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 p*seudomonad* 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.

'You move the mulch-grown sod in its entirety. It's grown on plastic, and you roll it like a carpet to move it. It's light and only an inch thick..'

You can see dollar signs in their eyes right now. The production technique is commercially feasible in France, but it's never been done on warm season grass in the South.

The tricky part is more frequent, more controlled watering by misters rather than traditional irrigation. Also, the old harvesting machinery isn't appropriate.

"You move the mulch-grown sod in its entirety," Dudeck explains. "It's grown on plastic, and you roll it like a carpet to move it. It's light and only an inch thick."

The bonus for outdoors-loving Floridians: 5,000-year-old Everglades muck soil can stay there and be productive for us, rather than be shipped throughout the Southeast to sod suburbia.

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Hoelon will kill your goosegrass without yellowing your turf. That's what Bert McCarty says.

"This is the first product since 1930 to offer this kind of control," said the weed control researcher at the University of Florida's Institute of Food and Agricultural Sciences in Gainesville. "It's pretty revolutionary."

Goosegrass is a semi-annual weed in fine turf, highly undesirable on putting greens and football fields because it clumps and because it grows horizontally.

In the past, because sprays yellowed turf, many golf courses used hand labor to pull goosegrass out.

After he read of Hoelon's anti-goosegrass success in wheat, grains and row crops, McCarty did research that helped get Florida the first 24-C (state-only) registration, allowing use of Hoelon on turf.

"Florida is the only state that has it currently," McCarty said. "Our golf courses are enjoying a pretty exclusive privilege. Hoelon is far superior to any other products available, which are materials developed in the 1930s."

The older materials require multiple applications and can discolor turf.

Hoelon (chemical name "diclofop") gives 95 percent control in one application per year at half the rate of active ingredient per acre.

"It definitely gives our guys an advantage," McCarty said.

Wayne Mixson at O.M. Scott's turf research center in Apopka recommended Hoelon be used with a pre-emergent herbicide to fight goosegrass.

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Mixson also reports: "We hope to have a product out by summer that

O.M. Scott's expects to release a product that kills bahaiagrass in bermuda

will kill bahaia in St. Augustine and bermudagrasses."

Bahaia is the grass used by the Department of Transportation on Florida roadsides. It pops up a seed head about four days after it's cut, and it inevitably creeps into golf courses.

"The new product takes care of broadleaf weeds, too. We have the fine turf rights from the company that makes the initial chemical."

The new chemical is in the family of sulfanilureas like Hoelon. It works at very low rates, an ounce or less per acre. It will be dry flowable and can be delivered through irrigation systems.

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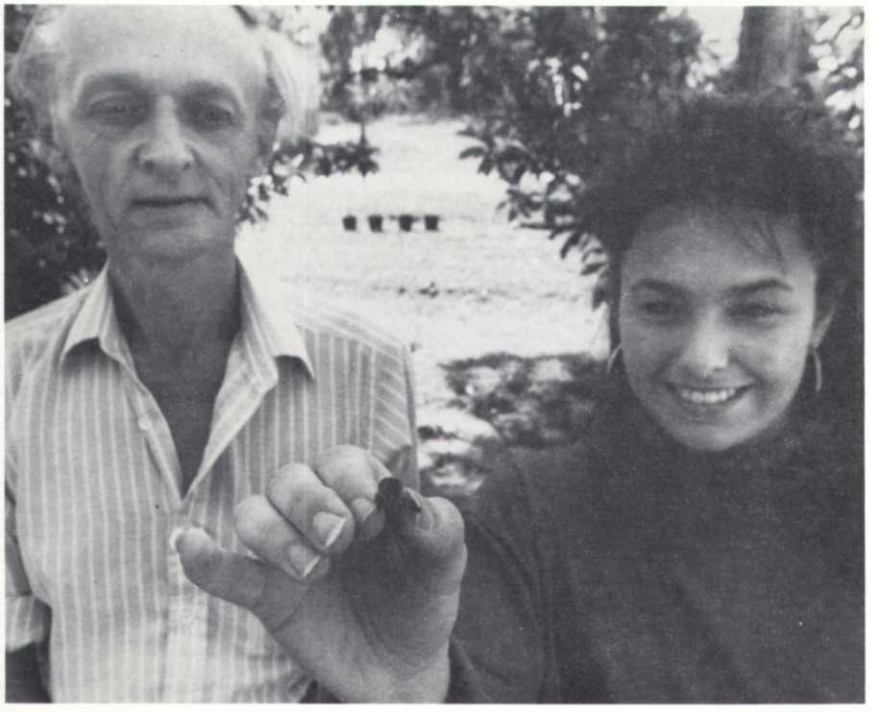
But new chemicals aren't all it takes to control weeds and have beautiful greens, Mixson emphasized.

"Most people — and most golfers — all they look at is the top green. The



DARCY MEEKER/IFAS

Teen wins Science Fair with mole cricket project

A project pitting a fungus against mole crickets won Donna Jaworsky top honors at the Science Fair at Palm Coast High School and for the region. Jaworsky varied strengths of the fungus for her entry in the state Science Fair in April. The 18-year-old senior's write-up will be included in the *Mole Cricket Annual Report* edited by Dr. Howard Frank, left, at the University of Florida's Institute of Food and Agricultural Sciences.

other half of the plant is roots and they're more important than the top green cover," he said. "Half of your weed control problem is solved by growing good turf."

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Dan Jones at Banyan GC in Palm Beach had to put up a sign to explain the IFAS-FTGA mole cricket experiments.

"It looked like something from outer space," he said. "Now the members are 100 percent behind it, and always bring their guests to see the sign and the callers."

The callers attract mole crickets to soil laced with one million mole-cricket-eating nematodes. Jones picked his worst mole-cricket area to be the research site.

The funny thing was, it also attracted armadillos, who went crazy over such a concentration of succulent mole cricket morsels. Now Dan put up a fence around the callers to keep the armadillos out. Most other clubs opted for a set-up that traps the mole crickets in a sand-filled bucket and allows them to distribute the infected crickets.

"Biocontrol is the wave of the future," Jones said. "If we don't get into this biocontrol, we're really going to be in big trouble. We won't have anything."

MEET THE EDITOR

Darcy Meeker is assistant professor at IFAS of The University of Florida.