

# How to improve playing conditions & optimize work efficiency

Micah Woods

Chief Scientist — Asian Turfgrass Center

[www.asianturfgrass.com](http://www.asianturfgrass.com)

14 December 2020



Sunrise at ATC Research Facility, January 2008

# Today's topics

1. A review of 4 factors that influence grass growth
2. Grass performance in Thailand
3. A simple system to optimize playing conditions



More days like this



Fewer days like this

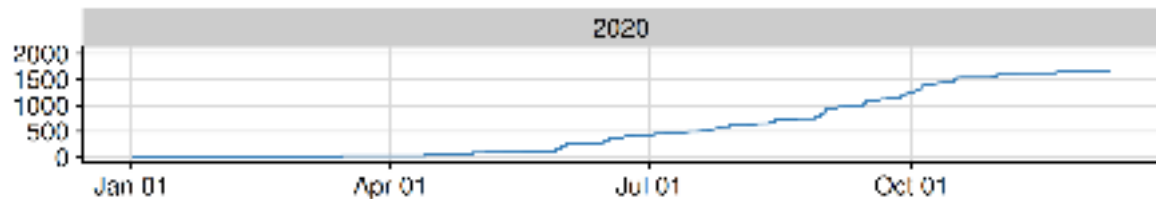
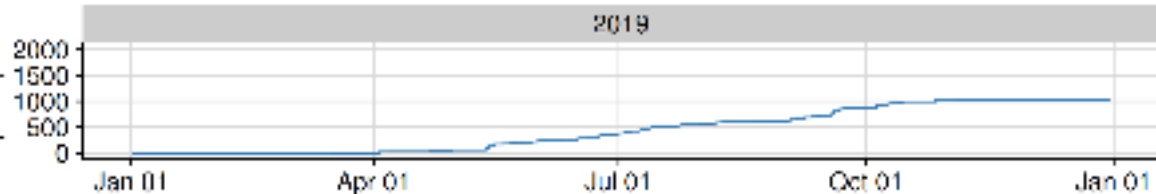
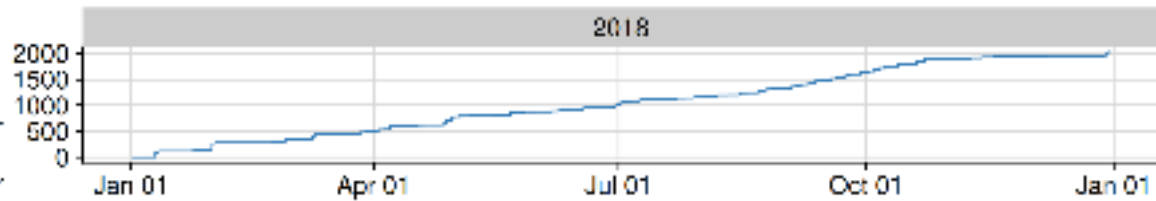


No days like this

# The 4 growth factors

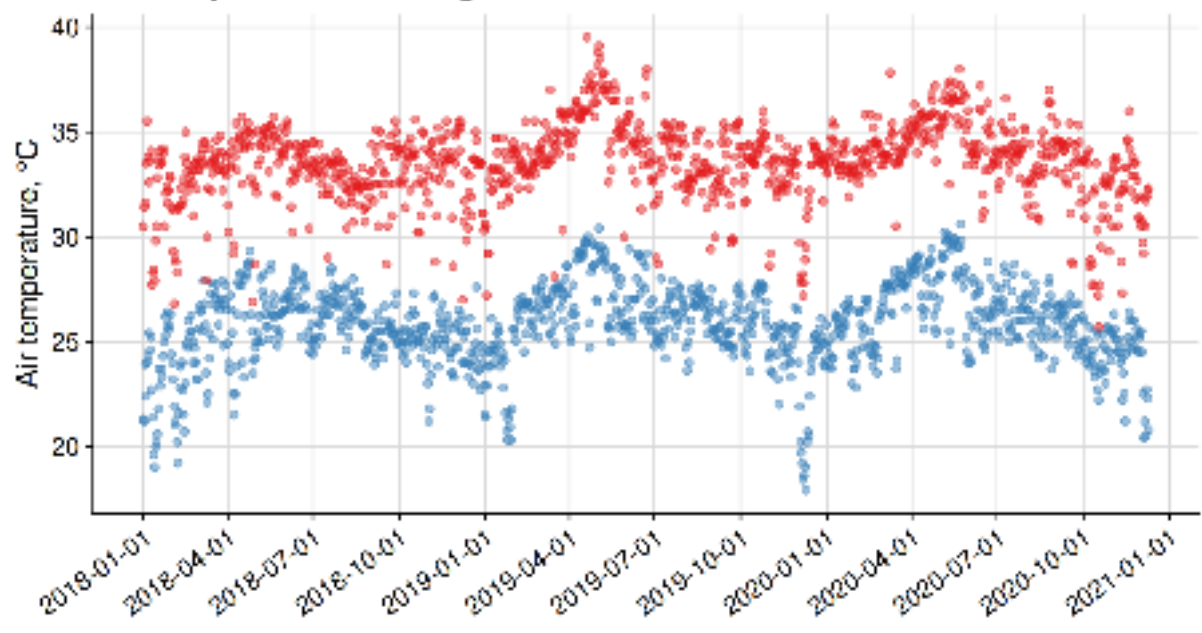
- ▶ Leaf nitrogen content
- ▶ Plant water status
- ▶ Temperature
- ▶ Light (photosynthetically active radiation)

## Precipitation at Bangna

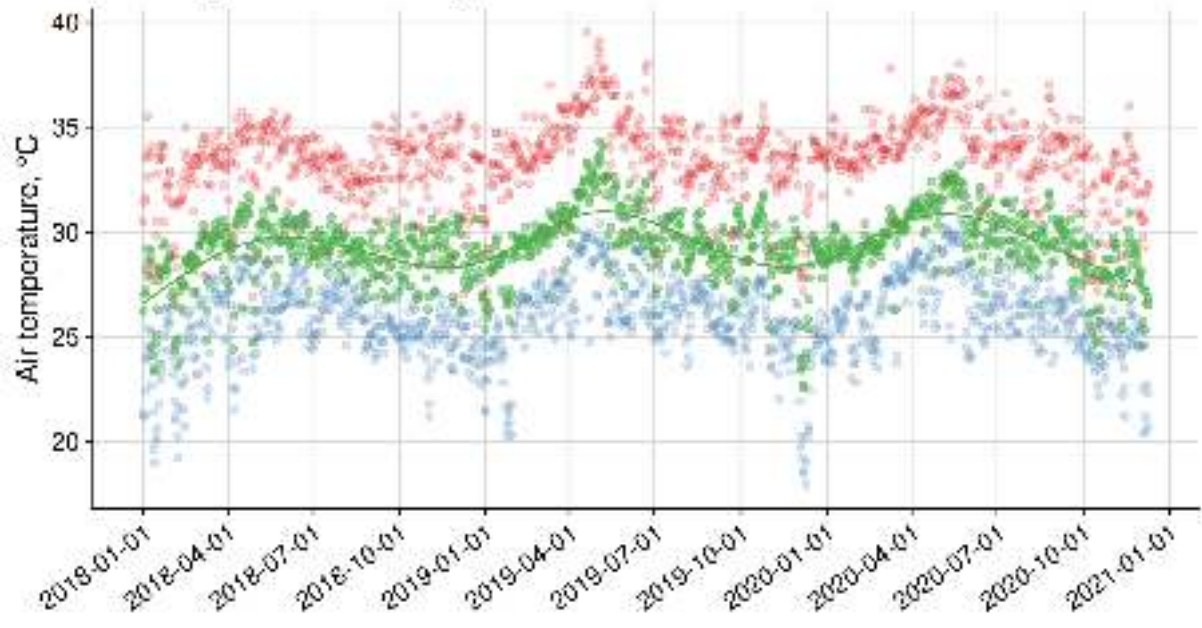




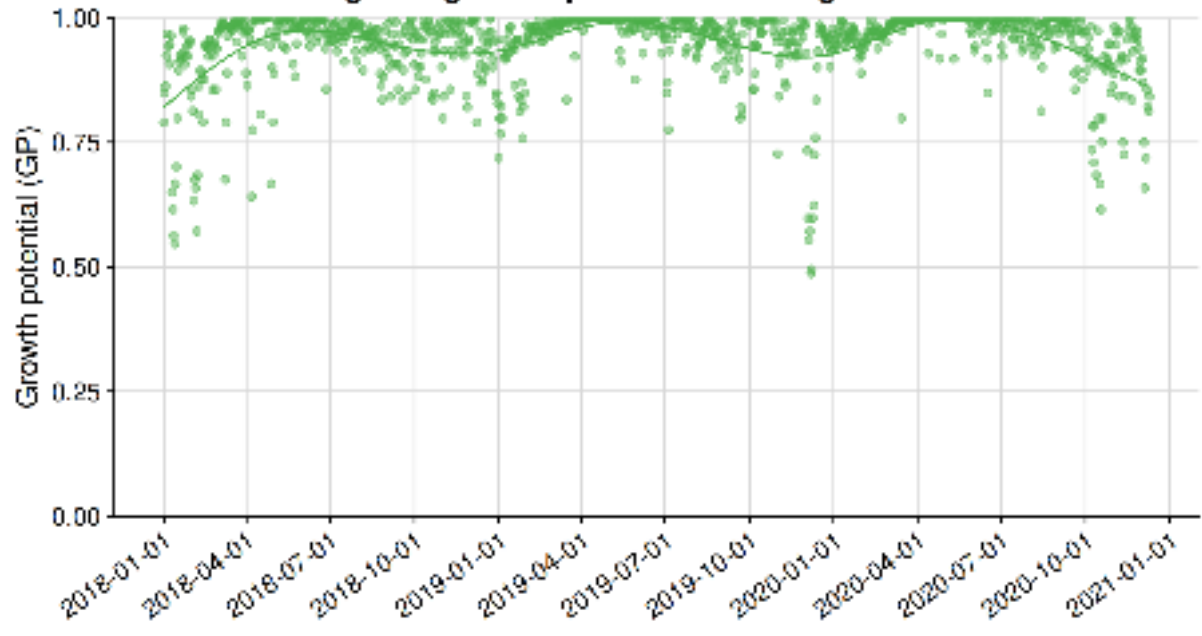
**Air temperature at Bangna**



**Air temperature at Bangna**

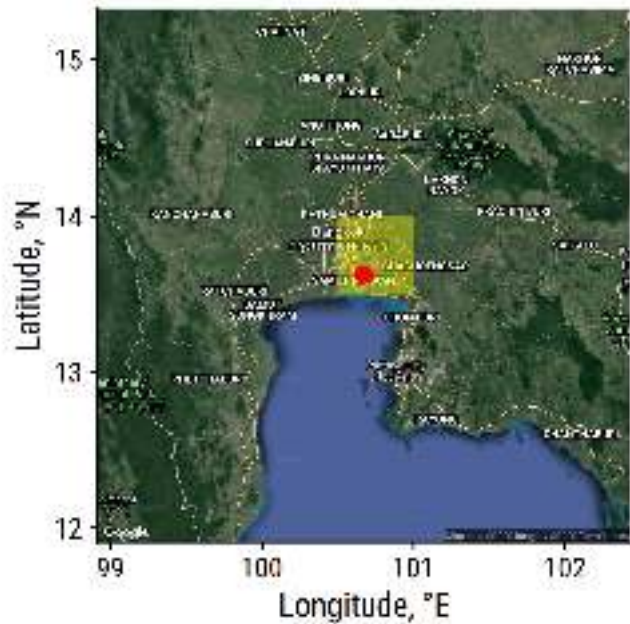


Warm-season grass growth potential at Bangna





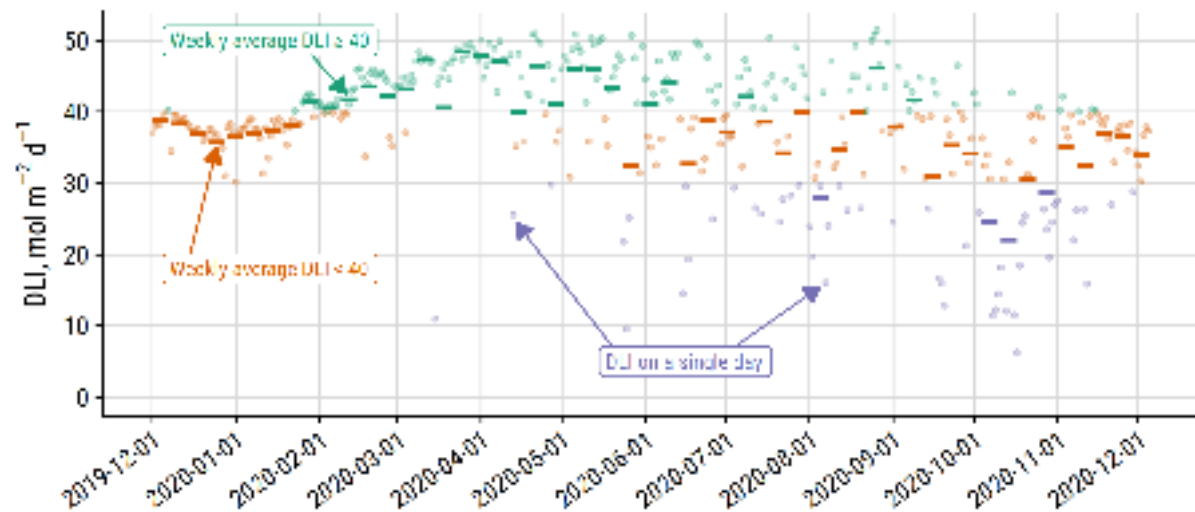
Cloudy day in Bangna



0.5° latitude & longitude box surrounding Muang Kae Golf Club

# Daily light integral (DLI)

for the past 53 weeks at 13.6° N & 100.7° E



These data were obtained from the NASA Langley Research Center POWER Project funded through the NASA Earth Science Directorate Applied Science Program: [power.arc.nasa.gov](http://power.arc.nasa.gov) using the [POWER](https://github.com/AdamSpicer/POWER) package by Adam Spicer

## Grass performance in Thailand





Irrigated zoysia fairway





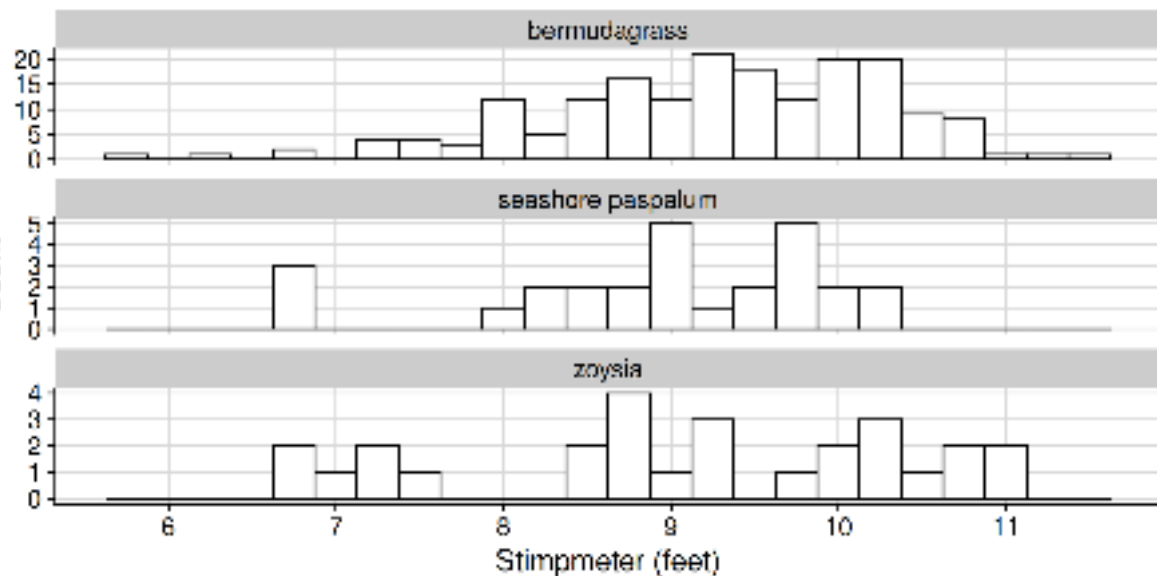
Dormant zoysia, green bermuda



Khet Udomsak GC, Chumphon

# Summary of 237 stimpmeter measurements

From 84 courses in Thailand







Soil properties that allow grass  
& surface to perform





Grass that's resilient to the  
necessary maintenance



Soil properties that allow grass  
& surface to perform

Result: the desired playing conditions



Grass that's resilient to the necessary maintenance



Soil properties that allow grass & surface to perform



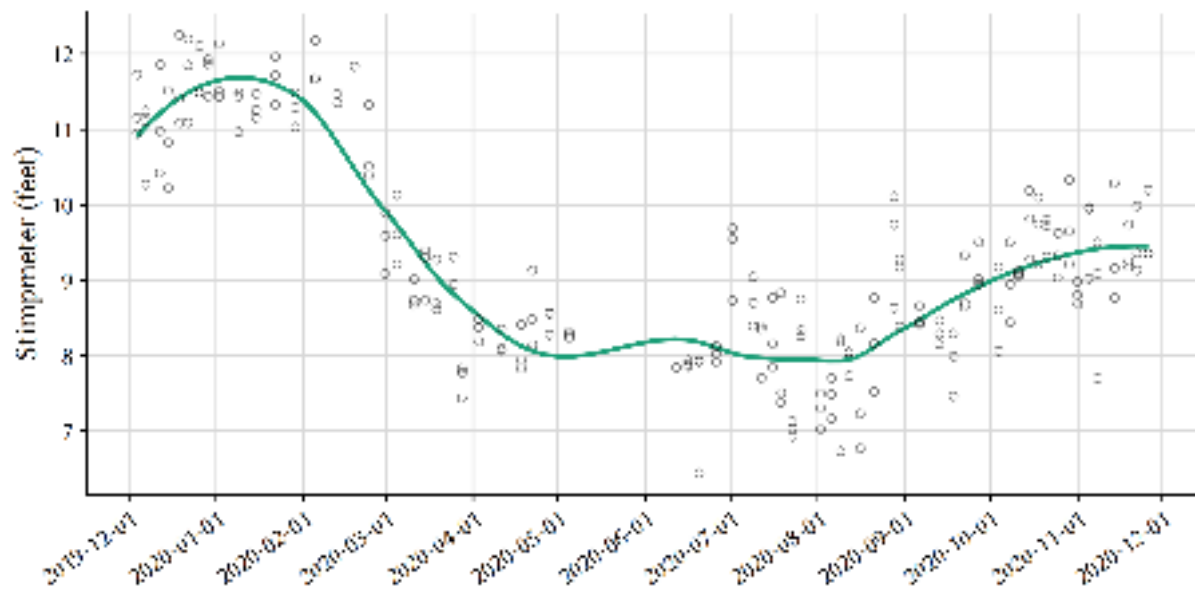
# What should we know?

## Surface performance

1. Stimpmeter



### A year of stimpmeter measurements



# What should we know?

## Surface performance

1. Stimpmeter

## Grass measurements

1. Nitrogen application rate

## 2020 Fertilizer Applications

## Greens

Date	Product	N	P	K
2020-03-23	21-0-0, Fe 0.5cc	0.50		
2020-04-09	46-0-0, Fe 0.75cc	0.58		
2020-04-27	46-0-0	0.58		
2020-05-08	46-0-0, 0-0-50, Traces 1.25cc	0.58		0.50
2020-05-19	46-0-0, 0-0-50, Traces 1.25cc	1.20		0.50
2020-05-28	46-0-0, Fe 0.75cc	1.20		
2020-06-01	46-0-0, 0-0-50, Fe 0.75cc	1.20		
2020-06-08	46-0-0, Fe 0.75cc	0.58		
2020-07-03	21-0-0, 0-0-50, Traces 1.25cc	0.58		0.50
2020-07-15	21-0-0, 0-0-50, Fe 0.5cc	0.58		0.50
2020-07-23	21-0-0, 0-0-50, Fe 0.5cc	0.58		0.50
2020-08-05	Traces 1.25cc			
2020-08-12	Traces 1.25cc			
2020-08-21	Traces 1.25cc			
2020-09-01	21-0-0, Fe 0.5cc	0.27		
2020-09-07	21-0-0, Fe 0.5cc	0.27		
2020-09-15	21-0-0, Fe 0.5cc	0.27		
2020-09-25	46-0-0, 0-0-50, 0-0-50	0.58		0.50
2020-10-05	46-0-0, Fe 0.5cc, 0-0-50	0.58		0.50
2020-10-15	46-0-0, — 0.5cc	0.58		
2020-10-20	46-0-0, Fe 0.5cc	0.58		
2020-11-12	46-0-0, Fe 0.5cc	0.58		
Total		12.0	0.0	3.0

# What should we know?

## Surface performance

1. Stimpmeter

## Grass measurements

1. Nitrogen application rate
2. Plant growth regulator application rate, timing, and effect



**Greenkeeper** is an essential decision - support tool designed exclusively for turfgrass professionals by the Turf Program at the University of Nebraska - Lincoln.

CONTACT

## Reapplication Reminder

Control of Work View has expired & follow up

### PRODUCT EXPIRATION LISTING

Green

Primo Macc (aguardente) - Trancoso (c/yl)

40%

U/Vozado 00/10/15 - 00/10/15

GGC: 014/100

Relative C: aging Yld: 0% Suspended

Primo Macc (aguardente) - Trancoso (c/yl)

50%

U/Vozado 00/10/15 - 00/10/15

GGC: 014/100

Relative C: aging Yld: 10% Suspended

Follow up

Primo Macc (aguardente) - Trancoso (c/yl)

30%

U/Vozado 00/10/14 - 00/10/14

GGC: 014/100

Relative C: aging Yld: 10% Suspended

Primo Macc (aguardente) - Trancoso (c/yl)

30%

713



U.V. 7001.9 600.9

### WEATHER

CURRENT as of 20:00

26°  
20% light rain  
100% Humidity  
Clear - Wind at 10km/h

FUTURE as of 20:00

30°  
10% light rain  
100% Humidity  
Clear - Wind at 10km/h

Next 30 Days

MON	TUE	WED	THU	FRI
34° 22°	34° 22°	35° 22°	35° 22°	35° 22°
54% 100%	54% 100%	54% 100%	54% 100%	54% 100%
25° 23°	25° 23°	25° 23°	25° 23°	25° 23°



### ENVIRONMENTAL TEMPERATURE

20:00:00

Temp: 26°

# What should we know?

## Surface performance

1. Stimpmeter

## Grass measurements

1. Nitrogen application rate
2. Plant growth regulator application rate, timing, and effect
3. Clipping volume

Morning clipping volume



data from paspalum putting greens in Haroi



# What should we know?

## Surface performance

1. Stimpmeter

## Grass measurements

1. Nitrogen application rate
2. Plant growth regulator application rate, timing, and effect
3. Clipping volume

## Soil measurements

1. Soil water content



# What should we know?

## Surface performance

1. Stimpmeter

## Grass measurements

1. Nitrogen application rate
2. Plant growth regulator application rate, timing, and effect
3. Clipping volume

## Soil measurements

1. Soil water content
2. Soil nutrient content



# Reference



September, 2014

## Minimum Levels for Sustainable Nutrition Soil Guidelines

The Minimum Level for Sustainable Nutrition (MLSN) Guideline is a new, more sustainable approach to managing soil nutrient levels that can help you to decrease fertilizer inputs and costs, while still maintaining desired turf quality and playability levels. The MLSN guidelines were developed in a joint project between PACE Turf and the Asian Turfgrass Center. All soil analyses were conducted at Brookside Laboratories, New Bremen, OH.

	MLSN Soil Guideline
pH	>5.5
Potassium (K ppm)	37
Phosphorus (P ppm)	21
Calcium (Ca ppm)	331
Magnesium (Mg ppm)	47
Sulfur as sulfate (S ppm)	7

# What should we know?

## Surface performance

1. Stimpmeter

## Grass measurements

1. Nitrogen application rate
2. Plant growth regulator application rate, timing, and effect
3. Clipping volume

## Soil measurements

1. Soil water content
2. Soil nutrient content
3. Quantity of sand applied



# What should we know?

## Surface performance

1. Stimpmeter

## Grass measurements

1. Nitrogen application rate
2. Plant growth regulator application rate, timing, and effect
3. Clipping volume

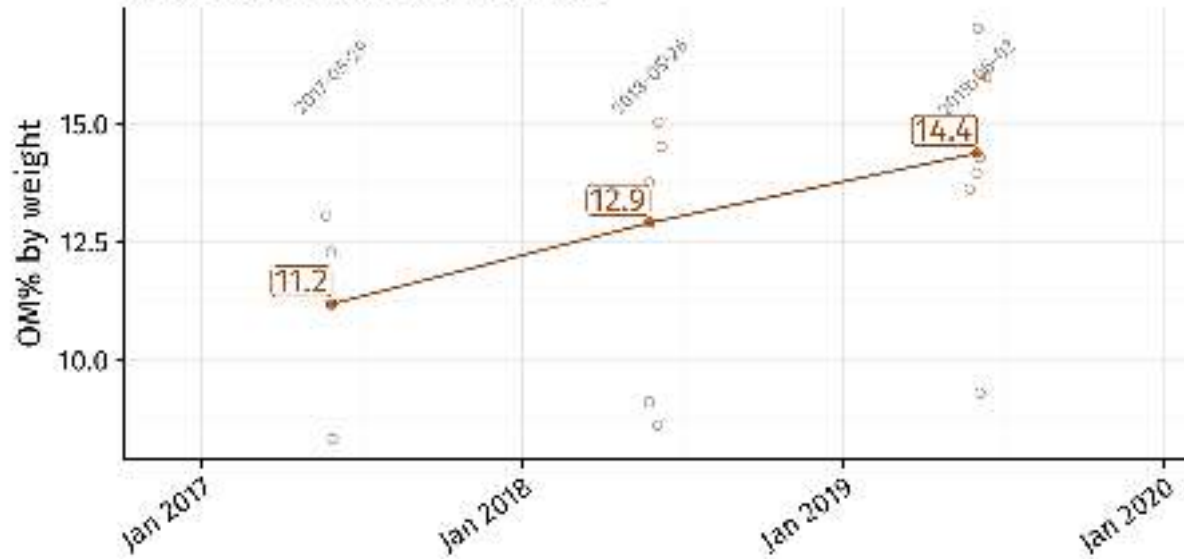
## Soil measurements

1. Soil water content
2. Soil nutrient content
3. Quantity of sand applied
4. Total organic matter (OM246)





**Total organic matter in top 2 cm**



Result: the desired playing conditions



Grass that's resilient to the necessary maintenance



Soil properties that allow grass & surface to perform



For more, please see  
[www.asianturfgrass.com](http://www.asianturfgrass.com)