November 18, 2019

2019 PRM RESULTS

Pinecrest Golf Course, Idaho Falls ID

PRM
PERFORMANCE RESOURCE MANAGEMENT

INTRODUCTION

Performance Resource Management is a premium agronomic service designed to deliver superior results. PRM improves playing conditions while saving water and other operational costs, which greatly benefits the business of operating a golf course.

Qualitative results that have been recorded this season include:

1. Improved turf density
2. Color improvement
3. More resilient turf

PRM has monitored multiple, quantitative data points that have contributed to the qualitative results that were observed over the season.

This report highlights the agronomic improvements that have been observed at Hillcrest Country Club over the course of the 2018 season. Notable, quantitative improvements include:

1. Thatch Reduction
2. Root Zone Expansion
3. Drainage Improvement

Charts, graphs, and tables included in the '19 PRM Results Report reference data representative of trends observed across the course since PRM was implemented in Spring 2019. Agronomic data has been gathered by PRM. We expect to see continued improvements throughout next year with the 2020 PRM program.

THATCH REDUCTION

Excess thatch is a problem that nearly every golf course struggles to manage. Thatch layering creates a perched water table, limiting drainage, the effectiveness of irrigation and the efficiency of root development. Managing organic material has posed a challenge for decades, and significant progress has been recorded this year.

Thatch thickness was measured in May, July, and September during the 2019 season. The figures 1 and table 1 (below) shows the decrease in thatch, by layer, over the course of 2 seasons. For example, the first layer of thatch decreased from 0.45 inches in May to 0.178 inches in the Fall on the Putter, a 61% reduction in the first layer of thatch.

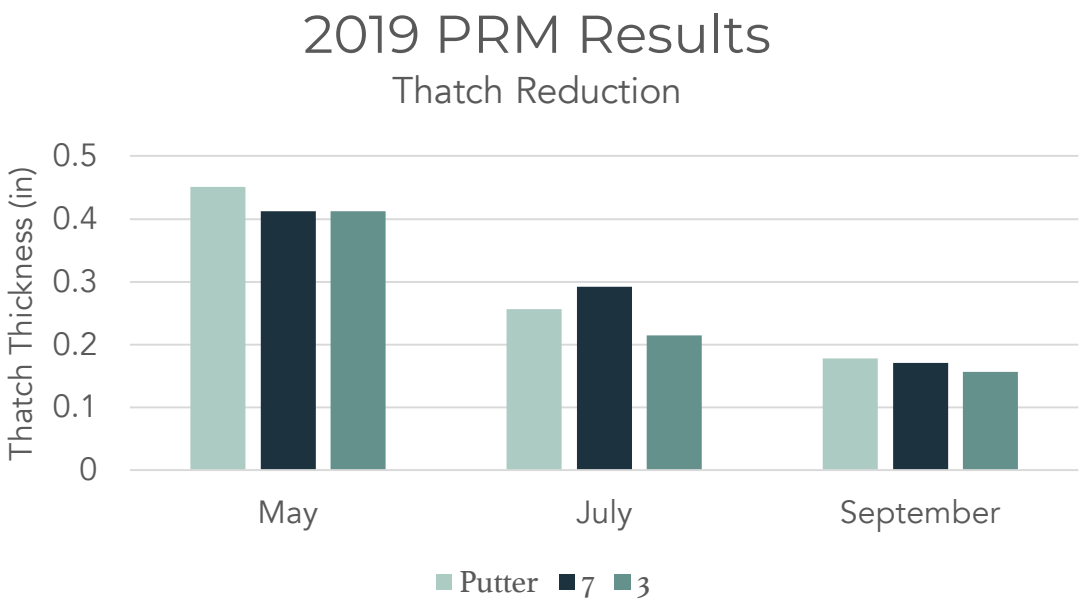

Figure 1: Thatch Reduction

Average Thatch Thickness (in)				
Surface	**May**	**July**	**September**	**% reduction**
7	0.412	0.292	0.171	**58%**
3	0.412	0.215	0.156	**62%**
Putter	0.451	0.256	0.178	**61%**
Average	0.425	0.254	0.168	**60%**

Table 1: Thatch Reduction

We have made significant progress combatting thatch, layering, and managing organic material during the 2019 season with PRM.

PRM

ROOT ZONE EXPANSION

The deeper roots can go into the soil, the more efficient the plant is in transporting nutrients and surviving extreme temperatures and drought. Running PRM causes the root zone to expand. Expanded root zone was observed across the entire season.

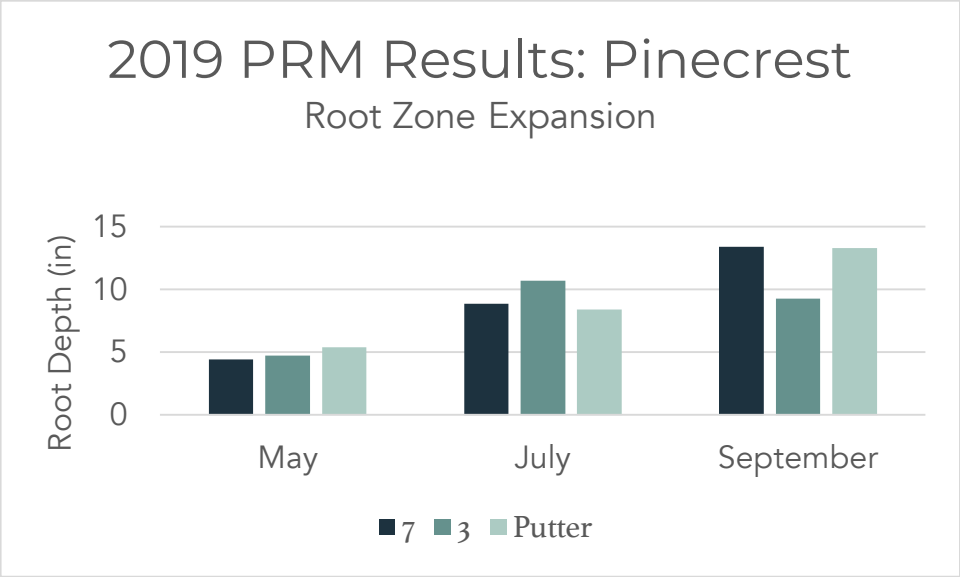

Figure 2: Root Zone Expansion

Root Zone (in)				
Location	**Spring**	**Summer**	**Fall**	**% increase**
7	**4.43**	**8.84**	**13.38**	**202%**
3	**4.74**	**10.68**	**9.29**	**96%**
Putter	**5.38**	**8.40**	**13.28**	**147%**
Average	**4.85**	**9.30**	**11.98**	**148%**

Table 2: Root Zone Expansion

A greater root zone enhances the resilience and increases the efficiency of turf, allowing it to handle more extreme conditions. The root zone expanded over the course of the season across each surface the PRM program was applied to.

Note 3 green experienced less expansion than 7 green and the putter, largely due to the trees to the East, causing an inability of the turf to get early morning sun.

COMPACTION REDUCTION

Compaction is the result of a combination of factors that affect growing a stand of turf grass. Factors that affect compaction include: thatch accumulation, traffic and a deteriorating soil profile. Compaction causes shallow root zones, reduced nutrient uptake, poor drainage, and accumulation of organic matter.

Over the course of the 2019 season, we managed to reduce compaction with the PRM program. Reduced compaction led to a healthier, expanded root zone, improved nutrient uptake, and led to the growth of denser and more resilient turf. Figure 3 and Table 4 below display the reduction of compaction over the course of the 2019 season.

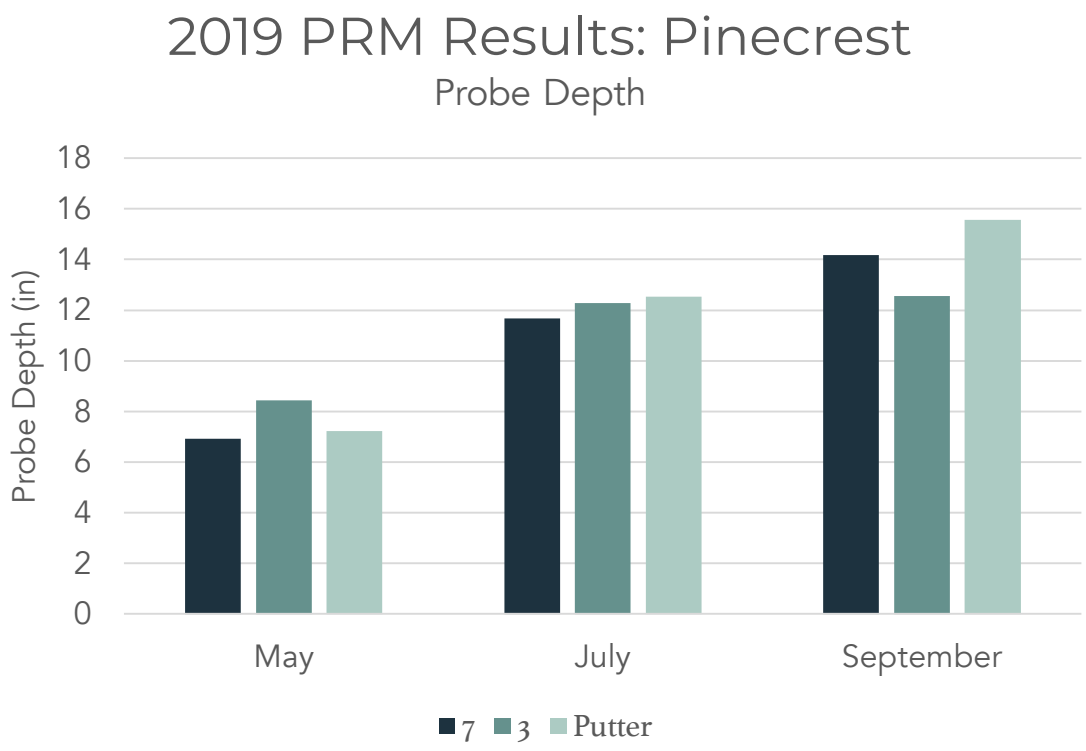

Figure 3: Compaction Reduction

Total Depth (in)				
Location	**May**	**July**	**September**	**% increase**
7	**6.91**	**11.66**	**14.19**	**105%**
3	**8.44**	**12.29**	**12.55**	**49%**
Putter	**7.23**	**12.53**	**15.58**	**116%**
Average	**7.53**	**12.16**	**14.10**	**90%**

Table 3: Compaction Reduction

DRAINAGE IMPROVEMENT

Drainage is the result of a combination of agronomical factors that are interrelated. Reducing thatch and compaction allows water to flow through the soil profile and also causes increased root development. All trends have been observed throughout the 2019 season.

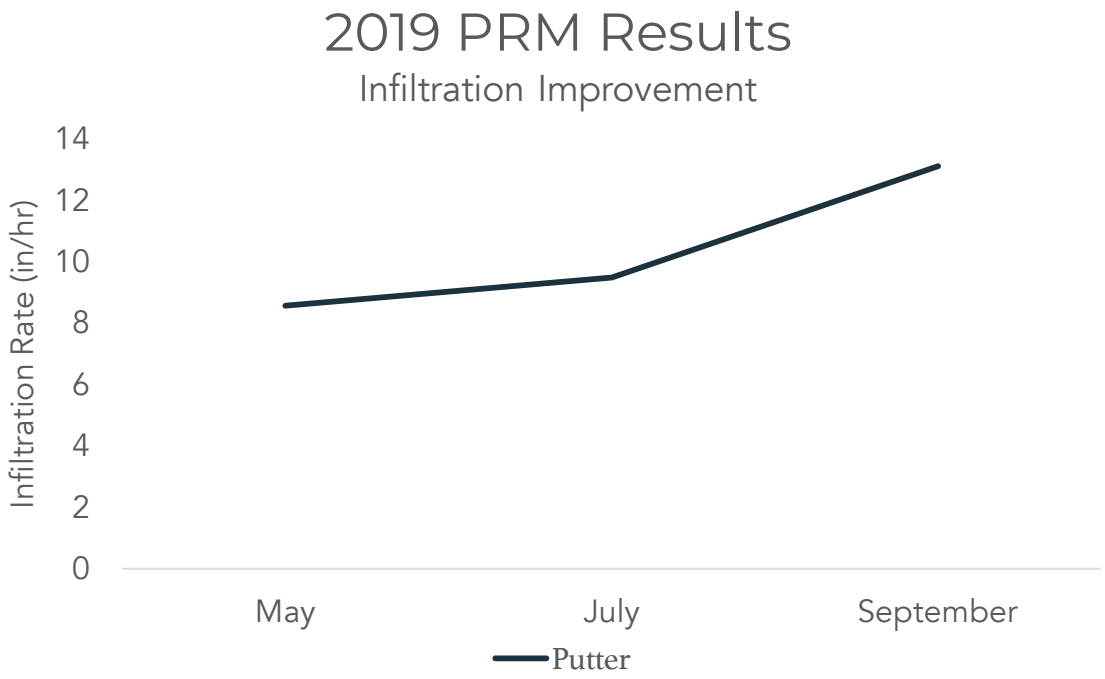

Figure 4: Drainage Improvement

Infiltration Improvement	
Putter	**4.6 in/hr**
Average	**17% increase**

Table 4: Drainage Improvement

Typically, we observe infiltration rates decrease over the course of the season, which is why it is standard for so many programs to aerify in the Spring and Fall seasons. The ability to manage organic matter, layering, and thatch by running PRM creates compelling evidence that there are opportunities to avoid having to aerify multiple times per season, which leads to more opportunities to host tournaments and more revenue opportunities for the golf operation.