Ohio’s greenhouse industry prepares to flower (again)
WHY WE'RE SETTING FUTURE PRIORITIES

The Strategic Plan mandates that we gauge our mission and vision.

Strategic planning, priority setting ... words spoken and ideas discussed daily. The College of Agriculture, including its constituent units—the Agricultural Technical Institute, School of Natural Resources, Ohio Cooperative Extension Service, and Ohio Agricultural Research and Development Center—is setting priorities to meet one of the major mandates of its 1990-1995 Strategic Plan: “to develop a plan for the allocation of resources and structure of the College based on an evaluation of the goals and objectives of each unit, considering whether each unit is complementary and contributes to the overall mission and vision of the College.”

Our mission of research, teaching (both resident instruction and extension) and public service is reconfirmed and updated in the plan. Also confidently stated is the vision “that each department of the College, the School of Natural Resources and ATI will be ranked among the top five in the country in their respective areas, thereby making the College number one in the country.” As we pursue this goal of excellence, it is imperative that we describe our strengths, and more importantly, identify areas that must be our hallmarks in the years ahead.

The essence of the process is determining subject matter—our content. The basic question is this: About what should we research, teach and provide public service? The financial resources from public funds are, at best, level. Current financial constraints will require substantial and painful reductions in both programs and personnel. Once immediate targets are met, what are our priorities to improve current programs and to restore curtailed or discontinued programs?

Call it strategic planning, priority setting or whatever. Both the nature and the quality of College research, teaching, extension and public service will be determined by our responses to these questions. It is the most challenging and critical issue facing us today and in the future. What we are about is clarifying and describing that “vision of the College” called for in the Strategic Plan.

Robert Warmbrod
Acting Vice President for Agricultural Administration and Dean of the College of Agriculture
The Ohio State University
**CONTENTS**

**COVER**
6  **SPLENDOR IN THE GLASS**
   How 25 standout scientists are brightening the future of Ohio's $126 million greenhouse industry. (Get ready for more marvelous 'maters.)

**FEATURES**
4  **THE TEACHERS AND THE FLOCK**
   Sheep farming offers a sustainable but economically precarious use of fragile land. You'll learn more from Jim Clay and the Moore family.
10  **BOX LUNCH**
   Your juice-sipping kids benefit from food technology's hippest holder. Soon cheap, light aseptic packaging might deliver a bigger banquet.

**NEWSFRONT**
2  **GROWING WHOLE FARM-FRESH FISH**
3  **TOUGH TURF 'EXCEL-LENT ADVENTURES**

**BACK FORTY**
12  **CHALLENGING THE (SEPTIC) SYSTEM**
   Water-quality specialist Karen Mancl knows what's in your sewers—and you gain from her knowledge. When her work's done, drink up.

**On the cover**
Cucumber flower, OARDC greenhouse, Wooster. Photograph by Margaret A. Latta
GROWING WHOLE

"Separate but equal" is not in Maudester Farmer's vocabulary. Just ask the 45,000 young people and hundreds of volunteers in Cuyahoga County's EFNEP program since Farmer became its Extension associate in 1976.

"EFNEP young people are integral parts of 4-H here," says Lajean Ray, 15-year EFNEP volunteer in Cleveland and former chair of the county Extension Advisory Committee. "In summer, they go to the fair, attend camp and receive ribbons. It's an excellent program for personal growth."

EFNEP is the Expanded Food and Nutrition Education Program. It's run in 19 Ohio counties to improve the diets of low-income families. While young people in EFNEP are regarded as being in 4-H, few counties nationwide run programs where youth are treated as full-fledged 4-H'ers. One exception: Cuyahoga County.

"We transition 4-H'ers from EFNEP into all 4-H opportunities so they can keep building self-esteem," says Farmer.

The effort takes teamwork. Greg Siek, Cuyahoga County 4-H agent: "We jointly recruit young people and jointly train volunteers to help 4-H'ers explore options. No one feels they're different than anyone else in 4-H."

Farmer wishes all young people in need could experience 4-H.

"Many kids suffer from a lack of attention," she says. "So many live in dire situations. I'd like to reach all the young people we can—to offer them opportunity."

For information, contact: Maudester Farmer, Ohio State University, Ohio Cooperative Extension Service—Cuyahoga County, 3200 W. 65th St., Cleveland, Ohio 44102, (216) 631-1890.—Scott Turner

FARM-FRESH FISH

You're eating more fish, and Piketon Research and Extension Center scientists are working to keep your plate full.

Konrad Dabrowski, Jim Ebeling and colleagues are studying aquaculture—"fish farming"—as a way to meet rising demand for seafood. Natural sources like Lake Erie and our oceans can't keep pace, they say.

"Aquaculture is agriculture," says Ebeling, a research associate and aquaculture engineer at the center. "Instead of livestock or chickens, we grow fish" for health-conscious consumers, he says.

Test ponds now harbor tasty yellow perch and endangered paddlefish. Lake sturgeon and channel catfish will be added next. Besides their commercial promise, paddlefish and sturgeon will be studied for reintroduction to the wild, Ebeling says.

Dabrowski is a professor of natural resources based in Columbus. His work centers on fish nutrition, a primary concern because feed can be more than half a fish farmer's total production costs.

The Piketon center, which opened in summer, has 12 quarter-acre ponds, two one-acre ponds and a 3,600-square-foot aquaculture building. Feasibility studies and production demonstrations will show Ohioans the best ways to farm fish, Ebeling says.

For information, contact: Jim Ebeling, Piketon Research and Extension Center, 1864 Shyville Rd., Piketon, Ohio 45661-0549, (614) 289-2071.—Kurt Knebusch
TOUGH TURF
Ohioans spend $1.16 billion a year taking care of turf, according to a recent survey by Ohio State University and the Ohio Turfgrass Foundation. A good chunk of that goes for chemical control of weeds and insects. But entomologist Dave Shetlar has an idea that could cut insecticide expenses dramatically.

"There's been about 10 years of research on varieties of grass that either resist or kill bugs before they can damage the turf," says Shetlar. "The problem is how to get those varieties established in existing turf without tearing everything out."

Some grasses resist billbugs, chinchbugs, sod webworms and the like. Others, such as endophyte-enhanced ryegrass and tall fescue, make toxins that kill insects.

Shetlar is testing ways to seed the new varieties into existing turf. And he's found a way to get the bugs to help kill themselves.

He cuts slits in existing turf and drops in new seed. The bugs feed on the old grass, killing it in the process. When the old grass is gone, the insects starve to death if resistant varieties were seeded, or poison themselves on bug-toxic grasses. Either way, what's left is pest-free turf, says Shetlar.

For information, contact: Dave Shetlar, Department of Entomology, Ohio State University, 1991 Kenney Rd., Columbus, Ohio 43210, (614) 292-5274.

For information on the Ohio Turfgrass Survey, contact: Tom Sporleder, Department of Agricultural Economics and Rural Sociology, Ohio State University, 2120 Coffey Rd., Columbus, Ohio 43210, (614) 292-0315.—Stan Ernst

'EXCEL'-LENT ADVENTURES
Mariah Byers says her job was simpler in 1979. "We face greater challenges and work loads compared to when I started," says Byers, a four-term Ashland County commissioner. "Sometimes, new commissioners don't realize we work on so many activities."

But a new Ohio Cooperative Extension Service effort called Project Excel is letting Byers and others ensure that elected officials know what it takes to lead. Project Excel has held more than 40 innovative training programs this year to help Ohio communities develop well-prepared leaders.

Byers, for instance, and a half-dozen current or former county commissioners met with Project Excel members to pinpoint traits and skills of successful commissioners. Other Project Excel meetings have ranged from building alliances to writing grants.

The initial programs form the basis for establishing an Executive Development Center for Ohio's public leaders, says David M. Boothe, project director.

"Research shows that a diverse and well-developed leadership base is more likely to deal effectively with economic and quality of life issues in the 1990s," he says.

Byers agrees. "This project offers a message to prospective leaders," she says. "If you have a broad range of experience and training, you have more to draw upon to make tough decisions."

Project Excel is funded by a $577,296 grant from the W.K. Kellogg Foundation in Battle Creek, Mich.

For information, contact: David M. Boothe, Community and Natural Resource Development, Ohio Cooperative Extension Service, 2120 Fyffe Rd., Columbus, Ohio 43210-1010, (614) 292-8436.—Scott Turner
THE TEACHERS AND THE FLOCK

Walk southeastern Ohio's steep, green hills. Catch your breath and you'll learn how sheep farming offers a sustainable—but for now, economically precarious—use of fragile land. Your guides: Jim Clay and the Moore family, sheep folks bound by friendship and a quest for success.

BY SCOTT TURNER

ike cowboys on the Plains, Stan Moore and his son Rick crouch when they speak. Maybe it's to get closer to the soil—thin, unglaciated earth that grows the forage that feeds their sheep. Seven generations of Moores have come from this hilly Harrison County farm.

"Most people keep sheep, but our sheep keep us," says Rick Moore, squinting into a blue afternoon sky. In front of him graze 75 pregnant ewes. "If you show that a technology will improve our business, we'll try it. The bottom line is being efficient."

The Moores' sheep operation arguably is Ohio's most efficient. They use few inputs. Their sheep rotationally graze over pastures. Spring lambing occurs outside—private, between ewe and young.

Yet the Moores soon might struggle to make ends meet. Lamb and wool prices have dropped so low that no matter how they manage, the Moores get less.

"The last three years have been the roughest," says a crouched Stan, his back to the ewes. "We don't know if we can stand three more years of this. We've cut costs as low as we can."

Such admissions don't shock Jim Clay, lifelong friend of the Moores, eastern-Ohio native and livestock management specialist with the Ohio Cooperative Extension Service. Clay shows farmers with under-used forages that sheep act as low-input harvesters. His latest research and advice rests on more traditional practices—many already adopted by the Moores.

"I feel responsible for saying 20 years ago that farmers could raise sheep in barns and make money," says Clay, walking up a grass- and legume-rich slope at the Eastern Ohio EORC sheep head for the hills: pasture managed under intensive grazing.
Resource Development Center near Caldwell. It’s a slope grazed intensely by sheep—deep-green testament to Clay’s new beliefs: “Given the soil, slopes and rising input costs, the most efficient and environmentally sound sheep-raising here is to intensively graze them and let them lamb outside.”

Clay is in the final year of a three-year study of a low-input livestock system for the forage-covered slopes of eastern and southern Ohio. Merino wethers form the system’s heart. (Merino is the breed; wethers are males castrated before sexual maturity to simplify management.) They efficiently graze low-quality forage, keeping fields free of unwanted brush and producing high-quality wool that’s sheared just once a year.

“Merino wethers can sustain on low-quality forages, increasing forage utilization for landowners,” says Clay.

So far, Clay has managed, without seed, fertilizer or machinery, to keep 55 acres of hills productive and erosion-free. He first allows lactating ewes, which need high-quality forage, to graze the slopes, then rotates wethers onto the pastures. (The land isn’t grazed in winter; Clay provides the forage.) Eight hundred sheep graze under the system.

“One reason for the accomplishments is that past seedings were appropriate,” says Clay. “We haven’t needed fertilizer because the soil had an initially good fertility level. The grazing system also recycles soil nutrients, with most elements returned in the feces and urine,” although the sheep retain enough nutrients for growth or milk production.

Ewes in the study give birth inside in winter and outside in spring and fall. Outdoor ewes produce healthy lambs with little help, says Clay. That cuts labor for cleaning, feeding and handling.

While Clay wants visitors to see the ewes, he won’t go too close.

“Ewes naturally go off by themselves to have their young,” says Clay, upset that a van traveled a couple of miles to see a herd. “Ewes go away before they're born. They can’t control foot rot, allow farmers to use sheep to manage forages.” About 35 percent of the state is best suited for forages and pasture, he says. Eight hundred sheep could keep clean. Farmers are going to cattle on some land, but they’ll need to bush-hog it in a few years.” Cattle leave unwanted plants that disrupt grazing.

“Stan Moore is right,” says Charles Parker, co-researcher with Clay and former chairman of the Department of Animal Science. Parker now directs producer services for the Denver-based American Sheep Industry Association. Like Clay, Parker was raised on a livestock farm in eastern Ohio. “Given the history of the area, it seems to be a case of ‘what goes around comes around,’” he says.

To provide wool for military uniforms during and after the Civil War, Harrison County farmers tended more than 250,000 sheep. Then, Ohio had almost nine million sheep. Now, Ohio has about 1,800 sheep on 500 acres of owned pasture and 1,200 acres of rented land. Their home sits along a steep hill, offering several-mile views in three directions.

“We’re near coal country,” says Stan, waving beyond his green hillsides and forested valleys. “It’s been mined all the way to Wheeling (W.Va.)—thousands of acres not utilized, land that sheep could keep clean. Farmers are going to cattle on some land, but they’ll need to bush-hog it in a few years.” Cattle leave unwanted plants that disrupt grazing.

Several of Clay’s wethers came from the Moores, who say working with the specialist is a two-way street.

“We learn from each other,” says Stan. The Moores raise about 1,800 sheep on 500 acres of owned pasture and 1,200 acres of rented land. Their home sits along a steep hill, offering several-mile views in three directions.

“We’re near coal country,” says Stan, waving beyond his green hillsides and forested valleys. “It’s been mined all the way to Wheeling (W.Va.)—thousands of acres not utilized, land that sheep could keep clean. Farmers are going to cattle on some land, but they’ll need to bush-hog it in a few years.” Cattle leave unwanted plants that disrupt grazing.

“Stan Moore is right,” says Charles Parker, co-researcher with Clay and former chairman of the Department of Animal Science. Parker now directs producer services for the Denver-based American Sheep Industry Association. Like Clay, Parker was raised on a livestock farm in eastern Ohio. “Given the history of the area, it seems to be a case of ‘what goes around comes around,’” he says.

To provide wool for military uniforms during and after the Civil War, Harrison County farmers tended more than 250,000 sheep. Then, Ohio had almost nine million sheep. Up to 90 percent were Merino wethers.

“Times change, but the setting is re-established,” says Parker. “New technologies, such as low-cost electric fencing, internal parasite control practices and use of zinc sulfate to control foot rot, allow farmers to use sheep to manage forages.” About 35 percent of the state is best suited for forages and pasture, he says. Half of that land is unimproved, including a million acres in eastern Ohio.

“If we can produce good wool at little cost, we can compete with the Australians,” says Parker. Australia produces one-third of the world’s wool and 70 percent of its apparel wool, providing the economic base for fine-wool prices worldwide. Most U.S. high-quality wool comes from sheep out West.

Clay begins a project next year to see if sheep can graze in pine plantations, eliminating weeds and the need for herbicides, while letting farmers produce wool, meat and softwood pulp. Most pulpwod reaches Ohio mills from Southern states.

“What’s so strong about Clay’s work is that he integrates ecological and agricultural concepts,” says Don Floyd, assistant professor of natural resources and project co-researcher. “I can’t think of a more harmonious approach to regional agriculture than Clay’s.”

Mention Floyd’s remarks and Clay smiles softly, looking down at his dusty shoes.

“We need a system sustainable through good and bad years,” says Clay. Crouching like the Moores, he adds, “Maybe sustainability means not risking yesterday’s profit tomorrow.”

That might make the Moores Ohio’s most sustainable farmers. They carry no debt and they’re proud of it.

But the Moores know firsthand how precarious even their position is. Ohio wool prices dropped from 74 cents per pound in 1989 to 39 cents in 1990. Yet premium prices are still paid for fine wool, keeping interest alive. The Moores know that, too.

“You have to love this business,” says Rick Moore, lifting his 5-year-old son Steve onto his lap. Steve wants to farm—the eighth generation on land deeded by President James Madison.

“We don’t owe anyone anything,” says Rick, smiling proudly. “If we screw up, we know who to blame.”

For information, contact: Jim Clay, Department of Animal Science, Ohio State University, 222 Animal Science Building, 2029 Fyffe Rd., Columbus, Ohio 43210 (614) 292-6791.

For Ohio Cooperative Extension Service publications related to sheep farming, call your county OCES office, listed in the government pages of your telephone book.
Ohio's rosy greenhouse industry blossomed for half a century, then got clipped by competition and the energy crunch. But Ted Short and colleagues are working to brighten the future of our hothouse 'mums and 'maters. (Wear your shades.)

BY KURT KNEBUSCH

Dawn breaks gleaming, and white beads filter from the roof above. The pellets insulated you from a cold night. Now they drain to let in the rising sun. Water flows below, bearing metered rations of your food and drink. Some fungal spores fall; they're no threat. You stand in compost and thrive.

From a room next door a computer runs the show. And, of course, your life. You're a tomato plant, and you live in the greenhouse of tomorrow.

You bloom under controlled lighting and shading. A "smart" roof screens the sun and holds in heat. You're fed nutrients by precise injectors, amounts dictated by sunlight levels. You face few pests and disease. And you use less water, fertilizer and fuel than your ancestors grown beneath old-style glass.

You breathe deep through open stomates, photosynthates flowing, as you blossom in
Utopia. Sixty days from now your fruit will make your grower money—and fill salad bowls in Bucyrus. You owe your blessings to Ted Short and friends, standout researchers who are building better greenhouses.

Twenty-five College of Agriculture faculty study "controlled environment plant production." They range from agricultural engineers, like Short, to plant pathologists, entomologists and horticultural economists. What they share is joint pursuit of the perfect greenhouse, a team effort no other university can match.

All the scientists are members of the Ohio Controlled Environment Plant Production program, an interdisciplinary group formed to identify and promote cooperative research. They come from the Ohio Agricultural Research and Development Center, Ohio Cooperative Extension Service, and Agricultural Technical Institute.

Short coordinates the program, backed by 20 years' experience in greenhouse research. "Our goal is to re-establish Ohio as the number-one greenhouse state;" he says from his tidy office in Wooster's Agricultural Engineering Building. "Lots of places conduct greenhouse research. What makes us unique is we have a broad cross-section of people who have depth beyond their individual disciplines."

That expertise benefits Ohio's $126 million greenhouse industry, once top dog in the United States, now fifth in value behind industries in California, Florida, New York and Texas. (Total value of the U.S. greenhouse industry: nearly $2.8 billion.) After flourishing for half a century, Ohio greenhouse growers were hit by competition and high fuel costs. But research could seed their return to prominence.

"Ohio has the ability to export quality greenhouse crops at good prices," says program member Peter Fynn, who specializes in computer climate control. "We need to look at our resources, then use those resources to the best of our ability—responsibly—to produce what we're good at producing."

THE HEART OF GLASS
Ohio's greenhouse roots trace to European immigrants who settled in Cleveland, Toledo and Cincinnati in the late 1800s. Many were outdoor vegetable farmers from the Old World who turned to greenhouses to lengthen Ohio's growing season. They found well-drained soils along Lake Erie and the Ohio River ideal; they grew hothouse vegetables, bedding plants and flowers for city dwellers. Pioneering methods helped them prosper.

One success story is the Cleveland Growers Marketing Co., established by greenhouse growers in 1921 to brace the industry's weak link—marketing. The co-op receives produce from member growers, then sells it to grocery stores and restaurants. The system frees growers of marketing concerns, often roadblocks to success. It spurred the northern-Ohio greenhouse vegetable boom that peaked in the '50s, says Short.

Another is Yoder Brothers Inc., world's biggest plant propagator. Ira and Menno Yoder built their first greenhouse near Smithville, then founded their company in Barberton in 1921. Using cell culture techniques 30 years ahead of modern biotechnology, the company has developed more than 600 chrysanthemum varieties and releases 25 to 30 new varieties a year.

More Ohio trailblazers:
► Toledo Bedding Plants, a grower cooperative that sends annuals and perennials to an Atlanta terminal. From there, impatiens, petunias, daylilies and others are shipped to Florida for sale. Then they work their way up the East Coast with the coming of spring. The marketing scheme supplies gardeners north to Maine and supports greenhouses from Toledo into southeastern Michigan.
► The Michelsons of Ashtabula, renowned for developing the first early poinsettia varieties. Today the family-run operation works to refine the tropical-looking New Guinea impatiens.
► And Green Circle Growers of Oberlin, founded by Aart Van Wingerden. The Dutch immigrant built his namesake Van Wingerden Greenhouse by teaming two layers of plastic with Dutch framing. The energy-efficient house—the top layer floats on air—is the industry's predominant design. The company, now led by Van Wingerden's son Jon, runs 30 "highly automated" acres and hosts growers from across the globe.

A gut feeling brought Green Circle to Ohio. "Aart Van Wingerden was living in New Jersey," explains Short. "He decided that
the double-plastic idea was a good way to go, and that if he was going to start a greenhouse business, it would be in Ohio. He had no information other than the perception that the place to be for greenhouses was around Cleveland, Ohio.

"There's a legacy here" due to that belief among the European immigrants, says Short. "That's one reason Ohio is known as the Greenhouse State."

But the Greenhouse State declined in the 1950s with the development of the nation's interstate highway system. Growers could take advantage of sunnier weather in California and Florida and still truck their crops to Midwest markets. Ohio growers, facing cheaper competition, saw profits tumble.

Then the 1970s energy crunch hit. Fuel for heat and lighting rose from a low of 30 percent of production costs to nearly 50 percent. High heating bills, coupled with rising land values in urban areas, shut nearly half Ohio's greenhouses, says Short.

Now Ohio ranks fourth in greenhouse area (404,075,000 square feet) behind California, Florida and Michigan. In 1990, the state supported 560 wholesale greenhouse operations with sales over $10,000, according to the Ohio Agricultural Statistics Service.

### WHY IT'S EASIER BEING GREEN

Scientists responded to the '70s by developing, among other things, fuel-saving greenhouses and plants that grow under lower temperatures and light. For the '90s, Short says the industry is in re-growth, helped both by rising demand and results of that research.

Short's focus is Select-A-Shade, an automatic system that blows polystyrene pellets between layers of plastic over greenhouses. At night the pellets enter channels between the layers to hold heat like a blanket. In daytime, they filter out to keep sunlight levels safe. Both shading and climate are computer-controlled.

Select-A-Shade cuts energy costs 90 percent compared with glass, says Short. That means profit can sprout as fuel use plummets. The system saves labor, prevents plant stress and yields higher-quality products, he adds.

A demonstration unit runs behind the Agricultural Engineering Building, operational since March 1987. Short and colleagues are working with the S.W. Joehlin Corp. of Toledo to develop Select-A-Shade for commercial use. For now, start-up costs equal those of first-rate glass greenhouses, says Short. But wider use could cut manufacturing costs.

Next door, a bearded, intense Peter Fynn sketches a graph on a well-used chalkboard, showing a visitor how computers can minimize waste from greenhouses. The agricultural engineer has been developing computer programs that calculate, hour by hour, the irrigation needs of a greenhouse crop. They do so by reading temperature, relative humidity and solar radiation, then figuring in the growth stage of the plants (provided by the grower).

"The computer programs give us a good handle on water requirements," Fynn tells the visitor. "That means we don't pump any more water than we need."

Fynn's work separates a plant's water and fertilizer needs, a break from current practice. Under conventional systems, nutrients are supplied in irrigation water at specific concentrations. In the middle of the day, however, plants use the water for cooling and take up little food.

"What happens," says Fynn, "is the plant..."
“We can produce quality crops here. That provides income for the state and employment for the people. That’s important.”

—Peter Fynn

leaves excess nutrients in the root zone, and the grower eventually flushes them down the drain. I’m trying to avoid supplying them in the first place.” Excess fertilizer wastes growers’ money and can pollute groundwater, lakes, rivers and streams, he says.

Fynn is teaming with horticulturist Bill Bauerle to describe changes in nutrient uptake in cucumber plants. They’re merging information on time of day and plant maturity with “green-thumb” know-how.

“We’re taking expertise from people like Bill and putting it into a computer,” says Fynn. “The computer measures solar radiation, temperature and relative humidity; the grower tells the computer the stage of plant growth. The computer then decides—based on this combination of expertise, environment and growth stage—what the best ‘recipe’ is, with one objective being to reduce effluent from the greenhouse.” The computer’s decision is enacted through variable “fertilizer injectors” designed by Fynn and Bauerle.

Ohio State researchers also are studying, among diverse areas, disease and insect control, computerized marketing, alternative energy, improved plant varieties, and water quality. Ground-breakers include:

► Plant pathologist Harry Hoitink, who’s using compost-amended and peat mixes as growing media to control fungal plant diseases. Based at Wooster, Hoitink and his graduate students and post-doctoral researchers are working to identify and describe beneficial microorganisms found in the “naturally suppressive” mixes. The findings are encouraging waste recycling and cutting pesticide use while maintaining productivity.

► Richard Lindquist, an expert in chemical and biological control of greenhouse insects. The Wooster entomologist is testing computer climate control to manage insect populations. He’s also studying how biological-control agents fight pests on crops such as cucumbers and poinsettias, and how factors such as resistance, temperature and plant position affect pests.

► Tim Rhodus, who specializes in the use of computers for marketing. A horticultural economist at Columbus, Rhodus is studying computer-assisted trading of fresh cut flowers. Benefits of electronic marketing, he says, include higher prices for growers and better market access for wholesale buyers.

► And 20 more scientists, including Robert McMahon, who teaches greenhouse production at ATI; Harry Tawara, Columbus, an expert in floral crop production and executive secretary of the Ohio Florists Association; Alan Erb, Wooster, who breeds disease-resistant, higher-yielding tomatoes; Chuck Powell, Columbus, a plant pathologist who advises growers on disease prevention; Elton Smith, Columbus, a horticultural production specialist for nursery crops in temporary or permanent greenhouses; and Randall Zondag, Ohio Cooperative Extension Service—Lake County, who advises northeastern Ohio growers.

Their goal is better understanding of the “total environment,” says Short, “We’re trying to get smarter.”

CRYSTAL BALL

Fynn sees the new understanding used in computer-controlled greenhouses added to already “smart” homes. These “food-growing units” will save energy and minimize pollution, he says. The problem ahead is making computers smart enough to grow more than one crop.

Commercial growers will gain from new understanding, too, says Fynn. Computer control, for example, means workers won’t enter greenhouses as often. That eliminates a major source of insects and disease—contaminated shoes and clothing.

And computers will link greenhouse growers with their buyers, key to selling crops once they’re grown, says Short.

From climate control to marketing, the scientists see computerization as the way to grow. “The Dutch send flowers here and still make money,” says Fynn, a Macintosh computer burbling by his side. “The reason is that their greenhouses and marketing systems are highly computerized. We’ve been slow to adopt that. There’s no doubt in my mind that computerization has helped the Europeans gain a substantial part of our market.”

So why compete? Why not leave greenhouse growing to the leaders, or to places in the sun? Fynn, earnest, says Ohio has advantages those spots lack—and the industry helps Ohioans.

“We have water, and believe it or not, our cold winters can be used to our advantage to control insects,” he says. “We can produce quality crops here. That provides income for the state and employment for the people. That’s important.”

Short leans back in his chair. A spring crabapple drops white petals in the window behind. “What holds us back in modern research is our inability to work in interdisciplinary ways,” he says. “What holds Ohio greenhouse growers back is their inability to work cooperatively—with government, marketing agencies and each other.

“If we can get all the players together, we can make Ohio a major exporter of greenhouse products, comparable to the Netherlands. We can do that right here in Ohio. The work we do supports that.”

WELLSPRING

For more information on the Ohio Controlled Environment Plant Production program, contact Ted Short, coordinator, Department of Agricultural Engineering, Ohio State University, 1680 Madison Ave., Wooster, Ohio 44691, (216) 263-3854 (telephone), (216) 263-3670 (fax).

For technical information, Short recommends this Ohio Agricultural Research and Development Center publication:


To order, write Mailing Room, OARDC, Ohio State University, Wooster, Ohio 44691. Make your check payable to The Ohio State University.
BOX LUNCH

Your juice-sipping kids benefit from food technology's hippest holder. Soon cheap, light aseptic packaging might deliver a bigger banquet.

BY MARTHA CARROLL

You want high-quality, convenient groceries at the right price.

You want to reduce waste and help the environment.

Whether you know it or not, you want aseptic packaging.

Your children already might be big fans of the packaging, named the most significant food science innovation of 1989 by the U.S. Institute of Food Technologists. You might be, too, if you occasionally enjoy a swig of fruit juice, chocolate milk or other beverage from a drink box—a poly-coated paper box with an oxygen-blocking liner.

But can you imagine a cupboard full of boxed "canned" goods? Just think how much space you'd save if your pork and beans, chicken noodle soup and canned green beans were packaged in rectangular, easily stackable cardboard containers. Think how much lighter your grocery sack would be and how much less garbage you'd generate by replacing glass and metal containers with lightweight, squashable boxes.

That day isn't too far away, if Sudhir Sastry has his say. The associate professor of agricultural engineering wants to perfect aseptic packaging for other foods to the strict standards of the Food and Drug Administration.

Aseptic packaging is fundamentally different than conventional canning. Traditionally, food is poured into a can or jar, sealed in, then heated long enough and hot enough to kill any microorganisms in the food and container. In the process, however, the food loses its freshness and many nutrients.

"In aseptic packaging, we sterilize the food and the container separately," says Sastry. The food is pumped into a "heat exchanger," which uses steam or another heating element that warms the food to high temperatures quickly. The food then travels through holding tubes to keep it hot long enough to be sterilized, and then is cooled and packaged in the already-sterilized containers.

"The product doesn't come in contact with heated surfaces the way it does in traditional canning, so it doesn't have as much of a 'cooked' flavor," says Sastry.

The process has plenty of other advantages, too [see the sidebar, "Boxing Loves"]. However, the FDA currently permits only liquids to be packaged aseptically. Temperatures of liquids are easily monitored, so it's relatively simple to be certain they heat up enough to be sterilized. "Particulate" foods—those containing chunks of meat, vegetables or both—pose more difficulties, says Sastry. That's where he comes in.

"We're close, but so far we don't have the technology to accurately measure the internal temperatures of particles in a continuous flow system," says Sastry. Each chunk of food must be heated sufficiently to its core before being cooled and packaged.

"If you don't design the system properly, a particle could pass through too quickly and not heat up enough," says Sastry. If that piece was contaminated by microorganisms, the container of food could become a breeding ground for toxins.

Some European countries, including Italy, the United Kingdom and Germany, already use the technology on a wide scale. But they also use less conservative safety standards than the FDA requires.

Overheating the product to make sure each piece of food becomes sterile is not the answer, says Sastry. "It would result in a severely
degraded product. We have to be conservative, but realistic!

In a project funded by the National Science Foundation, Sastry designed a way to study how food particles flow through holding tubes. In his warehouse-like laboratory in Columbus's Agricultural Engineering Building, he set up clear plastic tubing similar to that used in aseptic packaging systems. To simulate food, he used different-sized plastic marbles in a viscous liquid and pumped this "stew" through the tubes. After videotaping the movement and playing the tape at slow speed, he discovered a "speed lane" in the center of the tube.

"Some particles jump over others, get into that speed lane, and pass through the tube much quicker," says Sastry. "The fastest particles can travel twice as fast as the average speed!"

If the fast-movers aren't taken into account when determining the temperature and the length of time the food must stay in the holding tubes, they could pass through the system too quickly, Sastry says. On the other hand, the slower-moving particles could stay in the holding tubes too long, and they could lose the qualities the system is designed to protect.

Answers could lie in heating the particles and the fluid separately, says Sastry. But that would involve higher costs and decreased efficiency. There are plenty of other avenues to explore. In one project, Sastry is studying how the use of electroconductive heating instead of steam heat could improve the system.

Whatever the final solutions, Sastry feels they're close. The term "box lunch" might have a whole new meaning for Americans by the end of the decade.

For information on aseptic packaging, contact:

- Sudhir Sastry, Department of Agricultural Engineering, Ohio State University, 590 Woody Hayes Dr., Columbus, Ohio 43210-1057, (614) 292-2928.
- Joe Heimlich, environmental sciences, CNRD, OCES, 26 Agriculture Administration Building, 2120 Pyfe Rd., Columbus, Ohio, 43210-1010, (614) 292-8436.
- Susan Levine, Combibloc Inc., 4800 Roberts Rd., Columbus, Ohio, 43228, (614) 876-3777.

WELLSPRING

Among the benefits of aseptic packaging:

- **Food quality.** Aseptic packaging heats and cools food much quicker than traditional canning, producing a fresher, more nutritious product.
- **Reduced costs.** Aseptic packages are about one-third the cost of metal cans. Warehousing costs are also much cheaper—empty boxes are folded up or are available on bulk rolls for storage and shipping. According to the Aseptic Packaging Council, that allows a single standard trailer truck to transport more than 1.5 million boxes to a filling plant. It would take more than 14 such trucks to haul the same number of glass bottles.
- **Energy efficiency.** Aseptic packaging uses less energy to process and transport food than other methods. And, since aseptically packaged foods don't require refrigeration, they save energy during storage, too.
- **Waste reduction.** Aseptic packages allow a ratio of 4 percent packaging to 96 percent product for single-serving containers, by weight; that's compared with 15 percent package for steel cans and about 37 percent package for glass.
- **Recyclability.** Aseptic packages are 65 percent to 70 percent paper that can be recycled into products such as writing paper and facial tissues. The containers can be recycled with other poly-coated containers, such as milk cartons and paper cups. Combibloc Inc., an aseptic package producer in Columbus, hopes to start a juice box/milk carton recycling program in some Franklin County schools and communities by the end of this year.—Martha Carroll

BOXING LOVES

The top 5 reasons why it's hip to be rectangular.

A
Karen Mancl knows what’s in your sewers—and you gain from her knowledge. The water-quality specialist roams Ohio exploring, and teaching about, better ways to manage sewage. When her work’s done, drink up.

BY SCOTT TURNER

Some travelers are history buffs, reciting the words on historical signs in every small town they pass. On a warm spring afternoon, as Karen Mancl winds her navy-blue Ford through a western Ohio village, she excitedly explains the condition of the local sewage systems. Does that make Mancl a sewage buff? Ask her and she smiles. Mancl is water-quality specialist for the College of Agriculture. It’s her job to know the state’s septic systems.

On this day, Mancl travels back roads to teach rural leaders about managing sewage—a challenge facing small towns nationwide.

Karen Mancl is living out her childhood dreams. The oldest of eight children from an Appleton, Wis., family, Mancl teaches and studies wastewater treatment, private water supplies and land application of waste.

“When I was a kid and mom couldn’t find me, I was probably collecting items in the stream and sorting them out,” she says.

In high school, Mancl’s interests solidified after meeting biology teacher Wes Halverson.

“He was my mentor, getting us involved in an environmental monitoring club. We’d go down to the Fox River and collect water samples. One site was by the outfall pipe of the sewage treatment plant. I thought it was wonderful how the plant took in waste and treated it. That’s weird for a 17-year-old.”

Mancl, an associate professor of agricultural engineering, still relies on skills learned in the club. Those skills helped her in labs, on boats and along streams as she worked her way through three college degrees.

It’s evening, and golden sunlight reflects off a one-story building set beneath towering cottonwoods on the fairgrounds in Sidney. Inside, Mancl stands in a U of three tables in a brightly lit room. She’s talking about sewage, and she’s all smiles. Her audience: eight local leaders and the county’s agriculture Extension agent—nine men in boots and jeans, nine men worried about Shelby County’s seeping septic systems.

Mancl is teaching the fourth session of her two-month course, Wastewater Treatment Alternatives for Small Rural Communities. There’s one more session to come. A field trip three days ago explored local sewage treatment systems.

With a cup of coffee in one hand, Mancl asks the participants what they learned. A farmer and township trustee in his mid-60s says he learned operating costs vary greatly with system capacity. A tall, thin man in his 30s says he learned chlorine is cost-effective.

The session typifies Mancl’s teaching efforts: small groups of rural leaders and concerned citizens organized by a county agent.

Most participants are men with full-time jobs who manage their communities on evenings and weekends. All are grappling with using scarce resources for wastewater treatment while meeting mandates of environmental protection officials.

Rural communities rely on inexpensive, home septic systems to treat wastewater. Many systems are failing because of age, poor maintenance, second conditions or lack of space.

“That’s why my students are the citizens of Ohio,” says Mancl. “The sessions prepare people to make important decisions about handling and treating wastewater.”

Since 1987, Mancl has run 20 of the five-session, 14-hour courses in wastewater treatment. With a $115,590 federal grant, Mancl has trained Extension specialists from Maryland, Kansas, Texas and Oregon to hold courses for their local officials.

Mancl says working with Extension agents, such as Shelby County’s Roger Bender, is key to reaching statewide audiences. She trains agents through workshops or correspondence courses. Agents then teach topics such as managing private water supplies or arrange for Mancl to work with local leaders.

“It’s vital to provide agents with all the training and materials they need to handle each topic,” Mancl says. “They know they’re not climbing out on a teaching limb because I’m there to help.”

It’s 9:15 p.m., 10 minutes after the evening session. Mancl stands talking with four strugglers about finding funds to treat wastewater.

One man sits reviewing the course’s evaluation form. Shyly and a bit red-faced, he looks up from under his brown “Parker’s Hybrids” hat and says, “Looks aren’t in here.”

Mancl laughs and retorts, “There’s room for comments on the back.” More laughter.

Now, as Bender helps Mancl gather her materials for the two-hour drive back to Columbus, one participant, about 65, says that waste issues used to be simpler.

Says the man, in a mix of nostalgia and concern, “There were 15 kids in our family. Including our parents, 17 people would go one after the other to the outhouse with no problem. If each of us had carried a 5-gallon bucket of water and dumped it in, we would have flooded the place. But all we did was take turns emptying the outhouse once a month. And we had no waste problems.”

As she heads home to her husband and two children, Mancl says she couldn’t imagine not traveling and teaching.

“I’m definitely my father’s daughter,” Mancl says. “He was a grocer, always excited when he came home. At the dinner table, he’d animatedly describe all the wonderful things that happened at work.”

Suddenly, realizing she’s passing through another small town, Mancl cuts short the anecdote, saying, “See that street? It has several failing septic systems.”

Biography

Karen M. Mancl, 36, her husband Larry Antosch, and their daughter Earline, 6, and son Michael, 3, live in a 70-year-old brick home in Columbus’s Clintonville neighborhood.

Born in New Orleans, graduated from the University of Wisconsin-Green Bay in 1977, the University of Texas-Dallas in 1978 and Iowa State University in 1982.

Previously worked at The Pennsylvania State University as a water-quality specialist and assistant professor from 1982 to 1986.
MIGHTY LIKE A ROSE ...

... or in this case, a cucumber. Either way, our strong greenhouse trade stands poised to blossom. Learn why on page 6.