WHAT DID THAT PROFESSOR SAY?
Statistics made easy

We are surrounded by numbers every day. You may not realize it, but statistics plays a large role in our daily lives as well. Weather forecasting takes numbers and makes predictions about the weather based on weather models. Disease models for predicting turfgrass diseases do a similar service. Based on numbers related to temperature, humidity and leaf wetness, these models can forecast the startup of a turfgrass disease. We know that pest control products are tested for their effectiveness to control pests. Statistics are behind every medical study and batting average you hear about. Soon we will be bombarded with those political voter polls.

Statistics are sets of mathematical equations that are used to analyze what is happening in the world around us. It is a science of decision making. It is a science of "chance" or "probability." It is the science of collecting, organizing, and interpreting data whether it is numerical or non-numerical. We live in an information and technological age where we have everything at our finger tips. H.G. Wells, the father of science fiction, predicted that statistical thinking would be as necessary for daily living as reading and writing. Statistics may seem intimidating at first, but it is not once you develop a clear understanding of this simple subject.

BASIC UNDERSTANDING OF TERMS

Before we start, a discussion and understanding of some basic terms are needed. *Descriptive statistics*[are used to describe sets of numbers such as plants heights achieved due to applications of fertilizers. Researchers can organize these numbers into tables and graphs called *requency distributions* (the frequency a number may occur due to a factor involved). The following data set illustrates measurements of plant heights in centimeters after a fertilizer application). We will use this data to help us define some terms.

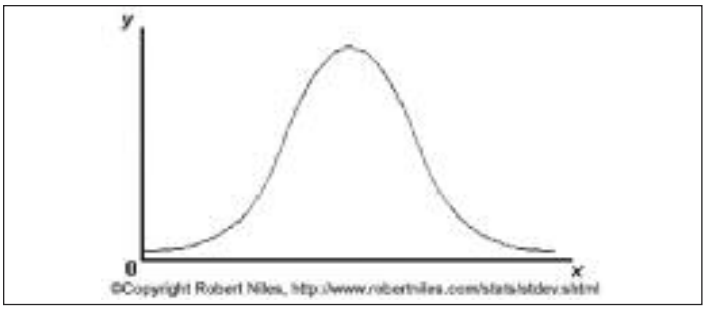
Plant Heights (cm) due to Fertilizer Applications				
10	14	11	12	15
15	12	13	14	13
12	8	12	9	10
13	11	12	8	10
9	16	7	11	9

As we look that this simple data set, we can determine a **median**, a **mean**, and **a standard deviation**. The median is the measurement that lies in the middle of the data, at the 50th percentile. In this example, it is 12 (range is 7-16). At times, it is better to express the median rather than the average (also known as the mean, see below), especially if the data contains outliers. The median could be a better indicator of true center especially when NBA salaries are being discussed.

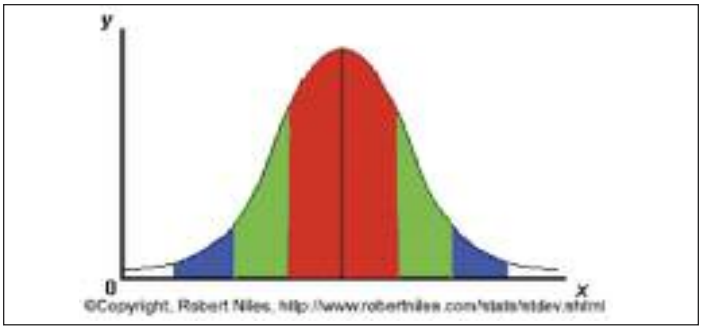
Plant Height (cm)	Frequency	Percent	Percentile
7	1	4	4
8	2	8	12
9	3	12	24
10	3	12	36
11	3	12	48
12	5	20	68
13	3	12	80
14	2	8	88
15	2	8	96
16	1	4	100
Totals	**25**	**100**	

The mean is simply the average (plant height x frequency observations = 286 cm / 25 frequency observations = 11.44 cm) for the data set. The standard deviation (SD = 2.38) indicates the average difference individual data varies from the mean; how concentrated the data are around the mean. So why is this important? Without standard deviation, you cannot get a feel for how close the data are to the mean or whether the data are spread out over a wide range. Without standard deviation, you cannot compare two data sets effectively. Two data sets can have the same mean, but vary greatly in the concentration of data around the mean; therefore different standard deviations.

The **distribution** of a data set can be a graph of all values and their frequency of occurrence. One of the most common distributions is called the normal distribution or *bell-shaped curve*displaying numerical data in a symmetrical curve.



The center of the bell is the mean and most of the data is usually centered on the mean.



The red area represents this data and one standard deviation +/- from the mean, 68% of the data (34% on either side of the average). The green area represents two standard deviations +/- from the mean or 95% of the data (red plus green) under the curve. The blue area then represents three deviations +/- from the mean or 99% of the data. Since every set of data has a different mean and standard deviation, an infinite number of normal distribution curves exist.

Confidence intervals (CI), usually set by the researcher, establish a level of confidence or reliability to an end result based on some treatment perhaps to a human being or plant in repeatable trials. The CI is represented by a percentage, so when we say, "we are 95% confident that the result of this herbicide application will provide 98% control of dandelion," we express that 95% of the observations will hold true. In practice, confidence intervals are typically stated at the 95% confidence level. However, they can be shown at several confidence levels like, 68%, 95%, and 99%. When a research trial is conducted, the confidence level is the complement of the respective level of significance, i.e. a 95% confidence interval reflects a significance level of 0.05, referred to as alpha (α). The level of confidence is often dependent on the number of observations with more observations yielding a higher level of confidence.

When data is collected, researchers typically look for something unusual or out of the ordinary and often ask if this is significantly different from a norm. Will it or does this happen with a very small probability of happening just by chance? **Least Significant Difference** (LSD) is a measure of significance usually with a level of significance (α= 0.05) denoted as $LSD_{\alpha= 0.05}$=0.05 or $LSD_{0.05}$. We will revisit the use of this term when we show an example of a data table and bar graph.

EXPERIMENTAL DESIGNS

How an experiment is designed can make the difference between the collection of good data and bad data. The objective of experiments is to make comparisons of *treatments* that will support a thought or hypothesis about an area of interest. Treatments can include the applications of fertilizers or pesticides, the incorporation of a cultural practice or the evaluation of disease resistant turfgrass cultivars or combinations thereof. While comparisons of treatments are important, so are comparisons to an untreated control to determine the true effects of each treatment if nothing was being applied. The untreated control establishes a baseline for comparison. Collecting good data and then applying the proper data analysis is important for drawing or making appropriate conclusions about the experiment.

In experimental designs, data (measurements/observations) are usually subject to various, uncertain external factors. Treatments and full experiments are usually repeated, *replications*, to help identify any sources of variation, to better estimate the true effects of the treatments thereby strengthening the reliability and validity of the experiment. Statistically, replications help to reduce experimental error due to unknown or uncontrollable factors (i.e. variations in soils). Replicating treatments within an experiment is as important as repeating entire experiments to see if results can be repeated with confidence. **Randomization** is also an important component to experimental design. One way to minimize bias in an experiment is to randomize treatments. This will become clearer as we look at some experimental designs.

Two common experimental designs that you may hear of in a seminar or conference presentation are illustrated below.

Complete Randomized Block Designs are one of the simplest, most common experimental designs for field trials. Here, you may be looking at the effects of one type of treatment, i.e. herbicide effectiveness. Treatments can be replicated three, four or more times dependent on the type of trial it is. Disease trials tend to have more replications due to the high variability among treatments from replication to replication. Treatments also remain in single blocks.

Complete Randomized Block Design							
Replicate 1	7	4	6	1	3	5	2
Replicate 2	6	4	1	7	5	3	2
Replicate 3	5	7	2	3	1	4	6

You will note that seven treatments are completely randomized in each of three replications or blocks. The treatment numbers can correspond to a treatment list.

Treatment No.	Treatments
1	Untreated control
2	Herbicide A, Rate 1
3	Herbicide A, Rate 2
4	Herbicide B, Rate 1
5	Herbicide B, Rate 2
6	Herbicide C, Rate 1
7	Herbicide C, Rate 2

Again, it is the randomness of the treatments that will eliminate bias of plot location within each block along with replicating the treatments that will help to increase reliability of the data.

Split Plot Designs are a special experimental design when several factors are being evaluated or some constraint (i.e. turfgrass species) prevents you from using a complete randomized block design. A variable could be the application of fungicides to test disease control on these specific turfgrass species. The diagram above demonstrates a split plot design.

Split Plot Design

Replicate 1	A 5	A 2	A 1	A 4	A 3	B 1	B 3	B 5	B 4	B 2
Replicate 2	B 3	B 5	B 1	B 2	B 4	A 4	A 3	A 2	A 1	A 5
Replicate 3	A 4	A 3	A 5	A 1	A 2	B 2	B 1	B 3	B 5	B 4

In many cases you need to fit the experiment into existing resources, like an established stand of grass. You will note that blocks A and B (i.e. two turfgrass species) are planted in blocks as a constraint of the experimental design, but are randomized within each replication. Within each replication, fungicide treatments are then randomized within each species. Treatment 1 may correspond to an untreated control, while treatments 2 through 5 may correspond to four different fungicides.

Additional experimental designs are available dependent on the number of factors being looked at; however, the more factors (i.e. species, fertilizers, pesticides, cultural practices, etc.), the more difficult it is to analyze, make comparisons, and draw conclusions.

ANALYZING THE DATA

After all the data has been collected, the choice of analysis is just as important as the experimental design. This is often considered the black box of statistics. The wrong analysis can lead to wrong conclusions. Researchers need to ask themselves this, "Will I be able to legitimately and correctly answer the questions that I set out to answer after the data has been analyzed?" **Regression and Correlation** can be used to test a cause and effect relationship and how well that relationship is correlated. An **Analysis of Variance** (ANOVA) can be used to test the effectiveness of one product to another and how well that data may fit a regression line.

Regression is all about relationships answering questions like, "Does nitrogen fertilizer cause turfgrasses to grow taller?" Here we can relate two variables like fertility and growth and understand that we may observe a positive slope on a graph—turfgrasses will grow taller with increasing rates of nitrogen

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THE PRICE IS RIGHT:
Chad's certifications make him an industry leader

Sports fields are a hot commodity and the construction industry that creates and maintains them is as competitive as the sports that play out on them. So when your livelihood depends on building and maintaining those fields, doesn't it makes sense to learn everything you can?

Chad Price thinks so. As the owner of Carolina Green Corp., a full-service athletic field construction company in Indian Trail, NC, Price is a strong advocate of remaining informed about the ever-evolving sports facility industry.

▲ **Chad Price,** CSFM, CFB

"A lot of things have continued to improve," Price noted. "The equipment, the science behind it, the education for, the training for it, even the associations for it. It just keeps changing."

Price has made staying current on technology and techniques his priority, to the point where he holds not one but two certifications related to the sports field industry: Certified Sports Field Manager (CSFM) obtained through the Sports Turf Managers Association, and Certified Field Builder (CFB), from the American Sports Builders Association.

While the two certifications differ in focus, both have prerequisites, including in-the-field experience as well as educational and activity requirements. Once all those are satisfied, each certification includes a written exam.

Price, who maintains both certifications, said he is glad to have gotten them—and that they continue to reap rewards for him.

"Both certifications have been very helpful professionally and personally as well," he notes. "I will say this about both tests; the material is different, there is a different emphasis on things for each, but both are very fair and thorough examinations."

The ASBA's Certified Field Builder program includes several options; builders can elect to gain certification as CFB-N (Certified Field Builder-Natural) indicating knowledge of natural grass fields, or CFB-S (Certified Field Builder-Synthetic), for those who concentrate on artificial turf. The CFB designation indicates a knowledge of both types of field.

In Price's opinion, while the ability to market his work is enhanced by the dual certifications, the increased benefit is to his customers, as well as other buyers, who can finally feel confident about finding an expert.

"It gives us the ability to give assurance to the owner that they will have people out there who know what they're doing. I'm just really happy and excited and thankful that STMA and ASBA offers these."

Price gained his CSFM certification approximately 10 years ago. He was delighted to see it offered in a still-developing industry.

"I've been in business maybe 27 years, and building fields exclusively for about 23 years. When I started, there was no construction manual; in fact, there was very little written information at all about how to do this or how to do that. There were very few contractors that specialized in it around the country."

Colleagues would share information, he noted, but "everyone was trying to learn from one another. I got the CSFM first; it was maybe the second or third year it was offered."

It wasn't until a number of years later that he heard rumblings about ASBA's plans to offer its own certification test, this one for field builders.

"Once I heard the CFB test had become available, I absolutely wanted to be the first one in that room."

The industry had grown, he noted, and a test was sorely needed to help owners find knowledgeable help.

"At the time, there were architects who knew how important it would be to have a qualified contractor, and how much we needed a pre-qualification requirement if someone wanted to bid on a job."

Owners, he noted, were not getting fair bids, since many contractors simply did not know all the facts about sports fields, whether synthetic or natural.

"You'd be competing for a job against someone who

thought you could go to the site and put stone down and grade it and put turf down and there you go. It's certainly not that simple. We were all hitting our heads against the same issues."

Badly built sports fields fail, and owners often did not have the funds to correct the myriad problems they were faced with. Price was glad to see a certification that would finally provide a benchmark.

"I think the certifications certainly hold a lot of weight," said Price. "More and more people are incorporating that into their specifications. Obviously it helps me when we see it on requirements."

The science of sports turf is growing overall. More universities are offering sports turf programs, and those programs are being expanded to cover not just golf (for which some were originally designed) but the plethora of other sports played.

"It's an exciting time," said Price. "I really feel like we're on the cusp of all that."

Certifications such as CFB and CSFM are not granted in perpetuity; those who hold them must maintain them on a regular basis by accruing educational and activity points.

"There's no question in my mind; if you can pass that test, without question you are qualified," said Price. "You have the knowledge."

It's not just personal opinion, either. In a 2008 decision by the Attorney General of Massachusetts, the AG upheld the right of a local school district to restrict bidding for a running track project to companies employing an ASBA Certified Track Builder. In defending its bidding restriction, the school district successfully argued it had encountered serious problems regarding the workmanship in prior track installations justifying the use of the certification requirement as a means of identifying qualified contractors. (It is also worth noting that the Massachusetts Attorney General Office supported a town's right to include minimum contractor experience clauses in bidding documents as long as they were reasonable).

Price is not surprised about the growing demand for certification and he is glad to see it. "I'd say certifications definitely sets us apart from other companies. It's good that there is a standard."

Note: Information on the Certified Sports Field Manager exam is available from STMA (http://www.stma.org/). Information on the Certified Field Builder exam is available from ASBA (http://www.sportsbuilders.org/) ■

Mary Helen Sprecher is a free lance writer who wrote this article on behalf of the American Sports Builders Association. ASBA is a non-profit association helping designers, builders, owners, operators and users understand quality athletic facility construction. ASBA publishes Sports Fields: A Construction and Maintenance Manual*, a comprehensive guide to the design, construction and maintenance of sports fields. The book is available for purchase either in hard copy or in electronic form. Information is available at www.sportsbuilders.org.*

▼ **Mid-season** turf replacement at Washington's FedEx Field using Carolina Green Corp.'s sod grown on plastic.

SUPER BOWL GROUNDSKEEPING CREW BEATS OUTDOOR CONDITIONS

▲ **Snow at MetLife Stadium** in East Rutherford, NJ before the Super Bowl.

In an otherwise empty MetLife Stadium near midnight on February 2, several t-shirt wearing, helmetless Seattle Seahawks players and their loved ones raced joyfully along the sidelines, reveling in the team's 43–8 demolition of the Denver Broncos in Super Bowl XLVIII.

The celebratory confetti dotting the green field would have looked just an hour earlier like unseemly dandruff needing to be promptly scraped off for marring the playing surface's otherwise handsome mien.

For the approximately 30 groundskeepers who'd lovingly tended the pasture over the previous weeks, its pristine condition for the game was a source of pride—all the more so, given concerns over this being the first Super Bowl scheduled for an outdoor, cold-weather venue.

But the unseasonably warm day that produced an evening temperature of 49 degrees at kickoff did little to diminish the crew's satisfaction at having readied the turf for winter's worst.

Among most groundskeepers' first tasks upon arriving in New Jersey in mid-January was unloading snow plows and snow-blowing and -clearing machines from several tractor-trailers packed with equipment to prepare the stadium's field, as well as those at the Jets' and Giants' prac-

tice facilities, where the two Super Bowl teams trained for what routinely is television's most-watched American sporting event.

Regardless of the climate, the crew was composed, as it normally is, of groundskeepers who've been on Super Bowl duty for many years and even decades and who, much like the athletes, are team players.

They included men and women recruited from the National Football League, Major League Baseball, college football, an Alabama turf farm, The Toro Company, and even two professionals from Japan and an Iowa State University senior majoring in horticulture.

"The Seahawks won the game, but the crew members, in my book, were also Super Bowl champions," said George Toma, who knows of what he speaks, having now worked every Super Bowl since the inaugural one in 1967.

Toma is retired from a long, full-time groundskeeping career, primarily with the Kansas City Royals. But he's drawn back to the turf for baseball's spring training and such highlight events as the Super Bowl, whose crew he once supervised. That job now belongs to Ed Mangan of the Atlanta Braves.

▲ **Left:** Lee Keller, University of Vermont, painting an end zone. **Right:** Terry Lee, George Toma, Gerald Anderson, & Randy Baker in frigid New Jersey.

"This year was probably the most challenging [Super Bowl] on so many fronts, and they did an unbelievable job maintaining that field and getting it to perform the way it did," said NFL director of event operations Eric Finkelstein.

The league, he explained, selects crew members who are "the best of the best."

While it's the biggest of the big games, the Super Bowl has company at the NFL's summit. Other important dates drawing the cream of the league's landscaping crop include the annual Pro Bowl exhibition and the regular-season contests played overseas. For 2013, that meant two games in London's Wembley Stadium; three are scheduled there for 2014.

Absent conflicts with their full-time jobs, most Super Bowl crew members work those special NFL dates, too.

Everyone must be a jack-of-all-trades, doing "a little bit of everything" to help whip the sites into shape, said Lee Keller, the University of Vermont's athletic turf manager for whom New Jersey was his 15th Super Bowl.

For the Super Bowl, that means, primarily, tending to the turf throughout the weeks of preparation, along with a heavy dose of painting: of the yard-lines and their numerical designations; team names; and NFL, AFC, NFC and Super Bowl trophy logos.

Getting it all done involves emptying much of the warehouse where the equipment is stored for shipment to the Super Bowl site. The items include standard gardening and carpentry tools, like rakes, shovels, brooms and drills; machines, such as motorized carts and sod cutters, and even end zone and sideline pylons.

The artistic-design side requires an abundance of supplies, too, such as multiple 5-gallon pails of specialized field paint, rails, boards to mark the lines, stencils of the numerals and hash marks, and turbine blowers to dry paint. Painting the teams' names and the conferences' logos in the end zones means having four stencils on-site, not two, since the shipment typically reaches the Super Bowl venue before the AFC and NFC championship games.

The frigid temperatures and snow in the days leading up to the Broncos-Seahawks matchup necessitated unusual measures. Heated tents were put up to prevent the paint from freezing as it was being applied. The Saturday night before Sunday's game, the artificial turf field was covered and heat blown under the tarpaulin to assure excellent on-field conditions.

The planning began as far back as last year's Super Bowl in New Orleans's weather-neutral Superdome, several groundskeepers said.

The preparations also included such micro issues as preparing the supply list, since departing and re-entering the game and practice sites involves security-related, hours-wasting delays.

"To leave the stadium to get a gallon of paint striper, paint rollers or sandpaper takes so much time, so we bring a lot of that stuff with us. If we need 'em, we got 'em," Keller said.

Getting the field ready is complicated by other Super Bowl-specific schedules. While sports' great appeal lies in its unscripted nature, so much about the Big Game's sidelights is choreographed. The pre-game, half-time and post-game shows are the products of rehearsals—not just of the musical performances, but also to swiftly erect and deconstruct the television, trophy-presentation and concert stages.

Sometimes, faux fields for that purpose are painted with precision in the host park's parking lots. At MetLife Stadium, that wasn't the case, so the field guardians had to work cooperatively with the entertainment and television producers.

When rehearsals ended, the groundskeeping staff put their powerful vacuums and magnets to work, scooping up such debris as errant nuts, bolts, paper clips and safety pins to prevent injuries and unsightly litter. That routine also is followed in-game.

In New Jersey, "there were probably more rehearsals" than at other Super Bowls, said Arizona State University's facility manager, Pete Wozniak, who would know, having now worked 19 Super Bowls. But the other crews, he added, "work well with us," including by taking care to stay off the freshly painted logos during rehearsals and on game day.

Another member of this year's grounds crew, Josh Lenz, is now just 18 Super Bowls behind Wozniak. From a national pool of 62 applicants from 40 colleges, the Iowa State student was selected by Toro and the NFL to work the game on the basis of an essay-writing contest on why the profession appeals to him.

The week-long Super Bowl internship program is an effective way to cultivate the next generation of talent, said Toro's sports fields and grounds sales manager, Dale Getz, CSFM.

From the moment he reached New Jersey the Sunday preceding the Super Bowl, his turf-management professors were plenty understanding of his absences from class, he said, Lenz kept busy handling whatever tasks he was assigned at the practice and game-day fields. He spent one day doing only snow removal, another primarily painting.

And he took smart advantage of the continuous networking opportunities.

"I tried to interact with as many [professional groundskeepers] as I could during the week. It was really cool to meet George Toma."

George, it turned out, wasn't the only Toma on duty. His son, Ryan, took time off from his job as an airline pilot to lend a hand, too.

As they departed the stadium hours after the game and after all the post-Super Bowl packing and clean-up was done before the snowstorm due Monday morning, the Tomas smiled.

For while Ryan's dad now has a 48-year Super Bowl streak going, XLVIII marked a first for George, since none of the previous 47 had been played on a Feb. 2.

On the enormous, end zone scoreboards appeared the elder Toma's likeness, along with the message, "Happy 85th Birthday, George."

Despite the first outdoor, cold-weather Super Bowl's failure to produce a single snowflake or hint of wintry pigskin magic, it was, for Toma and his colleagues, a singular experience. ■

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SEWING SYNTHETIC FIELDS V. GLUING

Editor's note: *The author is CEO of Turf Sewing Machines.*

I know what you're all thinking: here comes the most biased article I've ever read. As much as I'd like to put on my sewing pompoms, I'll go against my better judgment and remain mostly unbiased. For years I have heard the questions about sewing vs. gluing—which is better? Which lasts longer? Which is easier? Which is more cost effective? The fact is both are effective and both have their advantages.

WHY ARE GLUED SEAMS BETTER?

- Gluing is widely considered easier and I surely agree. See that, glue guys? I'm not so bad.
- The need for skilled, technically proficient labor is not required. This is an enormous advantage for crews that travel state-to-state or nationwide. Why? You can easily pickup unskilled labor anywhere you land. Finding and affording skilled labor is often an arduous task. Not to mention, you have to pay for their hotel, airfare, food, and expenses. Hey, that adds up.
- Glue doesn't need a technician or service station. By employing glue you don't have to contend with a sewing machine malfunction half way down a seam.

WHY ARE SEWN SEAMS BETTER?

Sewn fields cost exponentially less. Let's compare apples to apples in a cost analysis. Say Crew A, which sews, and Crew B, which glues, both install 10 full fields a year for 10 years. Crew A will make an initial $20,000 investment for two cart-style sewing machines; including repair maintenance and supplies, two cart sewing machines will cost you roughly $40-50,000 over the course of 10 years. Crew B will purchase glue for every field they sew. To glue a full field (with quality glue) it will cost approximately $15-20,000 per field. Let's go on the low side and call it $15,000 per field. A gluing operation over 10 years will therefore cost $1,500,000. Crew A will have spent $50,000. Double-check me, because I almost don't believe it. Tack another $300,000 in skilled labor for the sewing crew and sewing still saves you well over a million dollars.

Sewing fields can be performed year round; you don't have to worry about glue expanding/contracting in extreme temperatures. In addition, you don't have to waste a full day waiting for a field to cure. Crews can immediately work/walk/drive over a sewn seam.

If you are waiting for that biased "sewn seams last longer" comment, I won't go there. I'm just going with facts here.

Just to further prove I'm an equal opportunity, non-biased guy, my advice is, if you're going to glue go with the best product. ■

One installer's perspective

"Like everyone we glue and we sew. We've glued entire fields in the past, and we have also sewn entire fields and all combinations in between (inlays). From a skill set, we believe it is easier to glue full panels vs. sew. There are pros and cons to both but if you truly look at the bottom line over time, the sewn seam has proven to us to be a better product. Classic example is an all-green field with sewn seams from sideline curb to sideline curb; we have had almost no call backs to repair a seam. We've kept track of almost every repair from the fields we've installed since 2000 (about 45 million sq/ft) and about 95% of redo's and repairs are of glued seams.

Gluing full panels is surely trending up which may be a reaction to the tighter stitch gauges, underlayments and lighter infill weights being used. From our experience, the sewn seam has lasted longer than the average glued seam and has less call backs for post install care."-John Huard Jr., vice president, Northeast Turf

HOW SPORTS TURF SAVED A LIFE

For 28-year-old Craig Sampsell working in the sports turf industry has been his passion as long as he can remember. From youth sports to the professional ranks, he has manicured athletic fields of all shapes and sizes. But the path has been anything but straight and narrow.

Growing up near Indianapolis, Craig was quickly drawn to turf management through his father, who owned a sports field construction and renovation company called Diamond Designs. Before Craig could drive a car, he would accompany his dad and uncle to projects around the state to lend a helping hand. While most kids were competing on these fields, Craig was learning about proper safety and field preparation techniques.

His love affair with natural grass turned serious at 16, when he dropped out of high school to work full-time for Diamond Designs. Three years later, the company folded and, in early 2003, Craig and his dad were without jobs.

▲ **Louisville Slugger Field**. Photo by Mike Stewart.

Fortunately, their sports turf expertise was quickly acknowledged by Carmel Dads' Club, a 100-plus acre sports complex near Indiana's Clay County. Dad and son were hired full-time in August 2003 and spent countless hours together mowing, aerating, edging, overseeding and topdressing. As things just started to feel normal again, the family would suffer an even larger tragedy.

In January 2004, Craig's mom took her own life. Racked with grief, he began to head down a very dark road. For the next few years, he was uncertain of his purpose on earth. He didn't have a high school degree or any direction to follow. Craig gained significant weight and began smoking to deal with the stress. Regardless of the tough times, his appetite for sports turf never faded and he tried to stay focused on his work at Carmel Dad's Club.

Finally, Craig's luck began to turn. In January 2006, just 2 years after his mother's passing, he met his future wife, Caroline. She immediately started guiding him back to a better track and questioned why he hadn't pursued his GED. Craig didn't have an answer and, to be honest, he didn't have an answer for most questions in life.

With Caroline's persistence, Craig was a high school graduate by August 2006 with an Honors GED and, soon after, enrolled at Indiana University-Purdue University of Indianapolis (IUPUI) to study sports management.

To learn more about his specific trade, Craig became a member of the Sports Turf Managers Association (STMA) and conducted extensive research online. He reached out to other sports

Throughout his journey, Craig has numerous people to thank for their support and confidence that he would, one day, succeed. He's been so impressed with the STMA and how the organization has always emphasized the importance of acting like a professional and doing the job right.

◀ **Craig Sampsell**

turf managers via e-mail, phone and social media to try new techniques in hopes of improving the fields he was managing. The response was overwhelming and members from far and wide shared best practices with Craig.

His skills in sports turf management, especially baseball, improved and were slowly being noticed by others in the industry. Long-time STMA member Tom Nielsen took a particular liking to Craig's kind personality and tireless work ethic. In May 2010, he hired Craig to work for the Louisville Bats' turf crew, the Triple-A minor league affiliate of the Cincinnati Reds.

Craig and his wife packed their bags and headed south to follow his dream of one day helping to manage a professional baseball field. Once Craig got settled into his new position, Tom took a deeper interest in his lifestyle, helping him quit smoking and lose more than 70 pounds. By August 2010, Craig had transferred to the University of Louisville to continue his sports management degree while working full-time for the Bats.

Craig and Caroline wed on July 24, 2012. This past December, Craig graduated from the University of Louisville and was hired as the Bats' assistant groundskeeper February 1, 2014.

Throughout his journey, Craig has numerous people to thank for their support and confidence that he would, one day, succeed. He's been so impressed with the STMA and how the organization has always emphasized the importance of acting like a professional and doing the job right.

After receiving the new job offer from the Bats, Craig's family urged him to take time for himself and relax. While a few days to catch his breath was nice, it also have him an opportunity to reflect on the sports turf managers he had connected with along the way, and how they had been so instrumental in his career ascension.

The more he thought about it, the more people he realized he needed to acknowledge personally. In mid-January, Craig attended his first STMA Conference & Exhibition in San Antonio. It was the perfect opportunity to reconnect with friends and colleagues, while also thanking those whom he had never met but had spoken with online over the years.

On April 10, the Louisville Bats open the 2014 campaign versus the Columbus Clippers. Craig and the turf crew are putting in long hours before the first pitch at Louisville Slugger Field to make sure fans and players are greeted with a top-notch field. Every blade of grass and speck of dirt will be treated with care. It's something Craig has taken pride in his entire life and April 10 is no different. ■

Glenn Gray is with Buffalo Communications, the public relations agency for the Sports Turf Managers Association, @glenncgray on Twitter.

Student's senior project is a "DIAMOND IN THE ROUGH"

▲ **The Freedom High School** baseball team with a bat Steve Peeler, CSFM, won at an STMA SAFE Foundation auction.

In September 2013, Landon Kincaid had a dream when he set out to complete the senior high school project that is required for graduation in North Carolina; he wanted it to be unique. Landon found his first love in life, baseball, at a very young age. His dedication to the game is superior to a normal high school player and his work ethic is unstoppable. He is also a team player and he wanted to do something that would not only help keep his love of the game alive, but would also help his teammates and others for years to come at Freedom High School, Morganton, NC.

Rebuilding a baseball infield is not an easy task. It takes funding, time, and expertise to get it done the right way. But even facing these challenging obstacles, Landon was determined to make it happen. A plan was developed to raise funds and to bring his project to a reality, and through community support, professional mentoring, and a lot of determination, he reached his goal.

At the beginning of the project, the field was overgrown with no defined shape. The windscreen to cover the chain link fencing was in shreds, dugouts had been in disarray since a massive flood in 2010 when the entire field had been under 6 feet of water for days. Once the water had subsided, the field was totally covered with fine silt from the river which runs directly behind the outfield. To top that off, all of the equipment had been stolen 2 years after the flood and the team had very limited funding to

◀ **Landon Kincaid**

Landon got the ball that night to pitch on his newly renovated mound and he performed well, pitching five solid innings and getting the win.





replace it. Fencing and all other structures had damage 3 years after the flood.

Landon approached his coach, Clint Zimmerman, and I to gauge our interest in his project; Clint and I are both former players of the program. We both agreed immediately to assist him in his quest as professional mentors and a plan was designed to address the key factors on the field.

First on the agenda were the most important areas on the field: the pitching mound and the infield. Lips had formed over the years of play and the turf had grown in as much as 4 feet in some areas. The back arc had areas that were over 4 feet. Therefore the field would have to be laid out and reshaped to regulation. The pitching mound was more of a peak and had neither table nor landing area, or consistency of shape. There was no good quality clay for push off or landing to maintain the structure or help the pitchers perform better. Landon, being a pitcher, considered the mound his "office" so he took on the challenge to improve its performance. New mound clay was added to build a mound table and landing area. The slope was corrected to regulations of 1 inch per 1 foot. Landon was pleased with the progress and looked forward to using the mound for the 2014 home opener.

The infield skin and base paths were next. Over the past 30 years, a local infield mix had been added every year. The result of all the additional infield mix was an elevated surface more than 1 foot above foul territory and outfield. Grass edges were holding water on the infield at the back arc and had to be removed before any grading could take place. The Freedom HS baseball facility had never been graded with consistency before this project. Laser grading was the best approach to remedy the high and low spots in the infield and also drain any surface water away from the infield skin (70% sand and 30% silt, clay, and fines).

Drainage was not a major problem through the profile, but it had no stability once in play and left large divots after heavy use. Laser grading and balancing the current mix was the first step in getting the maximum benefit for the playing surface and player performance. Once the surface had been graded with the proper slope, a Stabilizer Solutions product was added to the surface and incorpo-

Sponsors help!

Landon would like to thank all of the sponsors that donated materials and funding to make his Sr. project a reality:

- Carolina Green Corp.
- Sports Edge
- Stabilizer Solutions
- Profile Products/Turface
- Corbin Turf
- Hickory Crawdads
- Gerber Collision & Glass
- Morganton Federal Savings & Loan
- Karin Cook-State Farm Insurance
- Leviton
- Silver Creek Restaurant
- Healthtique Group
- Table Rock Heating & Air
- Waters Body Shop
- Ace Hardware
- Lowes Hardware
- Jeanette Jarrett
- Jim & Phyllis Fox
- Wilton Daves
- Marie Daves
- Wayne & Lynne Turner
- Julie Ackley
- Scott Mauney
- Virgil Elkins
- Tom Ford
- Andrew Tallent

rated into the infield profile at a 1 inch depth. Results were instant. The surface held together and there was far less divots than before. A snow storm dumped 5 inches which was followed by an inch of rain on the morning of the first outdoor practice. The field was playable by that afternoon and allowed the team to practice while other surrounding fields were saturated and unsafe. Ball bounce was more consistent.

The dugouts damaged in the flood had many leaks through the back walls from ground water as algae had started to take over the dugout floors. Water lines had been leaking for some time and contributed to the additional damage to the footings of the dugouts. Graffiti had been painted on the wall and floors by vandals and were to be pressure washed and painted with team colors. Once the dugouts and backstop walls were a bright red color, a new windscreen was installed on the outfield fence to connect each new renovated section of the ballpark. The field really caught everyone's eye when up close or at a far distance as did the new warning track material that was placed from dugout to dugout and in front of the backstop wall. To finish off Landon's project, Opening Day logos were painted in front of each dugout on the grass.

February 27 was opening day for the Freedom Patriots baseball program. Work that began in October 2013 was complete and it was time for Landon's project to take center stage. What a proud moment it was! As the team prepared for the game, it seemed to have a spark of energy and motivation to perform to the best of their ability. A big league atmosphere had come to the small town of Morganton, NC.

Landon got the ball that night to pitch on his newly renovated mound and he performed well, pitching five solid innings and getting the win. What Landon had accomplished was not only for himself and his team; it was for the entire community and for many players to come in the future. A master plan has been developed by Landon for additional improvements to be made after he graduates and begins his college career at St. Andrews University, where he has received an academic/baseball scholarship. ■

Steve E. Peeler, CSFM, is a project manager for Carolina Green Corp. The author would like to acknowledge his former MLB colleagues who sent infield samples to put on this infield for Opening Day: Trevor Vance, Kansas City Royals; Bill Findley, St. Louis Cardinals; Dan Bergstrom, Houston Astros; Andy Bartley, Pittsburgh Pirates; Luke Yoder, San Diego Padres; Larry DiVito, Minnesota Twins; Roger Baird and Justin Spillman, Chicago Cubs; and Grant Trenbeath, Arizona Diamondbacks.

▲ **Left:** Opening Day at the new stadium. **Top Right:** Shooting bermuda stolons. **Bottom Right:** The design team decided to go with traditional Tifway 419 bermudagrass overseeded with perennial ryegrass.

The new Chicago Cub spring facility: ONE GROUNDSKEEPER'S SAGA

Editor's note: *The author is director of operations, Stabilizer Solutions, Inc., Phoenix, AZ.*

MARCH 2014:

Thousands of fans lined up outside the new stadium as 2 years of pent up anticipation finally comes to a head. Opening weekend at a new ballpark can be very stressful on a groundskeeper. Opening weekend with a torrential rain can be a nightmare. For John Knight CSFM, director of facilities and fields at the new Cubs Park, it was time to take a deep breath. "It's actually been a relief to get into day-to-day game activities. It is my first chance to exhale!" he said.

The new training facility for the Chicago Cubs, conjoined with the new Riverview Park in Mesa, AZ sits on the largest site of spring training homes in MLB, 146 acres. With dimensions modeled after Wrigley Field, the 15,000 capacity stadium should make visiting "North Siders" feel right at home with a brick wall behind home plate, light standards that mimic Wrigley's, and even a roof top deck in left field. Completed just in time for Opening Day, the park had a July 2012 groundbreaking which set a hurried construction pace for architecture firm Populous and Hunt Construction Group. For Knight, it felt as if he had been holding his breath on this project, not just through construction, but years beforehand.

▼ **Johnathan Knight, CSFM**

From 2006 to 2010, the City of Peoria gave Knight his first taste of spring training excitement. Working at the Peoria (AZ) Sports Complex and being very involved in the construction of Rio Vista Community Park prepared him for the magnitude of this project.

"The amount of earthwork was very time consuming. Some areas were very sandy, some areas were hard compacted clay soil," he said. Being on the edge of the Salt River complicated the Cubs Park construction timeline. An archaeological survey was completed to preserve any Native history that might be exposed. All of the wildlife on the site had to be relocated, and an attempt was made to nursery the existing trees. These site challenges put a major delay on actual field installation.

JANUARY 2013

USGA sand without amendment was imported at a depth of 12 inches for the stadium field and two major league practice fields, and at an 8-inch depth for the four minor league fields and two half fields. The sand layer was placed over a 4-inch pea gravel layer on top of a geotextile fabric, which drains into a Varicore lateral flat pipe drainage system. The system drains to retention basins on site, then evaporates or goes into dry wells, recharging groundwater.

Although he jokes that construction is still not complete, Knight said the most difficult aspect of the process early on was that it raised more questions than answers, questions specifically pertaining to his employment. In a strange twist of fate, his participation in construction weaved in and out, and back again, first as a City of Mesa employee and later as a Cubs employee.

As usual, the role of water in a desert spring training complex was critical. John believes his previous experience in the golf industry helped him better grasp watering efficiency for the park as a whole ecosystem. "Other Arizona Spring Training sites are on a horizontal pumping system, we are on a vertical system more like a golf course," he said.

The pumping system, an area of shared use between the Cubs and the City of Mesa, is more of a booster type station. The Rain

Bird pumping station uses three 75-hp vertical turbines that draw from an 8-acre lake on site. The lake doubles as an architectural feature and a fishing pond for Riverview Park. At the pumping station water pressure is around 105 psi. This is moderated down between 60 and 70 psi through a traditional valve block system. The water then makes its way to a combination of Hunter I40 and I20 heads for turf, and Hunter I25 heads on all skin infields.

The infields are constructed with Stabilizer Ballyard Brown infield mix, installed at 5 inch depth on both major and minor fields. The mounds are constructed with a combination of Stabilizer Ballyard Clay and Hilltopper Waterless mound clay.

Knight chose not to install warning track heads, instead opting for waterless warning track mix on the stadium field. "I decided on the Hilltopper warning track mix because of labor savings, but also to control dust. I looked at the contract costs of cleaning the seating bowl. Each dust related cleaning cost $3,000," he said.

In 2003, with Marriott Golf at the Royal St. Kitts Golf Club, Knight spent the greater part of 3 years learning the idiosyncrasies of paspalum turf. "What people don't realize is that although in the Caribbean, the island of St. Kitt's has an arid climate and little water. That is why I feel so strongly about using that turf in the desert." Using Seashore Paspalum Platinum TE on the Riverview Park soccer fields and common areas of the complex really became a passion project for Knight while employed by the City of Mesa. Some may view this as taking a risk, but he views it as "an opportunity." "That's one thing I learned from Ken Mangum (while working at the Atlanta Athletic Club); always look for opportunities to be innovative. We were definitely going outside the box."

For Knight, advocating for the use of paspalum, being so involved in the design, and even establishing a soccer field/parking area proving ground, truly made relinquishing control of this portion of the project bittersweet. The original design included an 8-inch sand cap over the existing bermudagrass, as a result of value engineering; this sand cap was left out, leading to bermuda contamination. Knight is currently researching how to solve this problem, which he thinks can be contained through patience and diligence. "It's tough to let the whole responsibility go, but I still get to consult for the City and share the responsibility to make it work."

JUNE 2013

At the optimal time in June and July, landscape contractor Siteworks stolonized three-quarters of the project, with the exception of the infields, which were sodded. For the baseball fields, the design team decided to go with a more traditional Tifway 419, overseeded with perennial ryegrass. The entire stadium field and berm were completely sodded in September 2013 without overseeding.

Construction delays pushed Knight's overseeding plans all the way back to November 26, not a good time for overseeding in general, but the new stadium made it even tougher. While a great design feature for fans, the majority of the seating area is shaded, especially along the 1st base line. Knight, still unsure of how overseeding worked out just in time for the season, could only explain, "I was really fortunate for a warm winter."

In September 2010, amidst rumors of the Cubs' leaving, Knight accepted the head groundskeeper job at HoHoKam Park for the City of Mesa. While the new ballpark was not yet approved, he took a calculated risk, believing the Cubs would not leave Mesa. Although welcomed, the 2012 announcement of the new complex created even more uncertainty. No one knew whether the Cubs or Mesa would be responsible for maintenance. To make matters worse, City officials were negotiating with the Oakland Athletics to lease HoHoKam Park. This pretty much meant that the A's would bring Chad Huss from Phoenix Municipal Stadium to manage HoHoKam, potentially leaving Knight without a home. "It was very challenging not knowing what would happen," he said.

After the groundbreaking, one piece of the puzzle was finally made clear. A facility use agreement was signed between the Cubs and Mesa, outlining the role of the Cubs in the stadium, facility and field management, and the role of the City in regards to the minor field timeshare,

Riverview Park and common areas. The Cubs began interviewing for the Director of Facilities and Fields position in February 2013. Knight quickly submitted his name. Still awaiting the Cubs decision, the City offered him the position to manage the Riverview Park portion of the complex. What should have brought relief, spurred even deeper soul searching. "I was happy to manage the paspalum for the city, but still very much wanted to be involved with professional baseball. For their patience and understanding I am very fortunate, and thankful to the City of Mesa management."

Despite the uncertainty, Knight continued the spring 2013 season operating as he always had, a loyal City employee treating the Cubs as a valued client. "I had to walk a fine line, being a fiscally responsible City employee and to be very customer service oriented at the same time. Although I'm a Cubs employee now, I still think of the coaching staff as my client. I think it helps me do my job better."

FEBRUARY 2014

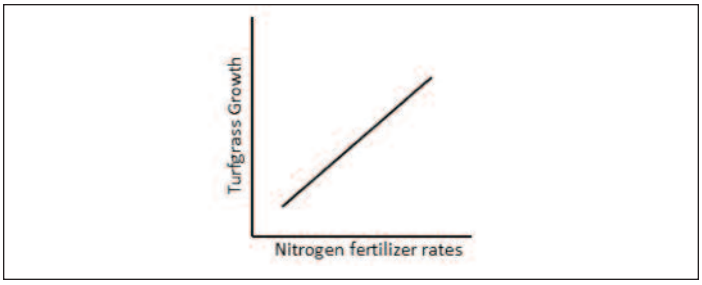
Involvement in the construction and maintenance of the facilities is the reason why Knight made the leap from the City of Mesa to the Cubs when finally offered the position. The Cubs will use the 65,000-square-foot training facility, with 10,000 square foot gym space as a year round rehab center. Featuring hydrotherapy rooms, weight room, and agility field, it is considered a medical facility, and maintenance must abide by stringent medical standards.

As Knight and his crew transition from construction to maintenance, an interesting dynamic is emerging. Responsibility for the site is shared between the Cubs and the City of Mesa. Maintenance must be coordinated between the two parties on a day by day basis. "We are still learning the facility and learning how to interact. It has been challenging and rewarding discovering a new operation method," Knight said. Many of Mesa's maintenance staff were employees of his at HoHoKam. The familiarity there, combined with his laidback personality, make this potentially tough sharing arrangement, a productive method for both parties.

Being part of the design with the City of Mesa, while executing his own spring training daily responsibilities at HoHoKam, not knowing his employment fate, then overseeing the construction process for the Cubs, and finally taking over the facility with a short timeframe before opening, have made the last few years a blur. At one point Knight, being the only Cubs employee on site, was responsible for giving tours of the stadium. Now that he finally gets to reflect on his journey, the challenges were what he learned from the most. "I'm starting to see a big picture view of how great a project this really is. I learned so much from the infrastructure construction. What I really learned is that without the help of my crew, we wouldn't be sitting here today." ■

Continued from page 10

fertilizer (X-axis equaling increasing rates of nitrogen fertilizer and the Y-axis equaling turfgrass growth).



However, we also need to ask, "Is nitrogen fertilizer the only factor that can increase growth?" The answer is obviously "no." External variable such as temperature and rainfall can influence results as well. So we can see that statistical relationships are not so clear cut and analyses try to find the best fit (the slope of the line) for this relationship.

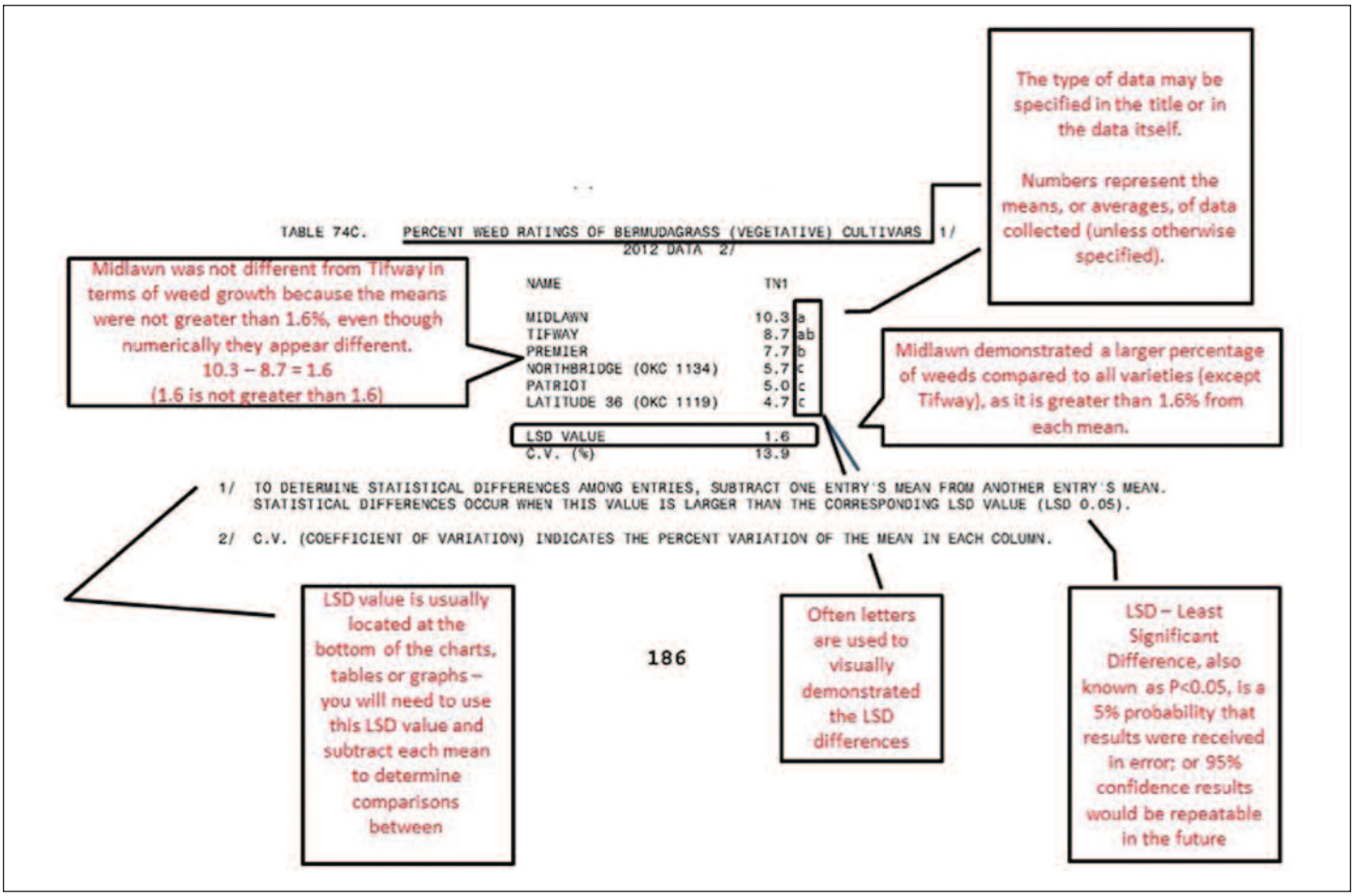
ANOVA is used to analyze differences or equality between treatment means. ANOVAs are useful for comparing two or more means for statistical significance. Significance between means is often determined by a threshold value such as the Least Significant Difference as one measure.

Analysis of data can be very confusing, drawn out and beyond the scope of this article. Those of us in Plant Sciences often consult with statisticians to aid in the analysis of large data sets. Let's leave this up to the experts.

EXAMPLES OF TABLES AND CHARTS & WHAT TO LOOK FOR

Understanding data tables becomes an easier task now that you understand some terms like the mean, standard deviation and least significant difference. The following example comes from the National Turfgrass Evaluation Program website. All tables should be titled; columns labeled and have some indication of significance between means.

This example shows a data table for weed ratings in some bermudagrass cultivars. The numbers listed under TN1 are means of three replications of percent weed ratings. Several text boxes explain much of the information on the data table; however, the most important question to ask, "Are there any differences, significant differences? " You will noted that the Least Significant Difference (LSD) value is 1.6 If the differences between means is greater than 1.6, then you will see a different lower case letter adjacent to that mean. It also specifies that the LSD is an LSD set at 0.05 or a 95% confidence level. Means with the



same lettering adjacent to it, are statistically equal (even if numerically appearing different).

Understanding Bar Graphs can appear to be easier than large data tables. They can present data in a cleaner, more simplified format; however, some cautions should be pointed out. First look at the vertical or y-axis and determine what measurement is being labeled and the scale. All scales should start at "0", but sometimes do not. Look at the units on the scale. Unit interval (unit interval of 1 versus a unit interval of 20) may tell you that differences in the bars are not as great as they may appear.

Just as data tables should, bar graphs should have some indication of mean separation and significance. Bars labeled with the same letters are equal to one another. Those with different letters (A versus B) are significantly different from each other. Bar graphs should be titled as well and have both axis labeled.

Data tables and bar graphs can be used to present supporting data for conclusions being made. Researchers will sometimes present large data tables and cluttered bar graphs that will cause you as a viewer to lose interest simply because you are unable to keep up with what is being said by trying to follow the numbers.

When a presenter displays data in a table or chart, there should be a reason to show such data other than just showing the numbers. When a table or chart is used in a PowerPoint, the presenter should explain all of the parameters of the information: what is it showing, define the numbers, explain the X and Y axis on a graph, point out and explain the level of significance and where significance exist. Highlighting areas of interest to make a point, or two at the most, is often best where large tables are used, but often not followed. This becomes difficult for the participant to pick up on the key points and often interest is lost in the presentation. Most often it is best to express large amounts of data as text statements rather than showing the numbers. For it's the results or conclusions that you want to take home at the end of the day.

The best advice to give where statistics are involved is to ask questions when things get muddled. Any presenter should be willing to explain their research results if they took the time to include those results in their presentation. Do not be shy or intimidated about statistics, because a little understanding can go a long way for everyone in the room. ■

Chad Follis is a Horticultural Instructor at Mineral Area College in Park Hills, MO. Brad Fresenburg is an Assistant Extension Professor of Turfgrass Sciences at the University of Missouri in Columbia, MO. To see a list of references for this article, see www.sportsturfonline.com