

**Seymour Aquifer Water Quality Improvement Project
FY 04 CWA 319(h)
TSSWCB Agreement No. 04-9A**

Quarter no. 1 From 10/1/04 Through 12/31/04.

I. Abstract

The project is still much in the initial planning stages. While no defined steps have been taken regarding educational activities as outlined in task 3, the SWCD technician, Mr. Dale Carroll, and Jones County Extension Agent, Mr. Todd Vineyard, have been in communication regarding an upcoming producer education event to address types of drip systems, necessary equipment and service providers.

Research personnel also worked during this first full quarter to coordinate and define scheduling, data collection, sample analysis and laboratory selection for efforts related to task 4. Furthermore, this information can be used in the development of the QAPP, another task in the initial phases at this point.

Finally, during this quarter, the Haskell SWCD Office announced the beginning of the drip irrigation cost-share program in the area. The application portion of the program closed in November and participants were selected during December.

Once participants are finalized and an approved QAPP is established, TAES researchers will be able to implement the proposed research plan.

II. Overall Progress and Results by Task

TASK 3: Water Quality Education of BMPs to Reduce Nitrate Infiltration

Subtask 3.1: TCE and TAES will assimilate/evaluate the adequacy of existing educational resources and resource needs to provide educational support for the project. (Month 1 through 12)

The following actions have been completed during this reporting period:

- a. No progress to report at this time.

0% Complete

Subtask 3.2: TCE, TAES and TWRI will provide 3 educational/training events on single- or multi-county level to improve grower knowledge and understanding of BMPs for nutrient and irrigation management. TSSWCB personnel and other agency personnel including Haskell, Wichita Brazos, and California Creek SWCDs, will be speakers to provide information on cost share and technical assistance programs available to assist producers. (Month 1 through 12)

The following actions have been completed during this reporting period:

- a. No progress to report at this time.

5% Complete

Subtask 3.3: TCE, TAES and TWRI will hold single follow-up meetings during subsequent project years 2 and 3 to provide information on project activities or results and provide additional training of implementing and sustaining BMPs as necessary. (Month 12 through 36)

The following actions have been completed during this reporting period:

- a. No progress to report at this time.

0% Complete

Subtask 3.4: TCE and TAES will conduct a preliminary survey of a select group of initial event participants to evaluate knowledge about ground water conditions in the aquifer and assess current knowledge and use of practices in irrigation and nutrient management. Follow-up surveys will be conducted in subsequent years to evaluate changes, if any, in producer awareness and in irrigation and nutrient BMPs. (Month 1 through 36)

The following actions have been completed during this reporting period:

- a. No progress to report at this time.

0% Complete

TASK 4: Evaluation of BMP Effectiveness

Subtask 4.1: As appropriate, the TAES, with assistance from the SWCD technician, will assess and compile existing data on the Seymour Aquifer and the effects of irrigation and other farming practices on aquifer water quality (Month 1 through 36)

The following actions have been completed during this reporting period:

- a. TWRI, TAES and SWCD personnel participated in a teleconference on 10-8-04 establish communication and define project roles. Specifically, the group discussed implementation and process of the cost-share program, overall project schedule and specific research needs and requirements. Meeting minutes can be found in Appendix A.
- b. TWRI personnel discussed potentially coordinating research efforts with USGS and UT Bureau of Economic Geology to better assess nitrate concentrations in the aquifer. Further discussions between TWRI, TAES, USGS and BEG will be arranged in the near future to identify each agency's involvement in the joint effort.
- c. Following the Texas Plant Protection Conference, TWRI personnel contacted researcher, Mr. Fred Vocasek, who spoke on nitrogen profiling, to obtain information for project personnel.

15% Complete

Subtask 4.2: TAES will assess impacts of conversion from furrow irrigation to drip irrigation on nitrate concentration and water quantity at field scale by continuing projects on established drip and furrow irrigation plots located in aquifer region to further validate current data, adding the following: install in-line flow meters to quantify water use in furrow irrigation and monitor nitrates in irrigation water and the soil profile on a seasonal basis (Month 1 through 24).

The following actions have been completed during this reporting period:

- a. In December, Mr. Jason Ott, Research Associate for TAES, took a position with TCE and will no longer be involved in the Seymour Project.
- b. TAES researchers continued monitoring drip and furrow-irrigated plots near Munday. Plots were harvested and yield and water use data were collected. As planned, data will be analyzed and utilized to support field scale efforts to be completed under task 4.3.
- c. Data collection at Munday will be terminated after the 2005 growing season as the plot area will no longer be leased by TAES.
- d. TAES researchers plan to continue furrow and drip irrigation plot studies at a site in Chillicothe; TAES projects this research to begin in 2006.

10% Complete

Subtask 4.3: TAES will assess impacts of conversion from furrow irrigation to drip irrigation on nitrate concentration and water quantity at project scale by synthesizing current plot-scaled data on water and nitrogen use efficiency (assuming implementation of BMPs) to field scale and by monitoring and modeling water and nitrate balance on fields being implemented with BMPs and cost-share drip irrigation. (Month 12 through 36).

The following actions have been completed during this reporting period:

- a. TAES researcher, Dr. Cristine Morgan, submitted a proposed field-scale research and sample collection plan to TWRI on 11-16-04. See Appendix B. Research plan is currently in draft format and will be revised to accurately reflect activities once field selection is completed and project QAPP is approved.
- b. Cost-share program application process ended in November and selection of cost-share program participants was made in December. SWCD technician is in the process of finalizing participant list to ensure commitment to program.

0% Complete

Subtask 4.4: TAES will assess impacts of conversion from furrow irrigation to drip irrigation on nitrate concentration and water quantity at aquifer scale by coordinating with the SWCDs, NRCS, Rolling Plains Groundwater Conservation District and Lower Seymour Groundwater Conservation District to verify assumptions made when scaling up data and modeling fields being implemented with BMPs and cost-share drip irrigation (Month 24 through 36).

The following actions have been completed during this reporting period:

- a. No progress to report at this time

0% Complete

Subtask 4.5: TAES will forecast amount of irrigation conversion necessary to meet water quality standards (if achievable), BMP system efficacy and economics (cost/ac-ft), and amount of water savings over the expected life of drip irrigation systems (Month 24 through 36).

The following actions have been completed during this reporting period:

- a. No progress to report at this time.

0% Complete

Subtask 4.6: TAES will develop DQOs and a QAPP to be approved by the TSSWCB and US Environmental Protection Agency (Month 1 through 6).

The following actions have been completed during this reporting period:

- a. TCE submitted project information to TWRI personnel to begin QAPP development including laboratory selection on 10-12-04.
- b. After much discussion, project personnel identified a sampling plan, a technical laboratory to analyze samples and a tentative schedule for field data collection. All information was submitted to TWRI personnel in charge of QAPP development.
- c. TWRI projects a draft QAPP will be submitted within the next quarter.

20% Complete

Subtask 4.7: TAES will provide the annual revisions and/or amendments to the QAPP (Month 1 through 36).

The following actions have been completed during this reporting period:

- a. No progress to report at this time

0% Complete

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

None to report at this time.

IV. Projected Work for Next Quarter

The following will be accomplished during the coming quarter:

- a. Meetings between TWRI, TAES, USGS and BEG will be held to discuss each agency's involvement in the joint effort.
- b. A draft QAPP for the project will be submitted to TSSWCB.
- c. SWCD and TCE will host an educational meeting for producers to discuss drip irrigation systems and the variety of services available in the area.
- d. Following educational meeting, SWCD projects that participant list will be finalized to ensure program participants are fully committed allowing for smooth data collection in

- the field-scale research effort.
- e. SWCD will work to finalize Water Quality Management Plans for program participants providing TAES researchers with additional information for field-scale research efforts.
 - f. TAES researchers will select the 6 fields (3 furrow and 3 drip) to conduct field-scale research.
 - g. TCE will further plan educational events and resolve issue of the planned 3 events versus the 5 events proposed in the contract scope of work.
 - h. TCE will work to potentially coordinate a preliminary survey at the producer education event scheduled for the next quarter.

Appendix A

Meeting minutes from SWCD, TAES and TWRI project planning teleconference.

**Summary of Seymour Project Discussion
October 8, 2004**

Participants: SWCD: Dale Carroll, Charlie Upchurch
TAES: John Sij, Phyllis Dyer, Jason Ott
TWRI: Cecilia Gerngross

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Cost-share Program Status

- Applications received to date:
Knox County – 4 applicants
Jones County – 10 applicants
Haskell County – 1 applicant
- Program budgeted for 5 plans per county, but funds can be adjusted to better fit program interest
- Application period scheduled to end November 1, but will extend if necessary to reach more applicants
- Drip installation systems will be installed by companies selected by landowners. However, drip systems must be installed per NRCS specifications.
- To date, every applicant has a furrow-irrigated field adjacent to a field to be converted to drip.
- It is assumed the same water source will feed both drip and furrow systems. However, this will ultimately be determined on a case-by-case basis.
- Applicants will have 2 years to install systems. However, Dale predicts most are ready to begin this fall. Field selection for research will favor systems installed this season.
- Applicants will be selected based on the eligibility worksheet after the closing date, and first step in the process will be to initiate a water quality management plan for each selected application site.

Field Research

- TAES Researchers with assistance from Dale will select 6 fields (3 drip and 3 furrow). An effort will be made to select one set of fields per county.
- Following field selection, John suggested an on-site visit at each location for all involved.
- Dale would like to be updated regularly on collection of samples, analysis, etc. as this information will be solicited from him. Cecilia suggested setting up a communication system between Cristine and Dale, which will also benefit quarterly reporting efforts.

Appendix B

Proposed Research and Sampling Plan for Field-scale Data Collection

Seymour Project

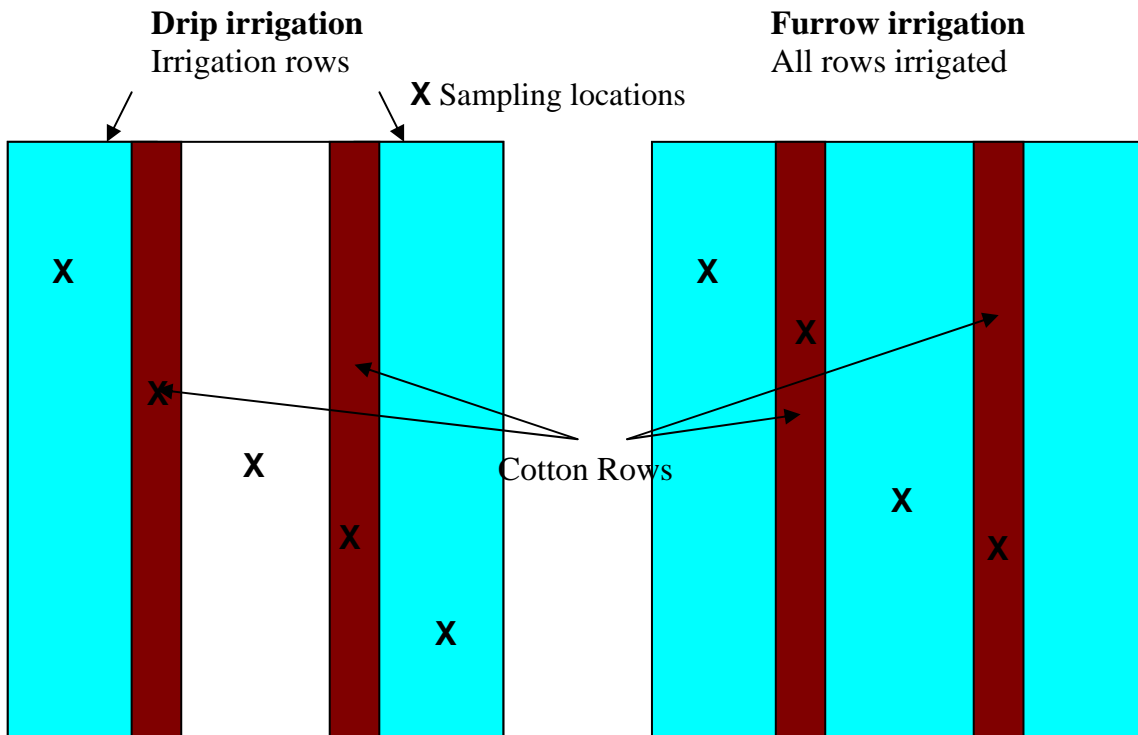
Objective: Assess impacts of conversion from furrow irrigation to drip irrigation on nitrate concentration and water quantity at the field scale, and verify assumption made to scaling information from plot to field to aquifer scale.

Experimental design for nitrogen and water balance on fields

1. Six fields will be chosen from the list of land owners agreeing to convert agricultural fields from furrow to drip irrigation. Three fields will be furrow irrigated and three will be drip-irrigated. All fields will be under BMP according to the nutrient and water management plans created by the TSWCB.
Field selection priorities for this experiment are the following:
 - 1.1. Furrow and drip irrigated fields next to each other with similar soils and same field manager. Creates a paired test.
 - 1.2. Three sets of fields with soils representative of the Seymour aquifer agricultural lands.
 - 1.3. Location of all fields in close geographical proximity to minimize driving and sample collection times.
2. The 6 selected fields will be surveyed using GPS and bulk electrical conductivity. In each field, 4-5 areas will be selected for individual nitrogen and water balance.
 - 2.1. A GPS and an EM38 mounted onto an ATV will be used to non-invasively collect continuous soil electrical conductivity measurements on 10 m transects. The EM38 survey will be used to identify soil heterogeneity and sampling areas.
 - 2.2. 4-5 sampling areas (experimental units) in each of the 6 fields will be identified using the EM38 map. These field areas will be where the nitrogen information is collected. Experimental units will be 3 x 4 m, and subsampled. Initial soil samples will include textural and organic carbon analysis.
 - 2.3. For the 3 drip irrigation fields, drip irrigation will be installed late winter 2005 before the 2005 planting season.
3. Water Balance
 - 3.1. **Irrigation:** Inline flow gauges installed in both furrow and drip irrigation systems.
 - 3.2. **Irrigation Management:** scheduling will follow the water conservation plan, which will be about 75% PET as recommended by weather stations located at XX, XX miles from the sites.
 - 3.3. **Rain:** Hobo tipping bucket rain gauges will be installed at each field site, and rainfall will be collected in 5-gal buckets to estimate inorganic nitrogen in rain.
 - 3.4. **Evaporation:** Daily/Hourly meteorological data will be collected at weather stations.
 - 3.5. **Transpiration:** After emergence, plant LAI will be measured every two weeks using a Licor LAI2000, estimates of green LAI will be made as the plant senesces.
 - 3.6. **Drainage:** Total drainage for each field will be estimated by using ENWATBAL.
4. Nitrogen Balance
 - 4.1. **Soil Samples**
 - 4.1.1. Collected before and after harvest at each of the sampling locations. Soil samples will be 120 cm deep (~90% of the rooting depth of cotton) or to a root limiting (caliche) horizon.
 - 4.1.2. Soil samples will be collected using a 2 inch diameter Giddings soil probe, soil bulk density will be estimated by measuring the depth of the sampling hole at each

sampling interval 0-15, 15-30, 30-60, 60-120 cm. The first 15 cm may be sampled with a bulk density sampler.

- 4.1.3. Soil samples will be air dried before analyzed for total organic nitrogen and carbon (Dumas method) and KCL extraction (1:7) for total inorganic nitrogen.
- 4.1.4. Geometric design of the samples is shown below. The cotton will be planted on 40-inch rows. The sampling locations are noted with an "X". The first year, samples will not be composited. After year one, data will be analyzed and decisions on compositing samples will be made.



4.2 . Water Samples – water samples will acidified and refrigerated until analysis can be done. Samples will be analyses monthly.

4.2.1. Grab samples of irrigation water will be collected weekly (or bi-weekly depending on irrigation rates) during irrigation and analyzed for total inorganic nitrogen (KCL 1:7 extraction)

4.2.2. Rainfall will be collected at the sites and analyzed for inorganic nitrogen (KCL 1:7)

4.3. Plant Samples

4.3.1. At each sampling location in each field, 2 rows by 1 meter of cotton plants will be harvested before the plants are defoliated for mechanical harvest. The plants will be separated into leaf, stem and fruit, air-dried and weighed. Air-dry plant subsamples will be analyzed for Kjeldhal-N. The remaining plant tissue will be oven-dried and weighted for total dry biomass.

Work Plan

The following tasks that need to be accomplished are listed below. Beside each task, I have listed the frequency of the task and who I propose perform the task. This task list is a rough draft and completely negotiable. The task list is being included to start discussion of possibilities and to provide clarity to expectations.

Task 1: Site selection: Dale Carroll has agreed to prepare a map of the cooperating farms. Once the map is ready, Cristine Morgan and John Sij will select the final location based on geographical location, a site visit, and preferably a visit with landowner/farmer.

Time: December - January

Task 2: Field Survey: Cristine Morgan and Omar Harvey will perform the EM38 survey and then make selections for the sampling areas.

Time: Between January and before irrigation is installed

Task 3: Soil and Plant sampling: Omar and Cristine will do this with the assistance John Sij's technician. We will use John's giddings probe.

Time Before planting, after harvest

Task 4: Irrigation well and rainfall sampling: Possibly Dale can do some of this with occasional assistance of Phyllis. Cristine and Omar will collect the samples monthly. Dale can download the rain gauge data loggers monthly and email Omar the data.

Time: as needed

Task 5: LAI measurements. Cristine would like to train Dale or Phyllis to do this once every two weeks when the plant is at peak growth.

Task 6: Irrigation Management: Who will take care of calculating PET from the weather stations so farmers know when and how much to irrigate??

Task 7: Record Keeping: Cooperators will be asked to keep very good records of fertilization, management, and yield. Can Dale be present during the first year harvest to make sure the yield is weighed in properly?

Sample Analysis:

Soil: Dumas dry oxidation/combustion on soil samples for organic C and N. (TCE lab, Tony Provin)

Inorganic N, KCL extract. & Auto analyzer, Colorimetric (TAES lab, Omar Harvey)

Particle size analysis, pipet method. (TAES lab, Omar Harvey)

Plant: Organic N Kjeldahl/wet oxidation (TCE lab, Tony Provin)

Water:Inorganic N, Auto analyzer/Colorimetric (TAES lab, Omar Harvey)