



Repeating occurrence of bermudagrass genetic off-types on a Florida green reduced the putting quality.



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An important safeguard is blind testing, where the scientists do not know the true identities of the material being evaluated

Scientists are still making improvements to this new approach of DNA fingerprinting.

and AP-PCR (arbitrarily primed PCR), both from 1990; another method, DAF (DNA amplification fingerprinting), was introduced in 1991. The main characteristics distinguishing the methods are the length of the primer, the primer concentration, the choice of gel and method of staining for displaying banding patterns. Some methods borrow aspects from other methods.

Scientists are still making improvements to this new approach of DNA fingerprinting. Presently there is no universal standard for PCR profiling. Typically, a particular laboratory uses only one method. Consequently, there are few objective comparisons among methods. The goal of choosing a method is to produce powerful, repeatable results from the same plant materials. So, in adopting a PCR profiling method, it must be shown to work in different laboratories. Internationally, most scientists use an adaptation of RAPDs. During 1994 and 1995, according to a major literature citation service, there were over 350 publications citing the use of RAPDs.

Are there pitfalls?

Yes, several. A comparison is only as good as the sample, and only as good as the standard with which it is compared. If only one sprig was sampled, it might check out to be the expected grass, but the entire remainder of the field could be a contaminant. To be 100% sure, each of the million of sprigs in the field would have to be DNA fingerprinted. If one wanted even 95% certainty that the sprig field source was 95% pure, it would require 59 DNA fingerprints, cumulatively costing about \$20,000 at current prices.

Costs could be reduced by various means. Sample pooling might help sometimes, but excessive pooling would reduce the sensitivity of the test, creating confusion. A thorough look at the genetic makeup of a field of grass is costly beyond imagination, so DNA fingerprinting must be used judiciously. Morphological markers and chromosome counts are less costly, and are therefore the front lines for off-type detection. The hybrid bermudagrasses are all supposed to have 27 chromosomes, while common bermudagrasses (in-

cluding most seedling variants) have 36 chromosomes.

What safeguards are needed?

An important safeguard is blind testing where the scientists do not know the true identities of the material being evaluated. No procedure is 100% reliable, either because of inconsistent chemical reactions, human error or unexplained sources of variation. Another safeguard, mentioned previously, is to effectively repeat a procedure in different laboratories, and get the same results.

Standards are another sensitive issue, because it must be shown that the source standard (either breeder's or foundation stock) is itself consistent. Besides, the same standard should be used every year. There is currently no single national repository for maintaining the source material of released cultivars. At the University of Florida we are carefully maintaining source materials, which we have propagated from a single sprig.

How might DNA fingerprinting provide a research solution?

The first step is to document, through scientific publication, that a problem exists. This has never been done!

Next, DNA fingerprinting, in combination with morphology and chromosomes, should be used to discover the variation among bermudagrass off-types. By systematic procedures, we can test alternate hypotheses for their origin (Table 1). If we judge that off-types occur commonly as spontaneous mutations, then golf course superintendents and greens committees will be so informed.

If recurring mutations are the source of the problem, then they may not be preventable. This is probably not so, however, because there exist 30-year-old greens showing no evidence of off-types.

How might DNA fingerprinting provide a solution for the golf course?

DNA fingerprinting should be considered first as a tool for certification of source material, secondly for the validation of a grower's field and as

DNA fingerprinting can be a helpful tool in certification

a last resort for the golf course. While there is legal rationale for DNA fingerprinting a golf course, this will not correct the source of the problem. Without certification and other quality control efforts, the issue of off-types will continue to be debated and unresolved. The solution is for turfgrass certification inspectors to use chromosome counts, morphology and DNA testing as a routine quality control step, before grass is put on the market.

What can we do meanwhile, before research is completed?

Four things: references, accountability, personal inspection and performance. (1) Request a list of 1-3 year-old plantings from prospective grassing contractors. (2) Request written documentation on where the source grass originated. (3) Personally inspect prospective source fields, hopefully having the opportunity to look at areas where the grass has been mown closely over sev-

eral months. (4) Include appropriate performance specifications in the bid with timelines for inspection of quality and consistency and an appropriate remedy (hence, a performance bond.)

Conclusions

DNA fingerprinting can be a helpful tool in certification, if the technology is powerful and repeatable for bermudagrass off-types. DNA fingerprinting would help ensure the consistency of source plant material and sprig stock, and it can be used with chromosome counts and simple morphology.

It is important to show that the technique really works on bermudagrass off-types, and to document the presence and nature of off-types. This has never been done. We believe it will work. We also believe that it will give us a treasure of practical information on how to maintain the purity of improved bermudagrass.

While there is legal rationale for DNA fingerprinting a golf course, this will not correct the source of the problem

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Table 1.

Examples of hypothetical origin and genetic nature for off-type bermudagrasses. There is not a single instance in which any of these hypotheses has been either proved or disproved. Some suggested explanations are more probable than others.

ORIGIN	GENETIC NATURE		
	MUTATIONS	SEEDLINGS	CONTAMINATION
History of Planting Source;	Spontaneous mutation occurred once in breeder's plots, 35 years ago, and no effort was subsequently made to repropagate from a single sprig;	Bermudagrass seeds blew in from a pasture to the certified sprig field and seedlings were unknowingly propagated;	Sprig grower allowed runners of different cultivars to creep across ditches separating adjacent fields; fields were mown high, and this variation went undetected
Golf Course Construction	Dozer operations caused mechanical stress on underground bermudagrass rhizomes, causing them to mutate into new genetic variations	A little bird flew over the golf course one day, dropping a seed. A few weeks later, the seed germinated, forming a plant which eventually took over the golf course	Fumigant was unable to penetrate deeply enough to kill dormant rhizomes of 'Common,' because a high organic content tied up MeBr near the surface
Planting and Grow-in	An herbicide was used which is known to be a mitotic arrester, thus potentially mutagenic; a combination of chromosome breakages and endopolyploid cells resulted in new genetic variations	'Common' bermudagrass seeds were tracked in from adjacent rough; because soil was primarily bare, these had an opportunity to germinate and become established	Planting crew used the same truck to haul 'Tifdwarf' and 'Tifway' sprigs, without cleaning between loads. 'Tifway' was inadvertently carried over in the lot of 'Tifdwarf.'
Golf Course Operations	Greens were exposed to UV light, which caused turf cells to mutate spontaneously	In a one-in-a-million occurrence, 'Tifway' produced an unreduced gamete, which was fertilized by pollen from 'Common' bermudagrass growing along an adjacent highway	Golfers, golf car tires or mower parts carried seeds or sprigs from rough; cup cutter inadvertently redistributed contaminants

What is DNA?

DNA is the blueprint for all life forms, from animals to plants. As a script tells the actor or actress what part to play, DNA tells the organism what it will be: animal, plant, microbe. DNA differences between two organisms can be small or

large. This explains how siblings can be similar, yet not the same. DNA differences also explain how a virus can produce another virus, and an elephant can produce another elephant. ➤

So DNA is genes?

No, not entirely. Most DNA in plants and animals has no essential purpose in the organism. Most DNA is either repetitive script, or a series of scrambled messages that are no long part of the required genetic script. Sometimes this extra DNA is called *junk DNA*.

How is DNA organized in the cell?

DNA is a linear text, packaged into chromosomes. Because the DNA molecule is a double helix, there are two strands. One strand is the *code*, which tells the cell what to do, and makes you you. The other strand is a *complementary image*. Both strands are copied to produce two new double-stranded molecules. The copying of DNA is an exact process, due to the exact manner by which two strands bind to one another. This exactness is called *complementarity*, and it results because subunits bind only with certain other subunits.

How does the cell read and write the DNA text?

As with any language, there are subunits. The basic subunit for talking the language of DNA is the nucleotide. Although DNA has only four kinds of nucleotides, they can be arranged in a multitude of combinations. A few thousand nucleotides are enough to blueprint an important kind of chemical in the cell, a protein. Different kinds of proteins serve as enzyme catalysts and provide other vital functions in the cell. Since human DNA is composed of a sequence of three billion nucleotides, our DNA text easily blueprints the tens of thousands of enzymes needed to create each of us.

How does knowing the genetic code help identify grasses?

It doesn't. For identifying grasses, the actual function of DNA is pretty much irrelevant. We treat DNA as if it were just like a fingerprint, something for which it doesn't matter if there is a purpose. Some DNA fingerprinting procedures use DNA that is known not to be part of a gene. Why? Because there are lots of those sequences, their degree of repetition can be characteristic of a particular individual, and these sequences show more natural variation than is normally found in essential genes.

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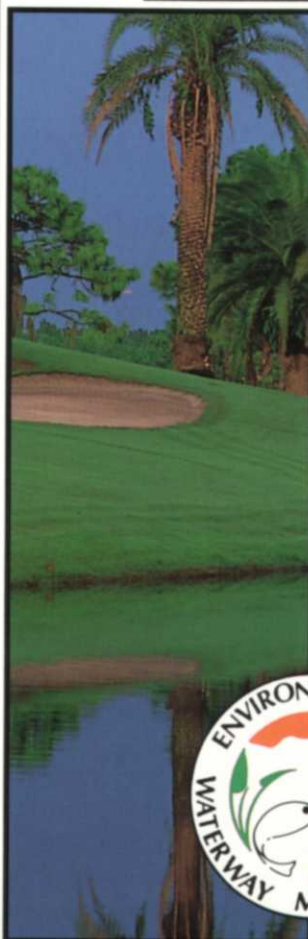


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Where Has Our Loyalty Gone?

In my opinion, 90% of all superintendents are underpaid for what is expected of them

I just finished reading the commentary entitled “Management Groups” written by Greg Plotner. I agree with some of what Greg says in the article. There are some situations where an honorable management group is good and can help struggling clubs. I also agree that there are several fly-by-night management groups that are ruining clubs and our industry for personal financial gains, but that’s a whole other topic. However, there is one comment Greg makes that disturbs me tremendously.

Greg comments that if you work for a management group, you will be asked to operate on a tight budget and do more for less. That part is admirable! Most good superintendents are masters at getting the most from their dollars, no matter what the budget is. Budget cuts are a way of life for most superintendents, and a good superintendent will endure. What angers me is where Greg says you will possibly be expected to work for a wage less than what you consider fair. BS!!

Attitudes like that are tearing apart the foundation and hard work established by all who preceded us in building the credibility of our profession.

The standards of our excellence grows in leaps and bounds every year. Therefore our compensation should also grow. In my opinion, 90% of all superintendents are underpaid for what is expected of them. Working for less than what is considered

fair is starting to and will continue to cheapen our profession. PGA professionals surely don’t undersell themselves — why should we? Certain standards should be set and no member of any superintendents association should settle for less than those standards.

I know what a lot of management group superintendents make. All those supers I know are making about \$20,000 a year less than they should. I find it hard to believe that a management group couldn’t come up with \$20,000 extra a year for the most important person in a golf course operation.

Most of the clubs run by management groups are high-volume clubs. If a club plays 40,000 rounds of golf a year, increasing the greens fee or cart fee 50 cents per round will compensate the superintendent. That is only one way to raise sufficient funds — there are many more.

In my opinion, our loyalties should lie within ourselves and our profession, not with management groups who want a lot for a little.

By selling yourself short you are hurting yourself, all who follow you, and you are ripping apart all the hard work of those who fought for years to improve our image. The demands on superintendents increase yearly. It’s time for all superintendents to take a stand and demand more compensation.

— Mark Hamilton, CGCS

‘Our loyalties should lie within ourselves and our profession, not with management groups who want a lot for a little’

Greg's response: Supers aren't clones

Dear Mike,

There are several points that you make reference to that I would like to comment on.

First of all, the statement which I made about working for a wage that is less than what that person might consider fair, is the same statement you make about supers making \$20,000 a year less than they should.

Most superintendents are indeed, as you said, *underpaid*. That is what my statement is saying but in a different context. If it says anything different, I didn't intend for it to.

Another point you bring up is that loyalties should lie within ourselves and

'From what I've seen over the years, being outspoken about wages doesn't usually get one anywhere other than terminated from employment'

our profession, which I totally agree with. You continue by making the comment, "Don't sell yourself short."

This is also true, but what does one do when in a position of working for a wage less than he or she considers fair? Does that person abandon ship and go to the unemployment office?

Most supers I know will continue with that job until a new one arises or changes within that job are made. From what I've seen over the years, being outspoken about wages doesn't usually get one anywhere other than terminated from employment.

A third point you make states that certain standards should be set (which I assume have to do with wages), and that no superintendent should settle for less than those standards. Bravo! Some might agree, but I don't! Just as all jobs have different salary demands, so do most superintendents. It's the American way!

There are many reasons why salary

structures are so different and many reasons why all job descriptions are so different. Supers aren't clones, and I think it's great that each of us has our own unique methods of bringing about positive results within our own operations.

Those methods determine one's place of employment and salary. If it happens

to be employment at a management owned and/or operated facility, then it may be at a wage that is comparable to other clubs within its web. Or, it may be at a wage less than what that person considers fair, then who's responsibility is it to change it? End of story!

— Greg Plotner, CGCS

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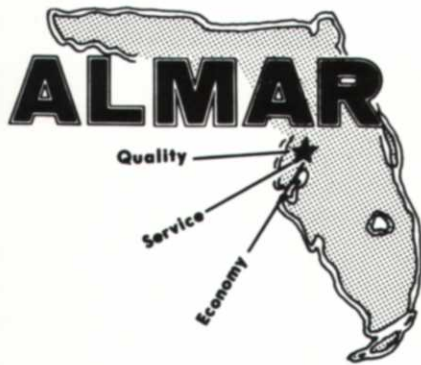
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Superintendent's Top Ten Causes of Stress

BY TOM HILFERTY, SUNCOAST GCSA

- (10) Owner wants you to hire nephew, who is going to school to become a superintendent.
- (9) Spray tech thinks calibration works best by trial and error.
- (8) Mechanic believes three different cutting heights is the best way to get that striped look.
- (7) Greens chairman enters you in big weed growing contest.
- (6) Weekend crew turns out to be you!
- (5) Your only friends are salespeople.
- (4) "Top Man" mows 45 acres of rough with mower in backlap.
- (3) High kryptonite levels in soil samples have you feeling run down.
(Sorry! That's Superman Stresses!)
- (2) Most of your membership are big Paul Harvey fans.
- (1) Last entry in missing spray tech's log is "Round-up greens. ha-ha-ha."

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Brooke Tymeson, left, with Dr. Max Brown

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Fairness –

From the WGCSA *Grass Roots*

BY MIKE SEMLER

There are occasions when I get a sense of being completely helpless. This feeling always seems to come in the middle of the summer during hot and dry spells. It starts with one small occurrence and then steamrolls in an entire series of events that finally culminate in one major ordeal.

The latest ordeal started about two weeks ago when a normally reliable pin setter decided to break the monotony by setting the pin in number 18 green on the top of a mound. The pin placement was clearly an unfair setting for the golfers. But this fine young person decided to put it there anyway.

You can imagine the uproar that followed because of the principles which were broken that morning. My guidelines on pin placement dictate that all locations should be fair for the golfer. This one clearly was not!

A few mornings later, in a matter of minutes after leaving the building, all of the equipment was back in the maintenance facility for needed repairs. Normally, we would have dealt with this in a cool, calm manner. However, this morning was our first shotgun start, and speed was of the essence.

“Unbelievable,” I thought, “how every piece can leave in perfect working order, and return in such a short time for needed repairs.” I must have walked under a stepladder that morning.

The final straw came a few days later on a rainy morning, when I decided it was time to clean out some old files.

Included in this assortment were some past newspaper and magazine articles that I kept because something in them caught my attention and I figured I could use them later. Two of these articles pertained to two new courses that were on the verge of opening to play for the first time. Included in the articles were lengthy comments about the staff additions made to the clubs, namely the golf professional and the clubhouse manager.

The articles gave very pleasant histories of these gentlemen and the positions they had previously held. Overall, they were very well-written articles. Except for one thing. The authors forgot to mention one very key element in these golf course operations — the golf course superintendent! Shame on the authors for forgetting one of the most important people at any golf club.

The two superintendents at these two clubs had every right to be angry because, once again, they were left out of the limelight. Their names did not appear in print, and they received absolutely no recognition for the hard work they had done in the establishment of these golf courses. Most of that work had been completed before the golf pro or clubhouse

The authors forgot to mention one very key element in these golf course operations — the golf course superintendent!