Agriculture

Cultivating alternative agriculture

If you eat grapes, chances are you've eaten some grown by the Pavich family of Delano, Calif. The Paviches produce 1 percent of U.S. table grapes, some 12,000 tons a year. But consumers who eat Pavich grapes get little else on their fruit, because the family eschews chemical pesticides, herbicides and fertilizers in working its 1,800 acres of vineyards.

Instead, the *Anagrus* wasp, a natural parasite, controls leafhoppers, a major grape pest. Sulfur dust controls fungal diseases. Workers pull weeds not controlled by a permanent cover of perennial ryegrass and native grasses, periodically chopped. Composted steer manure, not chemical fertilizers, nourishes the soil.

The Pavich Family Farms and 10 other U.S. farms won praise in a Sept. 7 National Research Council report for their use of alternative farming methods. The report, "Alternative Agriculture," endorses a shift in U.S. agricultural policy from a price support system that emphasizes volume production and rewards liberal use of chemicals to one that encourages soil-conserving methods and reduces chemical use.

"One of our committee members called this the third major revolution in agriculture in a century," says John Pesek of Iowa State University in Ames, who chaired the report committee. Mechanization and hybridization marked the first such revolution, he says, and chemical agriculture the second.

To fuel the new revolution, the report recommends boosting federal funding for alternative-agriculture research from $4.5 million to at least $40 million per year.

Lester R. Brown, president of the Washington, D.C.-based Worldwatch Institute, predicts the report will influence congressional debate over the new farm bill. "This is important not only for what it means for U.S. agriculture, but what we have learned and what we do learn will be beneficial to the entire world, especially developing countries," Brown says.

As defined in the report, alternative agricultural – also described as biological, low-input, organic and sustainable – embraces a variety of systems, including crop rotation, biological pest control, disease prevention in livestock rather than routine use of antibiotics, and genetic improvements to enable crops to resist pests, disease and drought. While agricultural researchers have focused on individual facets of diseases, pests and crops, they haven't done enough to help farmers put the findings to work, according to the report. One exception, the committee notes, is integrated pest management, in which farmers can reduce the need for pesticides through crop rotation, timing of planting and biological pest controls.

Alternative methods require careful attention. For instance, rotating legumes with grain crops can increase soil nitrogen, but the enrichment varies depending on soil chemistry, tillage and legume variety. Manure can contribute nitrogen, phosphorus, potassium and other nutrients to soil, but storing and spreading methods influence nutrient availability.

Robert M. Goodman, executive vice president of research and development at Calgene, Inc., a biotechnology firm in Davis, Calif., says that if the report prompts policy changes, these might create more markets for such products as seeds engineered to resist pests. But he cautions that the report, financed by the W.K. Kellogg Foundation and the Department of Agriculture, among others, won't lead to a "nationwide abstention from agricultural chemicals." Improved management and technology must accompany chemical reductions, he says.

Ron Phillips at the Fertilizer Institute, a trade group in Washington, D.C., criticizes the report's focus on successful case histories and cautions that what works for 11 farms may not work or be wanted by all farmers. The institute endorses farm program changes that give farmers more flexibility to adopt better management practices, he says.

Behavior

The anatomy of memory loss

In animal experiments and autopsies of human brains, researchers have found that the hippocampal formation – an inner-brain region consisting of the hippocampus and several other related structures – is critical for the formation of long-term memory. Now, through the use of magnetic resonance imaging – a technique that exposes the anatomy of living brains – scientists have identified an abnormality in the hippocampal formation of amnesia patients.

The most complete magnetic resonance images of the hippocampal formation are obtained when patients lie down with their heads tilted back, a procedure not used previously, say Gary A. Press of the University of California, San Diego, School of Medicine and his colleagues. Magnetic resonance used in this way may help clinicians diagnose Alzheimer's disease in its early stages, they maintain, since autopsies of Alzheimer's patients have revealed extensive damage to the hippocampal formation.

The researchers examined magnetic resonance images of the brains of three men with amnesia and four healthy male controls. Amnesia patients scored extremely low on memory tests, but they had normal intelligence and performed well on tests of general thinking abilities.

The size of the hippocampal formation in the amnesia patients was just under half that of the healthy controls, the investigators report in the Sept. 7 NATURE. Thus, they conclude, reductions in the area of the hippocampal formation, combined with symptoms of memory loss, may signal the presence of Alzheimer's disease.

Left-brain snow job

An epilepsy patient whose right and left brain hemispheres have been surgically disconnected to control his seizures sits in a laboratory. Researchers flash a picture of a chicken claw in his right visual field (processed by his left hemisphere) and a picture of a snow scene in his left visual field (handled by his right hemisphere). Next they spread an array of pictures before him and ask him to pick the ones associated with the pictures he has just viewed.

With his right hand he chooses a picture of a chicken, and with his left hand he chooses a picture of a shovel, both correct responses. But when asked why he chose those items, the man replies: "Oh, that's easy. The chicken claw goes with the chicken, and you need a shovel to clean out the chicken shed."

What's behind his fowl logic? As in most people, says psychologist Michael S. Gazzaniga of Dartmouth Medical School in Hanover, N.H., the man's left hemisphere handles complex thinking skills, such as language, and makes inferences about how the world works. Thus, his left brain interprets the picture of the shovel consistently with what it already knows – chicken feet, not snow.

Researchers have documented hundreds of similar observations with "split-brain" patients, Gazzaniga notes in the Sept. 1 SCIENCE. In contrast, it appears the right hemisphere is poor at making inferences and seeing causal relationships on its own. Gazzaniga concludes there is a left-brain "interpreter" that generates hypotheses about thoughts and emotions triggered by specialized brain regions throughout both hemispheres.

The left-brain interpreter is a unique aspect of human evolution, in Gazzaniga's opinion. It "not only presents the human species with a mechanism to both form and modify beliefs, but perhaps also frees [us] from the shackles of environmental stimuli," he contends.

In split-brain patients, whose brain hemispheres can have separate and isolated experiences, the left-brain interpreter creates a sense of conscious unity, even if that means recruiting a wayward chicken shed.