FORECAST EL NIÑO–SOUTHERN OSCILLATION PHASES AND BEST IRRIGATION STRATEGIES TO INCREASE COTTON YIELD

R. Louis Baumhardt
USDA-ARS Conservation & Production Res. Lab.
Bushland, Texas
Steve A. Mauget
USDA- ARS Cropping Systems Res. Lab.
Lubbock, Texas
Prasanna H. Gowda
David K. Brauer
Gary W. Marek
USDA-ARS Conservation & Production Res. Lab.
Bushland, Texas

Abstract

Equatorial Pacific sea surface temperatures cause a systematic El Niño-Southern Oscillation (ENSO) coupling with the atmosphere to produce predictable weather patterns in much of North America. Forecast ENSO phases and associated rainfall frequency and amount were related to modeled dual purpose wheat grazing and grain production in Texas. The use of ENSO forecast weather permitted optimization of management practices for improved production. Similarly, irrigation management could be varied by ENSO phase to improve lint production for forecast growing season conditions. Our objective was to optimize partial pivot deficit irrigation strategies based on simulated cotton lint yield response to irrigation capacity and duration during different ENSO phases for the Texas High Plains. We used, GOSSYM, with ENSO phase specific weather records during 1959-2000 at Bushland, TX to simulate net lint yields. Cotton growing conditions began with 50 or 75% initial soil water contents and continued under irrigation rates of 2.5, 3.75, and 5.0 mm/d for a duration of 0, 4, 6, 8, and 10 weeks. Early growing season, June, forecasted ENSO phase conditions often differed from the maturing phases of fall. The most consistently classified La Niña phase, 80 % success, consistently featured limited rain that depressed lint yields compared with the wetter Neutral and El Niño phases. Deficit irrigation strategies that focused fixed water resources on a smaller area were well suited to conserve or increase net lint yield during the drier and warmer La Niña phase conditions. Favorable rain during both El Niño and Normal phase years increased net lint yield for irrigation strategies that spread water more uniformly over larger areas except when both initial soil water and irrigation amount were limiting.