Long after Toledo's water supply was cut for days in August 2014, researchers such as Jay Martin have continued to work to improve water quality throughout Ohio.

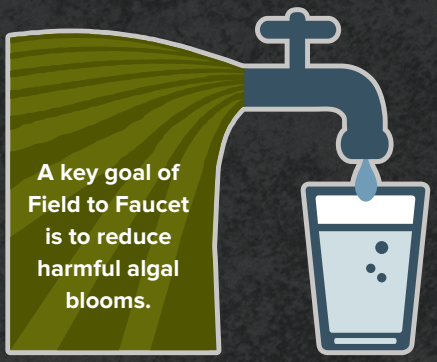
Project works to improve Ohio water quality, one farm at a time

Field to Faucet was conceived by The Ohio State University College of Food, Agricultural, and Environmental Sciences. The college invested $1 million toward the effort after dangerous microcystin levels in Lake Erie shut down Toledo's water supply for two days in August 2014.

Headed by Jay Martin, an ecological engineer in the college, Field to Faucet seeks to ensure safe drinking water while maintaining an economically productive agricultural sector. The goal is to reduce nutrient runoff and protect downstream ecosystems and water quality, helping farmers increase crop yields at the same time.

The initiative involves researchers from multiple colleges within Ohio State, as well as from other Ohio universities. Current research projects supported by Field to Faucet include a tri-state, cost-share program to help protect water quality in Ohio's Western Lake Erie Basin, as well as the development of a weather-risk-management tool to warn farmers of impending storms to help lessen the risk of runoff from nutrient application.

More: **field2faucet.osu.edu**



ESSENTIALS

Field to Faucet projects currently underway include:

- Developing an app for farmers to record nutrient application rates and methods.
- Developing a controlled-access, geospatial-data warehouse that allows producers and researchers to secure and share publicly available data.
- Finding ways to best remove phosphorus and nitrogen from manure and anaerobic digester discharge before the materials are applied to fields. This effort will especially benefit the watershed around Grand Lake St. Marys in western Ohio.
- Using unmanned aerial vehicles to provide real-time data on concentrations of microcystin created by harmful algal blooms in Lake Erie; and developing a sensor to detect real-time concentrations of microcystin in the lake.

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"There continues to be pressure on farmers to be good stewards of our water resources. Beck's and the College of Food, Agricultural, and Environmental Sciences are conducting joint research to monitor water quality in different cropping scenarios over time. We are also looking at other agronomic studies such as fertilizer utilization and tile spacing."

— Scott Beck, president, Beck's Hybrids

Scott Beck

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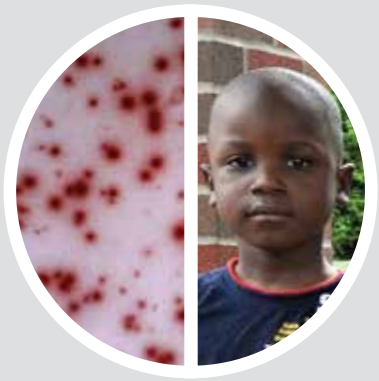

Food Security, Production and Human Health

Environmental Quality and Sustainability

Advanced Bioenergy and Biobased Products

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Public health policymakers view the work of Robert Scharff, right, as invaluable when determining how to direct tight resources to fight foodborne illnesses.

High cost of foodborne illnesses: OARDC researcher provides state-by-state breakdown

Foodborne illnesses cost Ohio up to $2.9 billion every year. In other states, such costs range from just $181 million all the way to $12 billion, according to a 2015 study by Robert Scharff, economist with the Ohio Agricultural Research and Development Center.

Costs fluctuate between states for a variety of reasons, including population, cost of medical care, climate and other factors, Scharff said. Those variations can have a significant impact on local decision making.

Scharff's *Journal of Food Protection* study is a first-of-its-kind economic analysis designed to offer public health authorities detailed information to help evaluate the cost-effectiveness of food-safety education efforts and how best to prioritize resources.

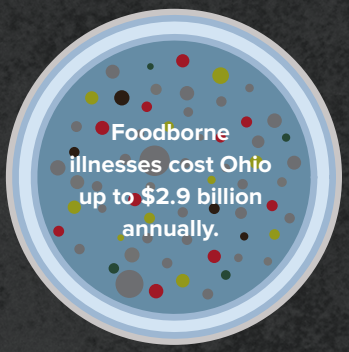
"Take an illness from a pathogen like *Vibrio*," Scharff said. "It's associated with seafood, particularly raw seafood in summer. States with higher shellfish consumption — those in coastal areas — have a higher incidence, and so it makes sense for them to devote more resources to battling it."

More: **go.osu.edu/fdillcost**

"Scharff's work has been indispensable to our efforts. His estimates of the economic impact of these illnesses — considered both on a nationwide and state-by-state basis — help make the case that the benefits from policies aimed at preventing food safety problems clearly outweigh costs."

— Sandra B. Eskin, director of food safety, The Pew Charitable Trusts

Sandra B. Eskin



ESSENTIALS

Robert Scharff's study, "State Estimates for the Annual Cost of Foodborne Illness," provides both conservative cost estimates — following the model typically used by the U.S. Department of Agriculture — as well as higher estimates that include loss of quality of life, which is the model used by the U.S. Food and Drug Administration.

Using those models, the costs related to foodborne illnesses in Ohio are estimated to be:

- $1,039 to $1,666 per case.
- $156 to $250 per resident, annually.
- $1.8 billion to $2.9 billion in total annual costs.

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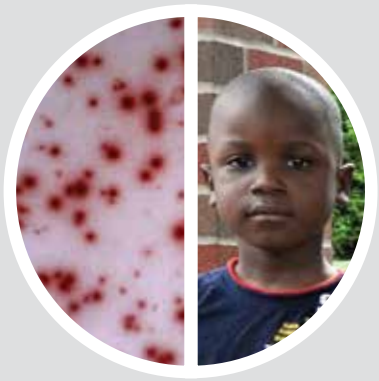

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Urban Farms of Central Ohio, part of the Mid-Ohio Foodbank, uses OARDC high tunnel technology to train new farmers and help feed the hungry.

A simple, low-cost way to grow more food

High tunnels help farmers grow more food of higher quality, and Ohio Agricultural Research and Development Center scientists are working to widen their use.

Especially suited to small and urban farms, the simple, low-cost structures make the growing season longer. Inside, fruits and vegetables ripen earlier in spring and yield later in fall, with no need for fossil-fuel heat. "High tunnels translate into greater food production, greater food security and greater potential farm income," said OARDC scientist Matt Kleinhenz.

At OARDC facilities in Piketon and Wooster and also on cooperating farms, Kleinhenz and OARDC colleague Brad Bergefurd are studying high tunnels, documenting their benefits and refining the best ways to use them. Then, they're sharing their findings with farmers.

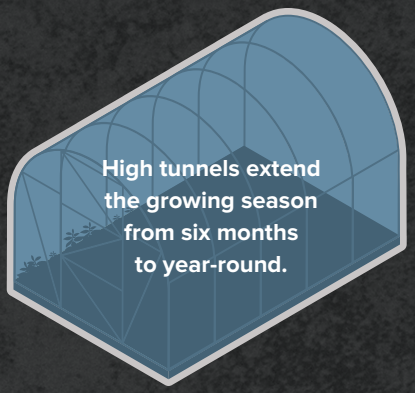
Thanks to their efforts, Dana Hilfinger of Urban Farms of Central Ohio said, "We've been able to market our produce earlier in the season, generating more revenue to support our mission and generally supporting central Ohio's local food economy."

More: **hcs.osu.edu/vpslab**

"We're a nonprofit commercial farming organization providing fresh produce access to food-insecure individuals. We've used OARDC's high tunnel research to increase our impact by providing high-quality produce for more months of the year."

— Dana Hilfinger, farm manager, Urban Farms of Central Ohio

Dana Hilfinger



ESSENTIALS

- In Ohio, high tunnels can extend the marketing season of a farm from six months to year-round.
- High tunnels increase a farm's annual food production. Warm- and cool-season crops are grown and sold in succession. Hundreds to thousands of pounds of more and different kinds of produce are taken from tunnels when outside fields are dormant. That means more revenue to growers and greater choice and health benefits to consumers.
- Weather extremes disrupt normal farming practices outside, but not so much inside high tunnels. High tunnels protect crops from rain, snow, wind, cold and other stresses, including some pests and disease-causing pathogens. Tunnel production can use less fertilizer, irrigation, pesticides and labor.

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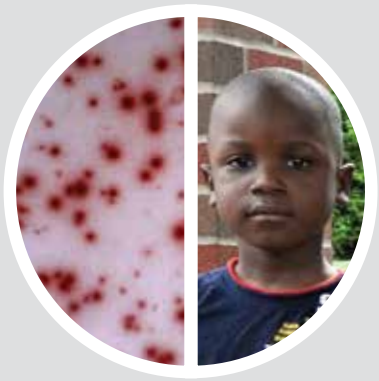

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New OARDC research will benefit businesses like Columbus Castings, shown here, say OARDC's Nicholas Basta, left, and Ohio Cast Metals Association's Russ Murray, right.

How U.S. metal foundries can save $40 million a year

What to do with 10 million tons of sand every year that would otherwise go in a landfill? Use it to grow plants and industry.

Ohio Agricultural Research and Development Center scientists Nicholas Basta and Elizabeth Dayton worked in tandem with the U.S. Department of Agriculture to do detailed testing of spent foundry sand for such toxins as heavy metals. The sand is a byproduct of the metal casting industry.

Their findings fed into a risk assessment by the U.S. Environmental Protection Agency. The assessment determined that spent foundry sand, when put back to use in some soil applications, is safe for people's health and the environment. The finding applies only to silica sand from aluminum, iron and steel foundries.

The work has opened new business doors. Ohio's green industry now can manufacture and market new soil mixes using the sand. And the state's many metal casting foundries can reduce their landfilling costs, save money and stay competitive.

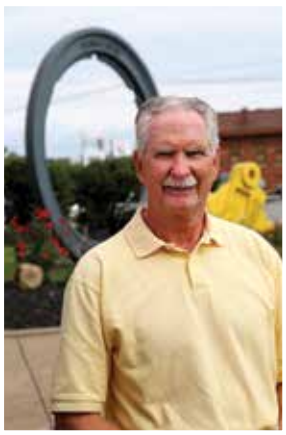
More: **go.osu.edu/SpentSandGetsSecondLife**

ESSENTIALS

- Ohio is the No. 1 metal casting state in the nation. Its 200-plus foundries provide 22,000 jobs and produce metal castings for products such as cars, trucks, tractors, turbines, aircraft and appliances.
- Reusing 10 percent of the 10 million tons of spent foundry sand sent to landfills every year can save U.S. foundries about $40 million annually. That's based on an average disposal cost of $40 a ton.
- The potential savings for Ohio and U.S. foundries will be a leg up in an increasingly competitive international market.
- Reusing spent foundry sand will also create new businesses and jobs. These businesses and jobs will be based on using spent foundry sand to make new soil blends and soil substitutes.

"Based on this research, Ohio EPA is developing new rules for beneficially reusing spent foundry sand. We're confident these rules will provide opportunities for Ohio foundries to significantly reduce their disposal costs for the sand. This should make these foundries more competitive."

— Russ Murray, executive director, Ohio Cast Metals Association



Russ Murray

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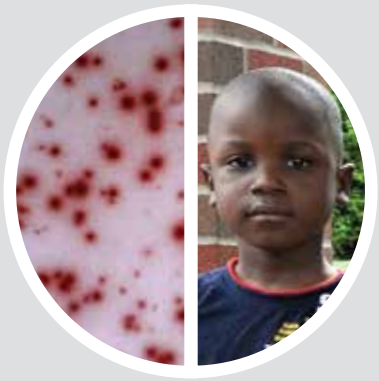

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Modern farm machinery and unmanned aerial vehicles are opening new doors for the collection of valuable data to help growers improve production and the environment.

Future of farming includes precision tech, smart use of 'big data'

In the world of agriculture, having access to rich data sources about field conditions, weather patterns, pests and more can make a huge difference in the profitability and sustainability of Ohio farms.

The Ohio Agricultural Research and Development Center is working with farmers, industry groups and state agencies to boost access to and analysis of field data gathered from new-generation farm machinery, satellite data and remote-sensing imagery captured by unmanned aerial vehicles (UAVs).

"Data can support farmers' management decisions, for example how much nitrogen should be applied to corn and whether or when a fungicide needs to be used," OARDC and Ohio State University Extension precision agriculture specialist John Fulton said. "But all this enormous amount of data needs to be gathered and provided quickly for farmers to make the best use of it."

A key goal of Fulton's work is to create a repository that will then be made available to growers in a user-friendly manner to help them make data-driven decisions.

More: **fabe.osu.edu/precisionag**

"The Ohio/Indiana UAS Center supports Ohio State and Dr. Fulton by flying a variety of aircraft and sensor combinations aimed at improving the efficiency and effectiveness of UAV-collected imagery. Together, we're working to leverage emerging UAV technologies into an affordable, practical decision tool for farmers and agronomists."

— Ryan Smith, director, Ohio/Indiana Unmanned Aircraft Systems Center

Unmanned aerial vehicle

ESSENTIALS

The enhanced use of precision farming technology and "big data" analysis can benefit the agricultural industry and society in three key areas.

- **Economy:** Providing remote-sensing imagery and other types of data to growers and their crop consultants can help growers make more efficient use of fertilizers and other expensive inputs, thus lowering costs.
- **Environment:** Reducing fertilizer and agrochemical applications benefits the environment, protecting water, pollinators and other valuable natural resources.
- **Research:** Developing an extensive data repository can help university scientists save time in their research projects and develop innovative recommendations to assist both farmers and the environment.

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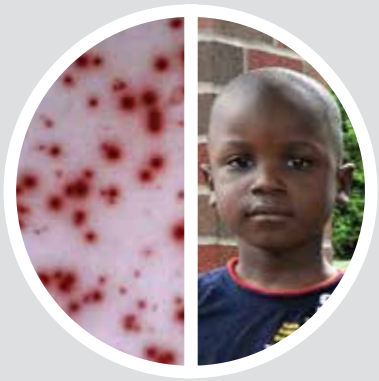

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In addition to the horticultural research conducted there, Secrest Arboretum provides spaces in which the community can engage with nature and improve their health.

New OARDC garden will help study links between plants and health

The Ohio Agricultural Research and Development Center's Secrest Arboretum has many gardens, but its newest addition stands out for its therapeutic and research value.

Established in summer 2015, The Lemmon and Rice Health and Wellness Garden was designed to boost visitors' sense of well-being and provide opportunities for research into the impact gardens and nature have on human health. The garden was constructed thanks to donations from Bill Lemmon, president and owner of Lemmon & Lemmon Inc., and Kevin Rice, vice president of Rice's Nursery and Landscaping, both located in the Canton area.

This is one of the country's few gardens designed around the concept of the pillars of wellness. The garden focuses on six of the nine pillars: environmental, physical, intellectual, emotional, spiritual and social. OARDC has teamed up with The Ohio State University College of Nursing to conduct future research in the garden.

"Many visitors already use the arboretum as a part of their wellness program," said Joe Cochran, Secrest's interim director. "One visitor told me he had lost 36 pounds somewhere on the paths throughout the gardens."

More: **go.osu.edu/healthgarden**

"I'm an Ohio State grad. My grandfather and father came from Wooster. This is something I wanted to do for the university. I believe plants are very important in people's health, and I hope this garden will be beneficial for people of all ages in the community, as well as for research."

— Bill Lemmon, president and owner, Lemmon & Lemmon Inc.

Bill Lemmon

ESSENTIALS

Studies have shown the benefits of gardens and other outdoor spaces on health and wellness.

- Gardening 3–5 times a week has been found to be a good strategy to combat obesity and lower stress.
- Patients with musculoskeletal pain taking part in horticultural therapy programs experience an improved ability to cope with chronic pain.
- Children with attention deficit disorder who play in grassy, outdoor spaces have less severe symptoms than those who play in windowless, indoor settings.
- Dementia patients who have access to gardens are less likely to display aggression or suffer injuries, and they display improved sleep patterns, balanced hormones and decreased agitation.

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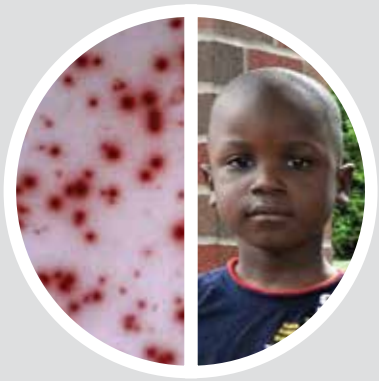

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As Ohio brewers seek out locally grown hops, research and education from Ohio State help growers such as Dave Volkman, bottom, and wife Nina Volkman, top, increase production.

The Ohio State University's hops research helps farmers, growing industry

Dave Volkman formerly grew produce on his 12-acre Maineville, Ohio, farm. But by attending a workshop on hops production offered by Ohio Agricultural Research and Development Center and Ohio State University Extension horticulturist Brad Bergefurd, Volkman learned about the crop's potential strong profit and high demand. As a result, he traded in his produce for hops. Volkman now has more than 400 plants on 12 acres, supporting two Ohio craft breweries. He also formed the Ohio Hop Growers Guild, which currently brings together more than 50 Ohio hops growers.

Hops are a key ingredient in beer manufacturing. Thanks to The Ohio State University's ongoing hops research and trials, hops are making a resurgence in Ohio after a 100-year absence. With Ohio-grown hops in high demand from Ohio microbrewers, the economic potential for growers and the state's economy is significant. Ohio growers are poised to capture the $30 million in hops sales and related jobs currently sourced out of state by Ohio's growing craft brewing industry.

More: **go.osu.edu/hopsres**

"After significant research and attending numerous Ohio State hops production workshops, I've gone from no hops to now more than 400 plants on 12 acres, supporting two Ohio craft breweries. With Ohio State's research and input, the economic potential for Ohio hops is huge."

— Dave Volkman, grower, Ohio Valley Hops, Warren County

Hops cones

ESSENTIALS

- One hundred Ohio breweries produce 1.09 million barrels of craft beer annually, requiring 4 million pounds of dried hops at 4 pounds per barrel — worth more than $30 million — all currently purchased from out-of-state farms.
- To meet this demand, an estimated 6,000 acres of hops are required by Ohio craft brewers at current-use rates. Today, 100 acres are planted with hops in the state, so the potential for growth is enormous.
- OARDC's hops research trials are helping growers identify the following: new hops varieties for Ohio, effective pest and disease management techniques, successful fertility and irrigation management methods, and mechanical harvesting tools.

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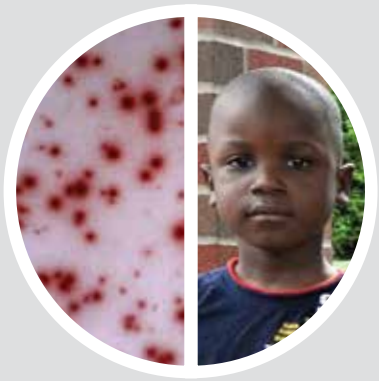

Food Security, Production and Human Health

Environmental Quality and Sustainability

Advanced Bioenergy and Biobased Products

Ohio Agricultural Research and Development Center

As the research arm of The Ohio State University College of Food, Agricultural, and Environmental Sciences, the Ohio Agricultural Research and Development Center (OARDC) employs nearly 650 scientists and staff members throughout the state.

Ohio State's Wooster campus is the largest agbioscience research facility in the United States. OARDC scientists work closely with researchers in The Ohio State University Colleges of Education and Human Ecology, Medicine, Public Health, Veterinary Medicine, Biological Sciences, and Engineering.

At any one time, OARDC researchers are engaged in nearly 400 research projects. Primary focus is in three signature areas:

- Food Security, Production and Human Health
- Environmental Quality and Sustainability
- Advanced Bioenergy and Biobased Products

The Ohio General Assembly established OARDC as the Ohio Agricultural Experiment Station in 1882. It is supported by a line-item appropriation from the Ohio General Assembly, competitive grants, gifts, contracts, federal grants and other sources. OARDC uses these funds to provide direct research support and economic development for Ohio's annual $100+ billion agbioscience industry. OARDC is not funded by student tuition or any other general funds of The Ohio State University.

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THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

Virologist Chang-Won Lee conducts research — including the development of new vaccines and diagnostic tests — to combat avian flu and other respiratory diseases of poultry.

Tackling avian flu and other dangerous poultry diseases

Since November 2014, an outbreak of highly pathogenic avian influenza H5 spread by wild waterfowl has gripped the U.S. poultry industry, killing close to 50 million birds in at least 19 states.

While the virus has not yet reached Ohio, Ohio Agricultural Research and Development Center experts are conducting innovative research to improve detection, prevention and management of avian flu and other respiratory diseases that threaten the state's valuable poultry industry.

For instance, virologist Chang-Won Lee leads a U.S. Department of Agriculture $7.2 million grant that partners scientists and colleagues at The Ohio State University with other universities. The project's goal is threefold: to better understand the ecology of poultry diseases in order to develop more effective prevention strategies; to validate diagnostic methods currently employed and create better ones as needed; and to gain a better understanding of the relationship between disease, host and environment in order to aid in the development of new control methods.

More: **go.osu.edu/birdflu**

ESSENTIALS

- The current avian flu outbreak is a serious threat to Ohio's $2.3 billion poultry industry, which directly supports more than 14,600 jobs. Nationally, Ohio ranks second in egg production and ninth in turkey production.
- If Ohio were to experience just a 50 percent poultry production loss, Ohio State University Extension estimates the effect would reach $1 billion in overall economic losses, including $815,000 in annual wages.
- Heavy losses to Iowa's egg farms from this virus have sent egg prices soaring across the United States. If the virus reaches Ohio, prices would increase even more dramatically, affecting both consumers and food manufacturers.

"The partnership between Ohio State and Ohio's poultry farming community has never been more important than during the current avian influenza crisis. As our industry faces unprecedented disease challenges, having a leader in animal science and veterinary medicine like Ohio State by our side, providing expert guidance and resources, is invaluable."

— Jim Chakeres, executive vice president, Ohio Poultry Association

Jim Chakeres

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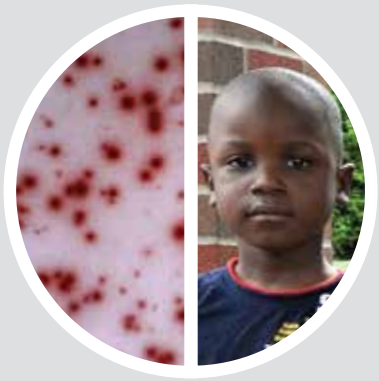

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