# Knowledge in the Making

## Tapping Cotton's Own Insecticides

Cotton plants make chemicals that can kill some of the plants' worst enemies: bollworms, tobacco budworms and boll weevils. These natural insecticides, called helocides, are among the chemicals produced in glands on cotton leaves and stems. Obviously, the plants do not put out enough insecticide to fully protect themselves; these insects cost Arizona cotton farmers tens of millions of dollars a year. But cotton plants without the glands are even more susceptible to bugs than other cotton plants are. Now, UA plant scientist **Dr. Frank R. Katterman** is working on a way to get larger amounts of helocides by growing cotton-plant cells suspended in liquids in laboratory flasks. He is comparing helocide production by cells from various parts of the plant and from several commercial and wild varieties of cotton. By repeated selection and by causing mutations in the cells, Katterman expects to get cotton cells that produce high levels of helocides. Such cells might then be grown in large enough quantities to make extraction of these natural pesticides economical. Or, with new gene-splicing techniques, the cotton cells' helocide-making ability might be transferred to bacteria that grow ten times faster than the cotton cells.

## Clean Air Byproduct Can Improve Some Soils

In the past 20 years, copper mines and coal-burning power plants have greatly reduced the amount of sulfur dioxide gas they release into the atmosphere. Trapping it turns sulfur dioxide into sulfuric acid. In the Southwest, a million or more tons of sulfuric acid are produced annually from air pollution control processes, but the current and projected demand for this byproduct is low. UA soils chemist **Dr. Jack L. Stroehlein** has explored possible uses of sulfuric acid for improving irrigation water and soil. In laboratory, greenhouse and field testing, he and his colleagues have found four specific agricultural uses for the acid: It can control the precipitation of lime in high-calcium irrigation water where that precipitation can encrust and plug irrigation equipment. In certain conditions, sodium from irrigation water can alter soil structure, resulting in poor water penetration into the soil. Sulfuric acid added to the irrigation water can ease that problem, too. Third, added acid can improve the efficiency of fertilizing a field with ammoniated irrigation water. The acid can halve the loss of nitrogen caused by ionization of ammonia into volatile ammonium. Also, treatment of some sodic (alkalai) soils with concentrated acid markedly increases the availability of phosphorus and iron in the soil and improves the soil's absorption of water. Stroehlein emphasizes that use of sulfuric acid helps only with specific problems of soil and water: "Indiscriminate use of acid is not likely to produce beneficial effects."

## New Method Saves Energy In Processing of Cattle Feed

UA animal nutritionist **Dr. William H. Hale** has refined and tested an energy-saving way to process milo for livestock feed. Milo, a grain sorghum, is often the main ingredient of diets for cattle in feedlots. Steam-flaking of milo, a widely used technique pioneered by Hale in the 1960s, increases its digestibility (thus its value in feed) by about 15 percent. However, the method requires steam, and the fossil fuels used for producing it have been rising in price. So last year Hale and colleagues tested another process, "reconstituition" of milo. The "recon" milo costs about 20 cents a ton to process, compared with about $5 per ton for steam-flaking, but it gives about the same improvement in digestibility. The two-step reconstitution process involves soaking the milo twice in unheated water, then letting it sit for 20 days or longer in an air-tight silo. There, the grain begins the first stages of germination, then ferments. For feeding, the grain is passed through a rolling mill and mixed with other diet ingredients. Most Arizona feedlots use natural gas for steam-flaking, but Hale expects many to try the recon method to avoid the high fuel costs.

## Soil's Drifting Along Spiked by Crumbling Tumbleweed

Look long enough, say three UA agricultural scientists, and you can find good in just about anything. Their case in point: tumbleweed, a troublesome invader of countless farms and ranches. **Dr. Arden Day**, an agronomist; **Dr. Curt Tucker**, a soils scientist; and **Dr. John Thames**, a hydrologist, believe they have found a worthwhile use for it in reclaiming disturbed land such as mine wastes. They do not plant tumbleweed; they grind it up and use it as a mulch for other plants. They compared the tumbleweed mulch to barley straw, the traditional soil-mulching material around mine reclamation projects. The two were equal in their ability to hold moisture in the soil. For example, in the case of an 80°F environment with 54% relative humidity, either mulch added about 7% of the water-holding capacity of coal mine spoils in northern Arizona. Hanging on to any available moisture is crucial in getting new plants to grow. The plant cover then reduces soil erosion, as well as sprucing up the site's appearance. At many mine sites, tumbleweed is more readily available than barley.