2008 Eastern SD Water Conference

By: Jarett Bies
SDSU Ag/Bio Communications

BROOKINGS, S.D. – Bringing together federal, state, and local governments, along with university and citizen insights, the 2008 Eastern South Dakota Water Conference will be held Oct. 22 and 23 in Brookings.

The event, in its third year, will take place at the Swiftel Center, 824 32nd Ave., and includes speakers and presenters from South Dakota State University, the U.S. Army Corps of Engineers, South Dakota School of Mines and Technology, the Day Conservation District, and others.

In addition to the conference, a competition for college students who prepare posters will be held. First prize is $200, with a $100 second prize.

John Davidson, a professor of law from the University of South Dakota, will deliver a keynote address on water law during lunch on Oct. 23.

“This event is a chance for hydrologists, geologists, engineers, legislators, scientists, and students to meet and exchange ideas,” said David German, an SDSU water resources research associate. “Water is a crucial part of South Dakota’s future, and this conference is intended to educate participants on the future of this resource.”

Information on the conference schedule is available at this link: http://wri.sdstate.edu/esdwc. Or ask for information at your county Extension office.

Call Jennifer Pickard, program assistant for the SDSU Water Resources Institute at (605) 688-5611 for more information.
This conference will bring together technical and real-world presentations from a variety of folks, including scientists and researchers from SDSU as well as on-the-ground work that’s been going on in various watersheds in South Dakota. Water is an important piece of the economic future of South Dakota, and this conference is intended to serve as a mechanism to educate participants on this resource.

Please join us on October 22-23, 2008, at the Swiftel Center in Brookings, South Dakota. There will be oral presentations both days and a poster session on October 22nd. Vendors will be on-site both days.

The conference will begin with a panel discussion and continue with concurrent sessions. The evening includes a poster session and is highlighted by a banquet and keynote address given by Dr. Charles Berry, South Dakota State University Professor in the Department of Wildlife and Fisheries, Leader of the South Dakota Cooperative Fish and Wildlife Research Unit. Thursday consists of concurrent sessions and lunchtime keynote address by Dr. John Davidson, University of South Dakota Law School, Professor of Natural Resources Law emeritus, and President of Northern Prairies Land Trust.

Registration includes dinner Wednesday evening, lunch on Thursday, breaks, and notebook with abstracts. Early bird registration of $120 and $20 (for students) is open through October 15th.

You still have time to register!

The conference sponsors are:
- Water & Environmental Engineering Research Center and Water Resources Institute at South Dakota State University,
- United States Geological Survey,
- East Dakota Water Development District,
- SD Department of Environment and Natural Resources,
- US Geological Survey, and
- US Army Corps of Engineers.

For more information or to register for the Conference, please visit the following link:
http://wri.sdstate.edu/esdwc/registration.cfm.
This email is a Request for Proposals for the State Water Resources Research Institute Program. This program, authorized by section 104 of the Water Resources Research Act of 1984, is a Federal-State partnership which:

- Plans, facilitates, and conducts research to aid in the resolution of State and regional water problems,
- Promotes technology transfer and the dissemination and application of research results,
- Provides for the training of scientists and engineers through their participation in research, and
- Provides for competitive grants to be awarded under the Water Resources Research Act.

The state water resources research institutes authorized by the Act are organized as the National Institutes for Water Resources (NIWR) (http://wrri.nmsu.edu/niwr/). NIWR cooperates with the United States Geological Survey (USGS) (http://water.usgs.gov/wrri/) in establishing total programmatic direction, reporting on the activities of the Institutes, coordinating and facilitating regional research and information and technology transfer, and in operating the NIWR-USGS Student Internship Program.

The South Dakota State University Water Resources Institute (SD WRI) is making plans for FY2008 regarding the State Water Resources Institute Program (SWRIP). The Department of Interior has not yet done the official "apportionment" of the funds; therefore, there has not yet been a final determination of the amount to be awarded to each institute under its base grant. We will be proceeding with the assumption that funding will remain at the same level as last year. Last year, the SDSU Water Resources Institute funded four research projects at SDSU totaling approximately $60,000. We will proceed at this time with the assumption that we will again fund research for an approximate total of $60,000 for 3-5 projects. That dollar amount is subject to change, depending on what happens at the Congressional level. Faculty employed at all state-owned universities and colleges are eligible to apply for these grant funds.

The deadline for pre-proposal submission to SD WRI is October 31, 2008. Pre-proposals will be reviewed and those selected for submission to USGS for funding will be notified no later than November 14, 2008 although if no Congressional action has been taken, this date will be pushed back. After review of proposals by the Institute’s Advisory Board, those highest ranked will be funded based on budgets and total research funds available. Full proposals will be due by December 26, 2008. We anticipate a start date for these one-year research projects of 3-1-09.

Keep in mind that the 104 Grant program requires a TWO TO ONE Match (two non-federal dollars per federal dollar awarded). Indirect costs are not allowed on the federal side, but may be used as match.

Please keep your pre-proposals to a two page maximum, not including budget sheet and budget justification. Please e-mail your pre-proposals to Jennifer (Jennifer.Pickard@sdstate.edu) in a Word or WordPerfect format. Examples of the pre-proposal format are available at: http://wri.sdstate.edu/USGS104b.cfm.

Feel free to send this announcement to anyone who may be interested in these grant funds who may not have received this notification.

**Pre-proposal submission due to SDWRI:** October 31, 2008

**Notification to submit full proposal:** November 14, 2008

**Full proposals due:** December 26, 2008
Evaluation of Deficit Irrigation Strategies for Corn

Introduction

Competition for water is increasing. Irrigated crop production will be required to play a large role in providing food, fuel, and fiber for the increasing world population. Corn has been and will continue to be a major irrigated crop, providing feed, food, and, increasingly, feedstock for biofuel.

To use irrigation water resources most efficiently, it is critical to develop and implement efficient deficit irrigation strategies, and to predict the impacts of deficit irrigation on corn yield. South Dakota State University Management Software was used to simulate center pivot irrigation and corn yield at seven locations across the Great Plains with historical weather data. Thirty irrigation strategies were evaluated across three soil water holding capacities and three pumping rates. Yield ratio was calculated based on a normalized transpiration ratio.

Methods

SDSU Management Software, developed by Oswald (2006) and modified by Heeren (2008), was used to simulate center pivot irrigation and corn yield at seven locations across the Great Plains with historical weather data. Thirty irrigation strategies were evaluated across three soil water holding capacities and three pumping rates. Yield ratio was calculated based on a normalized transpiration ratio.

Seven locations were simulated: Akron, CO; Brookings, SD; Nisland, SD; Oakes, ND; Ord, NE; Rock Port, MO; and St John, KS. Pumping rates included 37.9, 50.5 and 63.1 L/s (600, 800, and 1000 GPM). Three soil types were selected to represent a range of soils. Soil types included available water holding capacity (WHC) values of 37.9, 50.5, and 63.1 mm/m (1, 1.5, and 2 in/ft).

Irrigation strategies were defined by the minimum allowable water content for three periods in the growing season (examples shown in Fig 1).

Table 1. Locations where simulations were performed.

<table>
<thead>
<tr>
<th>Location</th>
<th>Planting Date</th>
<th>Season Length (days)</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akron, CO</td>
<td>April 1st</td>
<td>180</td>
<td>1983 – 2006</td>
</tr>
<tr>
<td>Brookings, SD</td>
<td>April 15th</td>
<td>165</td>
<td>1983 – 2006</td>
</tr>
<tr>
<td>Nisland, SD</td>
<td>April 15th</td>
<td>165</td>
<td>1988 – 2006</td>
</tr>
<tr>
<td>Oakes, ND</td>
<td>May 1st</td>
<td>150</td>
<td>1990 – 2006</td>
</tr>
<tr>
<td>Ord, NE</td>
<td>April 1st</td>
<td>180</td>
<td>1983 – 2006</td>
</tr>
<tr>
<td>Rock Port, MO</td>
<td>April 1st</td>
<td>180</td>
<td>1991 – 2006</td>
</tr>
<tr>
<td>St John*, KS</td>
<td>April 1st</td>
<td>180</td>
<td>1985 - 2006</td>
</tr>
</tbody>
</table>

*weather station at the Sandyland field station.

This project received 2007 USGS 104b funding.
Pumping rates included 37.9, 50.5 and 63.1 L/s (600, 800, and 1000 GPM). Three soil types were selected to represent a range of soils. Soil types included available water holding capacity (WHC) values of 37.9, 50.5, and 63.1 mm/m (1, 1.5, and 2 in/ft), as defined in Equation 1.

$$\text{WHC} = (\theta_{\text{FC}} - \theta_{\text{WP}}) \times 1000$$  \hspace{1cm} (1)

Here, WHC is in mm/m, \( \theta_{\text{WP}} \) is the volumetric water content at the wilting point, and \( \theta_{\text{FC}} \) is the volumetric water content at field capacity. For irrigation scheduling purposes, it is helpful to define soil water content as a percentage, with zero being the soil moisture at the wilting point and 100% being the soil moisture at field capacity. This plant available water (AW) is the amount of water available to the crop and is calculated by Equation 2.

$$\text{AW} = (\theta - \theta_{\text{WP}}) / (\theta_{\text{FC}} - \theta_{\text{WP}}) \times 100$$  \hspace{1cm} (2)

Here, AW is the available water (%), and \( \theta \) is the actual volumetric water content. An irrigation strategy offers a guideline for making irrigation decisions. A method was needed to numerically describe an irrigation strategy so that strategies could be changed and tested easily. An irrigation strategy was defined by the minimum available water (MAW) as it varies throughout the season. This concept is similar to the maximum allowable depletion (MAD), with \( \text{MAW} = 100 - \text{MAD} \). Irrigation events were triggered when the soil directly in front of the pivot dried to the MAW.

Thirty strategies were defined for the simulations. These were inputs for the SDSU Management Software, which ran center pivot simulations for each strategy. The general shape of most of the strategies required higher AW levels mid-season and lower AW levels early and late-season. This is based on the observed effects of stress timing, showing that corn is more sensitive to water stress during flowering than the vegetative and yield formation phases of development (Doorenbos and Kassam, 1979).

Each strategy was defined by timing parameters (defining the early and middle stages of the season) and correlating MAW parameters. A strategy can be conveniently labeled by the MAW values for early, middle, and late season. Many strategies have similar timing parameters, although “30-60-30 extended” has a longer peak than normal. Based on the parameters, the MAW for any point in the season can be determined, as illustrated in Figure 1.

**Recommended Strategies**

The yield-irrigation relationship is the most relevant of the yield-water relationships for evaluating irrigation strategies. An example yield-irrigation graph is shown in Figure 2, with strategies of interest labeled.

The basic shape and distribution of points (in relation to each other) in Figure 7 is representative...
of plots for all simulations. The 0-0-0 strategy, which irrigated only when the wilting point was reached, provided a lower bound on the data set. The 70-70-70 strategy, providing an upper limit on the data set, produced a minimal increase in yield (compared to similar strategies) for the large amount of applied water it required. The 30-60-30 strategy was the original strategy in the SDSU Management Software.

The historical strategy of 50-50-50 resulted in high yields, but it also consistently used more water than other strategies with similar yields. The 50-0-0 and 50-50-0 strategies, representing situations where available irrigation water was used up before the end of the season, consistently performed poorly. This indicates the benefit of good irrigation management, resulting in higher yields for a given supply of water.

Simulation data from the recommended maximum yield strategies were compared to results from a traditional strategy (50-50-50).

Water savings and changes in relative yield are reported in Table 3.

**Conclusions**

Strategies with high water use efficiencies performed well across all treatments and locations. The recommended maximum yield strategy is 30-60-30 (for early, middle, and late season). Recommended deficit strategies are 15-50-0, 0-30-0, and 0-15-0 for minimal, moderate, and severe water restrictions.

The full paper describing this research will be presented at the Irrigation Association Technical Conference, to be held in Anaheim, CA, 2-4 November 2008. Authors are Derek M Heeren, Hal D Werner, and Todd P Trooien.

![Figure 2. Example of yield-irrigation relationship with selected strategies labeled. Nisland, SD, all years.](image)

<table>
<thead>
<tr>
<th>I (mm)</th>
<th>Akron, CO</th>
<th>Brookings, SD</th>
<th>Nisland, SD</th>
<th>Oakes, ND</th>
<th>Ord, NE</th>
<th>Rock Port, MO</th>
<th>St. John, KS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional</td>
<td>720</td>
<td>372</td>
<td>671</td>
<td>359</td>
<td>456</td>
<td>392</td>
<td>593</td>
</tr>
<tr>
<td>Recommended</td>
<td>691</td>
<td>328</td>
<td>637</td>
<td>311</td>
<td>428</td>
<td>336</td>
<td>567</td>
</tr>
<tr>
<td>Change</td>
<td>-29</td>
<td>-44</td>
<td>-34</td>
<td>-47</td>
<td>-27</td>
<td>-56</td>
<td>-26</td>
</tr>
<tr>
<td>Traditional</td>
<td>0.892</td>
<td>0.983</td>
<td>0.910</td>
<td>0.984</td>
<td>0.968</td>
<td>0.981</td>
<td>0.924</td>
</tr>
<tr>
<td>Recommended</td>
<td>0.903</td>
<td>0.976</td>
<td>0.920</td>
<td>0.977</td>
<td>0.976</td>
<td>0.974</td>
<td>0.937</td>
</tr>
<tr>
<td>Change</td>
<td>0.011</td>
<td>-0.007</td>
<td>0.011</td>
<td>-0.007</td>
<td>0.008</td>
<td>-0.007</td>
<td>0.013</td>
</tr>
</tbody>
</table>

**Table 2.** Benefit of recommended maximum yield strategies. All WHCs, pumping rates, and years.
This year marked the third year that the South Dakota Water Resources Institute (WRI) hosted a Water Quality workshop in eastern South Dakota and the first year for a workshop to be held in the Black Hills.

The workshops were designed to teach adults about lake and stream ecology and provide them with the tools they need to pass this knowledge on to others.

The Water Quality workshops were expanded from two to three days in 2008 and attendees could earn continuing education credits through South Dakota State University. Dennis Skadsen from Day Conservation District and I combined classroom instruction with hands-on elements of water quality monitoring and bioassessment.

Teachers attending the workshops participated in activities designed to be incorporated into K-12 programs in their schools. Attendees learned how streams and lakes function within watersheds and how human influences affect water quality.

On the first day of the workshop, they became familiar with sampling equipment such as: a Kick net, D-frame aquatic dip net, screen bucket, and sieve pan, which are used to collect invertebrates. They also learned to identify the major groups of invertebrates and become “lake doctors” in an activity designed to assess water quality through identification of the critters according to their pollution tolerance. Attendees even assembled a reference set of organisms so they could teach their students how to be lake and stream “doctors.”

On days two and three of the workshops, classroom instruction was alternated with hands-on activities such as the Lake Game, Secchi disk-building, photosynthesis in a jar, dissolved oxygen, pH measurements, biomagnification, lake stratification, and blue green algae.

The workshops are a cooperative effort sponsored by the WRI information transfer program, the Day Conservation District, and the Environmental Protection Agency’s Section 319 Non-point Source (EPA 319) grant program through the South Dakota Non-point Source Information and Education Project (IEP) grant and administered by Anne Lewis at the South Dakota Discovery Center in Pierre, SD.

The expansion of the workshops provided educational opportunities in South Dakota by providing informational materials and increased opportunities for teacher training. Additional workshops are planned for 2009 and 2010.

Mr. David German is a Research Associate III in the Water Resources Institute at South Dakota State University. [http://wri.sdstate.edu](http://wri.sdstate.edu)

By David German

Brian Schmuck, a science teacher from Emery, SD, looks over a piece of submerged wood for invertebrates.
2008 ESDWC

Water, then and now

October 22-23, 2008 at the Swiflet Center in Brookings, SD.

Early Bird Registration: October 3rd
http://wri.sdstate.edu/esdwc

Water News

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Links of Interest

★ South Dakota Water Resources Institute
http://wri.sdstate.edu

★ Eastern South Dakota Water Conference
http://wri.sdstate.edu/esdwc

★ Water & Environmental Engineering Research Center http://weerc.sdstate.edu/

★ South Dakota Climate and Weather
http://climate.sdstate.edu/

★ East Dakota Water Development District
http://www.eastdakota.org

★ South Dakota Section of the American Water Works Association
http://sio.midco.net/sdawwa.website/index.htm

★ Missouri River Institute http://www.usd.edu/mri/

★ South Dakota Drought Task Force
http://www.state.sd.us/applications/MV31DroughtTaskForce/index.htm

★ South Dakota Water and Wastewater Association
http://sio.midco.net/sdwwa.website/index.htm

★ Missouri River Basin Association
http://www.mrba-missouri-river.com/

★ South Dakota Department of Environment and Natural Resources
http://www.state.sd.us/denr/denr.html

★ Resource Conservation Using Native Turfgrasses in the Northern Plains
http://hflp.sdstate.edu/turf/IALCFinal.htm