agronomy

*Article*

# A Model-based Real-time Decision Support System for Irrigation Scheduling to Improve Water Productivity

**Xiaoping Chen[1,2,3,4], Zhiming Qi [*1,2,4], Dongwei Gui[1,2], Zhe Gu[5], Liwang Ma[6], Fanjiang Zeng[1,2], Lanhai Li[1] and Matthew W. Sima[7]**

[1] State Key Laboratory of Desert and Oasis Ecology, Xinjiang Institute of Ecology and Geography, Chinese Academy of Sciences, Urumqi 830011, China
[2] Cele National Station of Observation and Research for Desert Grassland Ecosystem in Xinjiang, Cele, 848300 Xinjiang, China
[3] University of Chinese Academy of Sciences, Beijing, 100049, China
[4] Department of Bioresource Engineering, McGill University, Ste-Anne-de-Bellevue, QC, Canada
[5] College of Agricultural Engineering, Hohai University, 1 Xikang Road, Nanjing, 210098, China
[6] USDA-ARS Rangeland Resources and Systems Research Unit, Fort Collins, CO, 80526 U.S.A.
[7] Department of Civil and Environmental Engineering, Princeton University, Princeton, NJ, 08544 U.S.A.
* Correspondence: E-mail address: zhiming.qi@mcgill.ca

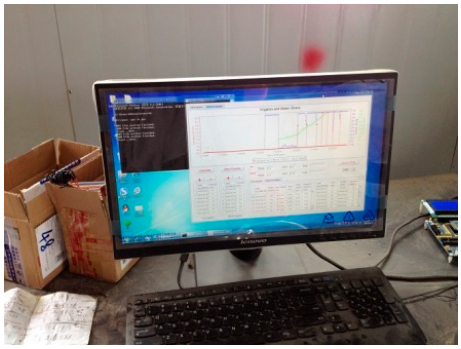
## Supplemental material

(a) installation of the sedimentation tank

(b) construction of the house

(c) outlooking of the system

(d) inside settings in the house



e) software activated

f) the site of programmable logic controller (S–PLC)

(g) frequency conversion controller (FCC)

(h) a cotton plot

**Supplement Figure 1.** Field experiment facilities.

**Supplement Table 1.** Economic analysis of the newly developed DSSIS applied to a 10-ha field with a 10-year operational lifetime.

| Irrigation scheduling | Total investment for the infrastructure $ ha$^{-1}$ y$^{-1}$ | Labor salary $ ha$^{-1}$ y$^{-1}$ | Irrigation m$^3$ ha$^{-1}$ | Water price $ m$^{-3}$ | Water bill $ ha$^{-1}$ y$^{-1}$ | Other cost * $ ha$^{-1}$ y$^{-1}$ | Total cost $ ha$^{-1}$ y$^{-1}$ | Yield Mgha$^{-1}$ | Cotton price $ kg$^{-1}$ | Total revenue $ ha$^{-1}$ y$^{-1}$ | Net profit $ ha$^{-1}$ y$^{-1}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DSSIS-based | 449 | 350 | 3250 | 0.04 | 130 | 1500 | 2429 | 4.44 | 1.3 | 5772 | 3343 |
| Sensor-based | 389 | 250 | 3160 | 0.04 | 126 | 1500 | 2265 | 3.4 | 1.3 | 4420 | 2155 |
| Experience-based | 0 | 500 | 4760 | 0.04 | 190 | 1500 | 2190 | 3.71 | 1.3 | 4823 | 2633 |

*Note: other cost includes fertilizer, seed, and other essential basic costs.