Biology

Chemical skirmish of plants and fungi

A plant may respond to fungal attack by producing toxic chemicals. More than 100 natural fungicides have been identified. But mold, mildew and root rot diseases still take a heavy toll of agricultural crops. Cornell University scientists Hans D. VanEtten and David E. Matthews report that some fungi are equipped with a protective chemical armor. After testing more than 200 strains of the Fusarium fungus, which attacks pea plants, they conclude that enzymes of the type known as monooxygenases defend the fungi. These enzymes convert the pea defense chemical, called pisatin, into a less toxic product. (Monooxygenases also serve in humans to detoxify foreign chemicals.) VanEtten says that some fungi depend on these enzymes to protect themselves while causing disease in plants. "We could throw a monkey wrench into the biology of a disease-causing organism by disrupting this enzymatic process, thus rendering the organism incapable of causing disease," VanEtten suggests. He envisions that monkey wrench as either genetic improvements in the crop plants or a chemical that is not toxic to other organisms.

Banking on genetic information

The material of heredity, molecules of DNA, is now being analyzed at a rate of more than half a million subunits a year. Los Alamos National Laboratory, working with the computer firm Bolt Beranek and Newman Inc., has received government funding to compile a definitive bank of DNA and RNA sequences. The laboratory already has a pilot project data bank that contains about two-thirds of published nucleic-acid sequences, most of which were determined in the last five years. Walter Goad, who will head the Los Alamos portion of the project, says, "It is vital that we provide a mechanism for storing and making available the information from this research. Our goal is to have all such sequences entered into the data bank within three months of identification."

Getting help to troubled plants

Both foresters and farmers need means to identify plants in need of human assistance. Two new techniques quickly reveal crops requiring irrigation and trees requiring the attentions of a plant pathologist.

A device that measures plant moisture should be a boon to farmers, says Ellis Graham of the University of Missouri at Columbia. The moisture tester Graham has developed determines water tension in a plant in 5 seconds by measuring light passing through a leaf. "It's usually difficult or impossible to tell by the eye alone if most crops need water," Graham says. He has already applied his device to corn, soybeans and Hawaiian tropical plants. More accurate irrigation could save scarce water and reduce pumping costs. Providing the right amount of moisture during critical periods in the plants' growth could result in bigger crops. The device may also be useful to botanists as a quick measure of photosynthesis. Graham expects the moisture tension radiometer to be commercially available in about a year.

Spotting tree problems may be easier with aerial photography, according to foresters and environmental engineers at the State University of New York at Syracuse. For four test sites the scientists compared ground survey data with information obtained by analyzing tree reflectance characteristics determined with aerial color and color infrared photography. Thomas M. Lillesand reports that photographs from the air can provide the same data as do more time-consuming ground surveys of individual trees. This technique is expected to be especially useful in cities, where it should be able to identify trees ravaged by salt, pollution, insects and disease and which need to be treated or removed.

Earth Sciences

A nod for refitting *Atlantis II*

Long-standing plans to refit the research vessel *Atlantis II* so that it can tend the Navy-owned research submarine *Alvin* will proceed apace now that Woods Hole Oceanographic Institution has an okay from the National Science Foundation's National Science Board. Partial funding for the more than $1.6 million conversion has been supplied by the Office of Naval Research, with the balance to come from NSF and the National Oceanic and Atmospheric Administration. The 19-year-old research vessel is already in dock for its "mid-life refit" and should be ready for scientific use in August 1983, says John Donnelly, manager for marine operations at Woods Hole. While necessary alterations are made on the Woods Hole vessel, the *Atlantis II, Alvin* also will receive its share of attention. A new system will be installed allowing it to be hoisted over the stern of the 210-foot-long ship. *Alvin*'s present hostess, the R/V *Lulu,* uses an elevator to lift and lower the submarine. The fate of *Lulu,* a much smaller, catamaran style craft replete with outboard motors, is still uncertain. When the crotchety-but-sturdy *Lulu* is no longer needed for use with *Alvin,* it will be returned to its owner, the Navy, which will decide whether to scrap it or, possibly, to use it for near-shore research cruises.

Taking Debby's measurements

As hurricanes go, Debby was a minor affair, a short-lived flurry of strong winds and currents that in mid-September threatened to hurl itself onto the land in its path... but never did. For scientific purposes Debby will have greater staying power. Meteorologists from the National Hurricane Research Laboratory in Coral Gables, Fla., collected information from Debby that utlimately may improve the ability to forecast and model hurricanes.

The project involved two planes operated by the National Oceanic and Atmospheric Administration. On the first day, one of the planes, equipped with Doppler radar, flew into Debby's center. In the first use of airborne-Doppler for observing hurricanes, the radar measured wind velocities in a vertical column from altitudes of about 40,000 feet to within 1,000 feet of the water's surface. During the two flight days one or both of the planes flew on the storm's periphery in a radius from about 400 miles to 90 miles from the storm center. From the planes, researchers dropped a total of 65 two-foot-long, cylinder-shaped instruments, each fitted with a parachute, into the churning ocean. As each of the instruments, called Omega dropwindsondes, made its 20-minute descent to the surface, it both received navigational signals from the aircraft and transmitted data about wind, air pressure, temperature and humidity. The wind information is especially valuable, say researchers Robert Burpee and David Jorgensen, because readings taken successively as the dropwindsondes fell provide data about the winds between altitudes of about 10,000 and 20,000 feet thought to be responsible for steering hurricanes. Satellites usually used to observe hurricanes supply little information about winds between these altitudes, and for hurricanes such as Debby, which are far from land, land-based weather balloons are of little use. "It's too early to assess the full impact of the data, but it appears to be very useful," Burpee says. "Typically there is a large void in the information at the altitudes we'd like to have." The combination of satellite and dropwindsonde data provides a "complete span" of readings from the storm, Jorgensen notes. Measurements taken from the dropwindsondes and by the planes flying at about 20,000 feet were entered into computers on the planes and sent instantly to the Hurricane Research Laboratory and to the National Weather Service in Washington, D.C., where they were used in forecasting the storm's movements. The Doppler readings were not used in forecasts but will be used to improve design of both airborne and ground-based Doppler systems.

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