

NEW ERA OF AG MICROBIOLOGY

Scientists are finding more ways to put microorganisms to work for crop producers

Microorganisms, the tiny workhorses of agriculture, are on the verge of having a much greater impact on crop production.

This new era of ag microbiology got its start in the 1950s, when scientists began making major strides in unraveling the secrets of molecular genetics. Knowledge of heredity and microbiology has been exploding ever since. This growing knowledge base has helped scientists develop more useful strains of naturally occurring microorganisms. What's more important, it has made it possible to create man-made microorganisms.

With genetic engineering, microbiologists are now able to move genetic material from one cell to another, and even from one species to another, to modify organisms for specific uses. The first generation of microorganisms produced in this way were merely laboratory oddities. Today, however, some man-made microbes are being used commercially. Many more are undergoing final tests and could soon be sold to crop producers or other potential users.

Microbes make medicine. Pharmaceutical-industry researchers were among the first to develop commercial man-made microorganisms. For example, several years ago they

engineered a new bacterium that now manufactures most of the insulin used to treat diabetes.

Meanwhile, other researchers have been making headway with microbes that have potential utility in crop production.

One of these scientists is Steven Lindow, a microbiologist with the University of California at Berkeley. Lindow has been working with man-made bacteria that can help prevent frost from forming on fragile crop blossoms. So far, the po-

might someday be used to boost crop yields or kill weeds.

A microbe that's already being used by some crop producers is the *Bacillus thuringiensis* (Bt) bacterium, which produces a toxin that kills certain insects. U.S. and Canadian farmers now use more than \$20 million worth of Bt-based insecticides each year.

One problem is that existing commercial Bt insecticides lose their poisonous effects after exposure to only a few hours of direct sunlight. So the products usually have to be sprayed on crops several times during the growing season. However, scientists are overcoming this problem, and also making other improvements in Bt-toxin technology.

"We're using genetic engineering to improve Bt insecticides in three basic ways," says Holly Hauptli, a scientist with Calgene, Inc., Davis, Calif. "The first approach is merely to do a better job than Mother Nature at designing the bacteria themselves."

Toward that end, scientists are developing Bt strains that survive longer in the field. They're also trying to discover or develop strains that are effective against insects for which no toxic Bt strains are now known.

While these efforts haven't yet led to commercial products, a second approach has been more successful. Scientists at Mycogen Corporation, San Diego, Calif., have used genet-



Bacteria carried in the bodies of nematodes killed this gypsy moth caterpillar in less than 48 hours.

tential usefulness of the bacteria has been demonstrated only in the laboratory. Court orders obtained by environmentalists have delayed field testing. However, Lindow hopes to field test the bacteria this year.

Scientists say there are many other ways microbes, or products made by them, might be used in crop production. One approach would be to harness bacteria for manufacturing enzymes and other products that regulate plant growth. These

Tsuneo Kaneshiro is studying rhizobia bacteria that give soybean plants an extra growth boost.

ic engineering to endow other species of bacteria with the ability to produce the Bt toxin.

Mycogen scientists modify *Pseudomonas fluorescens* (Pf) bacteria by inserting genetic material from Bt bacteria that codes for production of the Bt toxin. When caterpillar insects such as cabbage loopers or cotton bollworms consume the Bt toxin in the Pf bacteria, the insects die.

Light resistant. The toxin produced by the Pf bacteria isn't damaged by sunlight, says Andrew F. Barnes, operations manager for Mycogen. The Pf cells are treated with heat and chemicals in a patented process that further preserves Pf cell walls. The process protects Bt toxin from the field environment. The man-made Pf bacteria remain poisonous in the field long enough to provide some full season protection against caterpillar insects. The product could be offered for sale in 1989. The U.S. Environmental Protection Agency has allowed Mycogen scientists to test the man-made bacteria's toxic effects in the field. According to Barnes, all the bacteria have been killed before leaving the lab, so there's been no chance of their getting loose in the environment and reproducing.

Monsanto Co. scientists are using a slightly different variation of this approach. They're transferring the genetics for Bt-toxin production into *Pseudomonas* bacteria that are normally associated with the roots of corn plants. The idea would be to apply live bacteria as a seed coating at planting time. Theo-

retically, the toxin-producing bacteria would grow along with the roots and would be effective in controlling corn rootworms.

Calgene's Holly Hauptli says a third approach to improving Bt-toxin technology is to endow living plant cells with the ability to produce the toxin. In theory, for instance, corn plants with the Bt-toxin gene would be able to resist feeding by corn borers. If such plants could be developed, they could be used in conventional breeding programs to produce commercial corn hybrids with corn-borer resistance.

This third approach is more difficult than either of the first two. It's not easy to manipulate the genetic material of complex plant or animal organisms. However, Hauptli points out that scientists are having some success with this kind of genetic engineering. For example, researchers have recently transferred the genetic material for Roundup herbicide resistance from bacteria into plants. Now plant breeders are trying to make this trait commercially useful.

Even more familiar to most farmers than Bt bacteria is the rhizobia family, which lives in nodules on the roots of legume plants and fixes nitrogen.

Tsuneo Kaneshiro, a scientist at USDA's Northern Regional Research Center, Peoria, Ill., has recently demonstrated that certain rhizobia can also provide other benefits for growing

plants. Kaneshiro is studying bacteria treated in the laboratory to encourage genetic variation. One rhizobia variant, in addition to fixing nitrogen, also produces an enzyme that helps convert tryptophan into a growth regulator called indoleacetic acid. The acid stimulates plant growth over and above that which can be attributed to nitrogen fixation.

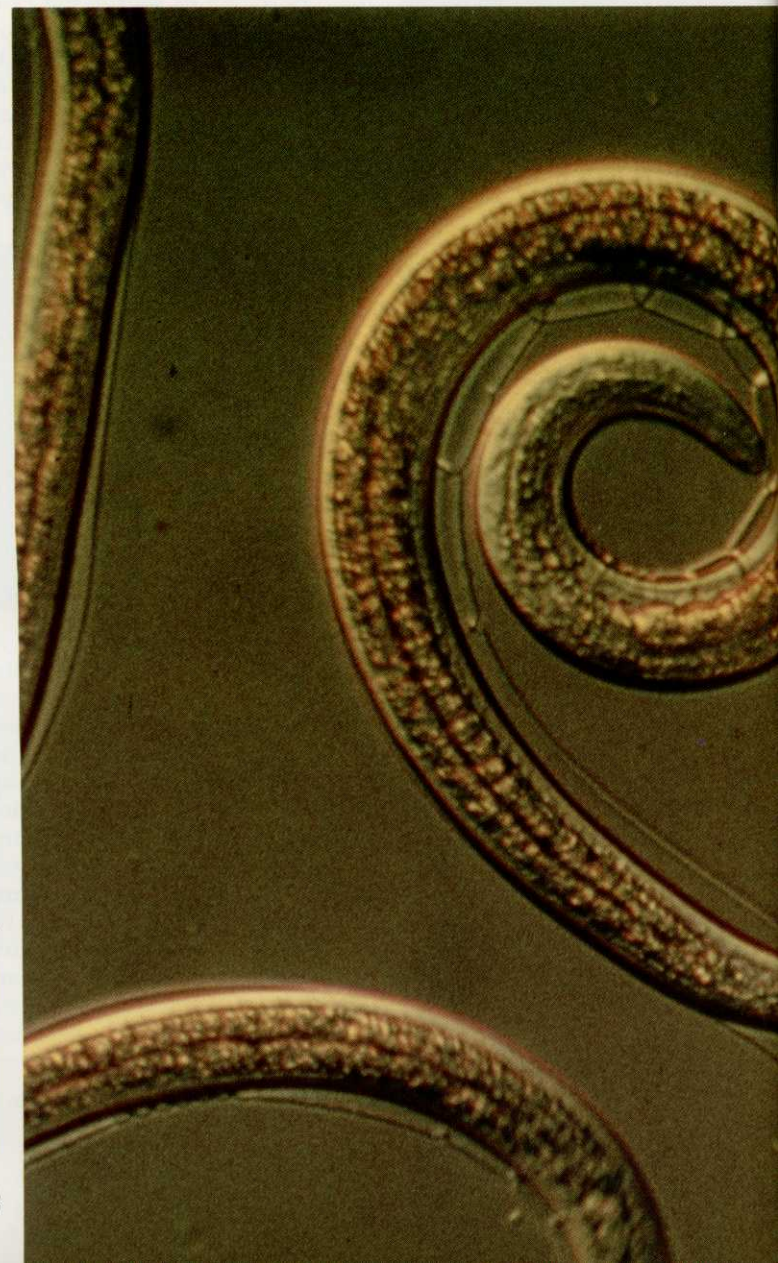
Other scientists are working with rhizobia strains that already exist in nature. For example, David Hume and his colleagues at the University of Guelph in Ontario recently tested a newly discovered naturally occurring strain. Soybeans treated with this strain yielded 9 percent more than soybeans treated with commercially available strains.

The Guelph scientists are also field testing naturally occurring bacteria that show a remarkable ability to protect crops from fungus diseases. "The bacteria protect the plants because they tie up iron in the root zone," Hume says. "Pathogens don't multiply as readily because they can't get enough iron. These bacteria help protect crops from take-all, pythium, fusarium, and rhizoctonia."

Special delivery. It's not enough, of course, to come up with microbes that are beneficial to plants. Scientists also have to come up with ways to get the microbes in the right place at the right time. Trevor Suslow, a researcher with Advanced Genetic Sciences, Oakland, Calif., has recently discovered naturally occurring strains of



Trevor Suslow applied bacteria to transplants in the left tray to protect the plants from some diseases.



Pseudomonas bacteria that attack the organisms responsible for certain plant diseases. In addition, he has gotten around the delivery problem. He injects a water solution containing the bacteria into the growing medium used in the greenhouse to produce transplants. "The same environment that keeps transplants alive is great for microbes," Suslow says.

Advanced Genetic Sciences has tested the treatment in cooperation with Growers Transplants, Salinas, Calif. Suslow says the treatment helps control pythium and fusarium. Treated transplants grow faster in the greenhouse and have higher survival rates when set out in

Steinernema nematodes control several insect pests, including black vine weevils in horticultural crops.

the field. Treated transplants also grow faster in the field. In fact, treated lettuce and celery have been ready for harvest two and a half to three weeks earlier than untreated plants.

Harnessing fungus organisms for crop production is another aspect of ag microbiology's new era. Researchers are working with fungus strains that help protect crops from drought, salinity, and poor soil fertility. These organisms aid plants by enhancing uptake of moisture and nutrients. They are already being used commercially, for instance, to increase survival and speed growth of tree transplants on poor soils, according to D.H. Marx, a USDA plant pathologist at the University of Georgia.

In the future, farmers might

be able to take advantage of other fungus strains, like the ones Richard Thomas and Robert Ames are studying at USDA's Western Regional Research Center, Albany, Calif. These fungi, which grow in association with plant roots, improve soil structure and might someday be used to help control soil erosion.

Friendly nematodes. Many farmers are accustomed to protecting crops from nematodes. However, certain strains of these organisms do no harm to crops but do attack spiders, insects, and other crop pests, says Harry Kaya, an entomologist and nematologist at the University of California, Davis.

According to Kaya, scientists have only recently begun to study how nematodes attack insects. *Steinernema* and *Heterorhabditis* nematodes are known to carry insect-killing bacteria in their bodies. The nematodes enter insects through natural body openings, then release the bacteria. While inside the nematodes, the bacteria are inactive. But they become active in insect tissue and can kill an insect within 48 hours.

One of the first private firms to offer nematodes for insect control is Biosis Company, Palo Alto, Calif. Art Kushner, marketing manager for the company, says Biosis plans to sell nematodes to control insect pests of artichokes this year. The company has found a way to

Fungus organisms growing on onion sets in these chambers are able to improve soil structure.

mass-produce nematodes and keep them alive during shipment. The nematodes are applied so they accumulate at the base of leaves, where life-giving moisture collects.

In research done in cooperation with Biosis by Jan Jackson, a USDA entomologist at Brookings, S.D., nematodes were effective in controlling corn rootworms. But it took 5 billion nematodes per acre to do the job.

Biosis is also working on ways to use nematodes for controlling navel-orange worms in almonds, wireworms in sugarbeets, gypsy moths in forests, and household pests such as cockroaches. Another promising opportunity exists in lawn care. Biosis has an agreement with CHEMLAWN to develop nematodes for controlling white grubs, mole crickets, and cutworms in grass sod. This control would reduce the need to apply conventional pesticides where people and pets play.

Ag microbiologists are active on other fronts, too. Some are working with microbes that make better hay and silage. Some are concentrating on microbes used in manufacturing cheese and wine, as well as other foods and beverages. Then there are the growing number of uses for microbes in livestock production. (That's a whole other story.) In addition, scientists will probably find some uses for microbes that can't even be imagined today. It's easy to see why experts are claiming that the new era of ag microbiology is just beginning.



Reprinted with permission, *The Furrow*, John Deere & Co.

Establishing a Disciplinary System FOR Golf Course Maintenance Crews

The performance of any organization is affected by employee acts as trivial as tardiness or as serious as drunkenness or fighting on the job. Often times the problem of discipline is as hard to deal with as it is necessary to face. Your effectiveness as a leader of your organization is determined a great deal by how you handle discipline problems.

Only a fair and consistent system of discipline and dismissal procedures provides a stabilizing force in employee control. Employees must understand that rules are made to be enforced, and that the company is not afraid to fire those who refuse to follow them. Unfortunately, many of us lack a standardized system for dealing with employee behavior problems. A standardized system is particularly needed when dealing with a relatively high turnover work force like we find on most golf courses.

Without a uniform policy for handling discipline problems, there are four problems which usually appear:

PARTIALITY - It is only natural to be more lenient with good workers or ones the manager is friendly with. But the surest way to make behavioral problems worse is to discipline some employees and not others.

INCONSISTENCY - Without guide lines for discipline, consistency of action is impossible. The word soon gets around and leads to further trouble.

USE OF DISCIPLINE FOR PUNISHMENT - The only constructive purpose for discipline is prevention, not punishment. It should be used to prevent the recurrence of behavior problems, not to get revenge. By misdirecting his efforts, a manager can create rather than solve problems.

FAILURE TO TAKE ACTION - Even when discipline is clearly called for, a manager or supervisor may fail to take action:

1. To avoid the unpleasant experience
2. Because he may fear being "tagged" as hard nosed
3. In an attempt to delay action by claiming lack of time
4. Because the employee realizes the offense and will not repeat it.

But, failure to deal with problems promptly often results in implied acceptance or approval of the offense. This will result in increased occurrences and the manager will lose control of one of his most important responsibilities.

MANAGER'S RESPONSIBILITY

It is up to management to create an effective and workable discipline policy. Management must also see to it that discipline is enforced consistently and impartially. By equal enforcement of standards, giving adequate warnings, and allowing warned employees the chance to redeem themselves, the organization can demonstrate that employee discharges are not done as vindictive punishment for past mistakes, but as preventive actions.

DISCIPLINE POLICY

The best approach to discipline is one in which the employee experiences the offense and its resulting discipline as one related event. Punishment is not given for moral reasons, but because a rule has been violated; the discipline is directed at the act, not at the person.

Not all offenses should be treated alike. Offenses fall into three categories according to the appropriate discipline action. The following is a partial list of common offenses to show how they fit into the three categories.

1. Offenses resulting in immediate discharge:
 - * Theft
 - * Fighting
 - * Refusal to Work
 - * Willful destruction of Property
 - * Gross Insubordination
 - * Falsifying time cards
 - * Under influence of drugs
2. Offenses resulting in a written warning with immediate suspension or discharge for a second offense:
 - * Careless or improper use of company property
 - * Sleeping on the job
 - * Two days absence without notice
 - * Failure to comply with an order, rule or regulation
3. Offenses resulting in an oral warning for first offense, a written warning for a second offense, and suspension or discharge for a third offense:
 - * Tardiness
 - * Unauthorized absence from job or work area
 - * Foul or abusive language
 - * Inefficiency, incompetence, or negligence in the performance of duties.

The above list is meant to be suggestive, and each golf course should tailor its disciplinary policy to suit its needs and circumstances. Once the disciplinary policy, guidelines, and action have been determined, they should be

(continued on page 65)

(continued from page 64)
widely posted and publicized.

LEVELS OF DISCIPLINE

There also must be uniform procedures for administering discipline on each of the four levels - oral reprimand, written warning, suspension, and discharge.

THE ORAL REPRIMAND

The most crucial aspect of the oral reprimand is how it is conducted. It must be delivered in private immediately after the infraction has occurred. Any delay could give the impression that the offense was condoned. The atmosphere should be non-punitive and informal, and the offender should be given the chance to tell his side of the story and explain the facts as he sees them. The supervisor should point out the problems that have arisen or will occur as a result of the infraction. A good rule of thumb is to address the offense, rather than the person who committed it.

When the supervisor has compared the facts of the offense with the employee's account of it, he should inform the employee of the resulting decision. This may include any expected improvement in the employee's performance, any assistance the supervisor plans to give the employee in correcting the problem, any penalty to be imposed, and the follow-up action that will be taken.

The supervisor should not be angry, hostile or sarcastic, but must be firm, show concern, and be clear about the response given to the infraction. It must be pointed out that the reprimand is not given because higher management expects it, but because of the employee's obligation to the supervisor and to the organization as a whole.

After the reprimand has been given, the supervisor should make a note for the employee's file of what was discussed and when.

THE WRITTEN WARNING

When a written warning is called for, it should be preceded by an interview similar to the oral reprimand, differing only in that the employee is told at the conclusion of the interview that a written warning is to be issued. The written warning should include a statement of offense, an identification of the rule that was broken, the consequences of continued infractions, any commitment on the employee's part to correct his or her behavior, and any follow-up actions to be taken. The employee should be given the original and asked to sign the personnel file copy. If he or she refuses it, a notation to that effect should be made on the copy.

SUSPENSION

A suspension notice should be issued only after a disciplinary interview has been conducted. For minor infractions, suspension is appropriate only after a record or oral and written warnings has been established. For major infractions, of course, suspension is

warranted without a record of prior offenses.

Suspension is used instead of dismissal when management feels that the employee is sincere about wanting to correct his behavior. It is also used when management feels a dismissal would not be upheld if taken into arbitration.

DISCHARGE

For offenses other than those that call for immediate discharge, management should not resort to dismissal unless all other problem-solving and disciplinary efforts have failed. Once the decision to discharge an employee is made, it is best for him or her to leave as soon as a written notice of dismissal (contains similar information to the written warning) can be prepared and presented to the employee. If the violation is so flagrant that the offender must be discharged on the spot, the written notice can be sent later.

CONCLUSION

An effective, formal discipline system has obvious advantages for management, and even for the disciplined employees themselves. Good employees like to know where they stand, what the rules are, and how the company feels about their performance. They like to know that the disruptive behavior of others will not go uncorrected. They like a just system aimed at prevention rather than punishment.

J.N. DeBra - DeBra Equipment

The above material is not all my original material. It is from notes and articles that I have accumulated. I hope you will find some helpful and thought provoking ideas for your unique situation.

J.N. (Jud) DeBra is Vice-President of DeBra Turf & Industrial Equipment Company and President of DeBra Equipment Company, Incorporated. Jud received a B.A. at Furman University, an M.H.A. at Duke University and has done further graduate business studies at Georgia State University and University of South Florida before joining the DeBra companies in 1968.



Everglades Golf Course Supt's Assn.

5/8/87

On behalf of the membership of the Everglades chapter, allow me to extend a special thank you to all the supplier agencies that donated time and money to the poa annua this year. Without your help we couldn't host such a successful tournament each year!

Thank You,
Guy Redden
Bob Sheeh
Everglades Board of Directors

Agronomic Resources
Almar Chemical Co.
Ameraquatic, Inc.
Andy's Plant Aids
Aquatic Systems
B & W Golf Cars
Central Fla. Turf
DeBra Turf & Ind.
DuCor Chemical
Elanco Products
E.R. Jahna Inds.
Estech Branded

E.Z.Go Textron
Fla. Irrigation
Gator Pumping
Hector Turf Inc.
Lesco Inc.
Lewis Equipment
Liquid AG Syst.
Neff Machinery
New Wesco Inc.
A.M. Scott & Sons
Prince Contracting
Rhone Poulenc
S. Fla. Liqua-Tech

Southern Mill Creek
Sunniland Corp.
Swiftline Trucking
Woodbury Chemical
Bill Branch Chev.
South Seas Plantation
Naples Beach Club
Nutri-Turf Inc.
Van Waters & Rogers
Total Tree Care
Pursley Turf Farms Inc.
Golf Car Carriages Inc.

NEW BOOK DOCUMENTS THE FALLACY OF THE
POLITICAL MYTH OF AGRICULTURAL CHEMICALS
AS CANCER CAUSING AGENTS

Rachel Carson was a dedicated scientist. There was room for little else in her life. During most of her career, she enjoyed an impeccable reputation among her peers.

Toward the end, she "cracked". Turning from fact to doomsday theory, she published *Silent Spring* in the early 1960s. As a result, she died lonely, discredited and forgotten by her colleagues.

But she spawned a "new school" of negativism that continues to gain momentum as it affects the lives of every resident of Planet Earth. Under the umbrella of "environmentalism", such words as contamination, carcinogen and pollution have become everyday expressions in our vocabulary.

New national and state governmental bodies like the Environmental Protection Agency and Occupational Safety and Health Administration drain our tax "contributions". Organizations like the National Institute of Environmental Health Sciences and the National Institute for Occupational Safety and Health provide jobs for persons rejected by the scientific community. Groups like the Audubon Society and Sierra Club have "conned" journalists and gained a platform for "issues" far beyond their ken and "far out" from the worthy purposes for which they were established.

The net result has been an ill-informed and disillusioned public.

Finally, after 20 years of chaos, an all-encompassing synopsis has emerged to help swing the pendulum back to the middle and bring these issues into rational focus.

With the publication this Summer of *The Apocalypitics*, Edith Efron points out the following:

- Most causes of cancer occur naturally. Man-made chemicals and other products contribute very little to this health threat.
- Projections linking cancer in laboratory animals to humans are not scientifically valid. The only way to properly evaluate this is to study man himself.
- By "laying the blame" on pesticides and other chemicals, science has been corrupted, and the public deceived by unqualified politicians who want to regulate business.
- Lazy journalists have perpetuated the myth by not bothering to investigate all sides of the controversy.

In reviewing this monumental compilation for Science, Bruce Ames, chairman of the Department of Biochemistry at the University of California, points out that "the rates for most types of cancer are declining. Only a small

fraction of human cancer appears to be due to occupation or pollution. Since the incidence of carcinogens in the natural world is very high, it is not sensible to try to regulate very low levels of man-made carcinogens.

"We are eating 10,000 times more natural toxic chemicals made in large amounts by plants to keep off insects and other predators than we are of man-made pesticide residues. Thus, the risk from man-made carcinogens is tiny compared to that from natural carcinogens.

"We need some Edith Efrons to remind us that the increased health and wealth that industrial society has brought us has come from not being unreasonably fearful about new technology," Ames concludes.

Carcinogen consultant William Havender adds in *Fortune*, that of the tens of thousands of chemicals produced by modern industry, only 10 can cause cancer in both animals and humans. One (arsenic) is carcinogenic in man, but not in animals. Of those that cause cancer in animals, evidence linking incidence in humans is not clear.

But, "every uncertainty in animal tests is resolved against the chemicals. The deck is deliberately stacked in every way imaginable."

Let's hope this definitive work rocks some complacent boats and helps bring this issue back into a sane perspective. If you can't find a copy in your bookstore, I'll be glad to loan mine. The line forms to the rear.

**DOUGLASS
FERTILIZER, INC.**

... SPECIALIZES IN ...

**DIRECT APPLICATION
OF LIQUID FERTILIZER
SUSPENSIONS AND
FERTIGATION
FORMULATIONS
FOR GOLF COURSES**

**CONTROLLED RELEASE &
SLOW RELEASE NITROGEN
NOW AVAILABLE IN
... LIQUID ...**

CALL 305-322-0443

P.O. BOX 2811
LAKE MARY, FLORIDA 32746

Letters to the Editor

Dear Dan;

I want to impose, and ask you to add 2 more names to the list of guys that receive "The Florida Green." Dan, this publication is 'ONE REAL DANDY.' I look forward to getting it — and when I do receive it, I read it from Cover to Cover.

1. A life long PAL of mine — Floyd Farley, Cathedral Drive #45-55, Sedona, Arizona 86336. Floyd is a past president of the 'Golf Course Architects Society of America.' Done some 70 plus courses out here in the middle west — he has left some Real Great Lay-Outs — 'A True Master at his Profession.' And he can still play golf — at age 79, he is still playing to a 7 handicap at his home club in Sedona, Arizona — he owns an absolute PERFECT GOLF SWING.

2. Please add my son Craig Metz on the mailing list for 'The Florida Green' — Craig is with Tom Fazio the past 3 yrs., doing his major finish work — he is finishing up a job at Vero Beach at present — and then he goes over to the Orlando Area for a couple of jobs that Tom Fazio has going at this time. Do look Craig up if you get in his area

— I would certainly like for him to meet you. Mail Fla. Green to him at — Craig Metz, 17755 Federal Hiway, Jupiter, Fla. 33458. Please send him a copy of this last issue.

Dan — drop me a note — I'd love to hear from you.

With Warm Regards,
Dick

PS — please send copy of this past issue to Floyd Farley.

Dear Sandra:

How exciting to see The Plantation Golf & Country Club on the cover of *Florida Green*. And, of course, this cover was even more exciting because it folded out.

Your story was just as terrific. It was readily apparent that you spent quite a great deal of time with Eddie.

As you know, a community is only as good as its staff. We believe The Plantation has one of the best.

Thank you for all your hard work on the story. We really do appreciate such good coverage. I hope we can work together on another story sometime soon.

Sincerely,

PEARSON, THOMAS/LEVY KING & WHITE

Beth Hardy
Public Relations Account Manager



SUPERIOR TURF CARE PRODUCTS AND SERVICE

SINCE 1923



TOLL FREE
1-800-432-3413

Atlantic-Florida
East Coast Fertilizer & Chemical Co.
P.O. Box 1488 Homestead, Fla.

- Fertilizer
- Pesticides
- Micronutrients



MUIRFIELD VILLAGE GOLF CLUB • DUBLIN, OHIO

These Special Places Rate Special Fertilizers... **PAR EX**[®] Professional Products.

The grass and grounds of these famous places are just as important as the structure or complex itself. That's why knowledgeable turf superintendents insist on specially formulated PAR EX Professional Products.

IBDU releases nitrogen slowly, earlier in the spring, evenly through the summer, and carries nitrogen response later into the fall.

Famous places like the park surrounding the St. Louis Arch, Deere & Company Corporate Headquarters and 53 of the nation's top 100 golf courses* are currently using PAR EX Professional Products. These include Muirfield Village Golf Club, Jack Nicklaus' home course, as well as most of the other courses he has designed.

Shouldn't you consider PAR EX with IBDU for your special place? Contact a PAR EX distributor and let him recommend a PAR EX program just for your grounds.

PAR EX and IBDU are products of Estech, Inc. Professional Products Division, P.O. Box 512, Winter Haven, FL 33882-0512.

*As listed by Golf Digest Magazine



THE GATEWAY ARCH • ST. LOUIS, MISSOURI



DEERE & COMPANY CORPORATE HEADQUARTERS • MOLINE, ILLINOIS

PAR EX[®] with IBDU[®]

PAR EX and IBDU are registered trademarks of Estech, Inc.

