# Example GC soil nutrient analysis and report

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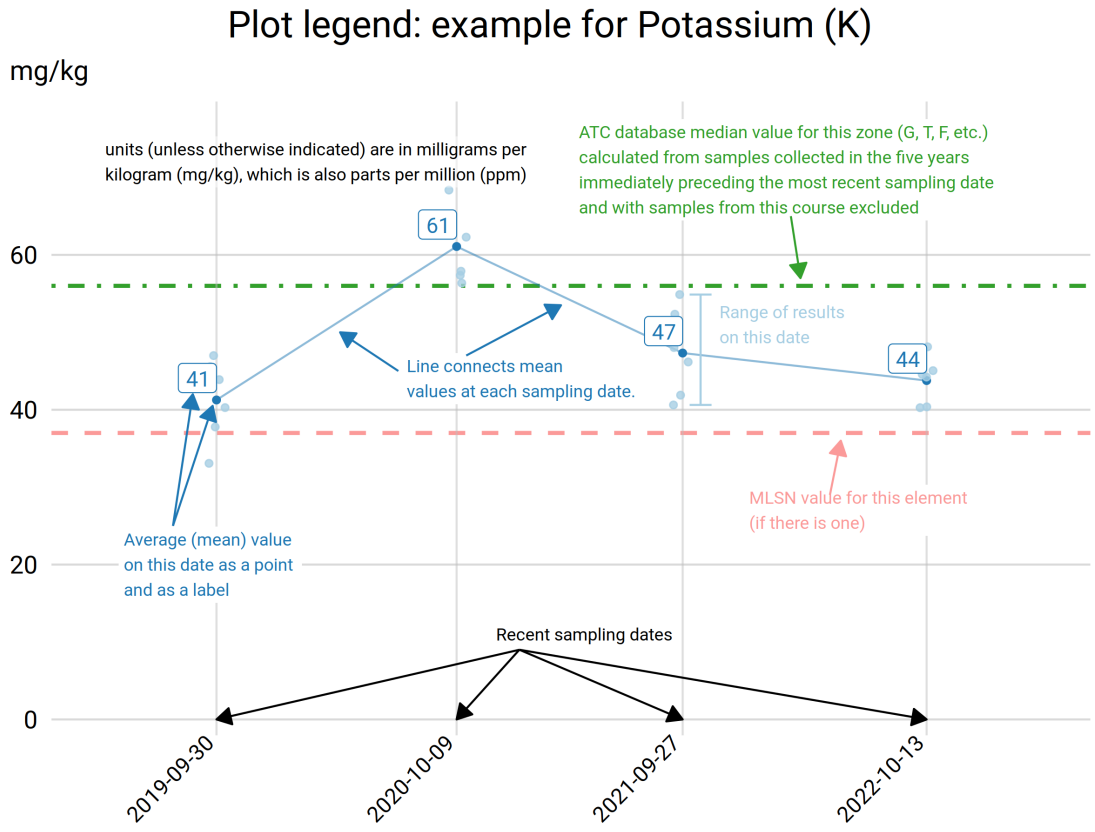



Figure 1: The annotations on this example chart show the information that you'll see on the summary soil test result charts.

# 1 Notes and recommendations

## 1.1 Recommendation summary

At this soil pH, I recommend a low rate of $CaMg(Co_3)_2$ to supply a little Ca and Mg and to keep the soil pH from dropping lower. I recommend adding dolomitic limestone at a rate of 25 $g/m^2$ this year.

The soil P remains at a high level of 169 ppm. There is no need to apply any P fertilizer this year. At the soil K level of 56 ppm, I recommend adding an N:K ratio of 3:1 this year.

The micronutrients are all at above average levels in the soil. There is no need to supply micronutrients this year.

Please let me know any questions about this report and about my recommendations.

## 1.2 Chart legend

This sample chart in Figure 1 shows how the data are presented for your samples from each area. When I look at these charts, I'm looking at three main things.

I look at the change over time (assuming you have a time series of samples). Is the test result for a particular soil parameter going up, down, or staying the same? I also look at how each parameter compares to the average from the area or zone[1] for samples in ATC's dataset from the most recent five years. For elements with an MLSN minimum, that value is shown on the charts as well, and I check if the element is above the MLSN minimum, or if the expected nutrient use over the upcoming year may drop the soil level below the MLSN value.

[1] I group **greens** together, **fairways** together, **tees** together, and **rough & lawns** together.

## 2 Greens

This is a summary and recommendations for the 6 samples from the greens.

**pH** The range is from 5.5 to 6.1 with a median of 5.8. This is an optimum level for soil nutrient availability and soil microbial activity.

**Organic matter** The average is 1.7%. This is a normal level for golf course putting greens.

**Potassium** The average is 56 ppm. See the notes and recommendations section at the start of the report for the K recommendation.

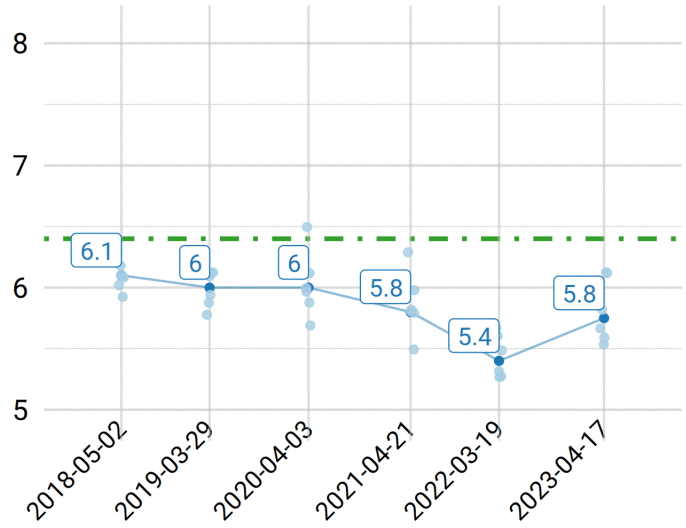
**Phosphorus** The average is 169 ppm. See the notes and recommendations section at the start of the report for the P recommendation.

**Calcium** The average is 587 ppm. This is more than enough to meet the grass requirements. Calcium fertilizer is not required.

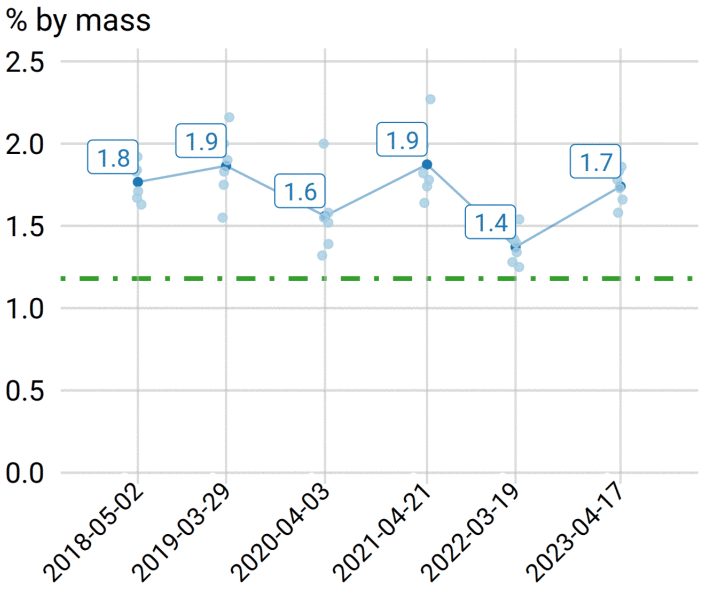
**Magnesium** The average is 54 ppm. This is more than enough to meet the grass requirements. Magnesium fertilizer is not required.

**Sulfur** The average is 11 ppm. This is above the minimum guideline of 7 ppm. No S fertilizer is required this year.

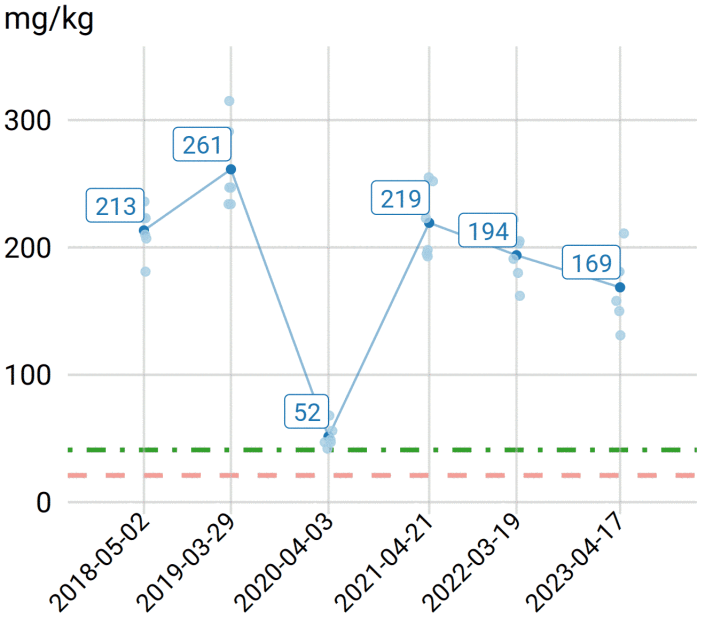
## Soil pH in 1:1 $H_2O$



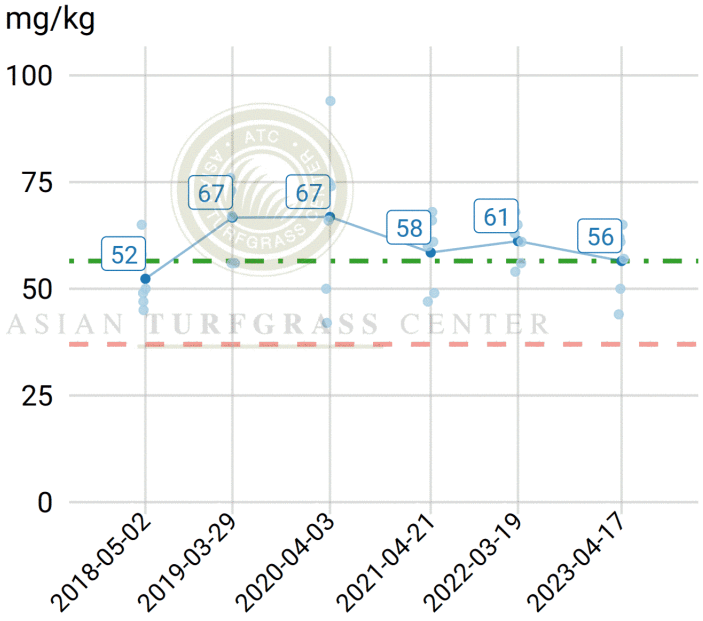

## Soil organic matter (OM)



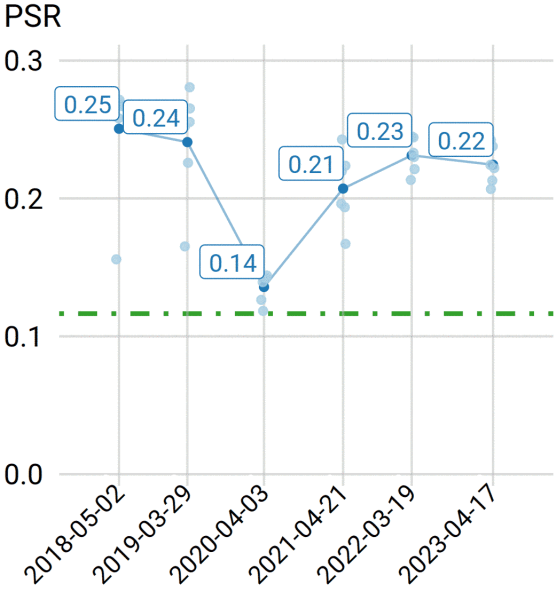

## Phosphorus (P)




## Potassium (K)

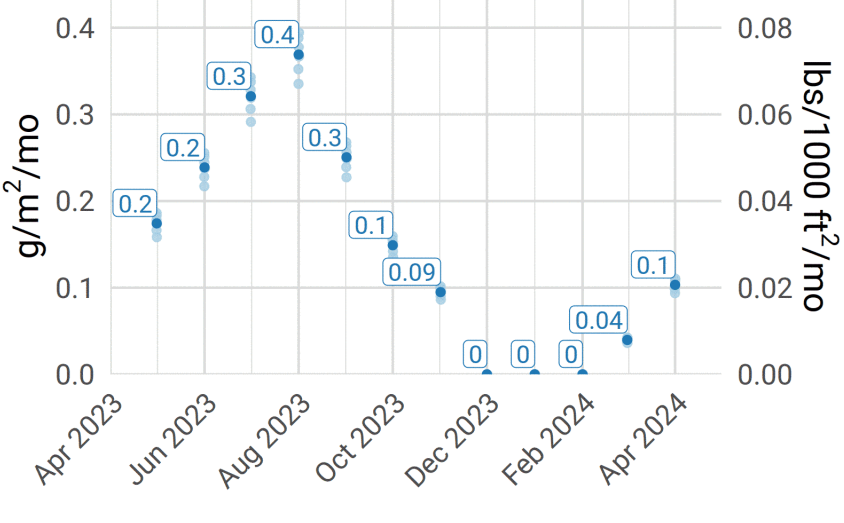



## P saturation ratio

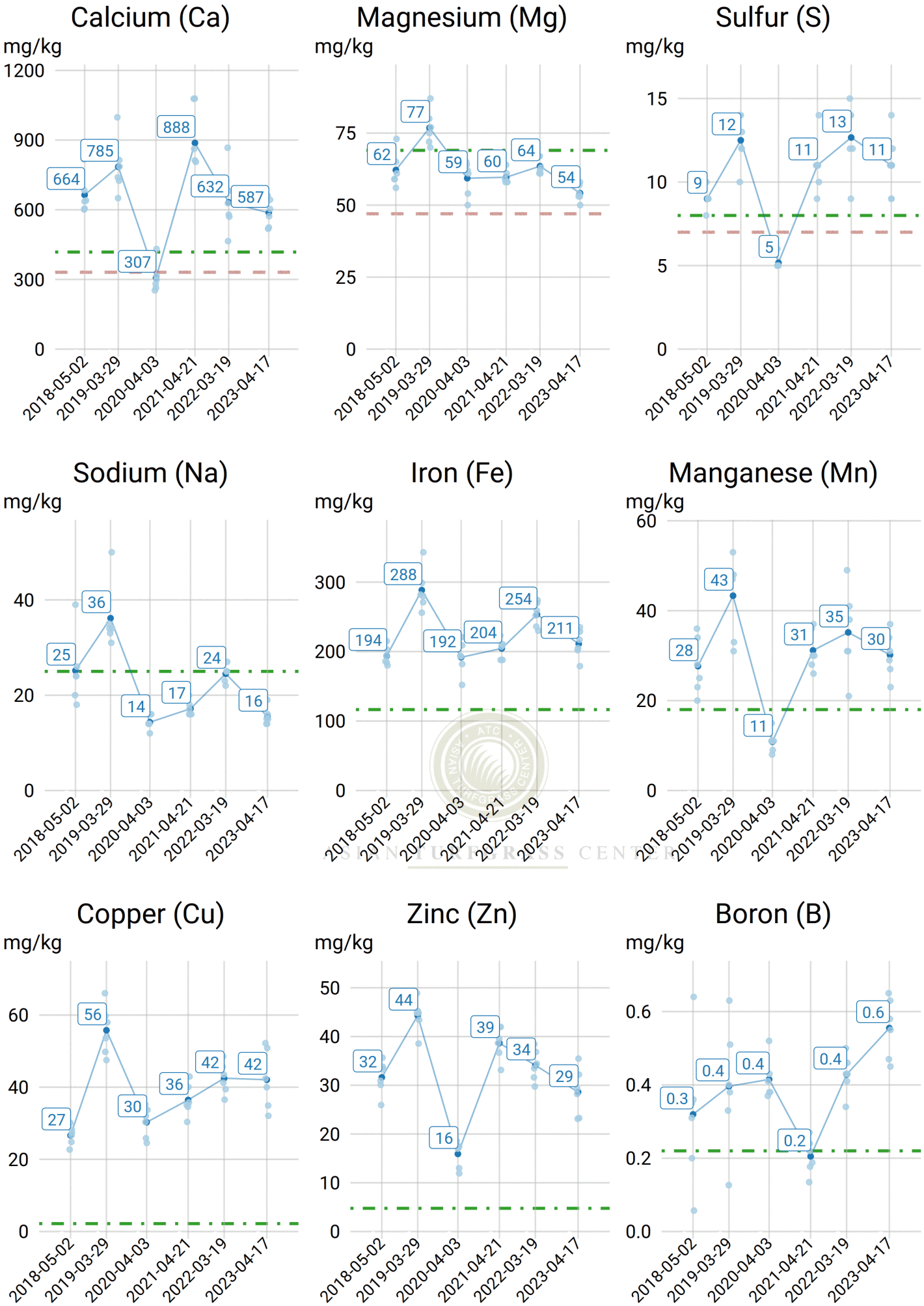



## Estimated nitrogen (N) mineralization

1.7 g annual total based on site-specific temperatures & a starting OM of 1.7%.



Example GC G charts 2/2



# A About this report

1. 1 ppm is 1 part per million. This means 1 mg of the element per 1 kg of soil (1 mg/kg).

2. All soil test results and fertilizer recommendations are elemental amounts unless otherwise stated. This is particularly relevant to phosphorus and potassium, in which this report refers to elemental amounts, but fertilizer labels usually report phosphate ($P_2O_5$, 44% P) and potassium oxide ($K_2O$, 83% K). Please make adjustments as necessary for fertilizer application.

3. The phosphorus saturation ratio (PSR) is a calculated index for the risk of P leaching. The formula is PSR= $\frac{P_{M3}}{Al_{M3}+Fe_{M3}}$ with the $P_{M3}$, $Fe_{M3}$, and $Al_{M3}$ expressed as the Mehlich 3 (M3) extractable amounts in units of mmol $kg^{-1}$. This is based on "Soil Testing to Predict Phosphorus Leaching."[2] If the PSR is above 0.2, you can consider that P has a high probability of leaching from that soil. If the PSR is higher than 0.2, you really want to be careful—I mean *don't add any*—about the application of P.

4. Sodium is included on the charts as an indicator of soil salinity. For cool-season grass, I recommend keeping the sodium below 120 ppm. If you have Na less than 120, no problem. If the Na is above 120 and you are growing cool-season grass, you'll want to consider leaching the salt from the soil. For warm-season grasses, excellent turf can be produced with Na of 200 or 300 ppm. However, if your salinity is that high, I recommend using an EC meter to monitor irrigation water and soil salinity to ensure it is kept at an acceptable level.

5. The predicted N mineralization by month for the next year is based on equations from Gilmour & Mauromoustakos (2011),[3] using average temperature information for your location, and assuming that the area is irrigated. More information on the recent temperatures at your site are presented in Appendix C.

Generated with ATC's `soil-report` 0.4.0 & typeset in XeLaTeX. Feature requests & bug reports at `atc-soil-report`.

[2]Maguire, R.O. and J.T. Sims. 2002. Soil testing to predict phosphorus leaching. J. Environ. Qual. 31:1601–1609.

[3]Gilmour, J.T. and A. Mauromoustakos. 2011. Nitrogen mineralization from soil organic matter: a sequential model. Soil Sci. Soc. Am. J. 75:317–323.

kg/ha

# BROOKSIDE LABORATORIES, INC.

48463-213

**SOIL AUDIT AND INVENTORY REPORT**

Name _____ City _____ State _____

Independent Consultant Asian Turfgrass Center Date 05/05/2023

| Sample Location | Example GC | G | G | G | G | G |
|---|---|---|---|---|---|---|
| Sample Identification | | 4 in 6 | 4 in 7 | 4 in 8 | 4 in 10 | 4 in 11 |
| Lab Number | | 0022-1 | 0023-1 | 0024-1 | 0025-1 | 0026-1 |
| Total Exchange Capacity (ME/ 100 g) | | 5.70 | 4.50 | 5.21 | 4.92 | 5.22 |
| pH | Buffer (SMP/ Sikora) | 7.2 | 7.3 | 7.2 | 7.3 | 7.2 |
| | $H_2O$ (1:1) | 5.6 | 5.8 | 5.5 | 6.1 | 5.7 |
| Organic Matter (360°C LOI) % | | 1.86 | 1.78 | 1.73 | 1.83 | 1.58 |
| Estimated Nitrogen Release | kg/ ha | 43 | 42 | 41 | 43 | 39 |
| ANIONS — SOLUBLE SULFUR* | ppm | 11 | 9 | 11 | 14 | 12 |
| ANIONS — PHOSPHORUS — MEHLICH III | kg/ ha P as $P_2O_5$ | 540 | 513 | 722 | 619 | 448 |
| | ppm of P | 158 | 150 | 211 | 181 | 131 |
| ANIONS — PHOSPHORUS — BRAY II | kg/ ha P as $P_2O_5$ | | | | | |
| | ppm of P | | | | | |
| ANIONS — PHOSPHORUS — OLSEN | kg/ ha P as $P_2O_5$ | | | | | |
| | ppm of P | | | | | |
| EXCHANGABLE CATIONS — CALCIUM* | kg/ ha | 960 | 783 | 774 | 987 | 900 |
| | ppm | 643 | 524 | 518 | 661 | 603 |
| MAGNESIUM* | kg/ ha | 75 | 79 | 87 | 85 | 81 |
| | ppm | 50 | 53 | 58 | 57 | 54 |
| POTASSIUM* | kg/ ha | 66 | 97 | 93 | 91 | 75 |
| | ppm | 44 | 65 | 62 | 61 | 50 |
| SODIUM* | kg/ ha | 22 | 22 | 28 | 21 | 21 |
| | ppm | 15 | 15 | 19 | 14 | 14 |
| **BASE SATURATION PERCENT** | | | | | | |
| Calcium | % | 56.40 | 58.22 | 49.71 | 67.17 | 57.76 |
| Magnesium | % | 7.31 | 9.81 | 9.28 | 9.65 | 8.62 |
| Potassium | % | 1.98 | 3.70 | 3.05 | 3.18 | 2.46 |
| Sodium | % | 1.14 | 1.45 | 1.59 | 1.24 | 1.17 |
| Other Bases | % | 6.20 | 5.80 | 6.40 | 5.20 | 6.00 |
| Hydrogen | % | 27.00 | 21.00 | 30.00 | 13.50 | 24.00 |
| **EXTRACTABLE MINORS** | | | | | | |
| Boron* (ppm) | | 0.55 | 0.47 | 0.65 | 0.58 | 0.45 |
| Iron* (ppm) | | 205 | 202 | 235 | 217 | 179 |
| Manganese* (ppm) | | 37 | 23 | 29 | 31 | 27 |
| Copper* (ppm) | | 32.07 | 42.38 | 52.19 | 39.99 | 34.92 |
| Zinc* (ppm) | | 23.12 | 29.33 | 35.47 | 32.19 | 23.27 |
| Aluminum* (ppm) | | 547 | 491 | 659 | 598 | 465 |
| OTHER TESTS — Soluble Salts (mmhos/ cm) | | | | | | |
| Chlorides (ppm) | | | | | | |
| $NO_3$-N (ppm) | | 1.3 | 3.0 | 1.8 | 3.6 | 1.1 |
| $NH_4$-N (ppm) | | 4.5 | 3.7 | 5.1 | 4.7 | 3.5 |
| | | | | | | |
| | | | | | | |

d - specific

* Mehlich III Extractable

kg/ha

# BROOKSIDE LABORATORIES, INC.

48463-213

**SOIL AUDIT AND INVENTORY REPORT**

Name _____ City _____ State _____

Independent Consultant Asian Turfgrass Center Date 05/05/2023

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Location | Example GC | G | | | | | |
| Sample Identification | | 4 in 12 | | | | | |
| Lab Number | | 0027-1 | | | | | |
| Total Exchange Capacity (ME/ 100 g) | | 4.33 | | | | | |
| pH | Buffer (SMP/ Sikora) | 7.3 | | | | | |
| | $H_2O$ (1:1) | 6.1 | | | | | |
| Organic Matter (360°C LOI) % | | 1.66 | | | | | |
| Estimated Nitrogen Release | kg/ ha | 40 | | | | | |
| ANIONS | SOLUBLE SULFUR* ppm | 9 | | | | | |
| ANIONS / PHOSPHORUS | MEHLICH III kg/ ha P as $P_2O_5$ | 619 | | | | | |
| | ppm of P | 181 | | | | | |
| | BRAY II kg/ ha P as $P_2O_5$ | | | | | | |
| | ppm of P | | | | | | |
| | OLSEN kg/ ha P as $P_2O_5$ | | | | | | |
| | ppm of P | | | | | | |
| EXCHANGABLE CATIONS | CALCIUM* kg/ ha | 854 | | | | | |
| | ppm | 572 | | | | | |
| | MAGNESIUM* kg/ ha | 79 | | | | | |
| | ppm | 53 | | | | | |
| | POTASSIUM* kg/ ha | 85 | | | | | |
| | ppm | 57 | | | | | |
| | SODIUM* kg/ ha | 24 | | | | | |
| | ppm | 16 | | | | | |
| **BASE SATURATION PERCENT** | | | | | | | |
| Calcium % | | 66.05 | | | | | |
| Magnesium % | | 10.20 | | | | | |
| Potassium % | | 3.38 | | | | | |
| Sodium % | | 1.61 | | | | | |
| Other Bases % | | 5.20 | | | | | |
| Hydrogen % | | 13.50 | | | | | |
| **EXTRACTABLE MINORS** | | | | | | | |
| Boron* (ppm) | | 0.63 | | | | | |
| Iron* (ppm) | | 229 | | | | | |
| Manganese* (ppm) | | 34 | | | | | |
| Copper* (ppm) | | 50.86 | | | | | |
| Zinc* (ppm) | | 28.22 | | | | | |
| Aluminum* (ppm) | | 540 | | | | | |
| OTHER TESTS | Soluble Salts (mmhos/ cm) | | | | | | |
| | Chlorides (ppm) | | | | | | |
| | $NO_3$-N (ppm) | 1.8 | | | | | |
| | $NH_4$-N (ppm) | 4.5 | | | | | |
| | | | | | | | |
| | | | | | | | |

d - specific

* Mehlich III Extractable

## C Site temperature summary

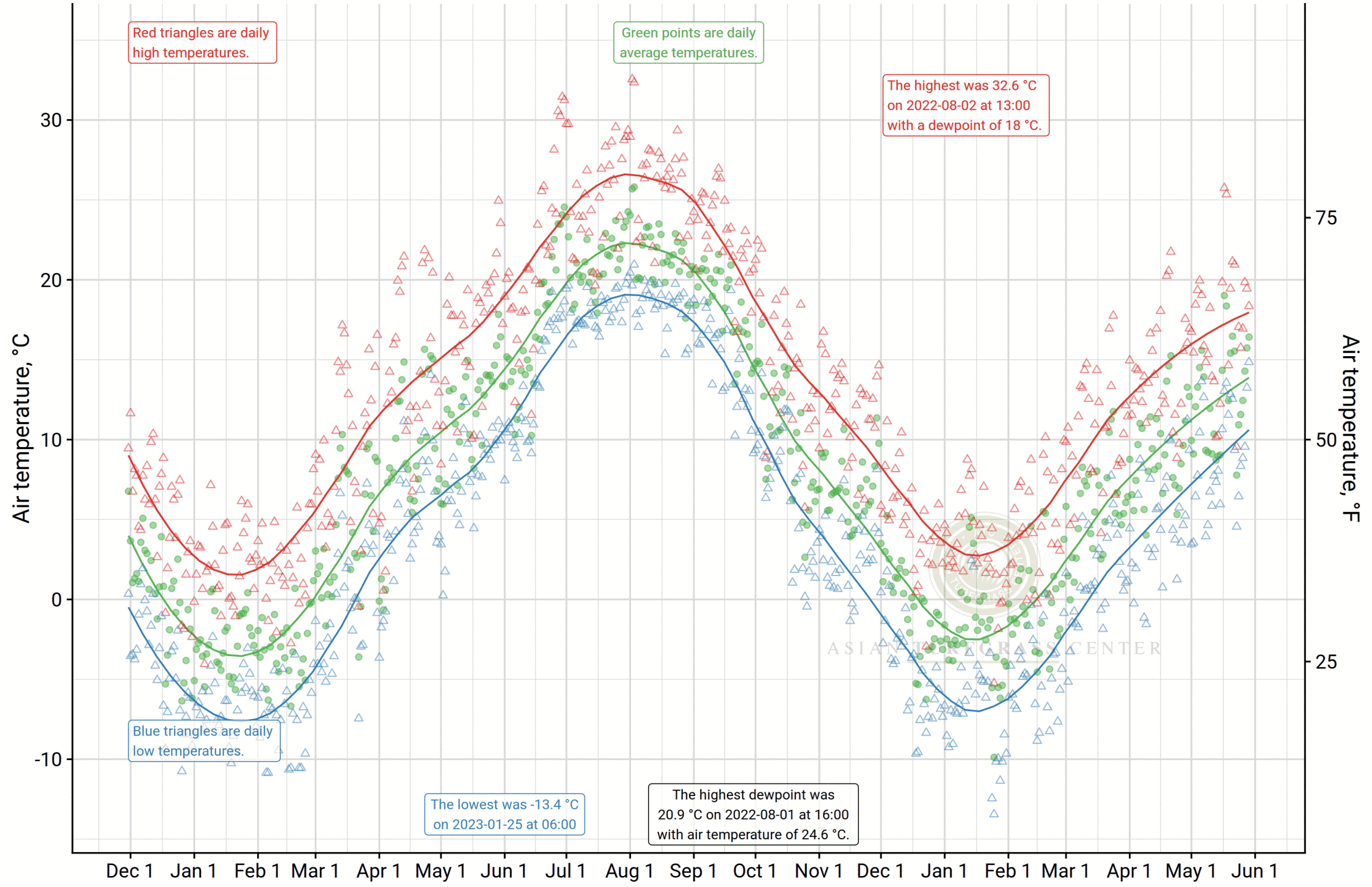
The charts in this section show the temperatures at your location. The weather has a controlling effect on how the grass can and does grow, and consequently the weather also has a big effect on grass nutrient use and on nutrient demand.

I've estimated the growth and nutrient use based on site temperatures. I have also used these temperatures, combined with the most recent soil organic matter test results, to estimate nitrogen mineralization.

The predicted N use and N mineralization and N fertilizer requirement are all estimates. You can consider them to be general guidelines that give an approximation of when the nutrient demand will be highest and lowest, and when the mineralization may be at a peak. As for the exact numbers, take them as estimates. You'll have to adjust the N rates that you apply based on grass performance, in order to achieve the desired growth rate and grass conditions.

# Daily temperature summary since 2021-11-30

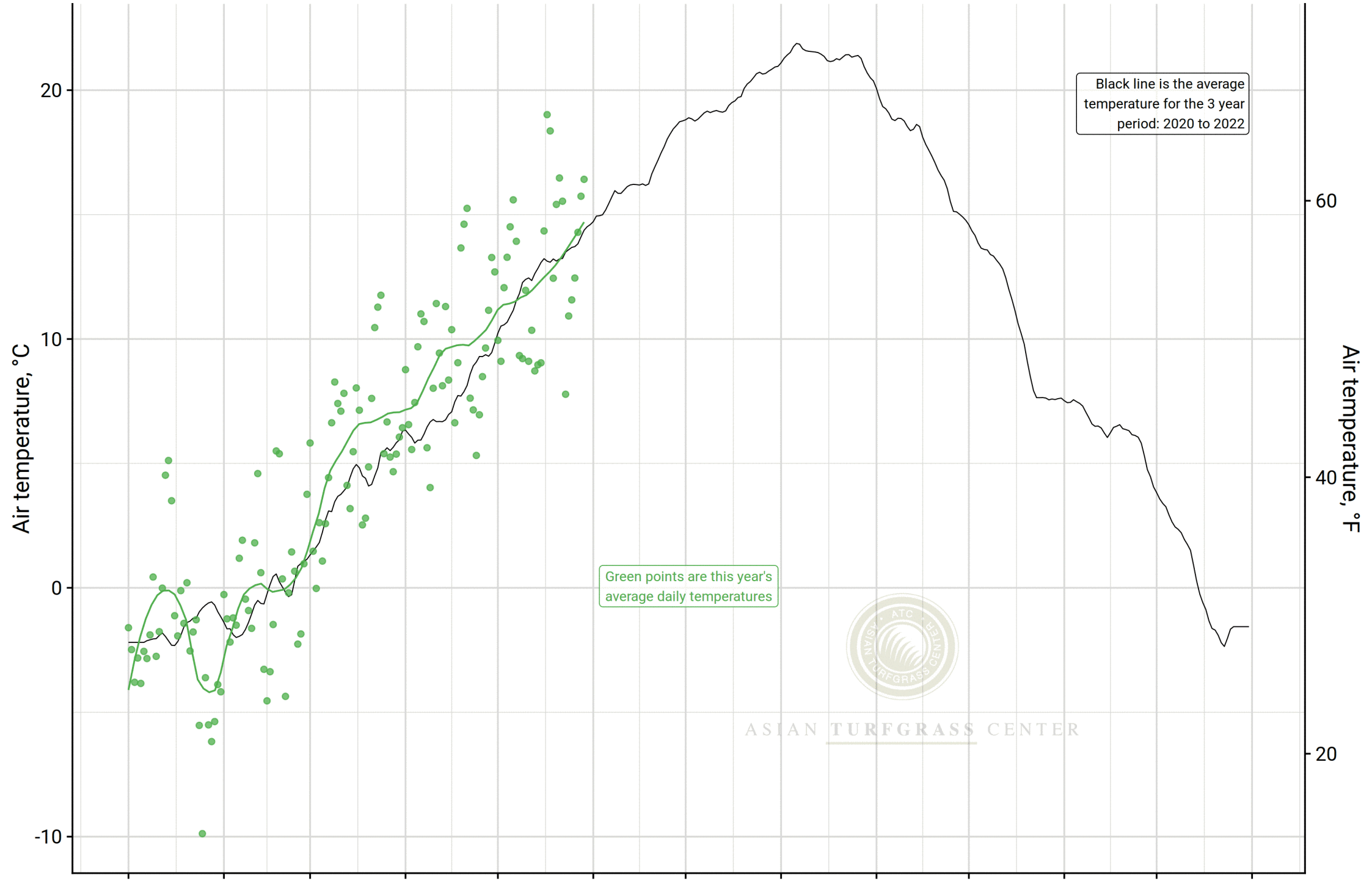
Example GC for the past 18 months




Growth potential (GP) and mineralization calculations are based off average temperatures.

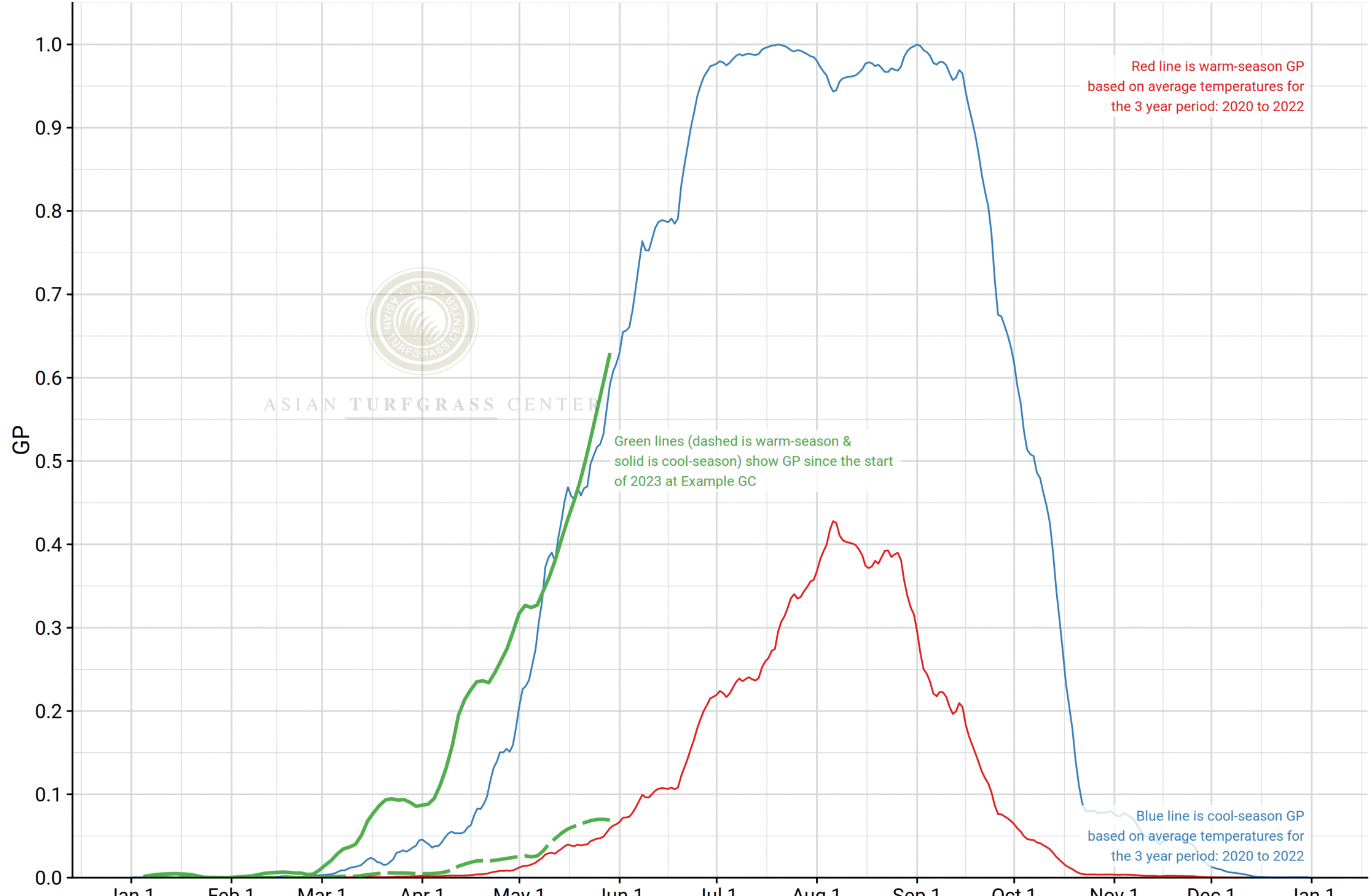
# 2023 year to date temperatures

Example GC



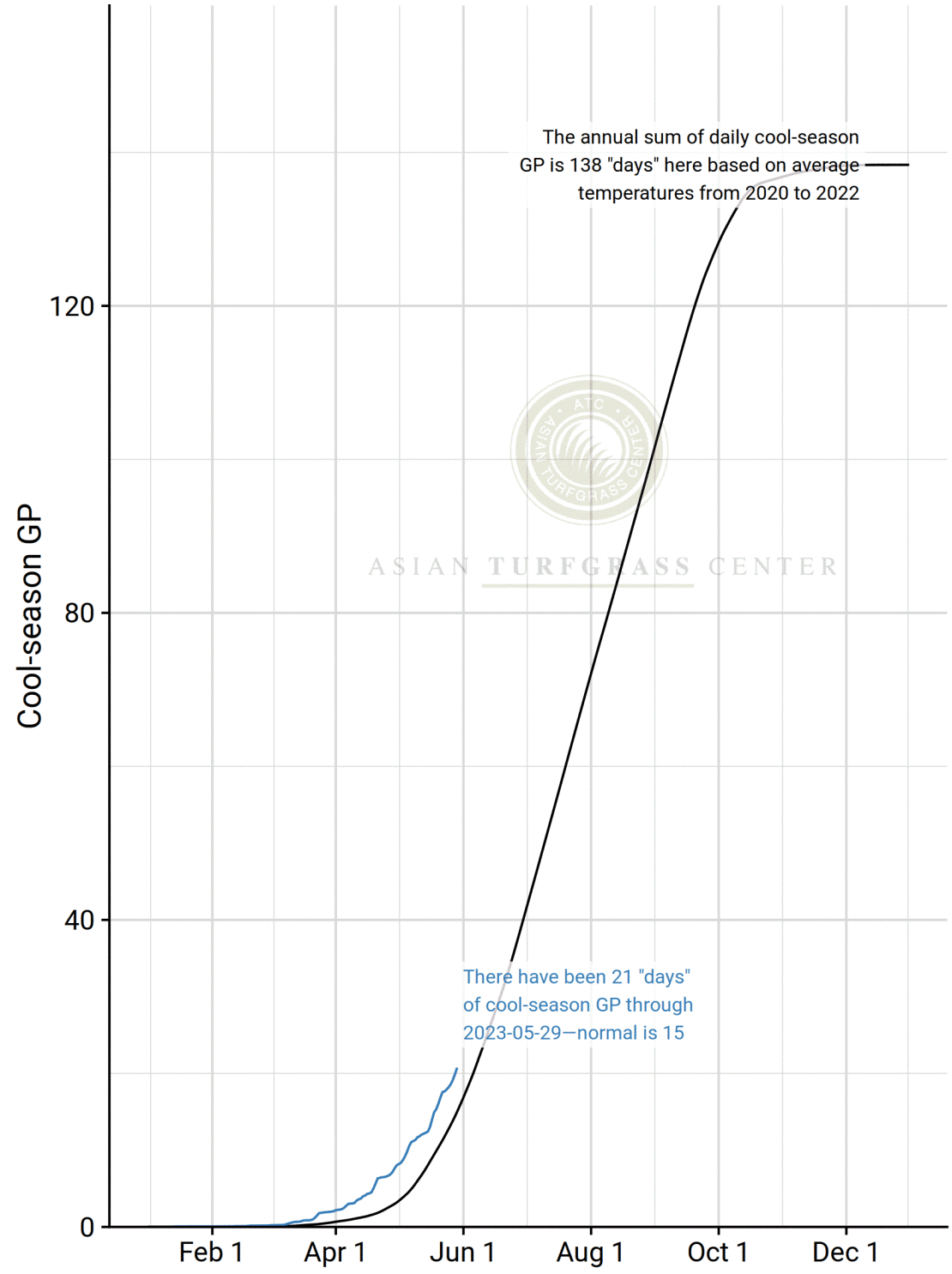
# Temperature-based growth potential (GP) in 2023

Example GC

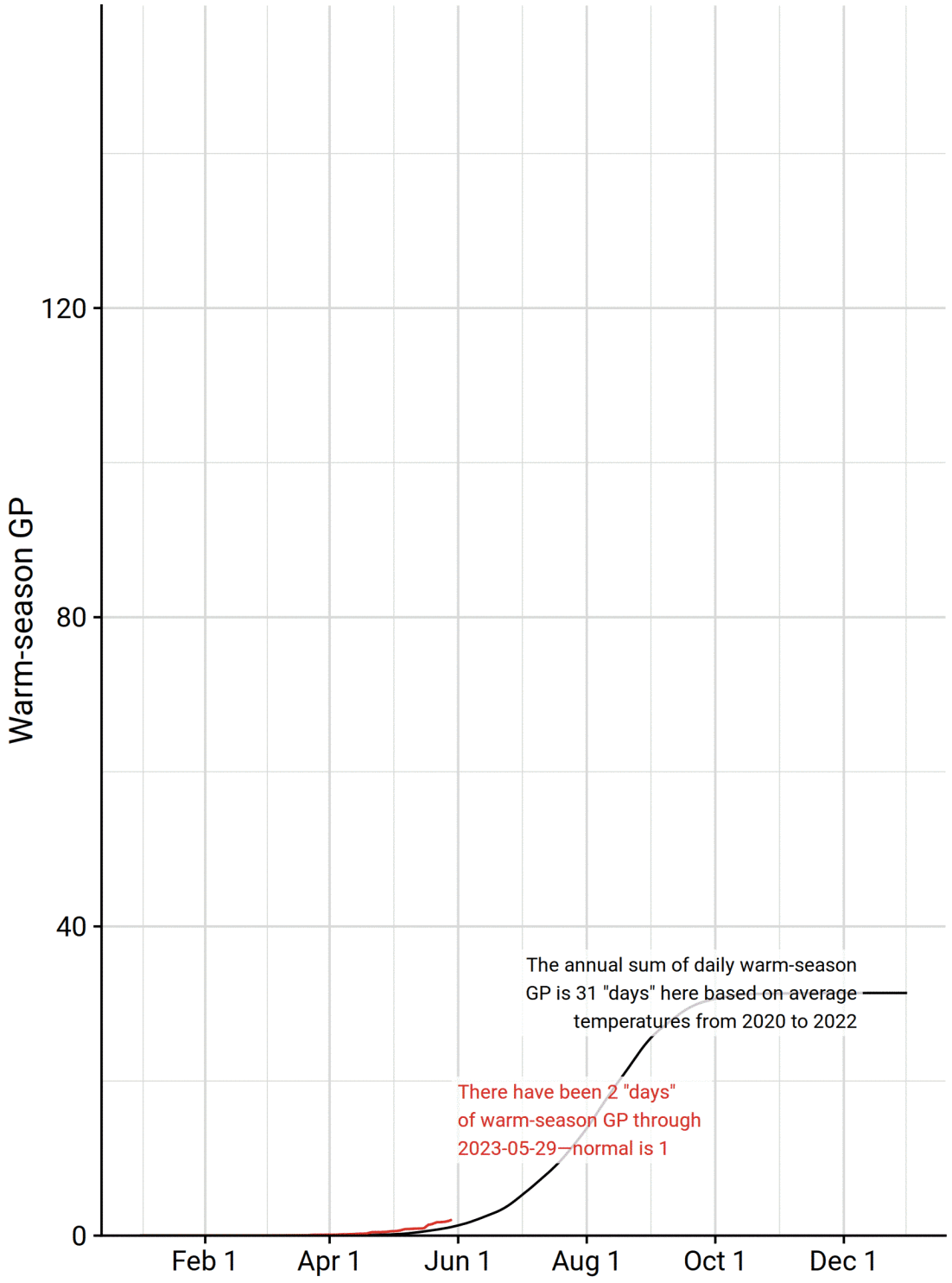


# Cumulative growth potential (GP) in 2023

Example GC

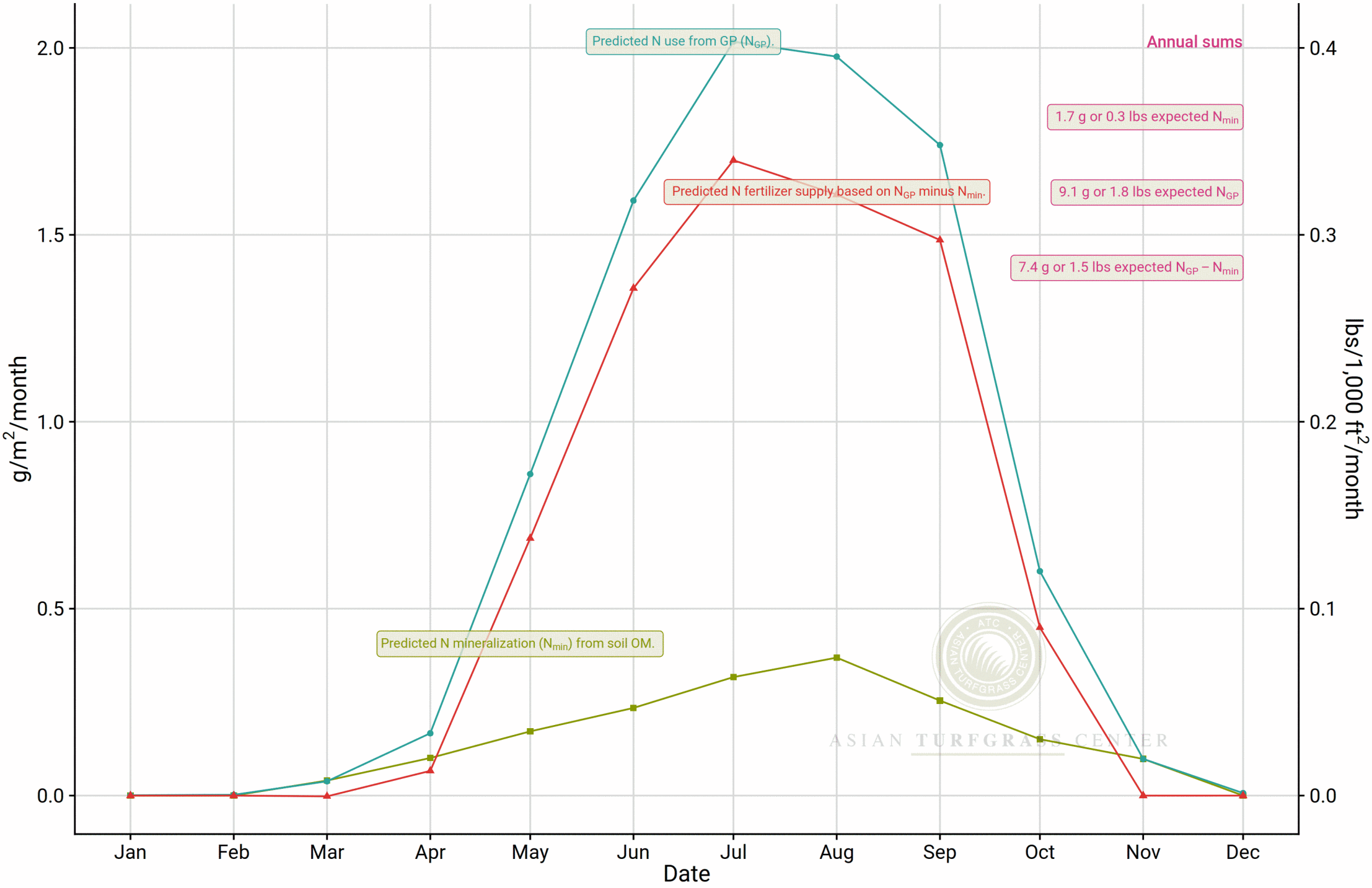




# Expected monthly N use, mineralization, and fertilizer requirement

Based on temperature data from Example GC, and starting soil OM of 1.7%




N from GP based on maximum monthly N of 2 g/m$^2$/month for bentgrass and fescue, 4 g for bermudagrass, and 3 for paspalum, zoysia, & Poa