Systematic improvement of course conditions

Micah Woods

March 6, 2023

Manitoba Golf & Turf Conference

Asian Turfgrass Center
www.asianturfgrass.com

PACE Turf
www.paceturf.org

Palmares Golf Resort, Portugal

Continuous improvement system

1. Measure soil nutrients, then adjust

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2. Measure growth rate, then adjust

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Continuous improvement system

1. Measure soil nutrients, then adjust
2. Measure growth rate, then adjust
3. Measure soil organic matter, then adjust
4. Measure surface performance, then adjust

Measure soil nutrients, then adjust


decreasing levels of soil K

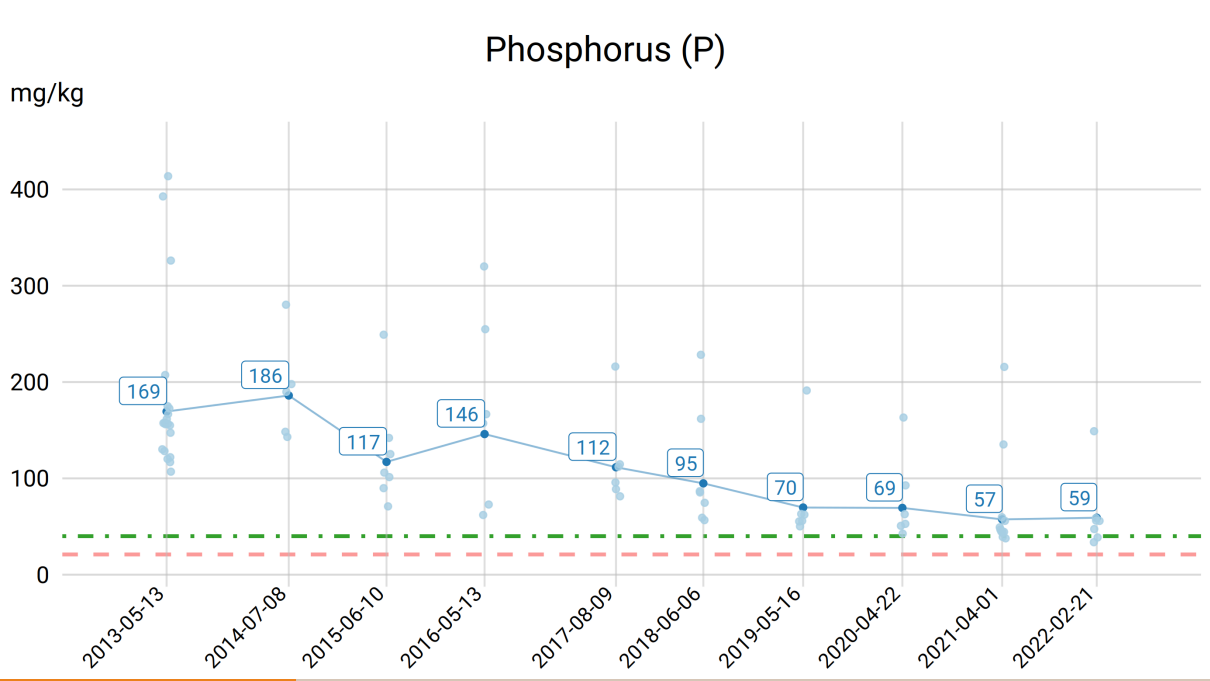

+EP
Tifeafe 1/0at
+EP
Royal 1/10
+EP
Sena 1/10
+EP
Wana 1/10
+EP
Royal 1/10
+EP
Wana 1/10

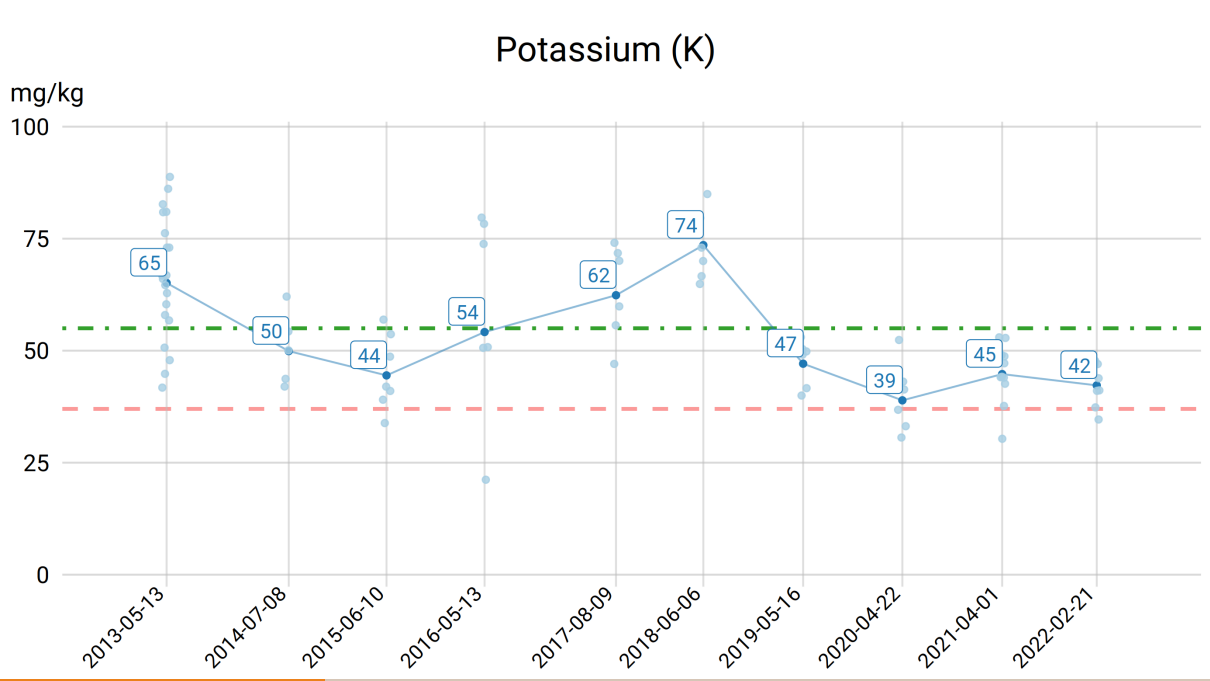

TifEagle


Tifeagle ultradwarf bermudagrass
28 days after planting as 3 cm
diameter plugs
15 g N/m2
18 g N/m2
3 g P/m2
15 g K/m2
18 g N/m2
3 g P/m2
15 g K/m2
200 g dolomite/m2

Tifeagle ultradwarf bermudagrass
45 days after planting

Let’s have a look at soil test phosphorus (P) and potassium (K) for a 10 year sequence. First, the soil P ...


Phosphorus (P)
mg/kg
400
300
200
100
0
169
186
117
146
112
95
70
69
57
59
2013-05-13
2014-07-08
2015-06-10
2016-05-13
2017-08-09
2018-06-06
2019-05-16
2020-04-22
2021-04-01
2022-02-21


Potassium (K)
mg/kg
100
75
50
25
0
65
50
44
54
62
74
47
39
45
42
2013-05-13
2014-07-08
2015-06-10
2016-05-13
2017-08-09
2018-06-06
2019-05-16
2020-04-22
2021-04-01
2022-02-21

Results

1. You apply the correct fertilizer.

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3. Unnecessary fertilizer applications are eliminated.

Results

1. You apply the correct fertilizer.
2. The grass is supplied with all the nutrients it can use.
3. Unnecessary fertilizer applications are eliminated.
4. Reduced risk of N & P pollution.

Keya GC, Fukuoka


Keya GC, Fukuoka

Measure growth rate


10
5


EX13
SUBARU
5

Christofer Andersson
@ChristoferAnde1

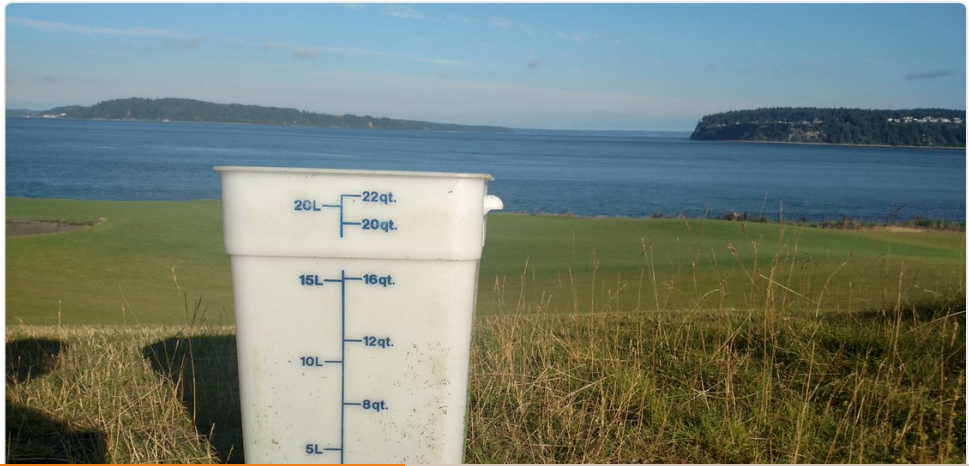
Easy way of measuring clippings. Picture uploaded to Slack. 3 man operation, 4 greens every time the mow.

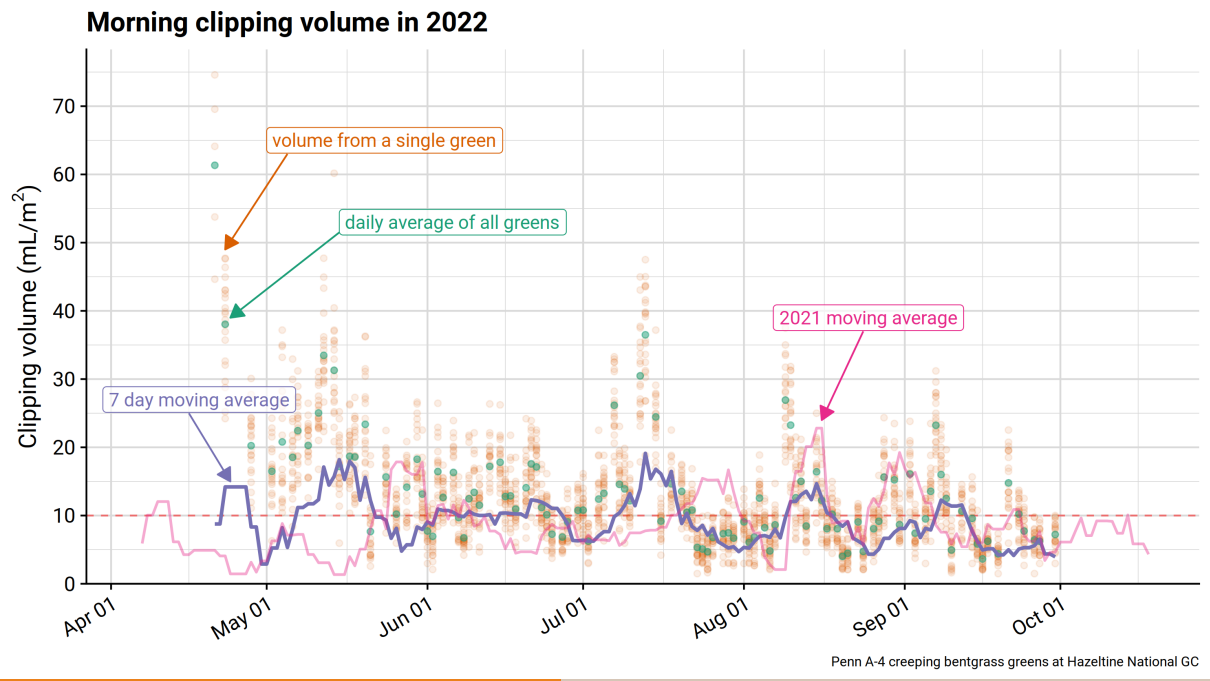
4:30 AM · Nov 1, 2022 · Twitter for Android

Eric Johnson
@altshot2

Following

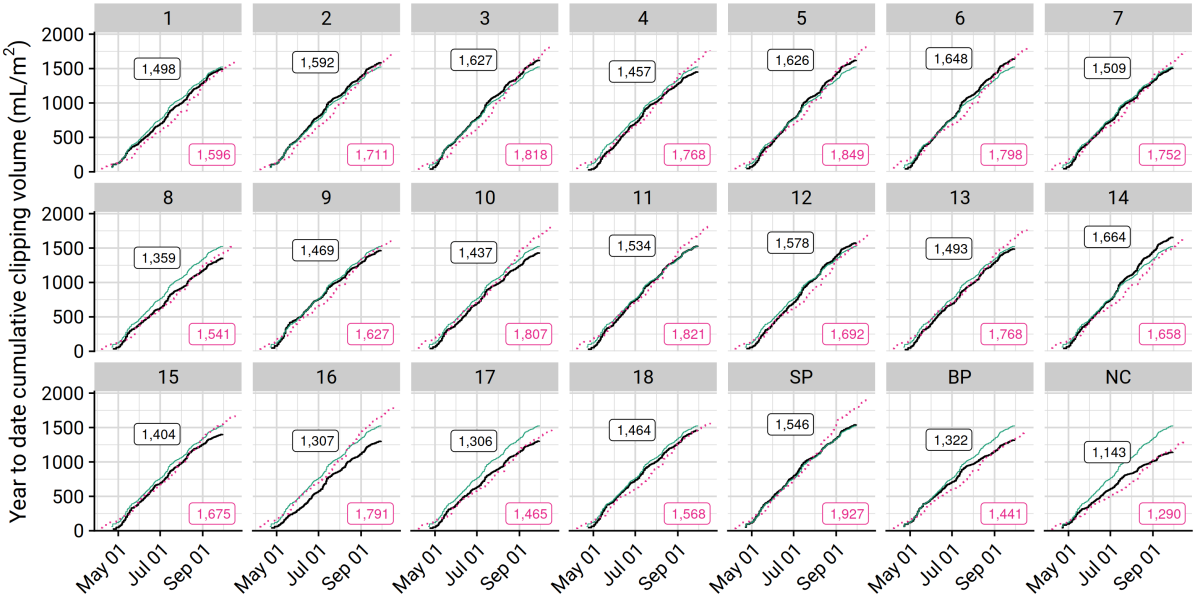
Nice day for harvest. #MLSN



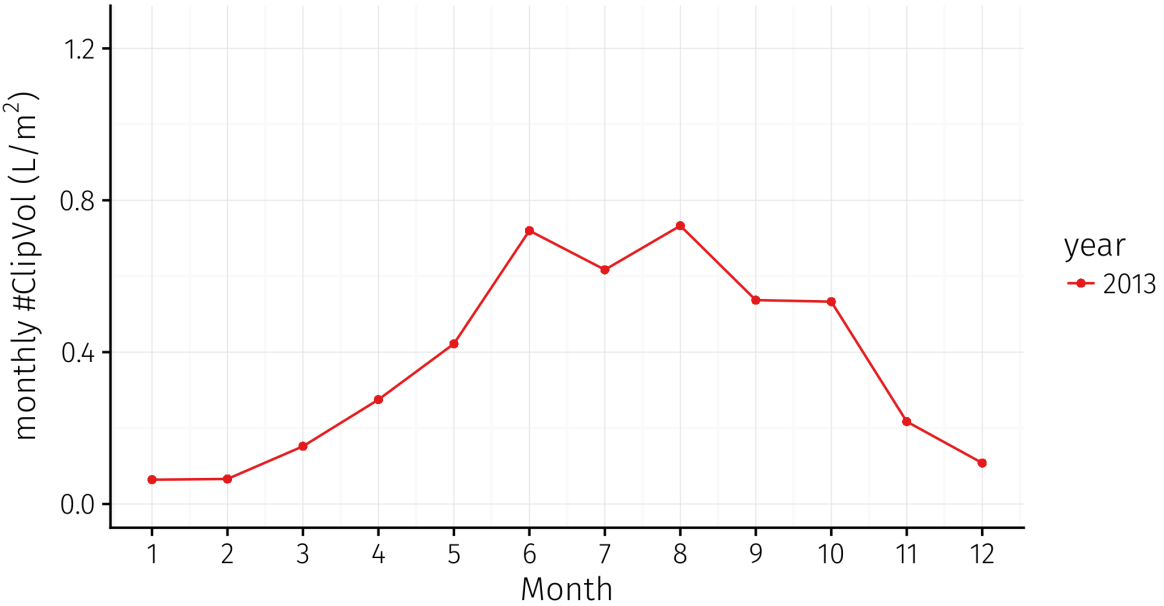

Morning clipping volume in 2022
Clipping volume (mL/m^2)
0
10
20
30
40
50
60
70
Apr 01
May 01
Jun 01
Jul 01
Aug 01
Sep 01
Oct 01
volume from a single green
daily average of all greens
2021 moving average
7 day moving average
Penn A-4 creeping bentgrass greens at Hazeltine National GC

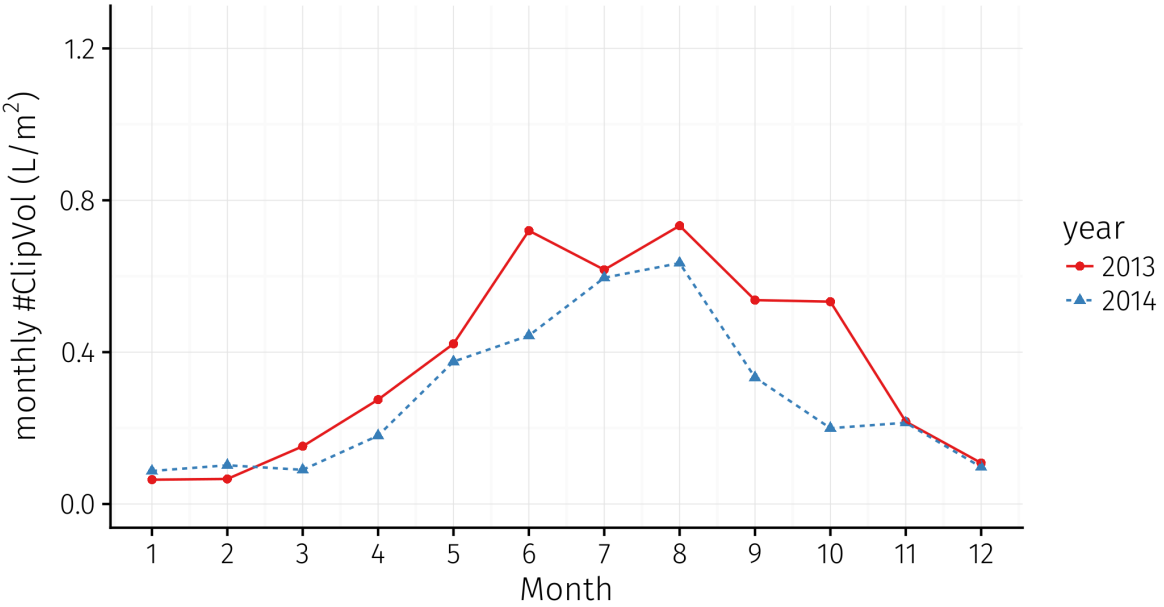
Cumulative clipping volume green by green

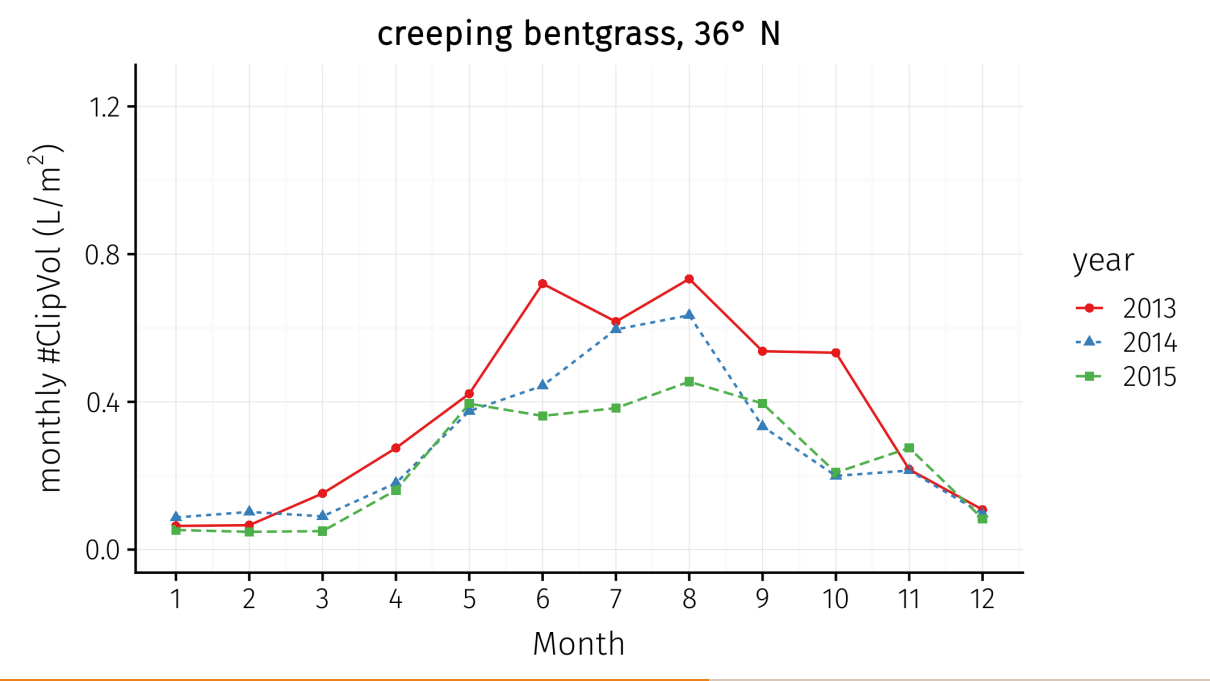
2022 in black, 2021 in pink, and the 2022 average across all holes in green.



Kanto region, Japan


creeping bentgrass, 36° N
monthly #ClipVol (L/m^2)
1.2
0.8
0.4
0.0
1
2
3
4
5
6
7
8
9
10
11
12
Month
year
2013


creeping bentgrass, 36° N
monthly #ClipVol (L/m2)
1.2
0.8
0.4
0.0
1
2
3
4
5
6
7
8
9
10
11
12
Month
year
2013
2014


creeping bentgrass, 36° N
monthly #ClipVol (L/m^2)
1.2
0.8
0.4
0.0
1
2
3
4
5
6
7
8
9
10
11
12
Month
year
2013
2014
2015

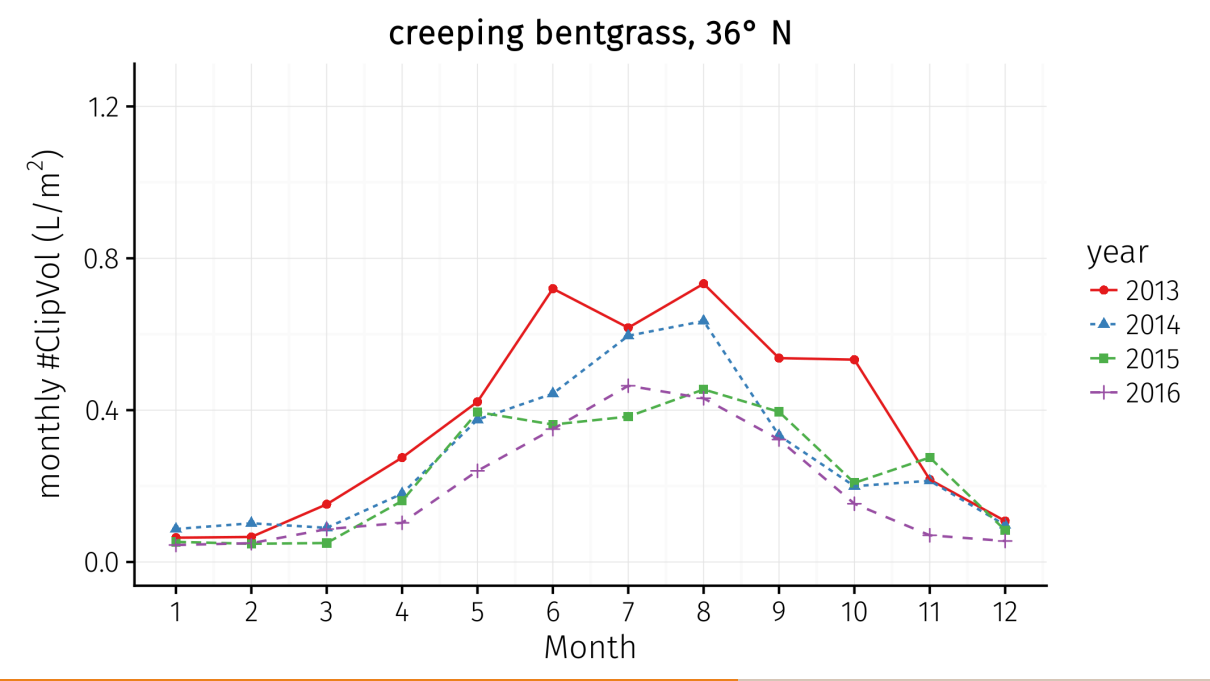

creeping bentgrass, 36° N
monthly #ClipVol (L/m^2)
1.2
0.8
0.4
0.0
1
2
3
4
5
6
7
8
9
10
11
12
Month
year
2013
2014
2015
2016

Table 1: Annual clipping volume at that location from 2013 to 2016

Year	Volume L/m^2	Estimated dry weight g/m^2	N applied g/m^2
2013	4.4	266	NA
2014	3.4	201	13
2015	2.9	172	10
2016	2.4	142	8.5

Measure soil organic matter

Fuji Classic GC, Yamanashi


Bangsai CC, Thailand

Bangsai CC, Thailand

Measure surface performance

A Year of Measuring Putting Green Performance

Taking the time to collect information about putting green performance pays off with more insight and improved management efficiency.

BY CHRIS HARTWIGER

As an agronomist, I am curious about what well-performing putting greens have in common. Are there things that good putting greens have in common, or are there many different paths to the same destination? How does performance fluctuate during a year, or among many years? When I ask these questions in the field, I find there are few golf courses that collect and consolidate information about putting green performance and management inputs that would allow them to provide definitive answers.

In 2018, USGA agronomist Addison Barden and I embarked on a project with six different golf courses to answer these questions by collecting daily putting green management information. Through this process of data collection and analysis, we hoped the participating golf course superintendents would use this newly accumulated information to make decisions that would smooth out the peaks and valleys in putting green performance and optimize the allocation of resources in managing their putting greens. This article will share a few details about the project, what we learned, and how you might use data collection to improve management at your golf course.

Collecting and visualizing data of key surface performance indicators and inputs enables superintendents to efficiently achieve specific surface performance goals with greater consistency.

in the USGA *Green Section Record*, November 2019

…een and avoid their best or worst …tting greens.

STEP 1: WHAT TO MEASURE

Next, we identified the variables we thought contributed most to those performance indicators. In other words, we had to decide which inputs

green surface management data

Recommend records of …

Key performance indicators

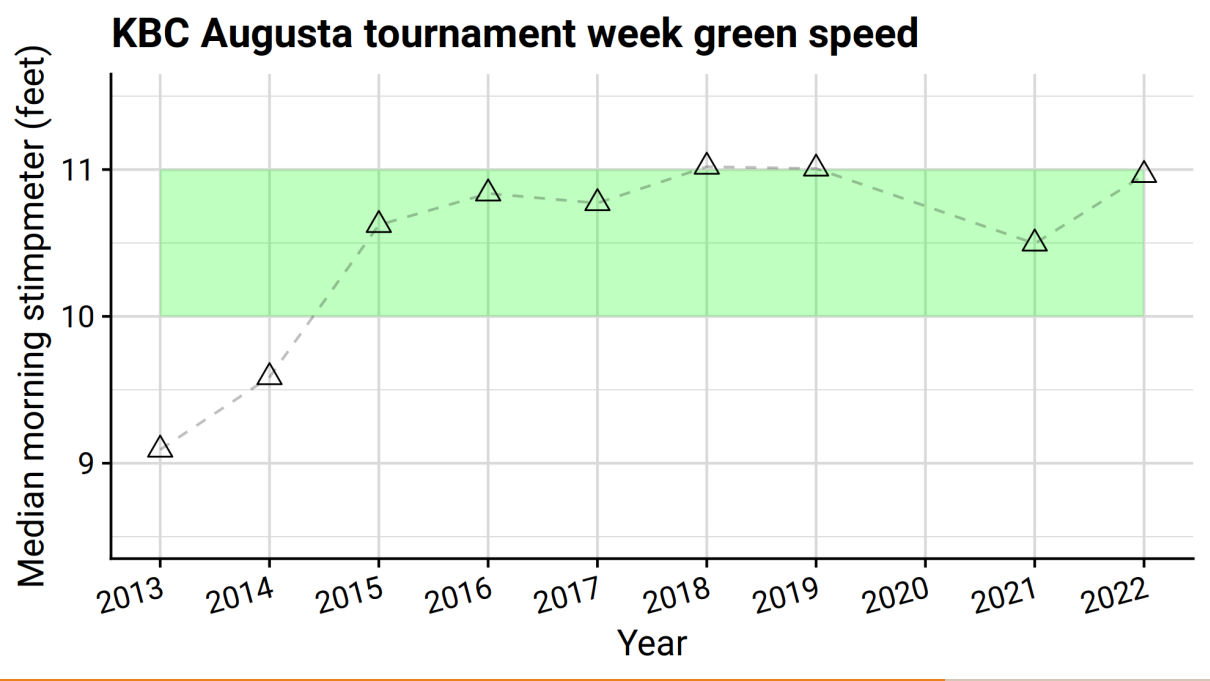
- Green speed
- Clipping volume

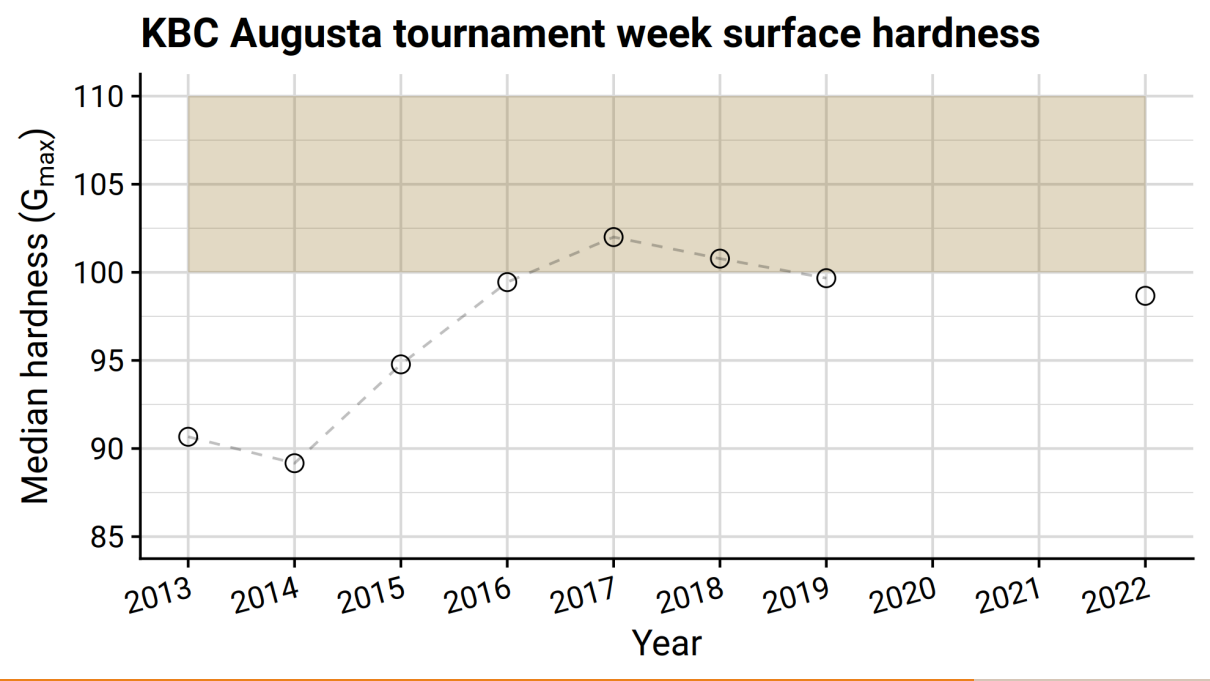
Cultural inputs & conditions

- Nitrogen applications
- Sand topdressing applications
- Growth regulator applications
- Daily high & low temperature
- Daily precipitation

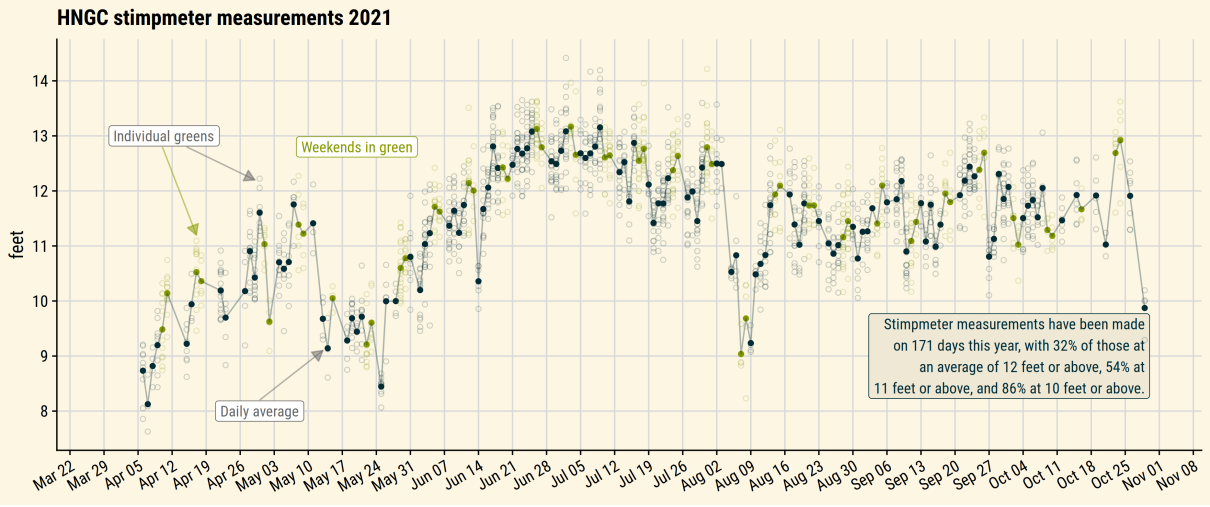
Surface maintenance practices

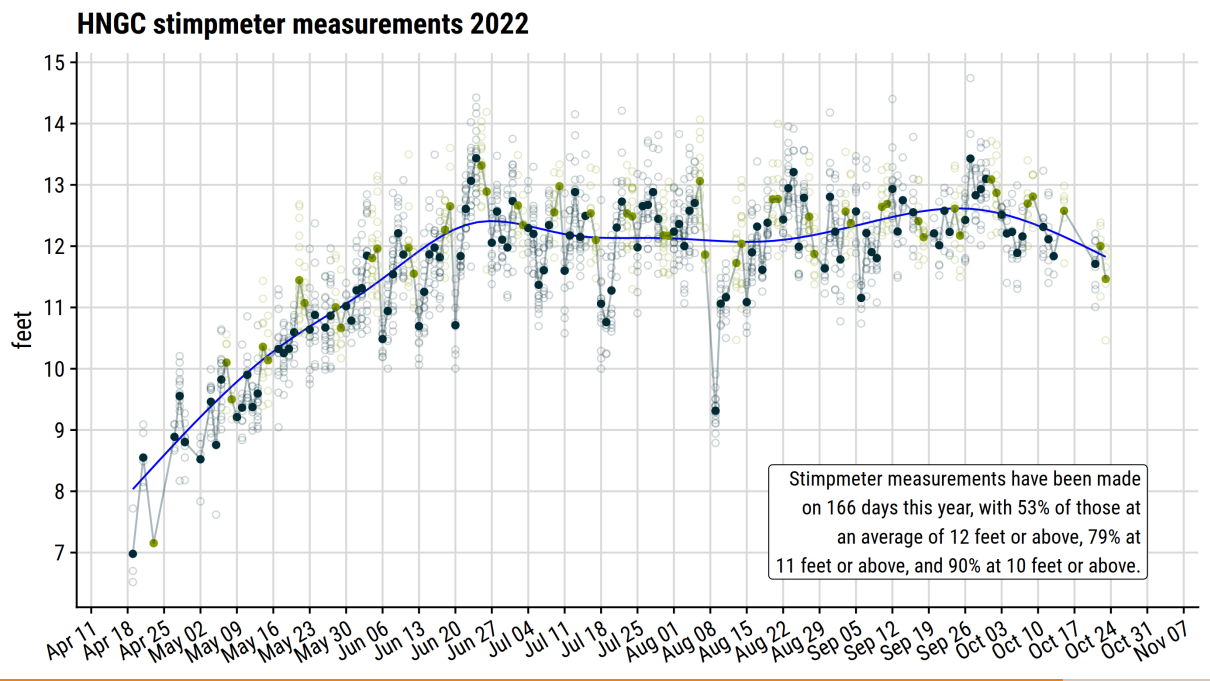
- Mowing height
- Mowing frequency
- Vertical mowing
- Grooming
- Brushing
- Rolling

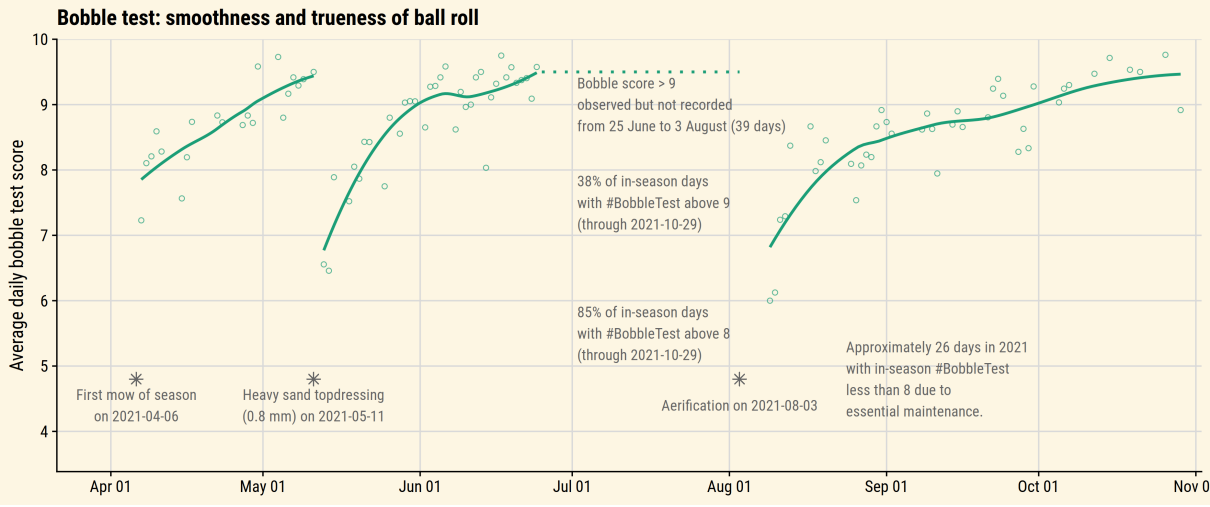

KBC Augusta tournament week green speed
Median morning stimpmeter (feet)
11
10
9
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
Year

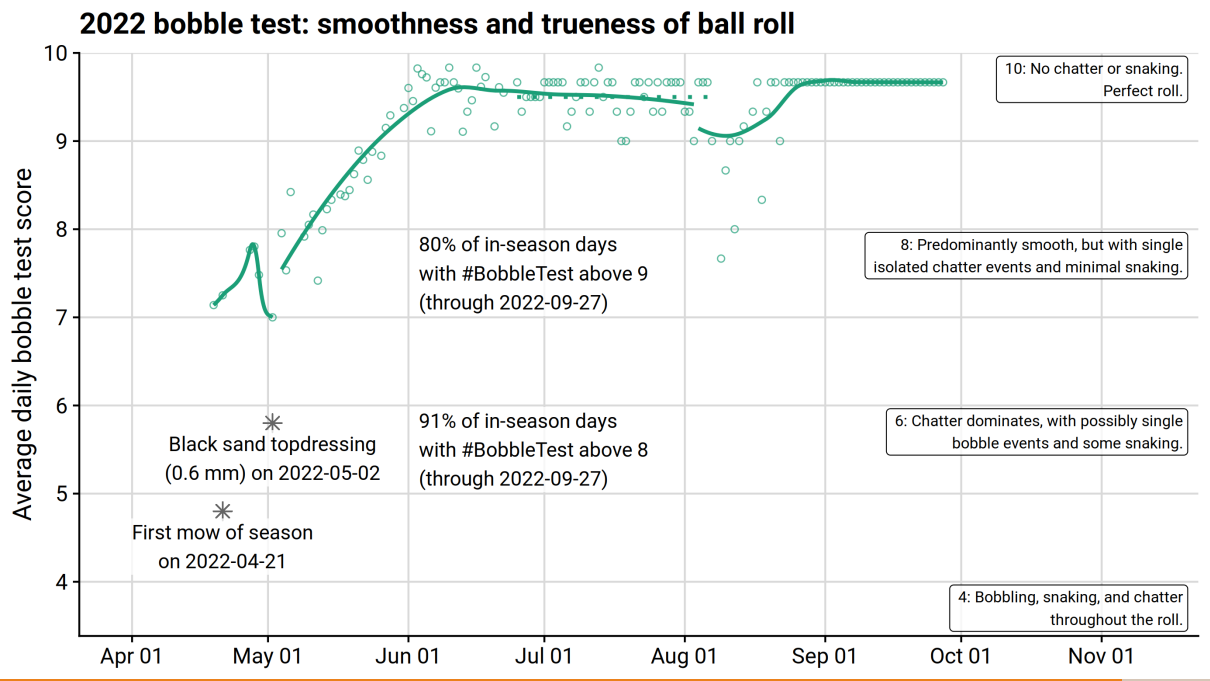

KBC Augusta tournament week surface hardness
Median hardness (G_{max})
110
105
100
95
90
85
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
Year

Keya GC, Fukuoka


HNGC stimpmeter measurements 2021
feet
14
13
12
11
10
9
8
Individual greens
Weekends in green
Daily average
Stimpmeter measurements have been made on 171 days this year, with 32% of those at an average of 12 feet or above, 54% at 11 feet or above, and 86% at 10 feet or above.
Mar 22
Mar 29
Apr 05
Apr 12
Apr 19
Apr 26
May 03
May 10
May 17
May 24
May 31
Jun 07
Jun 14
Jun 21
Jun 28
Jul 05
Jul 12
Jul 19
Jul 26
Aug 02
Aug 09
Aug 16
Aug 23
Aug 30
Sep 06
Sep 13
Sep 20
Sep 27
Oct 04
Oct 11
Oct 18
Oct 25
Nov 01
Nov 08


HNGC stimpmeter measurements 2022
feet
15
14
13
12
11
10
9
8
7
Apr 11
Apr 18
Apr 25
May 02
May 09
May 16
May 23
May 30
Jun 06
Jun 13
Jun 20
Jun 27
Jul 04
Jul 11
Jul 18
Jul 25
Aug 01
Aug 08
Aug 15
Aug 22
Aug 29
Sep 05
Sep 12
Sep 19
Sep 26
Oct 03
Oct 10
Oct 17
Oct 24
Oct 31
Nov 07
Stimpmeter measurements have been made on 166 days this year, with 53% of those at an average of 12 feet or above, 79% at 11 feet or above, and 90% at 10 feet or above.


Bobble test: smoothness and trueness of ball roll
Average daily bobble test score
10
9
8
7
6
5
4
Apr 01
May 01
Jun 01
Jul 01
Aug 01
Sep 01
Oct 01
Nov 0
Bobble score > 9
observed but not recorded
from 25 June to 3 August (39 days)
38% of in-season days
with #BobbleTest above 9
(through 2021-10-29)
85% of in-season days
with #BobbleTest above 8
(through 2021-10-29)
First mow of season
on 2021-04-06
Heavy sand topdressing
(0.8 mm) on 2021-05-11
Aerification on 2021-08-03
Approximately 26 days in 2021
with in-season #BobbleTest
less than 8 due to
essential maintenance.


2022 bobble test: smoothness and trueness of ball roll
Average daily bobble test score
10
9
8
7
6
5
4
Apr 01
May 01
Jun 01
Jul 01
Aug 01
Sep 01
Oct 01
Nov 01
10: No chatter or snaking. Perfect roll.
8: Predominantly smooth, but with single isolated chatter events and minimal snaking.
6: Chatter dominates, with possibly single bobble events and some snaking.
4: Bobbling, snaking, and chatter throughout the roll.
80% of in-season days with #BobbleTest above 9 (through 2022-09-27)
91% of in-season days with #BobbleTest above 8 (through 2022-09-27)
Black sand topdressing (0.6 mm) on 2022-05-02
First mow of season on 2022-04-21

Recommended approach

Assess playing conditions at least once per week

- green speed
- quality of roll (Bobble Test)
- surface firmness
- soil water content

Recommended approach

Then, compare conditions to the desired level

Objective: to maximize the number of days in the year with conditions at the desired level.

Continuous improvement system

1. Measure soil nutrients, then adjust
2. Measure growth rate, then adjust
3. Measure soil organic matter, then adjust
4. Measure surface performance, then adjust

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