2014	Average	0.40	0.41	0.41	0.41	0.007	2
2014	Total	12.82	13.14	13.23	13.06	0.217	2

[1]Location 1 was the National Weather Service station, south of the office building, location 2 was east of the North Farm area, and location 3 was at the western end of North Farm area, respectively.

[2]Percentage of variation. This calculation can be used as a method for comparing standard deviations associated with low or high precipitation weeks.