avoidance or heat escape."

"Those main goals are no small undertaking when one looks at the facts, says Dr. Phillip F. Colbaugh, associate professor and plant pathologist at the Dallas Center. Colbaugh's role on the research team is to identify bentgrass plants with disease-resistant qualities.

Teamwork is emphasized by Dr. James Reinert, resident director of research at the center.

"Scientists here pool their expertise and knowledge for the advancement of the total project," he says. "Our intent is to address as many factors as possible to develop the best turf system."

Computers also play an important role in the search for what ultimately will produce a better putting surface. Mountains of data taken from field plots are fed into the computers which analyze everything from the number of mites found on beetles to the types of elements found in the soil at each plot.

The problem with growing bentgrass in Florida "all has to do with heat and dehydration tolerance, which is part of heat stress resistance," says Lehman.

"You are growing in very high humidity environments with regards to transpirational cooling. The humidity actually inhibits the evaporative cooling mechanism and the plant cannot cool itself."

"Our project to find bentgrasses that can cool themselves is very simply stated but not so simply achieved," Engelke explains. "We have to collect bentgrasses with genetic diversity and bring those plants into our nurseries where we can evaluate them under multiple stress environments.

"In fact, we have samples collected from greens in Palm Beach County that have survived many growing seasons with no special care. We use these plants to expand our germplasm pool.

"This project is an opportunity for advancement of our industry," Engelke continues. "You have a need (for a superior stress-resistant bentgrass) and we have the ability to produce the product you need.

"And that is very exciting for our researchers here. This program did not happen overnight. The breeding program was established in 1980.

"Now 10 years down the road, we are beginning to see results."

What they're looking for... and how they go about it:

Researchers at Texas A&M have not yet found the ideal bentgrass plant, but they know what they're looking for. In order of importance, its characteristics:

1. Stress (dehydration, heat) resistant
2. Disease resistant
3. Good color
4. Fine textured, uniform, dense
5. Good survivor without a lot of fertilizer or water

Each candidate goes through a five-step evaluative process:

1. **Plant preservation:** the new plant is established in the greenhouse and then vegetatively divided for inclusion in greenhouse, laboratory and field studies.
2. **Field assessment:** growth, turf quality, wear tolerance to a traffic machine and compaction are evaluated.
3. **Greenhouse assessment:** root growth characteristics and disease resistance.
4. **Laboratory assessment:** High humidity incubation at 100 degrees Fahrenheit for 16 hours to pre-stress plant; high temperature water bath for tissue heat-tolerance test; determination of the precise temperature at which cell breakdown occurs.
5. **Seed production:** Strongest and best plants go on to Oregon where they are cross-pollinated with other strong, desirable plants. Resulting seed hopefully will have the best characteristics of both parents.

RESEARCH NOTES

By Darcy Meeker

Bacteria kills the nematodes, but it's tough to grow

A recent report in the *Wall Street Journal* interested several golf course superintendents. The story had it that one Bert Zuckerman, a tomato researcher at the University of Massachusetts, was looking at a bacteria to control root-node nematodes in tomatoes.

At press time, Dr. Zuckerman was off in Puerto Rico doing a field test, but at the University of Florida's Institute of Food and Agricultural Sciences in Gainesville, Drs. Don Dickson and Grover Smart were proceeding with FTGA-sponsored research on bacterial controls for sting and lance nematodes, the two major nematode parasites on turf grasses.

"These two feed on the outside of grass roots," Dickson said. "The root system becomes very abbreviated so the plant can't take up nutrients.

"This is a great big problem for Florida's golf courses. They all have to practice some sort of control, treating with nematicide once or twice a year with 15 to 20 pounds of active ingredient (organophosphate) per acre.

"Obviously we need some options. That's a heavy chemical load to put into soil. We would prefer not to have to use such high doses."

Dickson says scientists have found *pseudomonad* bacteria specific to the two pest nematodes. The bacteria get in roots and keep the nematodes out, perhaps by producing repellent chemicals.

There's just one problem, says Dickson.

"This bacterium cannot be mass produced. The Beltsville group (USDA researchers) has it growing and sporulating in media, but very slowly."

At IFAS, Bob Cox has been able to grow it vegetatively on *ascaris* (round worm) media, but hasn't gotten it to sporulate, which it needs to do so it can be used as a pesticide.

"We're a long way from the answer," Dickson said. "This organism is very host-specific. In our preliminary work, we took soil from areas infested with nematodes. We dried it and found that the soil can kill nematodes, but after we autoclave the soil, which kills the spores of the bacteria, the soil no longer inhibits the nematode."

The fact that these anti-nematode bacteria are so host-specific may make them hard to produce, but it's still a good thing: it means the anti-mole cricket nematode is safe.

IFAS nematologist Smart says, "The nematodes we're using have an extra cuticle, so they have an extra layer of protection but the bacteria don't seem to attack them anyway."

Smart said he has been studying *Pasteuria penetrans*, a bacteria that attacks root-node nematodes such as those that afflict tomatoes.

"The trouble has been growing sufficient quantities because we shouldn't grow it in vitro," he said.

The pattern runs like this: spores of *Pasteuria* bacteria attach to a nematode's skin and send a penetration peg into its body. In the soil, the bacteria are in spore stage. Eventually the growing bacteria fills the nematode's body — this is the vegetative phase of growth — then it goes into spore stage. The bacteria can't move around on their own. But thousands of spores emerge from one nematode host.

"If enough spores attach to a juvenile nematode, it may die outright," Smart said. "If the numbers are fewer, the nematode may go into plant roots and begin developing before it dies. If the spore load is low enough, the female will produce few, if any, eggs because the bacteria ruins its reproduction structure."

Just to put things in perspective, *Pasteuria* are about one fourth the diameter of a nematode, but the nematode is much longer, about one millimeter.

"They are barely visible, but so thin that they're hard to see," Smart said. "You can see a bunch of them; they look fuzzy. But seeing one is difficult.

IFAS tests compost as medium for sod

Dr. Albert Dudeck at IFAS in Gainesville is testing composted organic waste as soil to produce sod and turf. He thinks it could be a boon to Florida's $1.5 billion turf industry (76 percent of that is St. Augustine grass for home lawns).

"We're looking at a lot of things," he said, listing garbage, yard trash, tree trimmings, sludge/garbage combinations, wood chips, stable litter, mushroom compost, rice hulls, and sugarcane bagasse.

"The primary need is the mandated 30 percent reduction in landfill waste in the next couple of years."

The nutritious composted waste grows a crop of turf in three to four months rather than a year and a half. That could reduce the 75,000 acres now dedicated to commercial sod production.

Dudeck says, "It means a tremendous opportunity to use the waste.