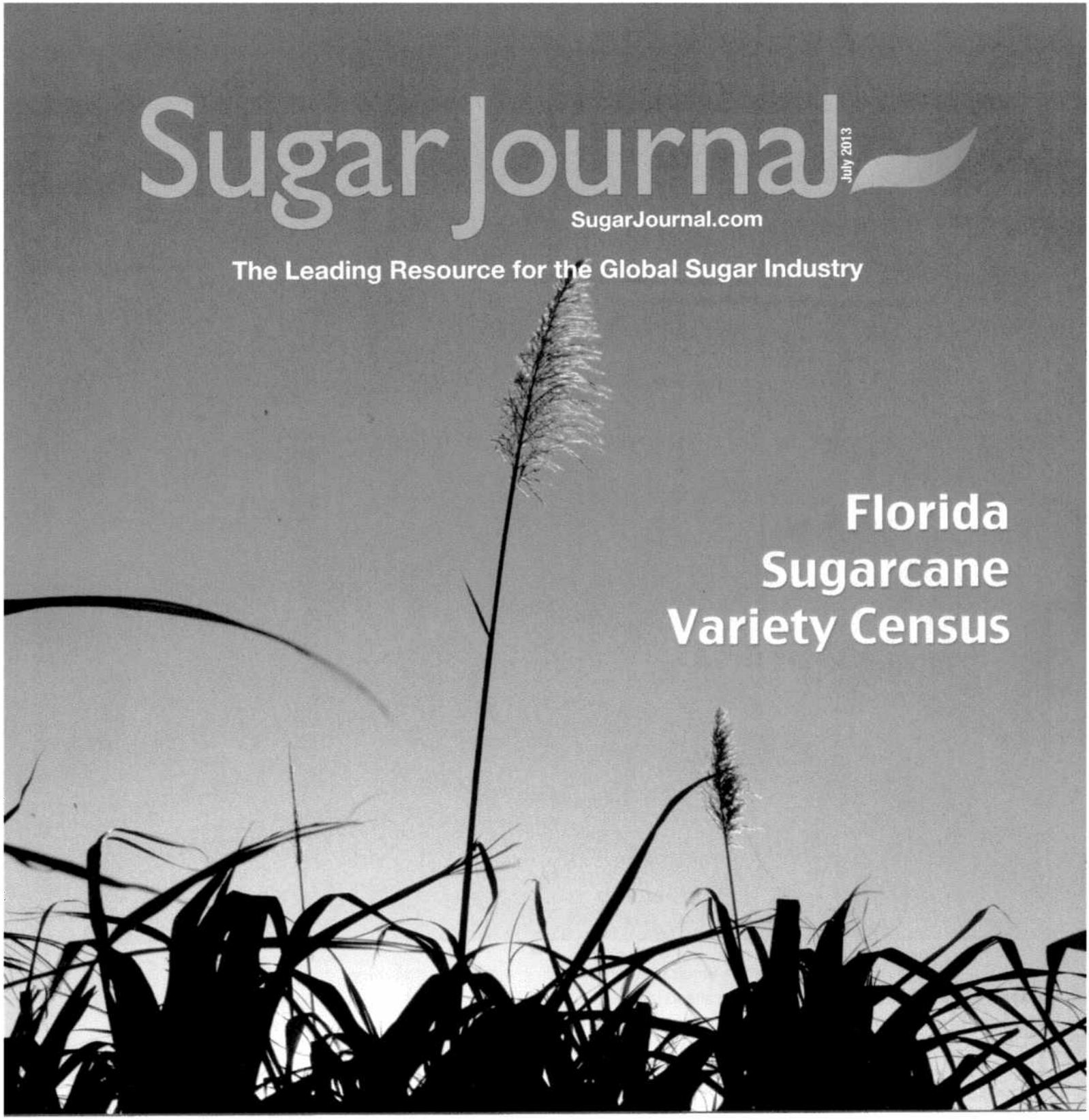

Florida, Texas, Hawaii Production Figures

Drought Resistant Sugar Beets

Agriculture • Processing • Refining • Energy • By-Products
Translations in Spanish and Portuguese

By David D. Tarkalson, Imad Eujayl and Bradley A. King

Drought Resistant Sugar Beets

In many sugarbeet production areas of the U.S., increased water demands and drought can cause water supplies to be less than needed for a sugarbeet crop. As a result, developing drought tolerant sugarbeet germplasm is one important strategy to sustain yields with less available water. This study assessed differences in drought tolerance among six genetically diverse experimental sugarbeet hybrids within the KWS SAAF AG sugarbeet breeding pool that have a diverse genetic background with regard to resistance/tolerance for Rhizomania, Curly Top and nematodes. Additionally, all hybrids were selected based on preliminary information about variation under drought stress conditions and a close relationship to currently available commercial hybrids in the Western U.S. One commercial hybrid from Betaseed Inc. was also included based on local producer popularity.

The study was conducted during the 2008, 2009 and 2010 growing seasons at the USDA Agricultural Research Service Northwest Irrigation and Soils Research Laboratory in Kimberly, ID. To assess the impacts of drought, each hybrid was subjected to six water input treatments, all based on the percent of water needed to meet the crops estimated water requirement (CWR): 125% , 100% , 75% , 50% , 25% and rain-fed (average across years = 8%). Each hybrid and water input treatment was replicated 4 times in an experimental design utilizing a line source sprinkler irrigation system to provide uniform irrigation application for a given perpendicular distance from the line. Irrigation depth decreased as perpendicular distance from the line increased. Irrigation input treatments ran parallel to the line and within each irrigation

treatment, the hybrids were randomly placed. Each plot was 9.1 m long and 2.2 m wide (4 rows).

Hybrid drought tolerance was evaluated by using linear regression analysis (slope and intercept comparisons) of sugar yield versus water input, calculation of a drought stress index (DSI), and comparison of yield potential under full irrigation (100% CWR).

Because of the location of our study, we had advantages over other research studies assessing similar objectives. Southern Idaho has a dry growing season with a 10 year average growing season [April 1 – October 15] precipitation at Kimberly, ID of 111 mm. This eliminated the need to use rainout shelters to reduce precipitation input that often occurs in other sugarbeet growing areas. Ober et al. (2004) used polythene covers in their study which affected the plot microclimate (decreased windrun, photosynthetic active radiation and ET) compared to an uncovered environment.

The relationships between the hybrids sucrose yields and water input during the three years of the study were similar to many reported crop yield responses over a range of a yield limiting input factors (e.g. nutrients) (Dobermann et al., 2011). The response was visually defined as a linear increase at the inputs deficient range, decreasing rate of increase as the input reaches a sufficient amount and a plateau or decline when the input is sufficient and in excess. Among the hybrids, there were differences in overall yield potential and in the sucrose yield response to water. Greater drought tolerance or greatest difference in sucrose yield between hybrids was seen at the lowest water input treatment (intercept difference). Linear regression analysis and DSI support the conclusion that one hybrid exhibited greater drought tolerance compared to the tested commercial hybrid (Figure 1). There were also differences in overall yield potential among the hybrids. This study found that differences in sugarbeet drought production response to water input exist among sugarbeet hybrids. Therefore, this genetic diversity can potentially be utilized to develop commercial varieties that produce high sucrose yields under various water input conditions. The use of screening procedures, such as the line source method utilized in this study, can be an effective way to evaluate and select drought tolerance of sugarbeet germplasm and experimental hybrids.

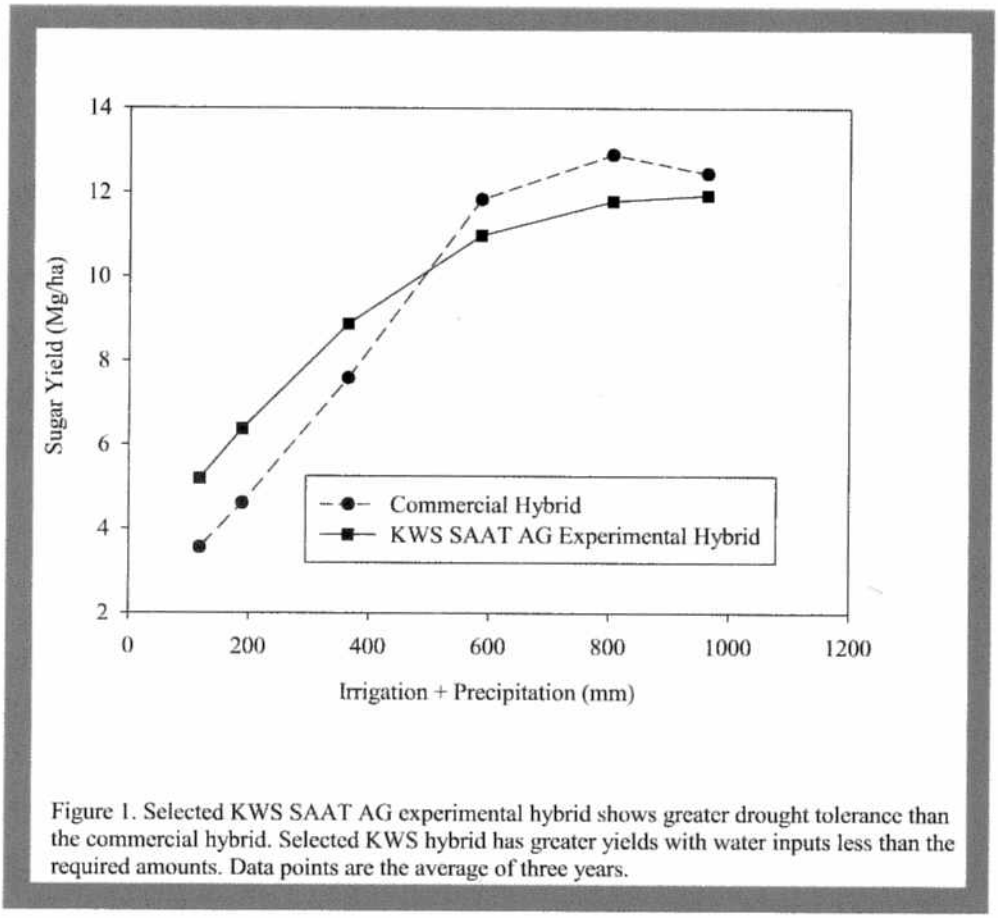

Figure 1. Selected KWS SAAT AG experimental hybrid shows greater drought tolerance than the commercial hybrid. Selected KWS hybrid has greater yields with water inputs less than the required amounts. Data points are the average of three years.

Co-investigators: David D. Tarkalson, Imad Eujayl and Bradley A. King USDA-ARS Northwest Soils and Irrigation Research Laboratory, Kimberly, ID; Werner Beyer, KWS-SAAT AG, Grimsehlstr 31 37555 Einbeck, Germany.

SJ