

# Gardener's Notebook

*Horticultural News and Research Important to American Gardeners*

## Amazing Source for New Plastics

MAKING PLASTIC from corn starch and corn oil used to be the stuff of science projects; the end product was recognizable as plastic, but far too crude to be marketable. Twelve years ago, Patrick Gruber, a young chemist and researcher at the Cargill Dow Company—with facilities in Minnetonka, Minnesota and, a new, \$300 million plant in Blair, Nebraska—set out to make a high-quality plastic. Working evenings and weekends on his kitchen stove, he finally hit upon the key ingredient: live lactobacilli—the kind of bacteria you find in yogurt. Those early experiments ultimately led to the first polymer to be derived entirely from an annually renewable resource: corn.



In addition to being an important food staple, corn is now becoming a source for biodegradable plastic.

“Traditionally, corn was grown for food and feed for livestock,” says Don Hutchens, executive director of the Nebraska Corn Board, “The development of new uses for corn brings agriculture and corn production to a new era.” The location of the Blair plant, in the heart of the Midwest’s corn belt, puts technology close to the harvest. In the Blair facility, carbon stored in plant starches is

broken down into natural sugars that form plastics through a process of fermentation and distillation.

This past June, NatureWorks’ polylactide polymer (PLA) fibers, the first to be derived entirely from plant sugars instead of petroleum, went on the market in comforters, pillows, mattress toppers, and pads, manufactured by the Pacific Coast Feather Company. These fibers, produced by Cargill Dow, are the vanguard of a whole range of PLA-based products—including clothing, carpeting, and compostable packaging.

The technology to produce plastic from corn dextrose has garnered the company several awards, including the U.S. Department of Energy’s 2001 Technology of the Year Award. Deputy Assistant Secretary Denise Swink described it as “a big improvement over making plastics from oil” as well as being “hands-down competitive with petroleum.” Cargill Dow also received an R & D Environmental Innovation Award from *Discover*, a general interest science and technology magazine, in June 2001.

Unlike the polymers manufactured by other companies, such as Dupont’s Sorona, Cargill Dow’s NatureWorks does not come from genetically modified plants. Unlike others, it is also biodegradable.

“We have grown too dependent on crude oil from the Middle East,” says Hutchens. “Anything you make from oil—from ethanol to biodegradable plastics—can be made from corn.”

## CAFFEINE FOILS SNAILS AND SLUGS

Beer has lured many a slug or snail to its death. Now there’s a weapon against teetotaler mollusks. While testing caffeine sprays to ward off the coqui frog, an introduced pest species that infests potted plants, research biologist Robert Hollingsworth of the USDA Agricultural Research Service (ARS) in Hilo, Hawaii, and colleagues noticed that the one- to two-percent caffeine solution they were using to repel frogs killed all snails.



A subsequent experiment showed a two-percent caffeine solution to be more effective than a standard dose of the commonly used metaldehyde to kill snails and slugs. Metaldehyde residues in food are banned in the United States, but caffeine is considered safe. While further research is needed, caffeine may prove to be an effective remedy for snails and slugs that is benign to the environment.

In the meantime, save your leftover coffee. “In our laborato-

ry leaf-dip tests, a concentration of about 0.1-percent caffeine was associated with partial repellency to large slugs,” says Hollingsworth, noting that “instant coffee has about 0.05 percent caffeine, and brewed coffee is usually stronger.” Just think what espresso could do.

## EARTHWORM CASTINGS

Gardeners have long associated the presence of earthworms with soil fertility. Recent research in the United States and abroad not only supports this notion, but demonstrates that the excretions of

worms—earthworm castings—are loaded with beneficial organisms and enzymes that regulate and enhance plant growth, prevent disease, and improve soil tilth. Called “vermicompost,” this nutrient-rich, 100 percent organic, odorless, biologically active fertilizer can be made at home in special containers designed for house redworms (*Eisenia foetida*) that eat kitchen wastes. A number of companies sell finished vermicompost by the pound as pure earthworm castings or in convenient liquid or tea bag forms.



The excrement produced by earthworms, called castings, is beneficial for the soil.

Vermicompost is not a standardized product; its nutrient content varies with the worm species and diet. Yet analyses of nutrient content have shown it to be generally superior to farmyard manure in percentages of organic carbon, total nitrogen, phosphate, and potassium. In addition, the passage through the gut of earthworms makes these nutrients more accessible to plants and the spongy texture of the castings allows for greater air and water retention. Unlike synthetic chemical fertilizers, which actually shut down beneficial microbial activity, earthworm compost is alive.

“It’s so important for people to realize the fundamental importance of biological activity in the soil,” says Scott Subler, former professor of soil ecology at Ohio State University and president of Living Soil, a company in Millheim, Pennsylvania, that sells earthworm castings and related products. “We’ve neglected soil biology. Things are so much better if we actually think and manage it. It’s preventive medicine.”

## TOBACCO TURNS OVER NEW LEAF?

The Surgeon General still warns that smoking tobacco is a health hazard, but new research indicates a variant of the

much-maligned plant may one day save the lives of cancer sufferers. Because the plant—an Australian variation of American field tobacco—can be propagated quickly and cheaply, companies such as Large Scale Biology Corporation, based in California, are using it to grow human tumor tissue within plant cells. In one experiment, scientists in Owensboro, Kentucky, hope to create vaccines from the extracted tissue for treatment of lymphoma patients.

The plant’s promise is connected with the so far elusive treatment phenomena termed “personalized medicine.” The concept is that vaccines would be customized to minister to each individual’s form of lymphoma, as opposed to standardized vaccines mass-produced by pharmaceutical companies.

Large Scale Biology was planning to distribute its vaccines this fall as part of the largest test to date on humans. Even if the treatment shows promise in initial tests, however, it generally takes 10 years to bring such vaccines to market.

## RESVERATROL IN SMALL FRUITS

Highly pigmented fruits such as blueberries, strawberries, raspberries, and dark-skinned grapes—especially muscadine grapes—have anti-oxidant action, providing intriguing new links between diet and health.



“We have solid evidence that these highly pigmented fruits have either direct or indirect cancer-inhibiting properties,” says ARS research plant pathologist David E. Wedge. “Of all of the fruits tested, muscadine was the most active, containing resveratrol,” the compound thought re-

sponsible for the cholesterol-lowering effects of red wine, he adds.

It is always tempting to look for the one chemical “silver bullet” that will cure cancer, says Wedge, but “the small fruits contain whole classes of compounds that are synergistic with each other. All have anti-oxidant activity, but you lose activity when you start separating them.”

Wedge suggests eating “as many fruits as you can possibly tolerate—especially those that are highly pigmented.”


## REEDY WEEDS

When young, giant reed (*Arundo donax*) looks a lot like corn, but this perennial grass grows much higher—over 18 inches a week under favorable conditions—to reach 12 to 18 feet. It grows best in places with abundant moisture such as streambeds, but it will tolerate almost any conditions or types of soil.

“Unfortunately,” says Tom Dudley, of the Department of Integrative Biology at the University of California, Berkeley, “it has escaped cultivation by the rhizomes washing into rivers during floods, and has now occupied tens of thousands of acres throughout California, displacing native riparian plants and providing very poor habitat for wildlife—a particular concern for migrating songbirds.”

Giant reed is an invasive throughout the southern United States, where, in addition to displacing native species, it promotes erosion because it is very shallow rooted and easily undercut.

Native to India, giant reed has long been naturalized in the Mediterranean region, where it was used for thatch, fencing, basketry, and musical wind instruments. Double clarinets made of giant reed—two canes tied side by side—have been excavated from Egyptian tombs of the 1st century B.C.

How it came to this country is uncertain. In California, one theory holds the Spanish mission fathers introduced giant reed as a quick-growing source of building material. Another attributes its introduction to French settlers who used it to stabilize banks. However it happened, this useful grass has become much too much of a good thing. 

*Compiled by Associate Editor Carole Ottesen. Freelance writer John Wolf contributed to this section.*