Knowledge in the Making

Governor Impressed By High-Tech Irrigation

At the newest UA farm, during a daylong tour of agricultural sites in southern Arizona in July, Gov. Bruce E. Babbitt praised the technological advances and water-conservation efforts being made by the state's farmers and agricultural researchers. Babbitt, Arizona Senate President Stan Turley and other visitors saw drip irrigation research plots at the Center for Agricultural Research, Extension and Teaching (CARET, the renamed UA farm near Maricopa). They started their tour at the Farmers Investment Company pecan orchard near Green Valley, the world's largest, and finished with aerial and ground-level viewing of the Paloma Ranch's 10,000 new acres of drip-irrigated cotton near Gila Bend. Other stops included a UA experimental water-harvesting project producing crops with rainwater on City of Tucson land in Avra Valley, the Ralph Wong farm and UA research farm at Marana, and drip-irrigated fields on Howard Wuertz's farm near Coolidge.

At CARET, UA President Henry Koffler noted that since so much of the world is arid, "Whatever we achieve here can be used as an example for a large part of the developing world."

Arizona Senate President Stan Turley (left) and Governor Bruce Babbitt observe Dale Buck's demonstration of an infrared-sensing gun for assessing plants' water stress. Buck, irrigation specialist with the U.S.D.A. Water Conservation Laboratory in Phoenix, is pointing the gun at drip irrigation test plots on the new UA farm near Maricopa.

Call It a Cowpea. Call It Black-Eyed. Call It Protein for Hungry Children.

Black-eyed peas, fixed in novel formats such as cookies and fritters, star in a scenario for easing children's protein deficiencies in Brazil and other Third World countries. The high-protein beans, also called cowpeas, are already a widely grown food in Latin America, Africa and parts of Asia, said UA food scientist Dr. J. Warren Stull. He and a Brazilian food scientist, Dr. Miranice G. Sales, have developed several foods based on flour made from roasted black-eyed peas. The foods round out the nutritional benefits from the peas, and score high in appeal to children in preliminary tests. Also important, the foods all can be prepared from scratch with simple methods and utensils practical for poor families, said Stull.

After a little more laboratory work in Brazil, Sales plans to introduce the cowpea cookies and fritters in school lunch programs in northeastern Brazil. She is head of home economics at Brazil's University of Ceara. "The cowpea is a good source of protein, and we have lots of protein malnutrition in the children (in Brazil)," she said.

Children's acceptance of the cowpea foods will be tested in the Brazilian school lunch program. "It's no good to develop a nutritious food if people don't like it," said Stull. He noted that Brazilian crop scientists have developed drought-resistant, insect-resistant, disease-resistant varieties of cowpeas that can be produced under severe conditions in the dry climate of northeastern Brazil.

Stull sees some irony in working with cowpeas for improving human nutrition: "When I was a boy on a farm in Illinois, we grew them and fed them to the cows. We let them grow to maturity, then cut and used the whole plant as hay." Now, he says, "Dr. Sales's work with cowpeas could have a major role in improving diets in many parts of the world."

Salts Cut Microbes' Production Of Potent Ethylene in Soils

UA soils scientists have identified conditions and microorganisms that increase soil levels of ethylene, a simple chemical that causes rapid and dramatic changes in plants even at the level of a few parts per billion. Dr. Ian L. Pepper and Dr. Hashim M. Babiker found that salts and sodium in soils inhibit production of ethylene by some microbes, and that organic matter in soils boosts ethylene levels.

Ethylene is used commercially to hasten ripening of some fruits. It can act as a plant hormone to alter growth

rates, but too much of it can harm plants, said Pepper. He and Babiker compared microbial ethylene production in 12 different soil types, and isolated several soil fungi that readily make ethylene when grown in laboratory cultures. Some of those fungi are related to the fungus that causes fusarium wilt in many crop plants.

Pepper is also studying ethylene's effects on the growth of beneficial soil microbes that make nutrients available to plant roots.

Wastewater Mixture Boosts Cotton Yields in Buckeye Tests

Using municipal wastewater to grow cotton in Arizona can improve crop yields while salvaging a limited resource, suggests research by agronomist Dr. Arden D. Day of the UA Department of Plant Sciences. Wastewater from Phoenix, mixed 50-50 with Buckeye-area groundwater, produced more cotton than groundwater alone did when used to irrigate commercial cotton fields in two seasons of tests near Buckeye.

Day reported the research at American Society of Agronomy meetings in Washington, D.C., in August. He said that the tests, run in cooperation with Ludeke Corporation of Phoenix, showed that wastewater can be used effectively in the commercial production of cotton fiber in the Southwest.

Day has earlier reported higher yields for alfalfa grown with a wastewater-groundwater mixture, compared with the same crop grown with straight groundwater. In both the cotton and alfalfa tests, the wastewater had more nitrogen and phosphorus, and less total salt, than the local groundwater. The wastewater-irrigated cotton had slightly lower lint percentage than the comparison cotton, but Day said that the advantages of using the wastewater outweighed that factor. Other fiber-quality characteristics, including length and strength, were the same under both irrigation sources.

Newly Found Virus Causes Fly-Borne Cotton Disease

Leaf crumple, a cotton disease carried by white flies, struck Arizona cotton fields in epidemic proportions in 1981, in connection with unusually high white fly populations that year. This year, UA researchers isolated and identified the virus that causes cotton leaf crumple. Dr. Merritt R. Nelson, head of the Department of Plant Pathology, and Judith K. Brown, his graduate student, reported that the fragile virus is probably one of a newly identified group called geminiviruses, with two small spheres attached like Siamese twins. No such virus has previously been reported in cotton.

Nelson and Brown are also studying two other types of crop-damaging viruses carried by white flies, the ones that cause squash leaf curl and lettuce infectious yellows. The latter is a thread-like particle longer than any other known plant virus. The information gained about the viruses' range of host plants and other biological properties, plus new information from entomologists about white flies, should help in devising ways to limit future damage from these diseases.

Coating Amplifies Seeds' Success Under Poor Sprouting Conditions

Some seeds trying to sprout under tough conditions can get a leg-up out of the ground from a natural chemical named AMP. Coating cotton seeds with the stuff improves the seeds' germination rate and seedling vigor when either the seed quality or the growing conditions are below par, said UA plant geneticist Dr. Robert G. McDaniel. He and UA cotton specialist Dr. B. Brooks Taylor developed and tested the seed treatment. The formula, patented by the Arizona Board of Regents and sold by a Minnesota farm-supply company, was used commercially in several states from California to Mississippi to Minnesota this year. Farmers tried it on corn, sorghum, peanuts, sunflowers, jojoba and wheat, as well as cotton, said McDaniel.

Patent royalties are supporting further seed-quality research at the UA College of Agriculture.

AMP, short for adenosine monophosphate, plays important roles in all animal and plant cells. One role is in the cells' use of food energy. Oxidation of food, such as the stored carbohydrates and oil in a cotton seed, transfers energy to AMP molecules. The AMP becomes ATP (adenosine triphosphate), like an unwound spring being rewound or a battery being recharged. In preliminary research, McDaniel found that the varieties of cotton-seed that tolerate cold best tend to be the the varieties with the most AMP in the seed. In cold soil, compared with optimum conditions, seedlings need more energy to reach the stage when they can use sunlight, he explained.

The patented seed treatment includes buffering ingredients to help protect the AMP from soil microorganisms that could break it down before it helped the seed. The Conklin Company sells the AMP treatment under the trade name Amplify.