Texas A&M AgriLife Research-Vernon

Directors’ Visit
August 28, 2013

Field Tours
(Smith/Walker; Lockett; Chillicothe Research Station)
Directors’ Visit to Texas A&M AgriLife Research and Extension Center-Vernon
Wednesday, August 28, 2013

Special Guests: Dr. Craig Nessler, Director, Texas A&M AgriLife Research
Dr. Bill McCutchen, Executive Associate Director, Texas A&M AgriLife Research
AREC-Vernon Research Advisory Committee

Hosts: Dr. John Sweeten, Resident Director, Texas A&M AgriLife Research-Vernon
Dr. Richard Teague, Associate Resident Director
Mr. Miles Dabovich, District 3 Extension Administrator

Presenters: Texas A&M AgriLife Research and Extension Faculty

7:30 a.m. Meet at Holiday Inn Express; depart for Smith/Walker Research Farm/Ranch

7:50 a.m. Arrive at Smith/Walker Research Farm/Ranch—Ansley, rangeland brush management at West Entrance off of U.S. 183; Teague discuss range ecology; travel to east 35 pasture, DeLaune – USDA-NRCS CIG project; Pinchak – grazing studies; Travel to West Walker, Rajan – flux tower.

8:35 a.m. Depart for Lockett Farm at Vernon Center

8:45 a.m. Arrive at Lockett (Malinowski – hibiscus, forages; S. Brown – Foundation Seed; Waggoner – Irrigation system; DeLaune – alternative crops.)

9:30 a.m. Depart for Chillicothe Research Station (CRS)

10:00 a.m. Arrive at CRS (Rajan – cotton; Rudd – wheat; DeLaune – cover crops, tillage, water use)

10:45 a.m. Depart for Lockett/Vernon Center

11:15 a.m. Arrive in Lockett/Vernon Center (Auditorium)

11:30 a.m. Roundtable discussions of Research and Extension Programs, all faculty (5-8 minutes each) – highlighting those programs not discussed/visited on field tours (Drs. Park & Ale; Mr. Bevers & Dabovich)

12:15 p.m. Working Lunch
Continue interactive discussion among faculty and administration

1:45 p.m. Reception – All faculty and staff & Research Advisory Committee

2:00 p.m. Meeting with Research Advisory Committee, Dr. Nessler, and faculty

3:00 p.m. Concluding remarks by Director Drs. Craig Nessler, Bill McCutchen, & David Lunt
● Discussion and wrap-up

3:30 p.m. Adjourn
Smith/Walker
Research Farm/Ranch
1. Ansley - brush mgt
   Teague - range ecology
2. DeLaune - soil health
   Pinchak - rumen DNA
3. Rajan - CO2 flux
Tour of Smith-Walker Research Facility

Texas A&M AgriLife Research, Vernon

28 August 2013

Jim Ansley
Richard Teague
Paul DeLaune
Bill Pinchak
Nithya Rajan
Jim Ansley
Brush Management & Ecology
Jim Ansley

Project Objectives

Objective 1 - Develop sustainable technologies to mitigate the negative effects of woody plant encroachment on rangelands

- Quantify shrub-grass competitive interactions
- Quantify ecological effects of aerial-applied brush herbicide treatments
- Quantify ecological effects of prescribed fire
Objective 2 - Determine the potential of rangeland woody plants for bioenergy uses

- Quantify biomass amount and distribution at regional scales using remote sensing
- Quantify mesquite regrowth rates and ecological responses following mesquite harvest
- Develop economic, carbon and energy budgets related to woody bioenergy production
Study with Dow AgroSciences

- Objective - Sendero herbicide; brush sculpting for wildlife habitat; preserve secondary shrubs; contrast effects on mature & regrowth mesquite

Pre-treatment north rep: North rep; 4 treatments; GIS located plot areas (yellow); RC = Roller chop & year

Our location
Study with Dow AgroSciences

- Post-spray GIS map of helicopter swath tracks
Mesquite Regrowth Biomass (Cleared Trt)
2007-2012

Pre-harvest mass per tree = 32 kg
Restoring ecosystem function is essential to sustain livelihoods, ecosystem services and human wellbeing.

Healthy agro-ecosystems are considerably more productive, stable and resilient than those in poor condition.

The value of ecosystem services to society is worth more to society than agricultural earnings.

Our research documents the positive impacts of leading conservation ranchers and studies how they have achieved superior results.
Importance of studying Management

Research results do not automatically translate into decisions that improve provision of private or public goods and services.

We need a data base that allows us to calculate how to achieve superior and sustainable results.

Leading farmers consistently achieve superior results by the way they:

- Allocate resources,
- Use different techniques,
- Novel concepts, and
- Adaptively change these elements to achieve outcomes that exceed the sum of parts involved

This is the “Art of farming” and has long been acknowledged as the producer of superior results.
Reductionist science is inadequate for understanding management as it simplifies and isolates inputs and treatments.

This precludes the discovery of emergent properties that are the signature achievement of leading managers.

Understanding management can only be done by assessing Systems Level, multi-year responses.

Management research investigates what combinations of Systems Level decisions have superior outcomes.

This compliments existing reductionist research by providing context.
Farmers need to know:

For research to more effectively result in improved management we need to provide answers to the following important practical questions:

- How good is any management option ecologically, economically and socially?
- Within what context is it most likely to be successful?
- How can the results be contextualized to make management options work as well as possible?

Generally scientists have not done this.
Current research framework

- Test the impact of different grazing management strategies at the scale of commercial ranches by studying impacts on neighbouring ranches to check for consistency of response across multiple counties.

- Expand small scale reductionist research to facilitate providing information needed at the systems level.

- Corroborate output of biological models with field results from commercial ranches under a range of management strategies.

- Test management hypotheses at the whole enterprise level using corroborated biological simulation models with an economic component.

- Use models to determine what combination of management choices yields superior results?
Future research

Develop and test theories to check conclusions for inconsistencies from various sources to include:

- Ranch-based research at scale of management.
- Retrospective, remote sensing impacts of different management at landscape scale.
- Test an extended range of treatments with corroborated simulation models.
- Evaluate perceptions of landowners.
- Examine policy options to eliminate perverse incentives.
Soil & Water Quality
(Paul DeLaune)

NRCS & Soil Health

- “Soil Health” workshops
- 5 Principles to improve soil health
  1) Armor the soil
  2) Minimize disturbance
  3) Plant diversity (4 crop types)
  4) Keep living root year round
  5) Livestock Integration
Objectives

- Demonstrate and quantify the impact of cover crops in dual-purpose no-till wheat on soil chemical, physical, and biological properties, soil moisture, crop growth, and water quality

- **Measured Parameters**
  - Nutrient cycling (macro and micro nutrients, C pools)
  - Soil moisture
  - Infiltration and runoff rates
  - Runoff water quality
  - Bulk density and soil strength
  - Biomass and N uptake
  - Wheat yields
Soil Testing

- USDA-ARS Soil Test, 0-6” only

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Solvita 1-day CO2-C</th>
<th>Organic C</th>
<th>Organic N</th>
<th>Organic C:N</th>
<th>Soil Health Calculation</th>
<th>Cover crop mix</th>
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<tbody>
<tr>
<td>South 35</td>
<td>16.08</td>
<td>159.51</td>
<td>10.39</td>
<td>15.36</td>
<td>3.68</td>
<td>70% Legume</td>
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<tr>
<td>North 35</td>
<td>29.00</td>
<td>147.01</td>
<td>9.03</td>
<td>16.28</td>
<td>4.15</td>
<td>70% Legume</td>
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<tr>
<td></td>
<td></td>
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<td></td>
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<td>30% Grass</td>
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## Conventional versus No-Till Comparison

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<thead>
<tr>
<th></th>
<th>Conventional</th>
<th>No-Till</th>
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<tr>
<td>Total Revenue</td>
<td>$245.00</td>
<td>$245.00</td>
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<tr>
<td>Total Variable Costs</td>
<td>$183.82</td>
<td>$170.38</td>
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<td>Planned Returns Above Variable Costs</td>
<td>$61.18</td>
<td>$74.62</td>
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<td>Total Fixed Costs</td>
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<td>Total Costs</td>
<td>$259.44</td>
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<td>Planned Returns Above All Costs</td>
<td>-$14.44</td>
<td>$9.23</td>
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<td>Breakeven to Cover All Costs</td>
<td>$7.41</td>
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<td>Advantage</td>
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<td>$23.67</td>
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## Warm Season Cover Crop Mix in Wheat at Vernon

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<tr>
<th>Crop</th>
<th>Rate (lb/ac)</th>
<th>Cost ($/lb)</th>
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<tr>
<td>Iron &amp; Clay Cowpea</td>
<td>6</td>
<td>0.90</td>
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<tr>
<td>Catjang Pea</td>
<td>6</td>
<td>0.90</td>
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<tr>
<td>Lablab Bean</td>
<td>1</td>
<td>2.10</td>
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<tr>
<td>Forage Soybean</td>
<td>8</td>
<td>1.20</td>
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<tr>
<td>Browntop Millet</td>
<td>1.5</td>
<td>0.90</td>
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<tr>
<td>G. Foxtail Millet</td>
<td>1.5</td>
<td>1.00</td>
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<tr>
<td>Sorghum Sudan</td>
<td>2.5</td>
<td>0.68</td>
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<tr>
<td>Buckwheat</td>
<td>3</td>
<td>1.00</td>
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<tr>
<td>Sesame</td>
<td>0.5</td>
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<tr>
<td>Inoculant</td>
<td>-</td>
<td>1.75</td>
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<tr>
<td><strong>Total</strong></td>
<td>30 lb/ac</td>
<td>$32.95/ac</td>
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Beef Cattle Research: Enhancing Sustainable Beef Production through Integrated Trans-disciplinary Sciences.
(Dr. Bill Pinchak)

The Pinchak lab group focuses on discovery and translational research as it applies to sustainable beef production through employing proper grazing management, mitigation of metabolic and pathogenic diseases, utilization of bio-fuel co-products, novel feedstuffs/forages and integrated understanding of the roles the gut microbiome plays and opportunities for manipulation.
Beef Cattle Research Programs

1. **Metabolic Disease: (Bloat, Acidosis and Nitrate Poisoning)** Linkage of environment and phenotypic characteristics of metabolic disorders to *in vitro* and *in vivo* physiology and rumen microbial ecology.

2. **Beef Cattle Nutrition, Health and Food Safety: (Morbidity mitigation, Co-products, Value-added strategies to enhance sustainable production efficiency in grazed and confinement beef systems.**

3. **Integrated Systems:** Dual-use wheat and forages using beef cattle as agents of change in native and introduced ecosystems
4. Ruminant Metagenome:
Characterize and elucidate commensal and pathogenic microbiomes of beef cattle as these relate to:

a. Disease state and animal health
b. Host-pathogen interactions
c. Metabolic pathways
d. Production efficiency and greenhouse gas mitigation
e. Novel proteins & enzymes for biofuel & animal health applications.
Key to Our Labs Success Has Been Establishing a Highly Functioning Trans-disciplinary Network

Trans-disciplinary Network

Texas A&M University
  Animal Science
    Tryon Wickersham
    Jason Sawyer
    Josie Coverdale
    Gordon Carstens
    Rhonda Miller
    Luis Tedeschi
  Plant Pathology
    Joshua Yuan
  Office of State Chemist
    Susie Dai
  College of Veterinary Medicine
    Garry Adams
    Jan Janechka
    Sarah Lahown
    Jan Sucodohski
Trans-disciplinary Network

USDA-ARS Southern Great Plains Center
  Robin Anderson
  Michael Hume
  Todd Callaway

Texas A&M AgriLife Research
  Jim Ansley
  Dariusz Malinowski
  Paul DeLaune
  Pablo Pinedo
  Genomics and Bioinformatics Core
    Charlie Johnson
    Scott Schwartz
    Rick Metz
  Jim MacDonald
  Richard Teague
  Brent Auvermann

J. Craig Venter Institute
  Oriana Brechster
  Karen Nelson
Graduate Student and Post-Doctoral Mentees 2000-2013

Graduate Students:

<table>
<thead>
<tr>
<th>Name</th>
<th>Degree</th>
<th>Year</th>
<th>University</th>
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<tr>
<td>Ingnacio Galvez Nunez</td>
<td>MS</td>
<td>2000</td>
<td>Texas A&amp;M University</td>
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<tr>
<td>Charles Lloyd Kneuper</td>
<td>MS</td>
<td>2000</td>
<td>Angelo State University</td>
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<tr>
<td>Galen P. Austen</td>
<td>PhD</td>
<td>2003</td>
<td>Texas Tech University</td>
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<tr>
<td>Douglas R. Tolleson</td>
<td>PhD</td>
<td>2007</td>
<td>Texas A&amp;M University</td>
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<tr>
<td>Karla J. Hernandez</td>
<td>MS</td>
<td>2007</td>
<td>University of Puerto Rico</td>
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<tr>
<td>Hector Gutierrez Banuelo</td>
<td>PhD</td>
<td>2008</td>
<td>Texas A&amp;M University</td>
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<tr>
<td>Shannon Bennet</td>
<td>MS</td>
<td>2010</td>
<td>Texas A&amp;M University</td>
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<td>Egleu Mendez</td>
<td>MS</td>
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<td>Ashley Wolford</td>
<td>MS</td>
<td>2011</td>
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<td>Merritt Drewery</td>
<td>MS</td>
<td>2012</td>
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<td>Katie Henderson</td>
<td>MWSC, non-thesis</td>
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<tr>
<td>Christine Warzecha</td>
<td>MS</td>
<td>2013</td>
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<tr>
<td>Joshua McCann</td>
<td>MS</td>
<td>2013</td>
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<td>Joel D. Suggs</td>
<td>MS</td>
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<td>Texas A&amp;M University</td>
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Post-Doctoral Research Associates

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<tr>
<th>Name</th>
<th>Tenure</th>
<th>Current Position</th>
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<tr>
<td>Dariusz P. Malinowski</td>
<td>1998-2000</td>
<td>Professor, Texas A&amp;M AgriLife Research</td>
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<tr>
<td>Byeng R. Min</td>
<td>2004-2009</td>
<td>Assistant Professor, Tuskegee University</td>
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<tr>
<td>Dipti W. Pitta</td>
<td>2009-2012</td>
<td>Assistant Professor, University of Pennsylvania</td>
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<tr>
<td>Ginger M. Shipp</td>
<td>2010-2013</td>
<td>Completes Post-Doc Aug 2013</td>
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Eddy Covariance Flux Tower

Nithya Rajan and Jim Ansley
Texas A&M AgriLife Research, Vernon
How is vegetation measured?
Eddy covariance method

Instruments (fast-response) measure CO$_2$ and H$_2$O absorbed and released by the plant canopy.

30-minute average CO$_2$ and H$_2$O fluxes are determined from fluctuations in vertical wind velocity and gas concentration.
Net Ecosystem Exchange (NEE) and Evapotranspiration (ET)

NEE is a measurement of the amount of carbon (CO₂) entering and leaving the ecosystem.

\[ \text{Flux of CO}_2 = \text{CO}_2'w' \]

Positive Flux: Carbon source
Negative flux: Carbon sink

ET: Direct measurement of vertical movement of water vapor by movement of eddies in the atmosphere

\[ \text{Flux of H}_2\text{O}= \text{H}_2\text{O}'w' \]
Substantial changes in ecosystem responses each year due to climatic conditions and management practices

- Air temperature
- Precipitation
- Soil water content
- Grazing
Lockett Farm
Tour of Lockett Research Facility

Texas A&M AgriLife Research, Vernon

28 August 2013

Dariusz Malinowski
Steve Brown
Alan Waggoner
Paul DeLaune
Breeding of Winter-Hardy Hibiscus (*H. x moscheutos*)

Dariusz Malinowski - Project Leader

Collaborators:
Steve R. Brown - Texas Foundation Seed
Dr. William E. Pinchak - Texas AgriLife Research
Background and Major Objective

- Project officially initiated at Texas AgriLife Research - Vernon in 2009.
- Majority of commercially available cultivars have flowers in white, red, and pink color. There is a significant interest in winter-hardy hibiscus because of its very tropical look and tolerance to low winter temperatures.
- Our major goal is to develop cultivars of winter-hardy hibiscus with unique flower and leaf color and shape, and to commercialize the cultivars.
Major Accomplishments

- During 2009-2012, we have disclosed over 80 unique breeding lines of winter-hardy hibiscus to TAMUS Office of Technology Commercialization.
- Currently, over 40 lines are in evaluation by two industry partners in the USA and one in Holland.
- In 2012, we released two cultivars, “Robert Brown” and “Blue Angel”.
- This program resulted in the first blue-flowering winter-hardy hibiscus lines in the world.
Hibiscus, Forages
(Dariusz Malinowski)

Improvement of Summer-Dormant Cool-Season Grasses
Background and Major Objective

- Project officially initiated in 2009, in collaboration with Grasslands Innovation (New Zealand).
- Tall fescue and orchardgrass base populations are owned by Texas AgriLife Research, ryegrass base populations originate from USDA-GRIN collection.
- Major goal is to develop cultivars of summer-dormant tall fescue, orchardgrass, and perennial ryegrass with superior persistence, forage productivity and disease resistance, and tolerance to drought and high temperatures in summer.
Major Accomplishments - Tall Fescue

- Pre-nucleus seed of three breeding lines was produced at Vernon in 2013. Further seed increase of the final selections will be conducted in New Zealand in 2014 to ensure high quality of seed for world-wide (USA, Australia, Argentina, Uruguay) evaluation studies.

- TAL-01 A wide-leaf selection infected with AR548 endophyte strain.
- TAL-02 A wide-leaf selection, endophyte-free
- TAL-03 A narrow-leaf selection infected with AR548 endophyte strain.
Major Accomplishments - Orchardgrass

- Pre-nucleus seed of three breeding lines was produced at Vernon in 2013. Further seed increase of the final selections will be conducted in New Zealand in 2014 to ensure high quality of seed for world-wide (USA, Australia, Argentina, Uruguay) evaluation studies.

- TAL-DG-1 (Gamla) - A wide-leaf selection resembling a continental type, high forage production, high seed yield.

- TAL-DG-2 (Pura) - A medium-wide leaf selection, good tillering plants, early maturity.

- TAL-DG-3 (Pura LM) - A late-maturing selection, medium-wide leaf, good forage production.
Major Accomplishments – Perennial Ryegrass

- Two synthetic lines are being developed, based on three accessions from the Mediterranean Basin:
  - An early-maturing line
  - A late-maturing line
- Pre-nucleus seed of the late-maturing selection was produced at Vernon in 2013. Further seed increase of the final selection will be conducted in New Zealand in 2014 to ensure high quality of seed for world-wide (USA, Australia, Argentina, Uruguay) evaluation studies.
- Pre-nucleus seed of the early-maturing selection will produced at Vernon in 2014.
Forage Systems Program – Additional Projects

- Cooperative research on complementary annual (winter wheat) and perennial (summer-dormant grasses) grazing systems.
- Development of annual/perennial legume – summer-dormant tall fescue grazing systems.
- Physiological and ecological effects of *Neotyphodium coenophialum* fungal endophyte on tall fescue.
Irrigation system
(Alan Waggoner)

Irrigation Capability Prior to Expansion
Approximately 27 ac. on the south side of U.S. 70 could be irrigated with a side-roll sprinkler system.
FY12

- Bore 120’ under U.S. 70 and install pipe sleeve for waterline; 5-30-2012
- Install 1650’ of waterline from well under U.S. 70 to the reservoir; 6-14-2012
- Construction of Earth Reservoir; 7-12-12
  - Capacity 3630 cu. yd., 2.24 ac. ft., 732,800 gallons
  - Top diameter 156’ & bottom diameter 72’; depth 10’
- Geomembrane liner installed in reservoir; 9-17/2012

See page 11 for aerial photograph of waterline & reservoir.
FY13

To Be Done:

- Install all material and power service for 3220' of underground pipe to include two pivot locations for a towable pivot, and waterline connections for a KIFCO hose reel sprinkler
  - The pivot will water two 4.6 ac. circles
  - The hose reel sprinkler will water 6.3 ac. of small bordered fields.

See page 12 for aerial photograph of pivot system.
Above: Pivot with bubble pads—large droplets are more resistant to evaporation and wind displacement

Left: Hose reel sprinkler—water application to small areas and circle corners inaccessible to the pivot
Future Objectives

- Limited irrigation research and supplemental irrigation to establish crop stands are primary uses.
- Seed increase opportunities for Texas Foundation Seed.
- Cool-season crops (wheat, canola, perennial forages)
- Warm-season alternative crops to enhance profitability and conserve water resources (guar, safflower, sesame, sunflower, sorghum).
Alternative Crops
(Paul DeLaune)

Summer Rotational Crops

- **Objective:** Evaluate rotational crops in cotton systems and their impact on subsequent cotton production and overall economic viability.
- **Evaluated crops:**
  - Continuous cotton vs. rotation with guar, safflower, sesame, sorghum, and sunflower.
- **Measured parameters:**
  - Nutrient cycling, soil health, crop yields, and economics
Chillicothe
Research Station
Texas A&M AgriLife Research at Vernon/Chillicothe

1. Wheat Breeding
2. Wheat Fertility (Cropping Systems Initiative)
3. Cotton Variety and Water Use Efficiency (Cotton Inc.)
4. Tillage and Water Strategies in Cotton, Guar & Sorghum (Cotton Inc., Cropping Systems Initiative, Texas Grain Sorghum Board)
5. Cotton/Sorghum Rotation (Cropping Systems Initiative)
6. Texas Foundation Seed Guar Seed Increase
7. Cover Crops and Soil Health (USDA-NRCS)
8. Wheat/Canola studies (USDA-NIFA, Texas Wheat Producers Board)
Tour of Chillicothe Research Facility

Texas A&M AgriLife Research, Vernon

28 August 2013

Nithya Rajan
Jackie Rudd
Paul DeLaune
Yield, water use efficiency and physiological parameters of cotton cultivars

PI: Nithya Rajan  
Assistant Professor (Cropping Systems)  
Texas A&M AgriLife Research
Objectives

- Evaluate the yield, water use efficiency and physiological parameters of cotton cultivars under different levels of irrigation and tillage management.

- Identify cotton cultivars with good yield stability for the Texas Rolling Plains region.

- Compare remote sensing based irrigation to the standard crop coefficient based irrigation.
Materials and Methods

- **Tillage**: Conventional tillage and no-tillage
- **Irrigation**
  - Sub-surface drip (40” spacing, 20” emitter spacing)
  - Irrigations Levels:
    - 90% ET
    - 45% ET
    - Remote sensing-based irrigation assuming no stress
    - Dryland
- **Cultivars**: PHY499, DP1044, PHY375, FM9170
All plots received an initial irrigation of 3”.

Results

Irrigation + Rain (8”)

90% ET - 25”
RS - 26”
45% ET - 17”
Dryland - 11”
Yields of all four varieties were similar except under the 90%ET irrigation treatment. Under 90%ET irrigation, PHY375 performed well.

PHY375 - 3.5 bales/acre
FM9170 - 3.3 bales/acre
DP1044 - 3.2 bales/acre
PHY499 - 3.0 bales/acre
Summary and Conclusions

- Amount of irrigation applied based on remote sensing method was similar to 90% ET-based irrigation.

- Cultivar differences in yields and water use efficiency were observed in 90%ET treatment – Average yield of PHY375 was 3.5 bales/acre. Lowest yield in 90%ET was reported for PHY 499 (3.0 bales/acre)

- All varieties performed similarly under dryland. Yield ranged from 0.6 – 0.8 bales/acre.

- Yield of cultivars was not affected by tillage.
TAM Wheat Improvement
(Dr. Jackie Rudd)

Design hard winter wheat varieties to increase the profitability for Texas producers and processors and increase value for Texas consumers

Improving Life through Science and Technology.
TAM Wheat Improvement

STATE WIDE
- Grain yield
- End-use quality
- Forage production
- Rust resistance
- Greenbug resistance

Rolling Plains
- Drought / high temp
- Hessian fly

High Plains
- Drought tolerance
- Water-use efficiency
- WSMV resistance
- Russian wheat aphid
Cultivar Development is a 15 Year Process

- Identify donor parents with desired characteristics
- Generate genetic variability through sexual hybridization
- Self pollinate for 3-4 generations while performing selection among and within populations
- Conduct multi-location yield trials to identify candidate varieties
- Purification and multiplication

12 to 15 YEARS
TAM Small Grain Breeding in the Rolling Plains

- SMALL GRAINS
  - Wheat and Triticale
- TRIAL LOCATIONS
  - Chillicothe, Lockett, Munday, Abilene
- STAFF
  - Jason Baker
  - Vacant Research Assistant
  - Jonathan Ramirez
TAM Small Grain Breeding in the Rolling Plains

- **ACTIVITIES**
  - Greenhouse Crossing
  - Grain Yield Trials
  - Clipping Trials to assess forage production and regrowth
  - Synthetic Hexaploid Introgression
TAM Wheat Variety Release Candidates

- **TX06V7266**  Awnless wheat with resistance to greenbug, Hessian fly, rusts, acid soil, and wheat soil borne mosaic virus. It has shown excellent grain yield and forage yield throughout Texas and will be very good in a dual-purpose (grazing and grain) production system.

- **TX07A1505**  High grain yield and has very strong dough strength properties. Because of the unique end-use quality attributes, it will likely be grown in an identity preserved system. Discussions with milling companies are in progress.
### Cotton

<table>
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<tr>
<th>Dependent Variable</th>
<th>Tillage (T)</th>
<th>Evapotranspiration Replacement (ET)</th>
<th>T x ET</th>
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<tbody>
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<td>Lint Yield</td>
<td>0.1975</td>
<td>&lt;0.0001</td>
<td>0.4719</td>
</tr>
<tr>
<td>Net Return</td>
<td>0.0895</td>
<td>&lt;0.0001</td>
<td>0.4719</td>
</tr>
</tbody>
</table>

![Graph showing the relationship between yield and net return with evapotranspiration replacement level.](image)

*DeLaune et al., 2012 Agron. J. 104:991-995*
<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Tillage (T)</th>
<th>ET Replacement (ET)</th>
<th>T x ET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield</td>
<td>0.3517</td>
<td>0.0307</td>
<td>0.1558</td>
</tr>
</tbody>
</table>
Guar Production

- Tillage Effects
  - No-till
  - Conventional

- Irrigation Rates
  - Dryland
  - Half rate
  - Full rate

- Desiccants
  - Yield
  - Quality
<table>
<thead>
<tr>
<th>Date</th>
<th>Stored Soil Water (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec</td>
<td>160</td>
</tr>
<tr>
<td>Feb</td>
<td>180</td>
</tr>
<tr>
<td>Apr</td>
<td>200</td>
</tr>
<tr>
<td>Jun</td>
<td>220</td>
</tr>
<tr>
<td>Aug</td>
<td>240</td>
</tr>
</tbody>
</table>

- **Conv. Till**
- **No-Till**
- **Winter Pea**
- **Crimson Clover**
- **Hairy Vetch**
- **Mixed**
- **Wheat**

*Cover Crop in Dryland Cotton*
Cover Crop in Irrigated Cotton

<table>
<thead>
<tr>
<th>Date</th>
<th>Stored Soil Water (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec</td>
<td>140</td>
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<td>Feb</td>
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<tr>
<td>Jun</td>
<td>200</td>
</tr>
<tr>
<td>Aug</td>
<td>220</td>
</tr>
</tbody>
</table>

Legend:
- Yellow: Conv Till
- Green: No-Till
- Red: Mixed
- Purple: Wheat