

**Texas AgriLife Research
Texas Water Resources Institute**

**Groundwater Nitrogen Source Identification and Remediation in the Texas High Plains and Rolling
Plains Regions
FY 09 CWA 319(h)
TSSWCB Project No. 09-03**

Quarter no. 14 From 1.1.2013 through 3.31.2013

I. Abstract

Work this quarter has focused on the completion of data analysis although a small portion of analysis remains. Evaluation of results also consumed the bulk of the quarter. Work also continued on a manuscript describing work being conducted and results found to date. The project's final report also began to be developed this quarter. Education and outreach was also a focus this quarter. Presentations on project findings were given at 3 conferences (1 regional; 2 national) and a graduate presentation at the American Society of Agronomy Southern Branch meeting in Orlando won 2nd place in the student presentation category. The local delivery of the Texas Well Owners Network program also afforded a local opportunity to convey project findings.

II. Overall Progress and Results by Task

TASK 1: Project Administration

Subtask 1.1: TWRI, with input from Texas AgriLife Research and UT-BEG, will prepare electronic quarterly progress reports (QPRs) for submission to the TSSWCB. QPRs shall document all activities performed within a quarter and shall be submitted by the 15th of January, April, July and October. QPRs shall be distributed to all project partners and posted on the project website developed and hosted by TWRI.

The following actions have been completed during this reporting period:

A. TWRI submitted the 14th Quarter, report to TSSWCB on April 12th, 2013.

98% Complete

Subtask 1.2: TWRI will perform accounting functions for project funds and will submit appropriate Reimbursement Forms to TSSWCB at least quarterly.

The following actions have been completed during this reporting period:

A. Expenditures thus far have totaled \$328,298 or roughly 73% of total project funding.

80% Complete

Subtask 1.3: TWRI will participate in meetings as appropriate in order to efficiently and effectively achieve project goals, coordinate monitoring efforts and summarize activities and achievements made throughout the course of this project.

The following actions have been completed during this reporting period:

- A. Several informal discussions were held this quarter regarding project progress and timelines for getting draft final reports completed.

95% Complete

Subtask 1.4: *TWRI will work with AgriLife Research and UT-BEG to develop a project final report summarizing the results of the groundwater nitrogen source identification and demonstration of nitrogen remediation strategies for submittal to the TSSWCB and EPA.*

The following actions have been completed during this reporting period:

- A. Project personnel are drafting their respective portions of the project final report. A complete draft is expected the middle of next quarter.

30% Complete

TASK 2: Quality Assurance

Subtask 2.1: *TWRI will develop a QAPP for activities in Tasks 3-4 consistent with EPA Requirements for Quality Assurance Project Plans (QA/R-5) and the TSSWCB Environmental Data Quality Management Plan.*

All monitoring procedures and methods prescribed in the QAPP shall be consistent with the guidelines detailed in the TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue (RG-415) and Volume 2: Methods for Collecting and Analyzing Biological Community and Habitat Data (RG-416).

The following actions have been completed during this reporting period:

- A. No activity to report at this time.

100% Complete

Subtask 2.2: *TWRI will submit revisions and necessary amendments to the QAPP as needed.*

The following actions have been completed during this reporting period:

- A. The annual QAPP revision was approved by EPA on May 17, 2012.

100% Complete

TASK 3: Groundwater Nitrogen Source Identification

Subtask 3.1: *To quantify the changes between native rangeland sites and cultivated sites that are in close proximity to each other, UT-BEG will use data from the USDA Bushland site near Amarillo where an area of the research station has been maintained under rangeland management and is adjacent to cropland.*

The following actions have been completed during this reporting period:

- A. Analysis results have been evaluated thus enabling likely N sources to be distinguished.
- B. Task complete.

100% Complete

Subtask 3.2: UT-BEG will quantify organic carbon and total nitrogen in the native and cropland profiles to quantify the reduction in organic carbon from the native to the cropland site. These data will be used to determine if changes in organic carbon and nitrogen can account for the increased nitrate found in profiles under cropland.

The following actions have been completed during this reporting period:

- A. Analysis results have been evaluated thus enabling the types of N sources to be distinguished and quantified.
- B. Task complete.

100% Complete

Subtask 3.3: UT-BEG will also examine carbon-13 isotopes on the organic carbon which may provide insights on the impact of the shift from native vegetation to cropland on the relative proportions of soil organic carbon derived the native system versus the cultivated system. Utilization of long-term CRP land may also be employed.

The following actions have been completed during this reporting period:

- A. Data analysis was completed this quarter.
- B. Result evaluation began.

95% Complete

Subtask 3.4: Mass balance analyses will also be conducted by UT-BEG, in collaboration with USDA-ARS, to evaluate the relative inputs of nitrogen from different sources. These results should be applicable to the entire Texas High Plains Ogallala and the Rolling Plains Seymour Aquifers.

The following actions have been completed during this reporting period:

- A. Mass balance analysis continued this quarter and should be completed next quarter following completion of isotope data evaluation.

90% Complete

Subtask 3.5: Nitrate derived from mineralization of native soil organic matter does not constitute a continuous input to the system and should move through the groundwater system as a pulse. UT-BEG will evaluate this process through mass balance analyses.

The following actions have been completed during this reporting period:

A. Result write up continued for this task this quarter.

90% Complete

Subtask 3.6: *Historical records of agricultural practices will be examined for dryland and irrigated sites by UT-BEG to determine relationships between nitrogen application rates and subsurface inventories. Based on these data and findings from UT-BEG, Texas AgriLife Research will develop recommendations on nitrogen application rates for farmers (Subtask 4.6).*

The following actions have been completed during this reporting period:

A. Task complete.

100% Complete

Subtask 3.7: *UT-BEG will assist Texas AgriLife Research with determining BMPs related to nitrogen fertilizer applications for producers.*

The following actions have been completed during this reporting period:

A. AgriLife Research and UT-BEG continued discussions regarding potential BMPs based on findings thus far. Plans have been made to develop a relevant fact sheet on these next quarter.

60% Complete

Subtask 3.8: *UT-BEG will evaluate nitrate input from mineralization of SOM. This mineralization mechanism with subsequent release of nutrients forms the basis of the crop's nutrient requirements in the northern portion of the Texas High Plains and may contribute substantive amounts of nitrate to the system. UT-BEG will supplement existing data by drilling additional boreholes in Lynn County where extremely high groundwater nitrate contamination is found.*

The following actions have been completed during this reporting period:

A. Results continued to be written up this quarter.

90% Complete

TASK 4: Evaluation and demonstration of Nitrogen Remediation Strategies

Subtask 4.1: *AgriLife Research will establish a 2.5 acre block under subsurface drip irrigation cropped to cotton at the Chillicothe Research Station to demonstrate and document benefits of irrigation water N crediting to area farmers.*

The following actions have been completed during this reporting period:

A. This task is now complete.

100% Complete

Subtask 4.2: *At Chillicothe, AgriLife Research will demonstrate nutrient management strategies*

based on the crop's agronomic (1) N requirements, (2) N and P requirements, (3) N requirement minus irrigation N credit, (4) N and P requirement minus irrigation N credit, and (5) control (N from irrigation water only) on plots cropped to cotton under subsurface drip, furrow, and overhead irrigation.

The following actions have been completed during this reporting period:

- A. Task complete.

100% Complete

Subtask 4.3: AgriLife Research will collect and analyze soil samples from a depth of 36 inches following each growing season. Soil samples will be analyzed by AgriLife Research at Vernon for nitrate, ammonium, total N, and P. Irrigation water samples will also be collected weekly throughout the irrigation season at demonstration sites and analyzed for nitrate. AgriLife Research will also conduct an economic analysis of different nutrient management practices (Subtask 4.2), demonstrating the most cost-effective BMP.

The following actions have been completed during this reporting period:

- A. Soil sampling and plant nutrient uptake sample analysis was completed this quarter.
- B. Data evaluation began and will be completed early next quarter thus defining cotton's ability to utilize soil and water available nitrogen.

96% Complete

Subtask 4.4: Based on findings from UT-BEG (Subtask 3.6), Texas AgriLife Research will develop recommendations on nitrogen application rates for farmers. Texas AgriLife Research will also work with UT-BEG to determine BMPs related to nitrogen fertilizer applications for producers. Texas AgriLife Research will provide these recommendations on application rates and BMPs via development of a technical report and fact sheet (see Subtasks 4.5 and 4.6 below) to Texas AgriLife Extension Service personnel, local soil and water conservation districts, NRCS personnel, TSSWCB personnel, Texas Water Development Board staff, underground water conservation districts, certified crop advisors, and directly to farmers to ensure delivery of these recommendations.

The following actions have been completed during this reporting period:

- B. AgriLife Research and UT-BEG continued discussions regarding potential BMPs based on findings thus far. Plans have been made to develop a relevant fact sheet on these next quarter.

60% Complete

Subtask 4.5: AgriLife Research will host a minimum of 1 field day at the demonstration site. Additionally, project results will be presented at the Beltwide Cotton Conference and American Society of Agronomy meetings. The Beltwide Cotton Conferences speed the transfer of new technology to U.S. cotton producers and other industry members. Coordinated by the National Cotton Council (NCC) and its cooperating partners, this annual forum is recognized as the global champion for cotton technology transfer. Regionally, project results will be presented at the annual meetings of the Texas State Support Committee of Cotton Inc. in Lubbock and the Texoma Farm and Ranch Show in Wichita Falls. These regional meetings are well attended by

producers, industry, and commodity board members. Finally, at least 3 workshop/stakeholder meetings will be held to discuss nitrate and irrigation strategies. AgriLife Research will work with UT-BEG to develop handouts, presentations, and posters (as appropriate) describing results along with other educational materials for the Texas High Plains and Rolling Plains regions for use at the field day, regional and national meetings, and workshop/stakeholder meetings. Specifically, at least one fact sheet is planned for development on recommendations on nitrogen application rates and BMPs. These materials will subsequently be made available to AgriLife Extension and others as listed in Subtask 4.4 above for use at other venues in the region and distributed to farmers.

The following actions have been completed during this reporting period:

A. Presentations on project findings to date were given at:

- 2013 Beltwide Cotton Conference in San Antonio on January 9th
- North Rolling Plains Ag Conference in Vernon on January 29th
- ASA Southern Branch in Orlando, FL on February 4th (grad student presenting won 2nd place oral presentation)
- Texas Well Owners Network in Wellington on March 28th

98% Complete

Subtask 4.6: AgriLife Research will work with TWRI and UT-BEG to develop a technical report and refereed journal publication summarizing results of the demonstration and groundwater nitrogen source evaluation for further technical transfer and incorporation into the final report submitted to the TSSWCB and EPA.

The following actions have been completed during this reporting period:

A. Efforts continued to develop the project final report.

35% Complete

III. Related Issues/Current Problems and Favorable or Unusual Developments

IV. Projected Work for Next Quarter

- Complete data analysis and evaluate findings
- Develop recommendations for nitrogen utilization BMPs and incorporate them into an Extension fact sheet
- Continue working on a draft final report describing project findings