ACCOMPLISHMENTS

2003

PUBLICATIONS

Abbasi, F., F. J. Adamsen, D. J. Hunsaker, J. Feyen, P. Shouse, and M. Th. van Genuchten. 2003. Effects of flow depth on water flow and solute transport in furrow irrigation: field data analysis. *Irrigation and Drainage Engineering* 129(4):237-246. WCL# 2376.

Abbasi, Fariborz, Jirka Simunek, Th. van Genuchten, Jan Feyen, Floyd J. Adamsen, Douglas J. Hunsaker, Theodor S. Strelkoff, and Peter Shouse. 2003. Overland Water Flow and Solute Transport: Model development and field-data analysis. *Irrigation and Drainage Engineering* 129(2):71-81. WCL# 2371.

Adamsen, F. J. and T. A. Coffelt. Flowering, seed yield, and oil content of nine rape cultivars and one crambe cultivar as affected by planting date. *Communications in Soil Science and Plant Analysis.* (Accepted 04-21-04) WCL# 2268.

Adamsen, F. J., T. A. Coffelt, and J. M. Nelson. 2003. Flowering and seed yield of lesquerella as affected by nitrogen fertilization and seeding rate. *Industrial Crops and Products* 18(2003):125-131. WCL# 2162.

Allen, R. G., A. J. Clemmens, C. M. Burt, K. Solomon, and T. O'Halloran. Prediction accuracy for project-wide evapotranspiration using crop coefficients and reference evapotranspiration. *Irrigation and Drainage Engineering*. (Accepted 08-10-04) WCL# 2387.

Allen, R. G., L. S. Willardson, C. Burt, and A. J. Clemmens. 2003. Water conservation questions and definitions from a hydrologic perspective. p. 159-170. *In* 24th Annual International Irrigation Show, San Diego, CA Nov. 18-20, 2003. WCL# 2385.

Barnes, E. M. and D. J. Hunsaker. 2003. Irrigation water requirements. *In Encyclopedia of agricultural, Food, and Biological Engineering*, Marcel Dekker, Inc., 270 Madison, Ave, NY, pp. 549-551. (Accepted 08-23-01) WCL# 2276.

Barnes, E. M., K. A. Sudduth, J. W. Hummel, S. M. Lesch, D. L. Corwin, C. Yang, C. S. T. Daughtry, and W. C. Bausch. 2003. Remote- and ground-based sensor techniques to map soil properties. *Photogrammetric Engineering and Remote Sensing* 69(6): 619-630. WCL# 2295.

Bautista, E. and A. J. Clemmens. Volume compensation method for routing irrigation canal demand changes. *Irrigation and Drainage Engineering*. (Accepted 04-22-04) WCL# 2386.

Bautista, E., T. S. Strelkoff, and A. J. Clemmens. 2003. Border irrigation management implications of imprecise infiltration parameter estimates. *In* 2nd Int. Conference on Irrig. & Drain, Phoenix, AZ, May 12-15, 2003. WCL# 2364.

Bautista, E., T. S. Strelkoff, and A. J. Clemmens. 2003. General characteristics of solutions to the open-channel flow feedforward control problem. *Irrigation and Drainage Engineering* 129(2):129-137. WCL# 2306.

Brooks, T. J., G. W Wall, D. Johnson, R. L. Garcia, and B. A. Kimball. Canopy gas exchange: an open chamber system for field use. *USDA-ARS Handbook.* (Accepted 6-17-1998) WCL# 2193.

Clemmens, A. J. 2003. Canal Automation. *Encyclopedia of Water Science* p. 53-56. WCL# 2343.

Clemmens, A. J. and S. S. Anderson. 2003. Proceedings of the 2nd International Conference on Irrigation and Drainage. 791 p. Clemmens, A. J Anderson S. S. (ed.). WCL# 2378.

Clemmens, A. J., E. Bautista, B. T. Wahlin, and R. J. Strand. Simulation of automatic canal control systems. *Irrigation and Drainage Engineering*. (Accepted 08-30-04) WCL# 2391.

Clemmens, A. J. and D. L. Bjorneberg. New furrow flume for high sediment loads. *Applied Engineering in Agriuclture*. (Accepted 08-11-04) WCL# 2407.

Clemmens, A. J. and J. A. Replogle. 2003. Irrigation Metering. *Encyclopedia of Water Science* p. 495-497. WCL# 2344.

Clemmens, A. J. and J. Schuurmans. 2004. Simple optimal downstream feedback canal controllers: Theory. *Irrigation and Drainage Engineering* 130(1):26-34. WCL# 2309.

Clemmens, A. J., R. J. Strand, and L. Feuer. 2003. Application of canal automation in central Arizona. p. 455-464. *In* 2nd Int. Conference on Irrig. & Drain, Phoenix, AZ, May 12-15, 2003. WCL# 2361.

Clemmens, A. J., T. S. Strelkoff, and E. Playan. 2003. Field verification of two-dimensional surface irrigation model. *Irrigation and Drainage Engineering* 129(6):402-411. WCL# 2238.

Clemmens, A. J., T. S. Strelkoff, and J. A. Replogle. 2003. Calibration of submerged radial gates. *Journal of Hydraulic Engineering* 129(9):680-687. WCL# 2346.

Clemmens, A. J. and B. T. Wahlin. 2004. Simple optimal downstream feedback canal controllers: ASCE test case results. *Irrigation and Drainage Engineering* 130(1):35-46. WCL# 2308.

Coffelt, T. A., D. T. Ray, F. S. Nakayama, and D. A. Dierig. Genotype and environment effects on guayule (parthenium agentatum) latex and growth. *Industrial Crops and Products*. (Accepted 07-14-04) WCL# 2314.

Colaizzi, P. D., E. M. Barnes, T. R. Clarke, C. Y. Choi, P. M. Waller, J. Haberland, and M. Kostrzewski. 2003. Water stress detection under high frequency irrigation with Water Deficit Index. *American Society of Civil Engineers Journal of Irrigation and Drainage* 129:36-43. WCL# 2289.

Colaizzi, Paul D., Edward M. Barnes, Thomas R. Clarke, C. Y. Choi, and P. N. Waller. Estimating soil moisture under low frequency irrigation using the CWSI. *Journal of Irrigation and Drainage Engineering* 129(1):1-70. (Accepted 7/06/04) WCL# 2401.

Cordy, G., N. L. Duran, H. Bouwer, R. Rice, E. Furlong, S. Zaugg, M. Meyer, L. Barber, and D. Kolpin. 2004. Do pharmaceuticals, pathogens, and other organic wastewater compounds persist when wastewater is used for recharge? *Ground Water Monitoring and Remediation* 24(2):58-69. WCL# 2377.

Cousins, A. B., N. R. Adam, G. W. Wall, B. A. Kimball, P. J. Pinter Jr., M. J. Ottman, S. W. Leavitt, and A. N. Webber. 2002. Photosystem II energy use, non-photochemical quenching and the xanthophyll cycle in *Sorghum bicolor* grown under drought and free-air CO2 enrichment (FACE) conditions. *Plant Cell and Environment.* 25:1551-1559. WCL# 2299.

Cousins, A. B., N. R. Adam, G. W. Wall, B. A. Kimball, P. J. Pinter Jr., M. J. Ottman, S. W. Leavitt, and Webber A.N. 2003. Development of C4 photosynthesis in Sorghum leaves grown under free-air CO2 enrichment (FACE). *Journal of Experimental Botany* 54: 1969-1975. WCL# 2335.

Derner, J. D., H. B. Johnson, B. A. Kimball, P. J. Pinter Jr, H. W. Polley, C. R. Tischler, T. W. Bouttons, R. L. LaMorte, G. W. Wall, N. R. Adam, S. W. Leavitt, M. J. Ottman, A. D. Matthias, and T. J. Brooks. 2003. Above- and below-ground responses of C3-C4 species mixtures to elevated CO2 and soil water availability. *Global Change Biology* 9:452-460. WCL# 2373.

Dierig, D. A. Recent Developments in Stress Tolerance Breeding in Oilseed Crops. *Haworth Press*. (Accepted 1-10-2003) WCL# 2348.

Dierig, D. A., M. A. Foster, T. Isbell, D. T. Ray, and M. E. Miller. Lesquerella potential for commercialization. *Dekker Encyclopedia of Plant and Crop Science.* (Accepted 02-06-02) WCL# 2325.

Dierig, D. A., C. M. Grieve, and M. C. Shannon. 2003. Selection for salt tolerance in lesquerella fendleri (gray) s. wats. *Industrial Crops and Products* 17:15-22. WCL# 2331.

Dierig, David A., Pernell Tomasi, Andrew M. Salywon, and Dennis T. Ray. Improvement in hydroxy fatty acid seed oil content and other traits from interspecific hybrids of three Lesquerella species; *Lesquerella fendleri, L. pallida* and *L. lindheimeri*. *Euphytica.*(Accepted 09-07-04) WCL# 2393.

Fitzgerald, G. J. Spider mite detection in cotton using hyperspectral imagery and spectral mixture analysis. *Precision Agriculture*. (Accepted 3-31-2003) WCL# 2315.

Fitzgerald, G. J. 2004. Portable hyperspectral tunable imaging system (PHYTIS) for precision agriculture. *Agronomy Journal* 96:311-315. (Accepted 7/24/2003) WCL# 2357.

Fitzgerald, G. J., D. J. Hunsaker, E. M. Barnes, T. R. Clarke, S. M. Lesch, R. Roth, and P. J. Pinter Jr. 2003. Estimating cotton crop water use from multispectral aerial imagery. 138-148.*In* Irrigation association exposition and technical conference, San Diego CA, Nov. 18-20, 2003. (Accepted 07-30-03) WCL# 2382.

Grant, Robert F., Bruce A. Kimball, Gerard W. Wall, Jonathan M. Triggs, Talbot J. Brooks, Paul J. Pinter, Matthew M. Conley, Micheal J. Ottman, Robert L. Lamorte, Steve W. Leavitt, Thomas J. Thompson, and Allan D. Matthias. Climate change effects on water requirements of irrigated sorghum: projections from a model tested with a free air co2 enrichment (FACE) experiment. *Agronomy Journal*. (Accepted 06/01/04) WCL# 2394.

Hunsaker, D. J., P. J. Pinter Jr., E. M Barnes, and B. A. Kimball. 2003. Estimating cotton evapotranspiration crop coefficients with a multispectral vegetation index. *Irrigation Science*. Vol. 22(2):95-104. (Accepted 06-18-03) WCL# 2351.

Hunsaker, D. J., P. J. Pinter Jr., G. J. Fitzgerald, T. R. Clarke, B. A. Kimball, and E. M. Barnes. 2003. Tracking spatial and temporal cotton ET patterns with a normalized difference vegetation index. 126-137.*In* Irrigation Association Tech. Conf. in San Diego CA, Nov. 18-20, 2003. (Accepted 07-30-03) WCL# 2381.

Idso, S. B. and C. D. Idso. 2002. Desertification control and greenhouse effect. *Encyclopedia of Soil Science* 331-334. Marcel Dekker, New York, NY. (Published on Internet) WCL# 2257.

Idso, S. B., C. D. Idso, and R. C. Balling Jr. 2002. Seasonal and diurnal variations of near-surface atmospheric CO2 concentration within a residential sector of the urban CO2 dome of Phoenix, Arizona, USA. *Atmospheric Environment* 36: 1655-1660. (Accepted 04/11/01) WCL# 2304.

Idso, S. B. and K. E. Idso. Carbon sequestration in soils to mitigate global warming. *Encyclopedia of Soil Science* Marcel Dekker, New York NY. (Published on Internet) WCL# 2278.

Idso, S. B. and K. E. Idso. 2003. Global temperature change and terrestrial ecology. *Encyclopedia of Water Science* 321-323. Stewart, B. A. and Howell T. A. Marcel Dekker New York NY (ed.) . (Published on Internet) WCL# 2260.

Keys, R. N., D. T. Ray, and D. A. Dierig. Characterization of Apomictic potential in guayule (parathenium argentatum gray) in vivo and in vitro. *Journal of American Society of Horticulture Science*. (Accepted 11/28/2001) WCL# 2228.

Kimball, B. A. Global Change and Water Resources. *American Society of Agronom6y Monograph Series*. (Accepted 9-22-03) WCL# 2324.

Kimball, B. A. Response of plants to elevated atmospheric CO2. *Indian Journal of Plant Physiology*. (Accepted 06-01-03) WCL# 2372.

Kimball, B. A. 2003. Global environmental change implications for irrigation water requirements. p. 87-105. *In* 2nd Int. Conference on Irrig. & Drain, Phoenix, AZ, May 12-15, 2003. (Accepted 11-26-02) WCL# 2358.

Leavitt, S. W., S. B. Idso, B. A. Kimball, J. M. Burns, A. Sinha, and L. Stott. The effect of long-term atmospheric CO2 enrichment on the intrinsic water-use efficiency of sour orange trees. *Chemosphere*. (Accepted 1-3-2001) WCL# 2318.

Moran, M. S. Thermal responses as indicators of plant ecosystem health. J. Luvall and D. Quattrochi (ed.) *In Thermal Remote Sensing in Land Surface Prooperties.* (Accepted 03-02-03) WCL# 2093.

Moran, M. S., G. J. Fitzgerald, A. Rango, C. L. Walthall, E. M. Barnes, W. C. Bausch, T. R. Clarke, C. S. Daughtry, J. H. Everitt, J. L. Hatfield, K. M. Havstad, T. J. Jackson, N. R. Kitchen, W. P. Kustas, M. R. Mcguire, P. J. Pinter Jr., K. A. Sudduth, J. S. Schepers, T. J. Schmugge, P. J. Starks, and D. R. Upchurch. 2003. Sensor development and radiometric correction for agricultural applications. *Photogrammetric Engineering & Remote Sensing* 69:705-718. WCL# 2323.

Moran, M. S., D. C. Hymer, J. Qi, and Y. Kerr. 2002. Monitoring agricultural crop and soil conditions by combining ERS-2 SAR and Landsat TM imagery. *Remote Sensing of Environment*. 79:243-252. (Accepted 07-17-00) WCL# 2152.

Mozingo, R. W., T. A. Coffelt, S. W. Swann, and P. M. Phipps. 2004. Registration of wilson peanut. *Crop Science*. 44:1017-1018. (Accepted 05/01/03) WCL# 2354.

Nunes, V. S. and N. L. Duran. 2003. Bioluminescent genes and their use in environmental studies. *Brazilian Journal of Microbiology* 34:1571-8382. WCL# 2326.

Perea, H., T. S. Strelkoff, J. Simunek, E. Bautista, and A. J. Clemmens. 2003. Unsteady furrow infiltration in the light of the Richard's equation. p. 625-636. *In* 2nd Int. Conference on Irrig. & Drain,

Phoenix, AZ, May 12-15, 2003. WCL# 2369.

Pinter Jr., P. J., J. L. Hatfield, J. S. Schepers, E. M. Barnes, M. S. Moran, C. S. Daughtry, and D. R. Upchurch. 2003. Remote sensing for crop management. *Photogrammetric Engineering and Remote Sensing* 69(6): 647-664. WCL# 2352.

Pinter Jr., P. J., J. C. Ritchie, J. L. Hatfield, and G. F. Hart. 2003. The Agricultural Research Service's remote sensing program: An example of interagency collaboration. *Photogrammetric Engineering and Remote Sensing* 69(6): 615-618. (Accepted 1/2003) WCL# 2350.

Ploschuk, E. L., G. Cerdeiras, L. Windauer, D. A. Dierig, and D. A. Ravetta. Alternatives for the development of different species of Lesauerella in Patagonia (Argentina); potential of L. angustifolia. *Industrial Crops and Products*. (Accepted 12-20-2002) WCL# 2347.

Ray, Dennis T., Terry A. Coffelt, and David A. Dierig. Breeding guayule for commercial production. *Industrial Crops and products.* (Accepted 5-07-2004) WCL# 2403.

Replogle, J. A. 2002. Some observations on irrigation flow measurements at the end of the millennium. *Applied Engineering in Agriculture* 18(1):47-55. WCL# 2281.

Replogle, J. A., R. Adler, and R. S. Gooch. 2003. Operational evaluations of new radial gate design. p. 421-433. *In* 2nd Int. Conference on Irrig. & Drain, Phoenix, AZ, May 12-15, 2003. WCL# 2368.

Replogle, J. A. and B. T. Wahlin. 2003. Head loss characteristics of flap gates at the end of drain pipes. *Transactions of the ASAE* 46(4):1077-1084. WCL# 2349.

Robinson, P., A. J. Clemmens, D. K. Carman, Z. Dalmut, and T. Fortner. 2003. Irrigation development in eastern Arkansas: water supplies, uses, and efficiencies. p. 283-292. *In* 2nd Int. Conference on Irrig. & Drain, Phoenix, AZ, May 12-15, 2003. WCL# 2360.

Salywon, Andrew M., David A. Dierig, Jon P. Rebman, and Diana J. Rodriguez. Evaluation of new lesquerella and physaria (Brassicaceae) oilseed germplasm. *American jounal of botany*. (Accepted 09-02-04) WCL# 2405.

Soon, W., S. Baliunas, K. Y. Kondratyev, S. B. Idso, and E S. Posmentier. Calculating the climatic impacts of increased CO_2: The issue of model validation. *Special Publication 463 European Space Agency, Noordwijk, The Netherlands.* (Accepted 10/11/2000) WCL# 2243.

Strelkoff, T. S., E. Bautista, and A. J. Clemmens. 2003. Errors inherent in the simplified infiltration parameter estimation. p. 735-745. *In* 2nd Int. Conference on Irrig. & Drain, Phoenix, AZ, May 12-15, 2003. WCL# 2370.

Strelkoff, T. S. and A. J. Clemmens. Transport capacity for eroded silts in irrigation furrows. *Hydraulic Engineering*. (Accepted 07-29-04) WCL# 2389.

Strelkoff, T. S., A. J. Tamimi, and A. J. Clemmens. 2003. Two-dimensional basin flow with irregular bottom configuration. *Irrigation & Drainage Engineering* 129(6):391-401. WCL# 2235.

Tabbara, H. 2003. Phosphorus loss to runoff water 24 hours after application of manure or fertilizer: I. Effects of post-application tillage and rate. *Environmental Quality*. 32:1044-1052. WCL# 2332.

Tamimi, A. H., A. J. Clemmens, E. Bautista, and T. S. Strelkoff. 2003. SIPES - Surface Irrigation Parameter Estimation Software. p. 615-624. *In* 2nd Int. Conference on Irrig. & Drain, Phoenix, AZ, May 12-15, 2003. WCL# 2362.

Triggs, J. M., B. A. Kimball, P. J. Pinter Jr., G. W. Wall, M. M. Conley, T. J. Brooks, R. L. LaMorte, N. R. Adam, M. J. Ottman, A. D. Matthias, S. W. Leavitt, and R. S. Cerveny. Free-air carbon dioxide enrichment (FACE) effects on energy balance and evapotranspiration of sorghum. *Agricultural and Forest Meteorology*. (Accepted 1/13/2004) WCL# 2366.

Wahl, T. L., A. J. Clemmens, and J. A. Replogle. 2003. The energy correction for calibration of submerged radial gates. p. 757-766. *In* 2nd Int. Conference on Irrig. & Drain, Phoenix, AZ, May 12-15, 2003. WCL# 2365.

Wahlin, B. T. Performance of model predictive control on ASCE test canal 1. *Irrigation and Drainage Engineering*. (Accepted 7/14/2003) WCL# 2356.

Wahlin, B. T. and E. Bautista. Feedforward control: volume compensation versus model predictive control. 2003. p. 487-496. *In* 2nd Int. Conference on Irrig. & Drain, Phoenix, AZ, May 12-15, 2003. WCL# 2363.

Wahlin, B. T., A. J. Clemmens, and J. A. Replogle. Procedure for estimating measurement accuracy for surface water flows. *Journal of Irigation and Drainage Engineering*. (Accepted 04/2000) WCL# 2216.

Wall, G. W. and G. McDonnell. 2003. Rapid excision apparatus for plants (reaper): design, implementation, and functionality. *Hortscience* 38(2): 207-211. WCL# 2287.

White, J. W. Solicited book review of Plant Physiology: Characteristics, Breeding and Genetics. *Quarterly Review of Biology* Dris & Barry-Ryan. (Accepted 10/15/2003) WCL# 2383.

White, Jeffrey W. and Consuelo Montes-R. Variation in parameters related to leaf thickness in common bean (phaseolus vulgaris L.). *Field crops research* (Accepted 06-10-04) WCL# 2398.

Zerihun, D., C. A. Sanchez, K. L. Farrell-Poe, F. J. Adamsen, and D. J. Hunsaker. 2003. Performance indices for surface N-fertigation. *Irrigation and Drainage Engineering* 129(3):173-183. WCL# 2311.

Technology Transfer

Following are summaries of the laboratory's major technology transfer accomplishments for 2003.

Irrigation and Water Quality

Scientist: Albert Clemmens **Canal Automation**

Central Arizona Irrigation and Drainage District (CAIDD) purchased the canal automation system developed by the U.S. Water Conservation Laboratory in cooperation with CRADA partner Automata, Inc. The canal automation system was installed in record time and allowed CAIDD to operate their canals remotely within a few months of ordering the system. The district has agreed to implement additional canal automation features provided by Software for Automated Canal MANagement (SacMan) over the next few years. Automata continues to actively market this product with their customers.

Scientist: John Replogle **Flow Measurement and Control**

A canal gate manufacturer, AquaSystems 2000/Inc. was assisted in installing a testing facility for calibrating special accordion-type, vertically-moving gate structures that incorporated the long-throated flume developed at the U.S. Water Conservation Laboratory as an improved measuring and control device for irrigated agriculture. These gates combine the upstream control capabilities of leaf gates, which are similar to lifting the downstream edge of a door across the canal that is hinged at the upstream edge, but without the large lifting force of the leaf gates.

A water-resources products manufacturer, Plasti-Fab, cooperated in laboratory tests to determine head losses caused by their rubberized-hinge flap gates. The tests were conducted at the U.S. Water Conservation Laboratory. These gates are meant to replace standard iron flap gates, which are typically installed on the end of drain lines to prevent backflow and entry of animals. Detailed design information from the laboratory tests is used for the selection and computation of head loss from these special gates. Historical data for the standard iron flap gates, from 8-inch to 48-inch diameter, was gathered from several sources, reformatted in both metric and English units, and combined for both types of gates for ready application by drainage engineers.

New concepts developed at the U.S. Water Conservation Laboratory were presented to the International Conference of the American Society of Agricultural Engineers, for designing and constructing total-load, stream-flow sediment samplers that can also serve as a stream-flow measuring device. Accurate total-load stream flow sampling has been a perpetual problem in sediment monitoring to document erosion into reservoirs and evaluate watershed treatments, which is increasingly important with the recent history of major forest fires. Usually a combination of bed-load sampling devices, suspended-load suction samplers, and a flume for total flow rate, are used. This new concept allows the performance of all three functions with one simplified device.

Environmental and Plant Dynamics

Scientist: Bruce Kimball **Global Climate Change**

Data from the 1998 and 1999 FACE Sorghum experiments on growth, weather, cultural practices, etc. were assembled and converted to a standard ICASA (International Consortium for Agricultural Systems Applications) format. The data were delivered to Dr. Robert Grant, University of Alberta, Edmonton, Alberta for use in validating the ecosys model. The data are now readily available for delivery to other plant growth modelers upon request. Similarly, our data from FACE Wheat experiments conducted between 1993 and 1997 continue to be utilized by plant growth modelers for validation purposes.

Scientist: Terry Coffelt **New Crops**

Seed of six guayule germplasm lines developed jointly with the University of Arizona was shared with a commercial company (Yulex) for establishing commercial fields of guayule in Arizona and California. Seed of these lines is also being shared with research cooperators in Australia, South Africa, and China.

Scientist: Dave Dierig **New Crops**

Seed of newly developed lesquerella germplasm was shared with cooperators in Saltillo, Mexico. Seed will be used in field experiments for a salinity study which is part of a student grant from International Cooperation between the U. S. and Mexico.

ARS WEEKLY ACTIVITY REPORTS

Throughout the year scientists submit items for the "ARS Weekly Activity Report. These reports are consolidated at ARS Area level and submitted to ARS headquarters for the information of agency and departmental management.

ARS Scientist Addresses 2nd International Congress of Plant Physiology in India: On 11 January 2003, Bruce A. Kimball, Research Leader with the U.S. Water Conservation Laboratory, Phoenix, AZ, presented a plenary lecture on "Response of plants to elevated atmospheric CO_2" at the 2nd International Congress of Plant Physiology in New Delhi, India. The Congress was organized by the Indian Society for Plant Physiology, the Indian Agricultural Research Institute, and the International Association for Plant Physiology. Dr. Kimball also chaired a session on "Global climatic change and plant productivity."