Unity for the Sake of Uniformity

New database allows superintendents to measure, compare patchiness of turfgrass

By Douglas Linde

When a golfer stands on the tee and looks out over the fairway, what does he or she see? Is it a well-defined, uniform green fairway or is it a patchwork of browns and greens with a barely visible fairway border? Which condition offers better playability? Which condition is more aesthetically pleasing? Which condition is more agronomically sound?

The answer to these questions is "it depends." It depends on the personal opinion of the course designer, golfers, superintendent and the course officials.

Parameters that assess aesthetics can be measured, but the interpretation of those measurements is subjective because "aesthetics (beauty) is in the eye of the beholder."

Turfgrass uniformity is one of these aesthetic parameters. Although it has been included as a parameter in evaluating turf quality for National Turfgrass Evaluation Program (NTEP) trials (Morris, 2005), turf uniformity alone is not commonly measured by turf managers and scientists.

Measurements of uniformity are most useful when they are compared to someone's or some group's expectation. For example, American golfers often expect a perfectly manicured golf hole, while British golfers are more tolerant of imperfection (Foy, 2002). Golfers who expect perfectly manicured turf likely have high expectations for turf uniformity, thus uniformity measurements become useful. Golfers who don't expect perfect turf likely have lower expectations for uniformity, thus uniformity measurements are not as useful.

Turf managers need to understand their customers' expectations and set turf uniformity standards based upon these expectations. In addition, measurements can be useful in determining if standards are being met and to quantify the effects of a management program change. For example, regular uniformity measurements can be used to monitor the progress of a species conversion program.

From January 2004 to August 2004 a project was conducted by the New Zealand Sports Turf Institute (NZSTI) to benchmark golf course conditions throughout New Zealand (Linde, 2004). The purpose of the project was to develop materials and methods to assess golf course conditioning. Those materials and methods were then used to create a database of course conditioning parameters that the NZSTI could use to advise golf clubs more appropriately.

Turf uniformity was one parameter used to describe conditions of each turf area on a golf course. The method to measure turf uniformity was adapted from a method used in soil science to describe soil mottling (Schoeneberger et al., 1998). Soil mottling is defined as spots or blotches of different color or shades of color interspersed within the dominant matrix color of a soil (Brady and Weil, 2000).

Soil mottles are described by characteristics such as mottle quantity, size and contrast. For this project, a similar term, "patchiness," was used in place of the term "mottling" to describe turf uniformity. A turf area that was uniform had no patches. A turf area that had patches was described by the patch quantity and patch contrast.

Patchiness and uniformity

Patches were defined as visible changes in color and/or texture with the dominant color/texture of the turf area. Patch quantity was the percentage of the area that the patches covered. Values ranged from 0-50 percent. A value of 0 percent patch quantity represented no patches and the turf was uniform. A value of 50 percent patch quantity meant that no one color or texture was dominant.

Patch contrast was a measure comparing how much the patch color or texture contrasted with the dominant color or texture. The area assessed was placed into one of three categories of patch contrast — Faint, Distinct or Prominent. The Faint category represented patches that were indistinct and evident only upon close examination (Figure 1). An example would be a patch of light-green *Poa annua* against a slight-

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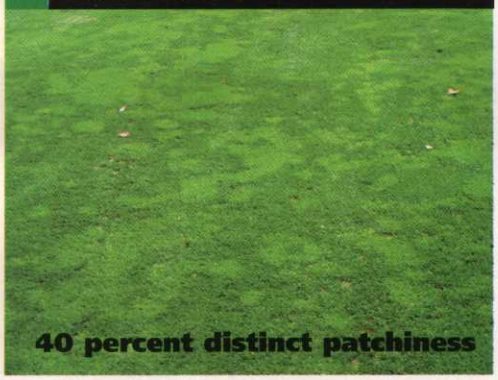
FIGURE 1

20 percent faint patchiness

FIGURE 2



40 percent distinct patchiness

FIGURE 3

50 percent prominent patchiness

FIGURE 4

40 percent prominent patchiness because of texture changes

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ly lighter green background — typical of a 100 percent *Poa annua* putting green.

The Distinct category represented patches that were readily seen and contrasted moderately with the dominant color or texture. An example would be a patch of light-green creeping bentgrass against a dark-green perennial ryegrass background (Figure 2).

The Prominent category represented patches that contrasted strongly with the dominant color or texture. An example would be a patch of dark-green perennial ryegrass against a straw brown background (Figure 3). Figure 4 is an example of prominent patches caused by dramatic texture changes. Prominent patches can be seen from hundreds of yards away. Values were assigned to each patch contrast category; Faint = 3, Distinct = 2 and Prominent = 1.

The entire area to be evaluated was walked. During the walk, the dominant color, patch quantity and patch contrast were assessed in various directions. Observations from directly above the turf and from looking across the turf were made. After the area was walked, the average patch quantity and average patch contrast were determined.

Filled and unfilled divots can be contributors to patchiness. Unfilled divots were included as part of the patchiness measurement. Although divots filled with light-colored soil (i.e. white sand) form distinct patches when among a green background and disrupt uniformity, filled divots were not included as part of the patchiness measure because the practice is accepted by most golfers.

Superintendents and officials who are concerned about filled divots standing out against the green grass would want to include filled divots in their patchiness measurement. Superintendents and officials that host televised tournaments are often concerned about camouflaging filled divots and therefore use dark-colored fill materials or paint to hide the divots.

Patchiness data was collected from 50 of the 400 golf courses in 14 of the 17 geographical regions of New Zealand. For each course, data were collected from three holes on one day of the year during fall or winter. As a result, the data did not fairly represent a course's patchi-

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ness throughout the year. The data more appropriately represented patchiness for a course of certain size revenue.

Results and discussion

The courses with annual revenue less than $70,000 had the least contrasting (more faint) patches when compared to all other courses for approaches, surrounds, fairways and rough (Tables 1 & 2, Figures 5 & 6). However, for greens, these courses had the most contrasting (more prominent) patches. The courses with annual revenue greater than $700,000 had the least contrasting patches on greens.

The courses with revenue greater than $700,000 had the lowest patch quantity percent for every area except surrounds. For greens, the courses in the $175,000-$350,000 and $350,000-$525,000 revenue ranges had the highest patch quantity.

Keep in mind that patch quantity and patch contrast should be considered together to assess patchiness appropriately. An area may have 50 percent patches, but those patches may be faint. On the other hand, an area may have only 10 percent patches, but those patches may be prominent. An area that is most uniform would have 0 percent patches. An area that is least uniform would have 50 percent prominent patches.

When considering patch quantity and contrast together, overall for all areas, the greater than $700,000 revenue courses had the fewest and faintest patches, thus had the most uniform turfgrass.

Patchiness (non-uniformity) in turf can be a result of one or more of the following: soil variability, different turfgrass species, weeds, climate, topography, management practices, mismanagement, pests and divots. Depending on its cause or causes, managing for turf uniformity can be costly and at times futile.

TABLE 1

Patch contrast data per turf area sorted by annual revenue of golf courses in New Zealand.

Annual revenue U.S. $ x 1000	Courses surveyed	Patch contrast[z] for each turf area													
		Green		Collar		Approach		Surround		Fairway		Rough		Tee	
		AVG	Range	AVG	Range	AVG	Range	AVG	Range	AVG	Range	AVG	Range	AVG	Range
<$70	11	1.8	1.0-2.0	2.3	1.0-3.0	2.5	1.7-3.0	2.4	1.7-3.0	2.7	2.0-3.0	2.5	1.7-3.0	2.4	1.7-3.0
$70-175	8	2.1	1.7-2.3	2.4	1.0-3.0	1.4	1.0-2.3	1.7	1.0-2.7	1.2	1.0-2.0	1.8	1.0-3.0	2.0	1.3-2.7
$175-350	8	2.4	2.0-3.0	2.2	1.0-3.0	2.1	1.3-2.7	1.7	1.0-2.7	1.5	1.0-3.0	1.9	1.0-3.0	1.7	1.0-2.3
$350-525	7	2.2	2.0-3.0	2.4	2.0-3.0	2.1	1.3-2.7	1.7	1.0-2.0	2.1	1.0-3.0	1.6	1.0-2.7	2.0	1.7-2.7
$525-700	6	2.3	2.0-3.0	2.2	2.0-3.0	2.2	1.7-2.7	1.8	1.0-3.0	2.0	1.0-3.0	1.3	1.0-2.0	2.5	2.0-2.8
>$700	10	2.5	2.0-3.0	2.6	2.0-3.0	2.4	1.0-3.0	2.0	1.0-3.0	2.4	1.0-3.0	2.0	1.0-3.0	2.2	1.3-3.0

z Values range from 1-3 with 1=Prominent, 2=Distinct, and 3=Faint contrast.

TABLE 2

Patch quantity data per turf area sorted by annual revenue of golf courses in New Zealand.

Annual revenue U.S. $ x 1000	Courses surveyed	Patch quantity[z] for each turf area													
		Green		Collar		Approach		Surround		Fairway		Rough		Tee	
		AVG	Range	AVG	Range	AVG	Range	AVG	Range	AVG	Range	AVG	Range	AVG	Range
<$70	11	36	12-50	26	4-37	26	18-40	26	7-50	33	17-50	30	15-50	25	6-40
$70-175	8	33	17-50	23	17-30	22	12-32	25	12-40	31	23-40	35	22-50	22	10-37
$175-350	8	43	27-50	22	9-50	24	15-37	20	8-27	26	9-47	28	10-47	22	10-40
$350-525	7	44	40-50	22	10-33	29	20-43	28	20-40	31	17-50	30	15-43	22	13-33
$525-700	6	36	22-43	21	14-28	19	7-30	26	15-50	25	18-33	32	19-50	24	18-32
>$700	10	25	0-50	19	2-50	18	12-34	26	15-50	24	7-50	25	15-50	17	4-30

z Represents the percent turf area that contained patches. Values range from 0-50%.

For example, a low-revenue New Zealand course located on sandy soils next to the Tasman Sea had undulating fairways that were very patchy. The course could not afford the fairway irrigation equipment or labor force to keep all the bumps and mounds adequately irrigated for the turf to remain uniformly green.

Patchiness does not indicate playability. For example, one of the greater than $700,000 revenue courses had 50 percent distinct patches in its greens, but the greens had excellent playability because their speed was 10 feet and their surface was classified as very smooth. In this case, the patchiness was because of one of the green's creeping bentgrass varieties turning dark purple during cool weather.

Conversely, a less than $70,000 revenue course had only 15 percent distinct patches in its greens but the greens had poor playability because their speed was 7 feet and their surface was classified as bumpy.

It was surprising to find that the less than $70,000 courses had the faintest patches in approaches, surrounds, fairways and roughs. These courses were very low maintenance. After speaking with the course superintendents, they mentioned that the approaches, surrounds, fairways and roughs were all maintained exactly the same using sheep as mowers. Although these courses had only faint patches in the sheep-grazed areas, the playability was usually not as good as higher revenue courses because the turf was bumpy, thin, weedy and had a variable height (Linde, 2004).

The NZSTI now has a technique to measure turfgrass uniformity and a database of uniformity data for golf courses that they can use to more appropriately advise superintendents and course officials.

In addition, turf managers that are concerned about turf uniformity can use the technique to monitor whether their management program is influencing turf uniformity and if standards are being met.

FIGURE 5

Average patch contrast per turf area sorted by annual revenue of golf courses in New Zealand.

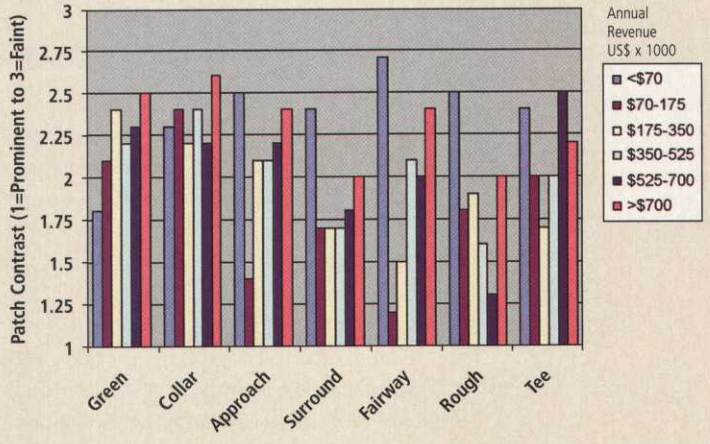
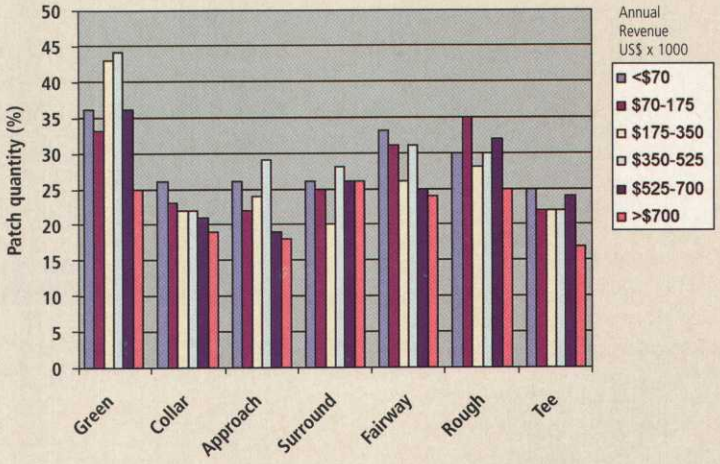


FIGURE 6

Average patch quantity per turf area sorted by annual revenue of golf courses in New Zealand.



Douglas T. Linde, Ph.D., is an associate professor of agronomy and heads the turf management program at Delaware Valley College in Doylestown, Pa. He is also the college's head golf coach. He can be reached at linded@devalcol.edu.

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