TECHNOLOGY TRANSFER

Following are summaries of the laboratory's major technology transfer accomplishments for 1999.

Irrigation and Water Quality

Scientists: Fedja Strelkoff and Bert Clemmens - Release of Surface Irrigation Simulation Software

Bert Clemmens and Fedja Strelkoff, a University of Arizona cooperator, formally released a new generation of user-friendly software for the simulation of surface irrigation events. The software provides quick responses to a variety of "what-if" scenarios that can be proposed by field advisors, consultants, extension personnel, etc., to assist in the development of recommendations for water-saving, high-efficiency surface irrigation with the methods suitable for their geographical area. A wide variety of surface-irrigation techniques and scenarios can be simulated with this program, and the output also can be used in irrigation training courses. In a nontraditional application, the program is being used in design efforts to reduce the sediment load of storm runoff passing through agricultural lands into waterways. The Natural Resources Conservation Service made its web site available to the general public for downloading the software. It is being downloaded by NRCS personnel, field offices, consultants, and university researchers. The expected impact is better design and management of surface irrigation systems with increased efficiency and decreased degradation of streams and groundwaters receiving the effluent.

Scientist: Herman Bouwer - Sewage Effects on Underlying Groundwater

Through meetings of such groups as the World Federation of Scientists, who met in Erice, Italy, in August 1998; presentations, and publications, Herman Bouwer has informed a broadly based audience in the scientific community and the public sector of a less-well-known potential groundwater hazard from irrigating with sewage effluent. In addition to the normal concern about groundwater contamination from salts, nitrates, and pesticides, careful scrutiny of effluent quality parameters indicates that other contaminants such as disinfection byproducts (DBPs) and pharmaceutically active chemicals (PACHs) can also reach groundwater. In relatively dry climates, the concentrations of these chemicals in the drainage water can be a multiple of those in the effluent itself. This is a worldwide problem. Sewage effluent increasingly will become an important source of irrigation water as growing cities need more water, growing populations need more food, and streams and lakes need to be kept clean. The impact of disseminating this information is to prompt research needed to guide policy and practices to address the problem. There are currently two research thrusts: a controlled greenhouse study with vegetated soil columns below fields to be conducted at the U. S. Water Conservation Laboratory (USWCL) and field studies in developing countries to sample groundwater below fields with a long history of sewage irrigation. Within the U.S., studies in cooperation with universities and health agencies are being planned, and plans for international participation have been initiated through the World Federation of Scientists.

Scientist: Herman Bouwer - Simplified Cylinder Infiltrometer Technologies

The simplified cylinder infiltrometer technology developed at the USWCL is gaining national and international acceptance as a simple and effective method to predict infiltration rates for groundwater recharge basins or other flooded areas. The infiltrometers are relatively small with diameters of about

2 feet, and they are about 1 foot deep. Effects of lateral flow in the soil around the cylinder, which formerly led to grossly overestimated infiltration rates, are taken into account. Also considered are water depth in the cylinder and limited depth of wetting of the soil to convert measured infiltration rates inside the cylinder to infiltration rates that would be expected for large flooded areas. The method has been used as a tool to screen sites for artificial recharge of groundwater and for design of infiltration systems. Technology transfer was via personal contacts with users, manuscript handouts, presentations at conferences, and publication in a peer-reviewed engineering journal.

Scientist: Bert Clemmens - Release of Software for Flow Measurement Structures
Over the last three decades, scientists at the USWCL developed technology for measuring the flow rate of irrigation water in open channel canals. In particular, research focused on development and use of long-throated flumes, which have become standard devices worldwide because of their low cost, simplicity, and high accuracy. Software developed by USWCL for the design and calibration of these structures was recently greatly improved through cooperation with U. S. Bureau of Reclamation engineers who converted the software to a more user-friendly windows environment. This software is now available on the Bureau's web site and has been distributed widely. This should significantly improve the adoption of this flow measurement technology.

Scientist: John Replogle - Measuring Irrigation Well Discharges
Construction and field-use information has been published related to a device developed by John Replogle that can be used to measure irrigation or drainage well discharges or to evaluate the behavior of an existing installed pipe meter. This special combination pitot-static-tube system is inexpensive and convenient to use, particularly on wells that spill directly into canals or streams. It can be constructed from standard materials using ordinary machine shop procedures, and the entire kit fits into a standard briefcase. The system provides irrigation district technicians an inexpensive, convenient tool to evaluate existing meter installations and to measure discharges from previously unmeasured wells. This device is expected to provide a means to evaluate both irrigation and drainage pumps, particularly in those instances where a few evaluations are needed on an infrequent basis and investment in alternate technology, such as ultrasonic-meter equipment and training, is not economically feasible.

Environmental and Plant Dynamics

Scientist: Bruce Kimball - FACE Wheat Data Sets
Testing of several wheat growth models against Arizona Free-Air CO_2-Enrichment (FACE) wheat data sets was one of the primary activities at the Workshop of the Global Change in Terrestrial Ecosystems (GCTE) Wheat Modeling Network held in Potsdam, Germany, in November 1998. Because the growth data were obtained at frequent intervals through the growing season and because many needed ancillary measurements were made, these data were especially valuable for the validation process for both present and future CO_2 conditions. The performance of each model in terms of its ability to simulate two of the Arizona FACE wheat data sets (as well as some others) is being made a part of the GCTE Wheat Network Metafile record of each registered wheat model. These experiments were supported primarily by the U.S. Water Conservation Laboratory and a Department of Energy grant to the University of Arizona.

Scientist: Dave Dierig - Release of New *Lesquerella fendleri* Germplasm Line

Scientists at the USWCL have developed and released a new line of *Lesquerella fendleri*, a potential new industrial oilseed crop, that will significantly advance its commercialization. The new line has less pigmentation, thereby overcoming the requirement for expensive processing to remove pigmentation from the oil needed for many uses. Development of lesquerella into a viable commercial crop will provide an alternative crop for U.S. farmers and an alternative domestic source of hydroxy fatty acids, presently filled by imported castor.