Photo by Mark Claesgens

LSU AgCenter researcher Dr. Cristina Sabliov, at left, and student Mark Gabriel have developed a second prototype for microwave extraction of soy isoflavones.

Team Develops Second Prototype *for Microwave Extraction*

An LSU AgCenter team has developed a second prototype to conduct continuous microwave extraction of soy isoflavones.

Dr. Cristina Sabliov, an assistant professor in the Department of Biological and Agricultural Engineering, has been working for 18 months on a process that could quickly extract bioactive compounds – like vitamin E and isoflavone oils – from plant materials such as soybean flour or rice bran.

"These oils could have uses in vitamin supplements or functional foods," Sabliov said.

Mark Gabriel, a junior in the department, designed the first microwave prototype, which provided a means of pumping a mixture of soybean flower and extraction chemicals through the specially designed apparatus.

After initial research, the scientists decided they could improve the process, so Gabriel designed a second prototype. The design of the new prototype allows researchers to investigate different parameters of extraction to increase the yield of the bioactive compounds. "This newer design allowed us to test the process at different time intervals," Gabriel explained.

This process is quick and involves less labor than batch extraction, Sabilov said, adding, "A conventional solvent batch extraction could take hours, with the solution soaking overnight."

Sabliov and Gabriel conducted tests varying the time the mixture spends going through the extraction process, which, in turn, varies the final characteristics of the mixture. They compared those results to a batch extraction method.

The team – which also includes Dr. Dorin Bolder, Dr. Marybeth Lima and Dr. Zhimin Xu – is fine-tuning this process of extraction, which would take mere seconds using the technology they are developing. This would be a significant advancement over the present solvent-based technology used to extract isoflavones.

Tests conducted so far have revealed that the continuous process could extract a volume of isoflavones more quickly than current batch extraction methods. The team also learned the new continuous extraction offered more consistent results than batch extraction.

In addition to the small prototypes, the team has a large microwave extractor in the works. This system looks nothing like a conventional home microwave, but the function is similar. Even with a large prototype, however, the team is not abandoning work on the small units.

"We still have more to learn from the small prototypes before we can move toward a system that can handle large quantities of solvent and flour," Sabliov said. The next steps will be to continue improving the design to achieve the optimum operating parameters for this process. Tobie Blanchard

Soybean Cultivars, Fungicides Evaluated for Disease Management

LSU AgCenter scientists continue to evaluate soybean varieties for agronomic characteristics and resistance to naturally occurring diseases.

Diseases reduced Louisiana soybean yields about 11 percent or 3.16 million bushels in 2006, experts estimate.

Resistant varieties and fungicides are the major components of disease management programs.

Fungicides are used to reduce the effects of soybean diseases when genetic resistance is not available. More than 30 fungicide trials were conducted by LSU AgCenter scientists in 2006, and 21 of those were at the Macon Ridge and Northeast research stations, said LSU AgCenter plant pathologist Dr. Boyd Padgett, who directed many of the trials.

"New fungicides have emerged in recent years, and older ones not previously labeled for use on soybean recently have been approved for managing Asian soybean rust," Padgett said. Evaluations of fungicides used in other countries are still being conducted in Louisiana, as well, he said.

Additional research also is being conducted to assess the impact of diseases on yield and quality.

"Yield loss assessments are targeted for Asian soybean rust, Cercospora leaf blight, frogeye leaf spot, pod diseases and aerial blight," Padgett said. "Results from this research will identify disease-resistant varieties, provide information on efficacy of new fungicides, determine which products are most beneficial, quantify yield losses from diseases and define when fungicides are likely to be most economical."

Environmental conditions also are monitored during the growing season in an effort to determine their effects on disease development. Some parameters recorded are leaf wetness period, ambient temperature, relative humidity, rainfall, wind speed and wind direction.

Such evaluations are the basis for recommendations from LSU AgCenter researchers and extension experts. Mary Ann Van Osdell

Photo by Boyd Padgett

Cercospora leaf blight was the culprit discovered in this soybean field at the LSU AgCenter's Macon Ridge Research Station last fall. Researchers say Cercospora is a particular problem for Louisiana growers, because fungicides have shown only limited effectiveness against the disease.

Microscopic Clues Analyzed to Defend Against Rust

Dr. Zhi-Yuan Chen and his colleagues in the LSU AgCenter are looking for clues about Asian soybean rust and its lifecycle, and they are taking the work to a microscopic level.

The hope is that learning more about the survival of rust spores over winter, how the disease infects the leaves of soybean plants and how those plants defend themselves against the disease ultimately will lead to better ways of controlling Asian soybean rust and its potentially devastating consequences to soybean crops.

This work is just part of a much larger effort devoted to monitoring the disease and its progress in the state, developing recommendations on controlling it with fungicides, searching for potentially resistant soybean germplasm, working on economic decision aids to help farmers assess whether fungicide applications will be cost-effective and investigating various cultural practices to see if they can help to control the disease.

"Based on our study, we believe that soybean rust spores can survive typical Louisiana winter conditions and cause a new cycle of infection in the next growing season," Chen, a plant pathologist, said of the results so far. "We also have compared soybean leaf protein changes before and after rust infection using state-of-the-art proteomic techniques in an effort to understand how the soybean plant defends itself against rust infection at the molecular level."

Researchers working on the project have identified several proteins that are induced upon rust infection

"These proteins have been sequenced to determine their identity," Chen explained. "One of these proteins is a pathogenesis-related protein 10, which has been shown to enhance resistance to scald disease in barley and blast disease in rice.

"We are trying to clone the gene from the soybean plant and develop ways to increase its protein level in soybeans to enhance disease resistance." Tom Merrill

Asian Soybean Rust
Getting Foothold in Area

Asian soybean rust appeared earlier and seemed to be spreading farther this year – giving experts reasons to suspect the disease could get a foothold if it goes unchecked.

Since the disease was first discovered in South Louisiana in 2004, LSU AgCenter experts have been cautiously watching it and working on ways to prevent it from devastating the state's soybean crop.

Until this year, most appearances of the disease had come later in the season, but it showed up in sentinel plots of soybeans in June and was discovered in production fields in central Louisiana in mid-July. Discoveries in additional areas were continuing in early August.

"This is the first time we've seen a significant infestation in a commercial field with the surrounding areas also infested," Dr. David Boethel, vice chancellor for research in the LSU AgCenter, said of the July discoveries. "The good news, however, is that our scientists have been on top of the situation – watching sentinel fields, communicating with farmers and consultants, conducting research and doing much more to combat this problem. I think the soybean producers in the state have been warned and have been poised to take action."

Among the potential actions are the use of fungicides to try to stem the effects of the disease, which has proven to be devastating to soybean crops in areas of South America. LSU AgCenter researchers are pursuing a variety of avenues to try to prevent such damage here. They also are staying in touch with other experts across the country who are monitoring the situation.

"There seems to be a marked increase in the commercial fields that are positive now," LSU AgCenter plant pathologist Dr. Clayton Hollier said in early August. "It would seem to say that the fungus has built up enough that it is starting to spread and move more easily."

Asian soybean rust was first discovered in the United States in 2004, when its windborne spores are thought to have come in on storm winds that summer. Although it's been known to exist since the early part of the 20th century, it was largely confined to Asia until recently – when it spread to Africa and then on to South America around 2000.

Since the initial U.S. discovery in South Louisiana, it has been seen in kudzu, another host plant, and on soybeans in a variety of Southern states, including Florida, Georgia, Alabama, Mississippi, Texas and Arkansas.

"Environmental conditions this year have been conducive to promoting this and other soybean diseases," Hollier said. "There are areas of Texas where there had never been rust before that are now showing up with rust as a result of the storms they've had go through there this summer."

The July discoveries in Louisiana came when much of the state's soybean crops were in the latter parts of the plants' reproductive cycles, known as R4, R5 and R6, where the soybean pods are formed and begin to fill.

"What the findings in these fields and the sentinel plots really give us and the farmers is a warning to be looking at commercial fields very carefully," LSU AgCenter soybean specialist Dr. David Lanclos said. "The whole point is to really get out and scout for signs of disease."

The LSU AgCenter experts said growers need to look carefully at plants and to be sure to examine areas well within the canopies of the plants for signs of disease – rather than taking a look at just the tops. They also said to look carefully around tree lines where shade may keep plants cooler and allow moisture to stay on them a little longer.

In addition to rust, soybean producers also can face other plant diseases such as aerial blight, Cercospora, pod and stem blight and anthracnose.

"Our parish agents, state specialists and research scientists have been working very hard monitoring soybean fields throughout the state," said Dr. Paul Coreil, vice chancellor of extension for the LSU AgCenter. "This excellent teamwork has resulted in the best possible notice to growers on rust identification in fields and management options. We hope that will limit the economic impact of this new crop disease." Tom Merrill

Photo by John Chaney

LSU AgCenter research associate Rose Berggren, at right, explains the basics of using a hand lens to check for signs of Asian soybean rust. The explanation about viewing soybean leaves for county agents Matt Martin, at left, and Hubert Wilkerson, center (with lens), came during an August workshop and field tour organized by LSU AgCenter experts. County agents, crop consultants, agribusiness representatives and others from across Louisiana and Mississippi participated in the event, which was designed to boost surveillance for the plant disease.

Irrigation of Soybeans on Rice Land Shows Promise in Louisiana Delta

(Continued from page 1)

said professionals from Phoenix were even called to share how they were growing cabbage on zero-grade land.

"They showed us how to get the water on and off as soon as possible," Daniels said. "So we put in spin ditches, and this helped give the water some push, so we could get it off pretty fast."

That process basically involved a series of trenches throughout the field that helped to drain the water, he explained.

Daniels said the research on the Angelina Farm over the past three years has proven yields can be doubled with proper irrigation.

The average yield for soybeans in Louisiana is about 30 bushels per acre, but Daniels said they are consistently harvesting between 55 and 60 bushels on his research plots.

"Last year we had a severe drought – and I mean it was bad. Some of the growers didn't even cut their beans, but we were cutting on average 55 bushels on these research plots," he said.

Branch, an agricultural engineering specialist whose LSU AgCenter work includes irrigation techniques, said rice traditionally has accounted for 60 percent of the irrigated acreage of agricultural crops in Louisiana – and for about 75 percent of the irrigation water used. Cotton, corn and soybeans account for most of the remaining irrigated land.

"Irrigation for these crops is seen as 'insurance' in growing seasons like last year's when there were some no-rainfall periods during the growing season," Branch said.

Daniels said the findings of the research so far show soybean yields can be increased tremendously if the irrigation is timed right. But he pointed out that there are still problems to be resolved with getting the water off the zero-grade fields as quickly as he would like.

Selection of the right soybean varieties, such as Terral TV49R12 and Delta King DK, also is a key in zero-grade irrigation, Daniels said, explaining that those varieties have more water tolerance.

Johnny Morgan

Looking for *Best* Soybean Combo

Dr. Ernie Clawson is looking for a combination that produces optimum soybean yields. Clawson, an LSU AgCenter agronomist at its Northeast Research Station in Tensas Parish, is studying row spacing, planting dates and maturity groups to find the best combination for soybean production.

In the study, soybeans were planted in narrow rows – 20 inches apart – and wide rows were on a 40-inch row spacing. Results in 2006 showed that when beans were planted in late March or early April, narrow rows yielded more than wide rows.

Photo by Mark Claesgens

LSU AgCenter agronomist Dr. Ernie Clawson explains some of his 2006 research with soybean maturity groups, planting dates and row spacing at a field day this year. Clawson is continuing the work, which is aimed at finding the optimum combination for soybean yields.

The yield difference between row spacings was less when the beans were planted from mid-April to mid-May. "There's not as much pronounced difference," Clawson said.

His work confirms that Maturity Group IV is higher yielding than MG III. Within a given row spacing, yields of MG IV generally were greater than MG III, regardless of planting date. And a single MG V variety performed well at early planting dates.

"We're not ready to make a recommendation for Maturity Group V beans, but we are pleased with the results so far," Clawson said.

Further research is needed to verify the results obtained in 2006, and a similar study is under way in 2007, he said. Bruce Schultz

Diverse Approaches Being Studied to Battle Soybean Diseases

(Continued from page 1)

That third approach is to adjust plant nutrients.

In one test, the LSU AgCenter planted a soybean crop for a comprehensive potash test during the last week of June 2007. Potash was applied immediately before those plantings, and other sources of chloride, such as ammonium chloride, plus manganese and boron will be applied at later stages.

Results from similar tests last year at a Florida research station clearly showed a reduction in severity of Asian soybean rust, and an earlier study conducted in Louisiana showed severity of Cercospora leaf blight also had been reduced.

"We don't expect that using these nutrients… would eradicate the fungus or completely eliminate the disease," Schneider explained. "But it may be possible to increase fungicide efficacy to the extent that a second application may be eliminated."

Even if the tests are successful, it will be important to determine whether these applications are cost-effective for commercial soybean farmers, Schneider pointed out.

A fourth method of defense being studied by LSU AgCenter researchers is the development of spore-trapping technologies, which help predict the onset of Asian soybean rust.

Researchers know Asian soybean rust is spread by windborne spores, so they've observed samples from Vaseline-coated microscope slides in spore traps made from PVC pipe. Those primitive tests have been inexact, however, because it's hard to distinguish the Asian soybean rust spores from other rust spores.

That's why the United Soybean Board is funding research to advance the effectiveness of spore-trapping technology. Schneider, who already has developed a new trap that is being tested near Baton Rouge, is coupling his work with that of researchers throughout the country.

For instance, spore trap research at the University of Florida's station near Quincy is aimed at identifying pathogens that could cause the Asian rust disease and other diseases, while University of Minnesota researchers are working on a DNA-based technology for use on spore traps. In addition, experts at Penn State are working to develop a computer simulation component to the technology.

The traps also might be used to monitor and study how the rust pathogen overwinters on kudzu plants along the Gulf South. Success with this "disease-alert" system could give farmers the extra time they need to react effectively.

"While a disease like Cercospora leaf blight is more of a 'Louisiana-specific problem,' Asian soybean rust is a national threat," Schneider said, adding, "It's a disease that could attack huge soybean-producing states like Iowa or Illinois."

Overall, coming up with solutions to the Asian soybean rust problem has become a national research collaboration.

"While a disease like Cercospora leaf blight is more of a 'Louisiana-specific problem,' Asian soybean rust is a national threat," Schneider said, adding, "It's a disease that could attack huge soybean-producing states like Iowa or Illinois."

In fact, in 2006, the disease had already spread as far north as southern Illinois.

"That's why there's a national interest in researching Asian soybean rust," Schneider said, pointing out that even Florida, which doesn't have a commercial soybean crop, has pitched in to combat the disease.

Schneider said the University of Florida's research area near Quincy is a premiere place to research Asian soybean rust because it's close to sites where rust pathogens overwinter on kudzu before blowing to soybean crops. That means it's one of the most likely places in America for Asian soybean rust to develop substantially.

"Usually when they (the Quincy, Fla., research site) plant soybeans, they're guaranteed to get rust," Schneider said. "But, this year, they're having drought; so that means Louisiana is now the center of the Asian soybean rust research in the country.

"A lot of farmers are depending upon what we find," he added. "Many of them look to us for recommendations to help prevent or fight disease and to maximize their crops." Randy LaBauve

Photo by Mark Claesgens

LSU researcher Dr. Ray Schneider checks instruments used to evaluate spore trapping devices. The equipment was funded by the United Soybean Board, and data from the site are used in research by a variety of universities across the country.