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Sprayer calibration: get it right

By J. A. Borger and M. B. Naedel

Today, materials applied through sprayers are commonplace. There are many different types and styles of spraying equipment. All have a common theme. Materials are mixed with a carrier, most commonly water, and then evenly applied to a turfgrass site via the spray unit. The uniformity of the sprayed material is imperative. In order to minimize equipment error and maximize the uniformity of the materials being applied, the spray unit needs to be calibrated. Calibration can be quite unique to the spray unit and the turfgrass manager that is conducting the procedure. Following are some general guidelines for sprayer calibration:

First, check the obvious by looking for broken hoses, clogged nozzles, leaking tank, that the gauges are working, etc. Many of these observations can be done just by starting the sprayer, adding straight water, and spraying a small section of a parking lot or any impermeable surface.

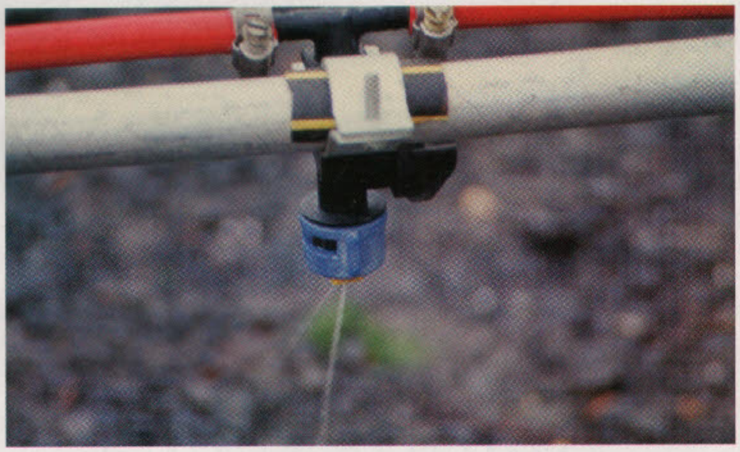
Once this test application has been made, let the spray unit sit at an idle (if it is motorized) with the water circulating in the tank and walk around the unit. This will allow for further examination of the equipment for leaking fluids. The actual sprayed area also serves a purpose. Watch the area dry because you can gain important information. This serves as a visual check of how uniformly the water has been applied. The water will evaporate eventually; if there is an area that has more water or less water than another it will dry slower or faster in comparison.

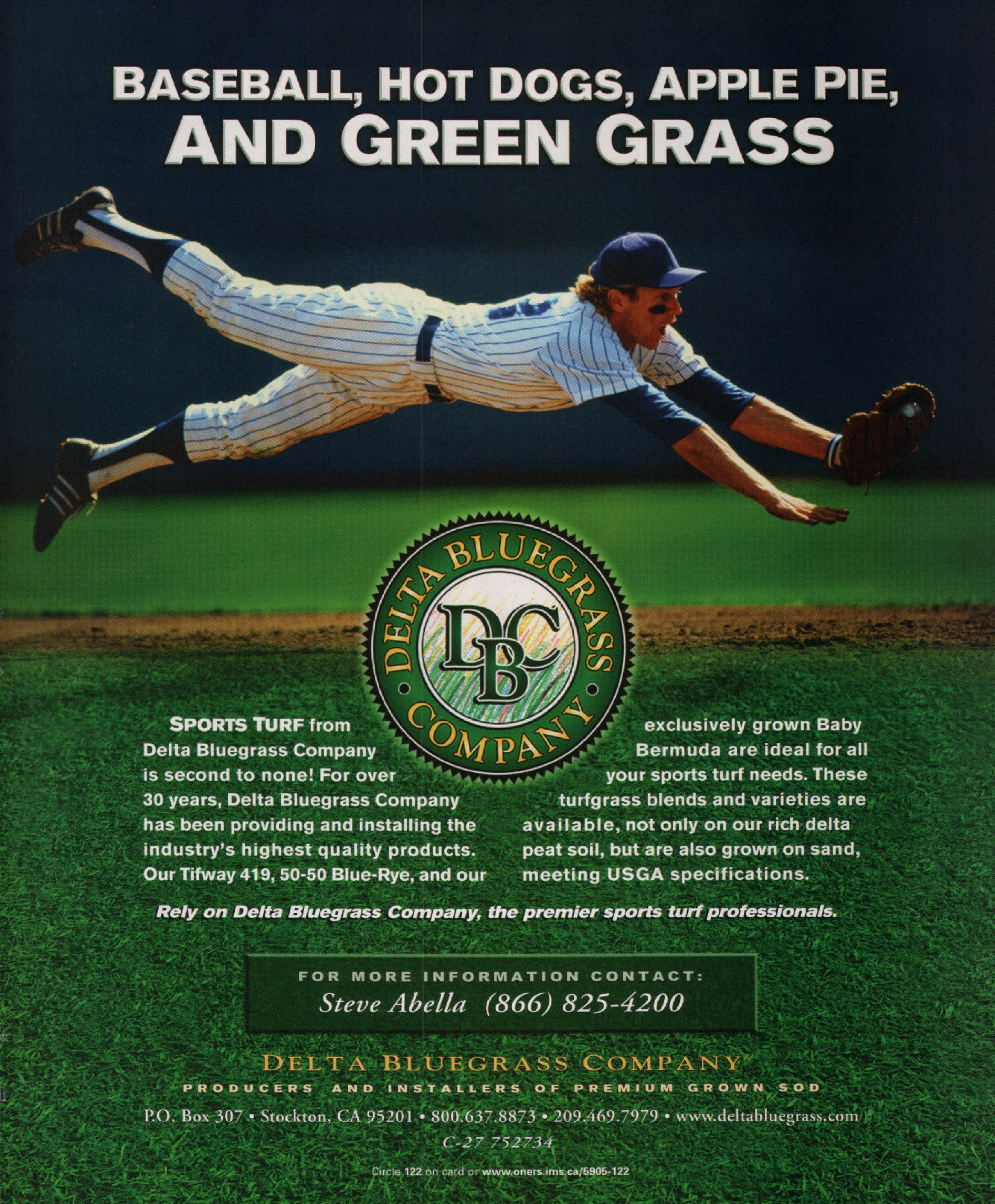
Streaking will be obvious when there are severe uniformity variations within the pattern. Correct this by checking the boom height, nozzle spacing, or replacing nozzles if needed. If there is little or no streaking, the spray unit passes the visual test of uniformity.

Next steps

Of course we're not done here. The calibration process is not complete. A simple question needs to be answered: "How much water does the sprayer apply to one acre?" Several items will be required: a stopwatch, measuring tapes (you may want to use two different tapes), a liquid measuring container, and a calculator. Your objective is to measure the volume of water applied to a known area over a given period of time (ATV–A = area, T = time, and V = volume). There are many ways to collect this information and the following is only one of them.

Define a calibration test area. Determine where the site is to be located and make several trial runs with the spray unit to be calibrated. A measuring tape should be used to find the distance (length) of the calibration test site, e.g., 100 feet. Once a workable distance is determined, again, make several trial runs with the spray unit applying water as if materials were being applied to a turfgrass area.

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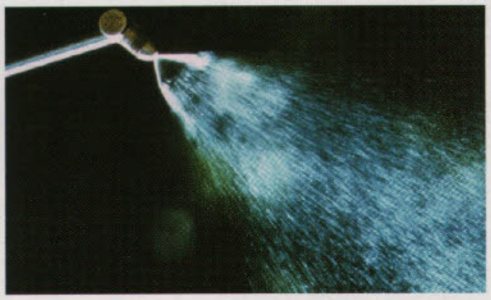

Measure the width of the application, e.g., 20 feet. The area can be calculated by multiplying the length by the width. In this example, length times width would be 100 feet X 20 feet = 2,000 square feet. The first variable of ATV, area (A), has now been defined.

To determine the second variable, time (T), make several additional trial runs over the same test area and time the procedure with a stopwatch. Make sure that the stopwatch is started and stopped at the beginning and end of the calibration test area. For this example, assume that it takes the spray unit 60 seconds, on average (of three or four trial runs), to travel from beginning to end of the designated calibration test area (T = 60 seconds).

The final variable to determine is V, the volume of water applied to the calibration test area. To accomplish this, activate the sprayer so that water is coming out of the nozzles, but the spray unit is not moving. Collect a volume of water from each nozzle on the boom for 60 seconds (the time elapsed to travel the calibration distance) at least three times each. Average the three volumes from each nozzle. There should not be more than a 10% difference (5% would even be better) between nozzles. If this limit is exceeded, replace the nozzle.

Once an average output of all the nozzles is determined (e.g., each nozzle average output is 49 ounces), multiply that by the number of nozzles (e.g., 12 nozzles) to determine the volume of water applied to the calibration test area. Therefore, for this example, 49 ounces X 12 nozzles = 588 ounces of water applied to the calibration test area.

Because the way to evaluate this application is in gallons per acre (GPA), a conversion from ounces to gallons is needed. In this example, 588 ounces divided by 128 ounces (128 oz in one gallon) = 4.59 gallons. The final variable has been determined: volume (V) = 4.59 gallons.

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All of the information has now been collected to determine "How much water does the sprayer apply to one acre?" Now you need to perform a simple calculation. The known information is that the spray unit applies 4.59 gallons of water to 2,000 square feet. To determine the GPA of this spray unit a proportion is used. The GPA can be expressed in numerical form: gallons/acre (one acre equals 43,560 square feet). Similarly, the example volume and area can be arranged in numerical fashion: 4.59 gallons/2,000 square feet. Setting both of these equations equal to one another is a proportion that can determine the GPA of the spray unit (see figure at right).

$$\frac{4.59 \text{ gallons}}{2{,}000 \text{ sq.ft.}} = \frac{? \text{ gallons}}{43{,}560 \text{ sq.ft.}}$$

Solving for ?:

$$? \times 2{,}000 = 4.59 \times 43560$$

$$? = \frac{4.59 \times 43560}{2{,}000}$$

$$? = 99.97 \text{ or approximately } 100$$

This means that the spray unit is calibrated to deliver approximately 100 gallons of water per acre or 100 GPA. If a change in the GPA is desired several variables could be adjusted. The ground speed of the spray unit may be increased to lower the GPA. Nozzles with larger/smaller openings could be used to increase or decrease GPA. Finally, to some degree the pressure could be changed. Note that nozzle manufacturers have a recommended operating pressure range for maximum performance that should be followed.

After the calibration procedure has been completed, you'll have a better understand of the spray unit's performance. This will enable you to apply materials with accuracy. To ensure uniform material applications spray units should be calibrated before every application.

J.A. Borger is an instructor and M. B. Naede1 is a research technician in the Department of Crop and Soil Sciences, The Pennsylvania State University, University Park.

John Mascaro's Photo Quiz

Can you identify this sports turf problem?

Problem: Brown Turf
Turfgrass Area: Stadium field
Location: Florida
Grass Variety: 419 Bermudagrass

Answer to John Mascaro's Photo Quiz on Page 45

John Mascaro is President of Turf-Tec International

1 Synthetic surface adhesive

This photo shows the seam for a synthetic turf football field being bonded with **NORDOT** adhesive. At bottom, adhesive is being spread on green seaming tape while up top the synthetic turf is being unfolded onto the adhesive-coated tape. The almost invisible seam runs down the middle of the tape after closing. While NORDOT is curing, its strength holds the turf seam securely regardless of weather conditions.

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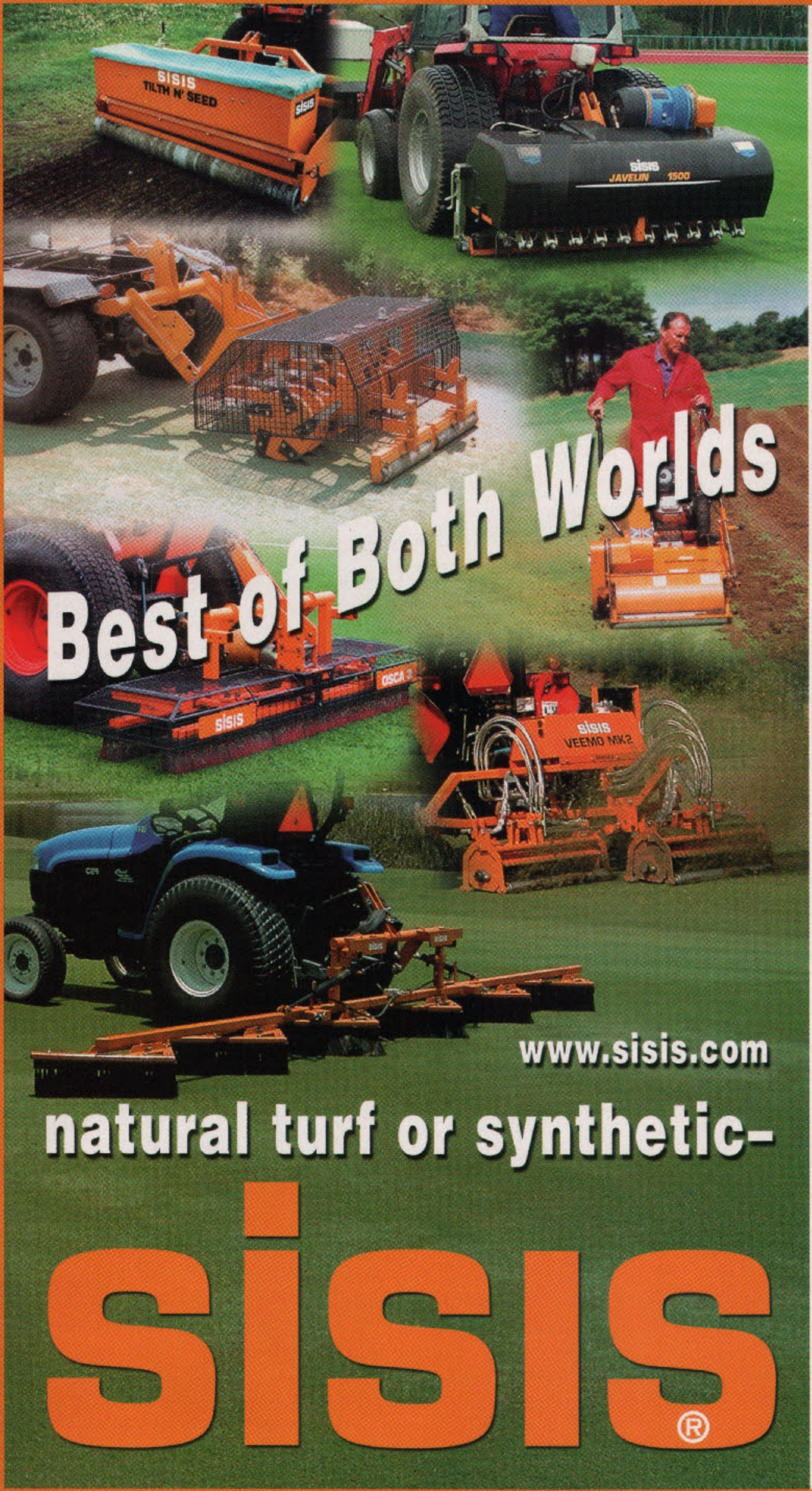

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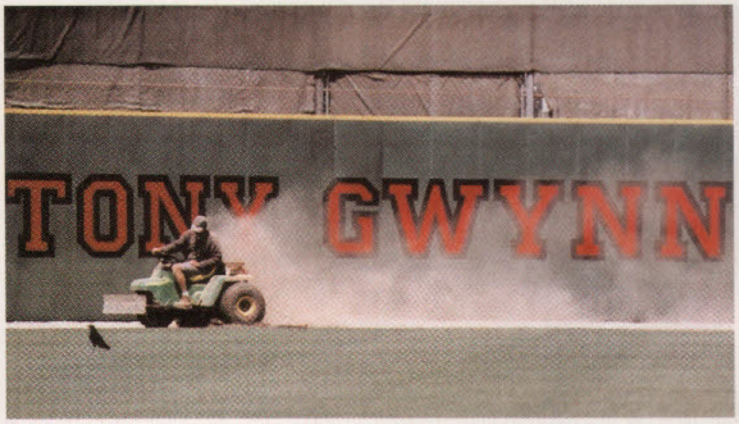

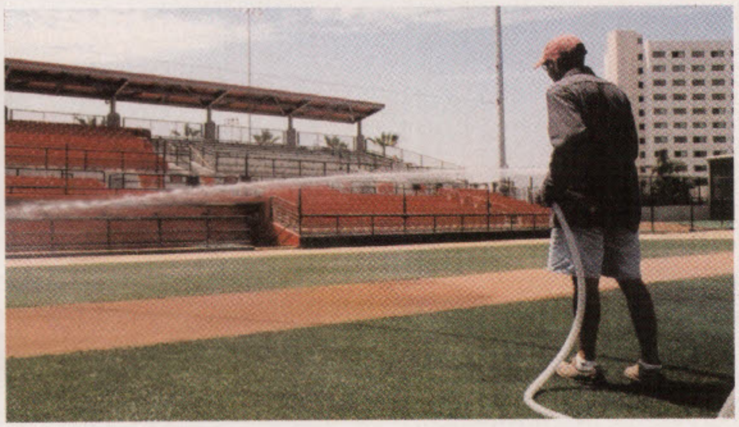

Tony Gwynn Stadium field also a star

San Diego State's Charlie Smith Field at Tony Gwynn Stadium, and its turf manager Ron Hostick, CSFM, won the 2005 STMA Field of the Year in the College Baseball category. Named in honor of former Aztec and San Diego Padre All-Star outfielder Gwynn, the facility is ranked 5th nationally by *Baseball America* magazine's collegiate rankings.

The sand-based field was originally built in 1998 and in 2004 the infield and sideline areas were completely renovated, including removal of artificial sideline surface in favor of hybrid bermudagrass and warning track. The infield skin also was replaced and now features a clay/sand blend with an added stabilizer; a new grade also was created for the infield turf and skin. Hostick and his crew, including full-time staffer Michael Radigan and part-timer Dennis Mitchell, handled most of the project themselves.

The decision to renovate coincided with completion of San Diego's Petco Park, and to assist in the financing, John Moores, owner of the Padres, allowed a 3-day tournament to be held at Petco. The tournament proceeds, combined with the commitment of in-house labor from the Physical Plant office, and made possible the renovation.

To add durability to the new sideline surface, Hostick chose topsoil rather than the sand the field is built on, and he added compost from a local landfill to increase organic matter. Other product decisions were made after Hostick consulted with local sports turf managers. Through that network, he found a company that supplied a warning track material, quality topsoil, a laser-grader who specializes in sports fields (through a local STMA seminar), and an infield dirt mix that holds "enough moisture for texture for texture yet repels excess moisture."