

ARS Report to NCR-101 Committee on Controlled Environment Technology and Use  
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**A. Homeland Security and Tornado Damage:** Approximately \$4.1 million was provided by Congress to BARC for Homeland Security during the current fiscal year. A new Security Director has been hired and additional security measures have been taken. Although the Beltsville Agricultural Research Center (BARC) sustained over \$21 million in tornado damage on September 24, 2001, only a little over \$7 million were obtained for greenhouse repair and replacement. Because of the extensive structural damage to greenhouses in Range 1, most have been torn down during the past several months. A committee has recommended that 3 new greenhouses be built (at an estimated cost of \$1 million each) in the some of the vacant space in Range 1. The Range 2 and Range 4 greenhouses that were damaged by the tornado are being used, but are still undergoing repairs. Windows were replaced in Bldg. 001 and tornado damaged shingles, gutters, and down spouts have been replaced throughout BARC-West in 2002. The landmark clock tower on Bldg. 003, which had stopped at 5:24 p.m. during the tornado, was repaired. Minor damage to the air intake system of the Controlled Environment Facility (CEF) has been repaired. Numerous glass panes have been replaced in the Range 2 and Range 4 greenhouses. Shade curtains have been replaced in all greenhouse sections in Range 2. The book stacks in the National Agricultural Library have reopened after being closed for a few months following tornado damage and subsequent cleanup and replacement of glass. Extensive landscaping has been completed at BARC-West to replace some of the plantings that were lost in the storm.

**B. New Facilities Planned or Installed:** Several construction projects are underway at BARC. Phase I (Bldg. 307B) and Phase II (Bldg. 307C) of the new Beltsville Human Nutrition Research Center (BHNRC) Facilities at BARC-East are currently under construction and are 80 and 95% completed, respectively; completion of Phase II is expected in August, 2003 and completion of Phase I is expected in November, 2003. A contract was awarded for the design of Phase III, renovation of the existing building 307. A new Architectural and Engineering Firm (Leo A. Daly) was hired to replace the previous firm. Phase III construction is expected to cost ca. \$20.6 million and is contingent on funds being approved by Congress. The Animal Biotechnology Facility was completed in August 2002. The new Feed Center has also been completed. Other facilities being planned include construction of Poultry Production Hatchery Barns (estimated at \$1.3 million). The design is at the 100% completion stage but construction awaits Congressional funding. An Insect Quarantine Research facility is also being considered; the estimated cost of this facility is \$300,000. Progress is continuing on construction of the Biocontainment Facility; the target date for completion is December 31, 2003. This facility will contain 5000 sq ft (including ca. 2500 sq. ft. under glass). To insure proper containment, a triple bead of caulking is being used to secure the glazing to an aluminum framework. Two 1/4 inch panes of tempered glass are mounted in the framework with a 1/2 inch space between the two layers of glass; the glass is placed on the bottom bead of caulking and two additional beads of caulking are used to seal the glass. The APHIS Containment Greenhouse on BARC-East is still not fully operational because of a number of technical issues. Renovation of Bldg. 004 has been completed; the Molecular Plant Pathology Lab is currently housed in this facility. The Controlled Environment Facility (CEF) at BARC was completed in 1998 and is now over 80% occupied with about 70% of the growth chambers (GC) in use. Primary users include the Alternate Crops and Systems Lab (ACSL, 19 GC), the Floral and Nursery Plants Research Unit (7 GC), the Phytonutrients Lab (3) and the Fruit Lab (8 GC). Other users include the Produce Quality and Safety Lab (1 GC), the Environmental Quality Lab (EQL, 4 GC), the Soybean Genomics & Improvement Lab (2 GC), and the Sustainable Agricultural Systems Lab (SASL, 1 GC). Plans are being made to install an alarm system in each growth chamber. During the past several years, growth chamber and greenhouse managers at BARC have made increased use of IPM measures, using biocontrol agents and insecticidal soaps to reduce the reliance on agricultural pesticides.

**C. Instruments and Sensors:** Plans are still underway in the Phytonutrients Lab (S.J. Britz, R.M. Mirecki, W.A. Bailey) to construct a <sup>13</sup>C plant growth chamber to study metabolism of carotenoids in humans using carrots as the source of food. The new minirhizotron and video camera system, designed by Bartz Technology Corp. (Santa Barbara, CA), was used to image root growth of eastern gamagrass grown in the field under a gradient of soil moisture in a joint study involving ACSL (D.C. Gitz, V.R. Reddy), Hydrology & Remote Sensing (HRSL) (J.C. Ritchie), and SASL (D.T. Krizek). BARC continued to participate in the USDA UV-B Monitoring Program. A description of this program (overview, climatological network, research activities, instrumentation,

intercomparisons, project bibliography, staff directory, and related resources) may be obtained at: <http://uvb.nrel.colostate.edu>. This monitoring program is managed by the Natural Resource Ecology Laboratory of Colorado State University (CSU). A suite of state-of-the art instruments (costing ca. \$1 million ) has been located on the South Farm since 1998 in close proximity to the Air Pollution facility to measure UV radiation and atmospheric optical properties. These instruments are maintained by personnel from CSU and State University of New York (SUNY) at Albany. The data for the CSU instruments are available on-line within 1 day of measurement. There are 36 stations in the network; each station incorporates several sensors from Yankee Environmental Systems (UV-A pyranometer, UV B-1 pyranometer, UV Multi Filter Rotating Shadow Band Radiometer (UV-MFRSR), and a VIS MFRSR, as well as environmental monitoring equipment. BARC staff (Steve Britz and Roman Mirecki, Phytonutrients Lab) are assisting in the operation of the facility. A quantum sensor has been installed on the South Farm to allow for comparisons between these quantum values and data obtained from the MFRSRs.

**D. Unique Plant Responses:** A major obstacle to successful establishment of eastern gamagrass plantings [*Tripsacum dactyloides* (L.) L.] is its erratic germination because of severe seed dormancy. Germination responses of three lots of eastern gamagrass seed (1998, 2000, and 2002) given a proprietary seed priming treatment (Germtec II™) were compared in 4-week germination studies conducted in a peat-vermiculite mix in ARS and NRCS greenhouses in March and September 2002. As in the previous year, the 2000 seed lot showed a much lower germination rate than the other seed lots, providing further evidence that the 2000 seed lot may have developed physiological and/or morphological barriers to germination during maturation. No new growth has been observed on the eastern gamagrass plots that experienced mysterious dieback on the North Farm in 2001 from the southern corn stalk borer. Plans are underway to conduct cooperative research with Michael Pogue and Alma Solis (Systematic Entomology Lab), Jerry Ritchie (HRSL), and John Englert (National Plant Material Center, NRCS) in an attempt to trap adult moths of this pest on the North Farm and at NPMC by using UV traps.

**E. Research Grants/Cooperative/Interdisciplinary Projects:** Work was concluded on the USDA Competitive Grant entitled: “Eastern gamagrass for forage, soil improvement, and buffer strips”, carried out in collaboration with researchers from AMS, ARS, NRCS, Tuskegee University and the University of Maryland. I am currently working with John Teasdale, Aref Abdul Baki, Ben Coffman, Tom Devine, and Dan Roberts, SASL, in developing a new CRIS project on “Management of Cover Crops for Enhancement of High Value Cropping Systems”. One objective that I will be working on will be to examine the combined use of cover crops, compost, and UV-blocking filters in high tunnels to extend the growing season for tomato production by 3-4 weeks in the spring and fall. Collaborators will include Bryan Butler, MD Cooperative Extension, Carroll County, Bill Lamont and Mike Orzolek, Penn State University and Yao-Chi Lu and Pat Millner (SASL). BARC is cooperating with NASA and the USDA UV-B Monitoring Program (funded by CSREES and operated out of CSU and SUNY, Albany) as indicated in C.

**F. Committees and Sub-Committees Served:** I continue to serve on the Editorial Boards of Environmental and Experimental Botany, and Biotronics.

**G. Workshops/Colloquia/Symposia:** Several oral and poster presentations were given at the International Horticultural Congress in Toronto, Canada 11-17 Aug 2002 and at the Third Eastern Native Grass Symposium held 1-3 Oct 2002 at the Univ. of North Carolina, in Chapel Hill, NC. I am currently organizing a Symposium on UV Effects on Terrestrial Ecosystems at the American Society for Photobiology (ASP) Meeting to be held at Baltimore Inner Harbor on July 7, 2003. Partial funding to help defray symposium costs were provided by ASP and the BA Director’s Office. I also plan to attend the ASHS Centennial Conference in Providence, RI in October 3-6, 2003.

**H. Personnel:** Daniel Thessen was appointed to the BA Director’s Office as head of the Security Services Unit. David Granstrom was appointed as Associate Director, Animal and Natural Resources Institute (ANRI).

**I. Recent Publications:** A selected list of publications is attached (See K).

**J. Internet Entries/Access:** Information on research programs at BARC may be accessed at the following home page: [www.barc.usda.gov](http://www.barc.usda.gov). Information on SASL may be accessed at: [www.barc.usda.gov/anri/sasl/sasl.html](http://www.barc.usda.gov/anri/sasl/sasl.html) and information on ACSL may be accessed at: <http://wizard.arsusda.gov/acsl/acslhome.html>. Images taken during the construction of the CEF, Bldg. 004, and the Human Nutrition Research Center facilities may be examined by opening: [www.barc.usda.gov/fmod/modern](http://www.barc.usda.gov/fmod/modern) and then selecting “Construction Site Picture Gallery”.

#### **K. Selected List of Recent Publications:**

- Abdul-Baki, A., S. Kotlinski, and T. Kotlinska. 2002. Vegetable production systems. Vegetable Crops Research Bulletin No. 57. Research Institute of Vegetable Crops. Skierniewice, Poland. 57: 11-21.
- Abdul-Baki, A., J.R. Teasdale, R.W. Goth, and K.G. Haynes. 2002. Marketable yields of fresh market tomatoes grown in plastic and hairy vetch mulches. HortScience 37:878-881.
- Britz, S.J. and D.F. Kremer. 2002. Warm temperatures or drought during seed maturation increase free "-tocopherol in seeds of soybean (*Glycine max* [L.] Merr.) J. Agr. Food Chem . 50(21):6058-6063.
- Bunce, J.A. 2002. Carbon dioxide concentration at night affects translocation from soybean leaves. Ann. Bot. 90:399-403.
- Buyer, J.S. 2002. Rapid sample processing and fast chromatography for identification of bacteria by fatty acid analysis. J. Microbiol. Methods 51:209-215
- Buyer, J.S., D.P. Roberts, and E. Russek-Cohen. 2002. Soil and plant effects on microbial community structure. Can. J. Microbiol. 48:955-964.
- Chung, S. and D.P. Roberts. 2002. Biological control of soilborne plant pathogens. Monthly Agriculture and Horticulture (Korean Magazine), March, 2002, p. 126-127.
- Fageria, N.K., V.C. Baligar, and R.B. Clark. 2002. Micro nutrients in crop production . Adv. Agron. 77:185-268.
- Gilker, R.E., R.R. Weil, D.T. Krizek, and B. Momen. 2002. Eastern gamagrass root penetration in adverse subsoil conditions. Soil Sci. Soc. Am. J. 66(3):931-938.
- Krizek, D.T., J.C. Ritchie, A.M. Sadeghi, C.D. Foy, E.G. Rhoden, J.R. Davis, and M.J. Camp. 2003. A four-year study of biomass production of eastern gamagrass grown on an acid compact soil. Commun. Soil Sci. & Plant Anal. 34(3&4):457-480.
- Mattoo, A., T. Cassol, R. Mehta, N. Ali, A. Abdul-Baki, and A. Handa. 2002. Genetic engineering of tomato fruit for sustained accumulation of polyamines during ripening to study their physiological role(s). Acta Hort. 575:157-161.
- Meyer, S.L.F. and D.P. Roberts. 2002. Combinations of biocontrol agents for management of plant-parasitic nematodes and soilborne plant-pathogenic fungi. J. Nematol. 34:1-8.
- Mills, D.J., C.B. Coffman, J.R. Teasdale, K.L. Everts, A.A. Abdul-Baki, J. Lydon, and J.D. Anderson. 2002. Foliar disease in fresh-market tomato grown in differing bed strategies and fungicide spray programs. Plant Disease 86:955-959.
- Mills, D.J., C.B. Coffman, J.R. Teasdale, K.L. Everts, and J.D. Anderson. 2002. Factors associated with foliar disease of staked fresh market tomatoes grown under differing bed strategies. Plant Disease 86:356-361.
- Radhakrishnan, J., S. Liang, C.J. Shuey, and J.R. Teasdale. 2002. Remote sensing of weed canopies. p. 175-202. In: R.S. Muttiah (ed.), From Laboratory Spectroscopy to Remotely Sensed Spectra of Terrestrial Ecosystems. Kluwer Academic Publishers, Dordrecht, The Netherlands.
- Rice, P.J., L.L. McConnell, L.P. Heighton, A.M. Sadeghi, A.R. Isensee, J.R. Teasdale, A.A. Abdul-Baki, J.A. Harman-Fetcho, and C.J. Hapeman. 2002. Comparison of copper levels in runoff from fresh-market vegetable production using polyethylene mulch or a vegetative mulch. Environ. Toxicol. Chem. 21(1):24-30.

Rillig, M.C., S.F. Wright, and V.T. Eviner. 2002. The role of arbuscular mycorrhizal fungi and glomalin in soil aggregation: comparing effects of five plant species. *Plant Soil* 238:325-333.

Rillig, M.C., S.F. Wright, M.R. Shaw, and C.B. Field. 2002. Artificial climate warming positively affects arbuscular mycorrhizae but decreases soil aggregate water stability in an annual grassland. *Oikos* 97:52-58.

Teasdale, J.R. 2002. Living Mulches. p. 463-465. In: D. Pimentel (ed.), *Encyclopedia of Pest Management*. Marcel Dekker Inc., New York.

Watkins, K.B., Y.-C. Lu, and J.R. Teasdale. 2002. Long-term environmental and economic simulation of alternative cropping systems in Maryland. *J. Sustain. Agric.* 20(4):61-82.

Wu, S., Y.-C. Lu, D.J. Mills, C.B. Coffman, and J.R. Teasdale. 2002. Economic evaluation of alternative production systems for fresh-market tomatoes in the Mid-Atlantic region. *J. Veg. Crop Prod.* 8:91-107.