Discussion of the Data Collected During the

2020 Summer Season

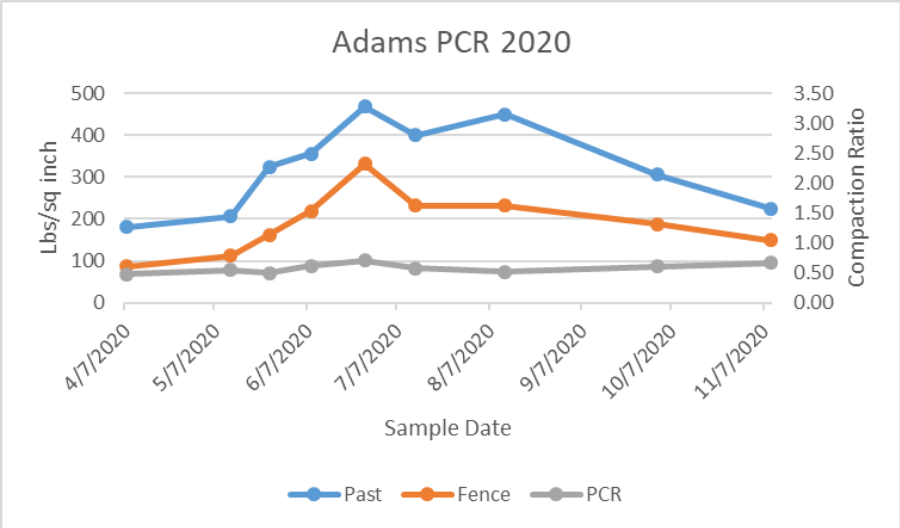
The following are the results of pasture compaction readings from nine paddocks in Central New York. Not all paddocks were able to have the same number of readings since during the dry time of the summer some of the paddocks had readings which surpassed the maximum lbs./inch^2 of 500 lbs./inch^2 which could be read by the penetrometer.

In our proposal we stated that we would use the soil resistance under the fence. Since it can be considered to have the "optimum compaction" for the soil since no animal or machinery has access to it. These readings will be compared to readings taken within 20 feet of the fence line in the pasture where compaction has taken place. The comparison of the two readings will be called the "Pasture Compaction Ratio". Our study of using this ratio has had multiple benefits:

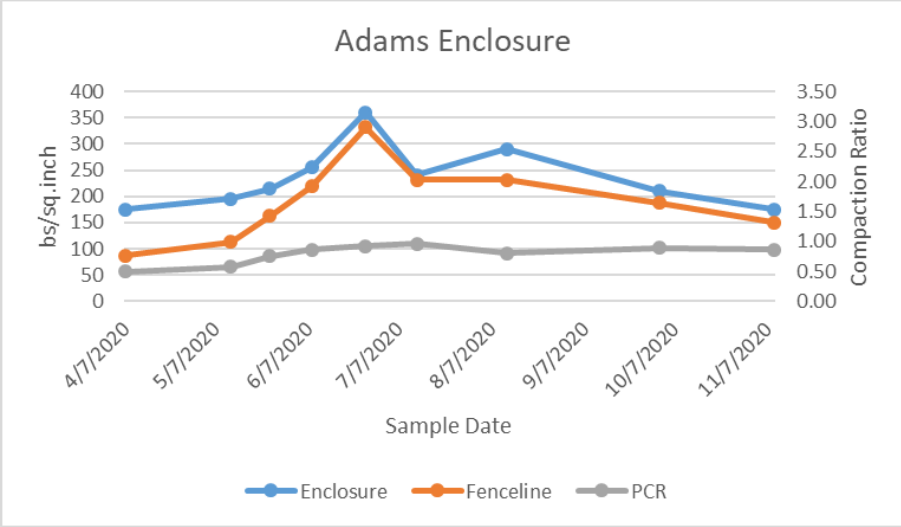
- First showing the difference between these two relatively close points in the same paddock will help alert the farmer to the presence of compaction.
- Second we wanted to test the repeatability or the standard deviation for the PCR over different soil moisture and temperature conditions. If there was little variation in the PCR as soil moisture and conditions change, it would allow the PCR to be a tool to measure management changes to the pasture.

Adams Paddock, Adams Enclosure, and Fenceline – The Adams farm paddock was chosen because it has been extremely overgrazed for many years. Very little forage grows on this pasture. There are usually 40+ beef animals are continuously grazed on 40 acres of open pasture plus 20 acres of wet overgrown shrub covered pasture. The only grass specie that has survived the constant grazing is Bluegrass. The grass rarely is more than an inch high before it is regrazed by the animals.

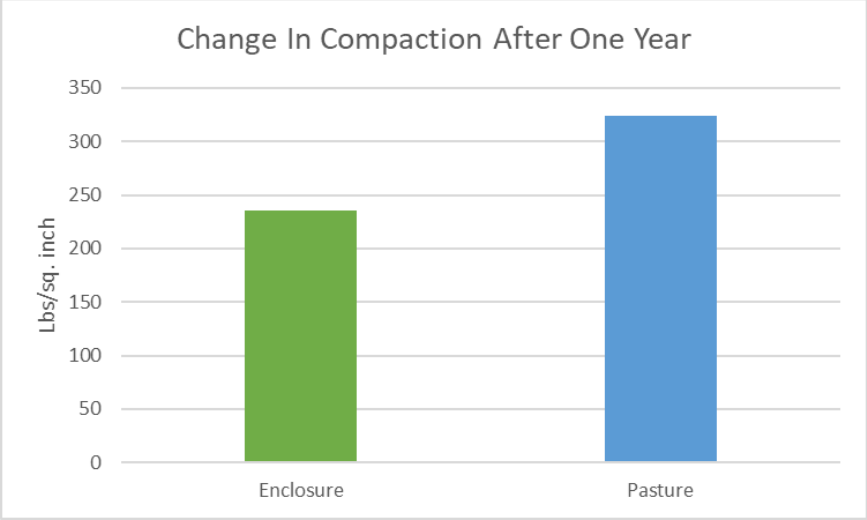
In November of 2019 a 10-foot X 10-foot enclosure was put in place near where compaction readings were taking place. Our goal was to see how the compaction level changed if the animals were removed from the pasture. Below are graphs of the compaction readings of the paddock soil, Fenceline soil, and another of the Enclosure's soil compared to the same Fenceline.



As expected, the compaction in the paddock was higher than the fenceline. Both area's compaction increased as the soil dried out. The grey line is connected to the right hand Y axis. It showed that as the compaction increased the ratio stayed relatively constant. This was a major goal of this project.

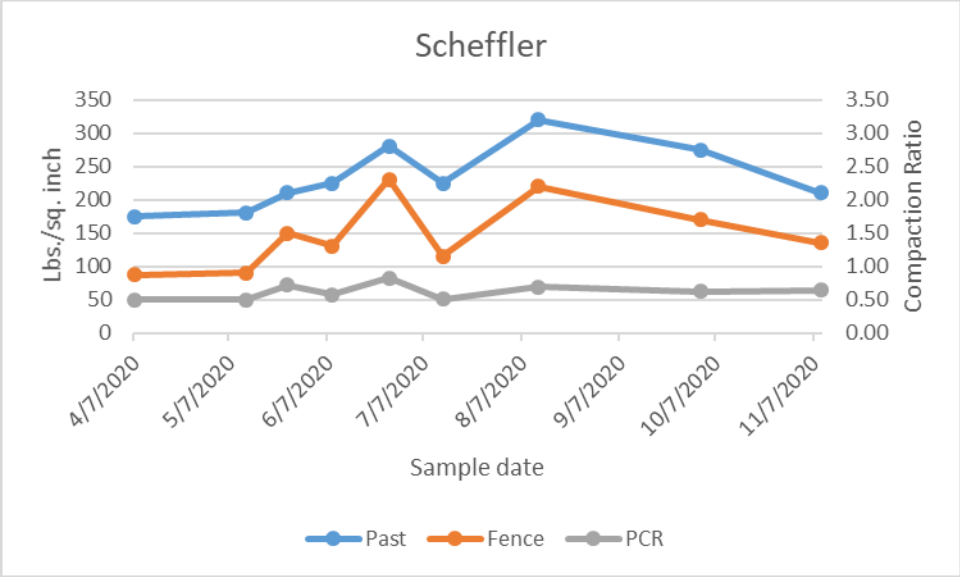


This graph shows the compaction within the exclusion enclosure compared to the fenceline. Notice that the red and blue compaction lines get closer during the early season. This indicates that the enclosure soil is getting closer to the "optimum" compaction of the fenceline.

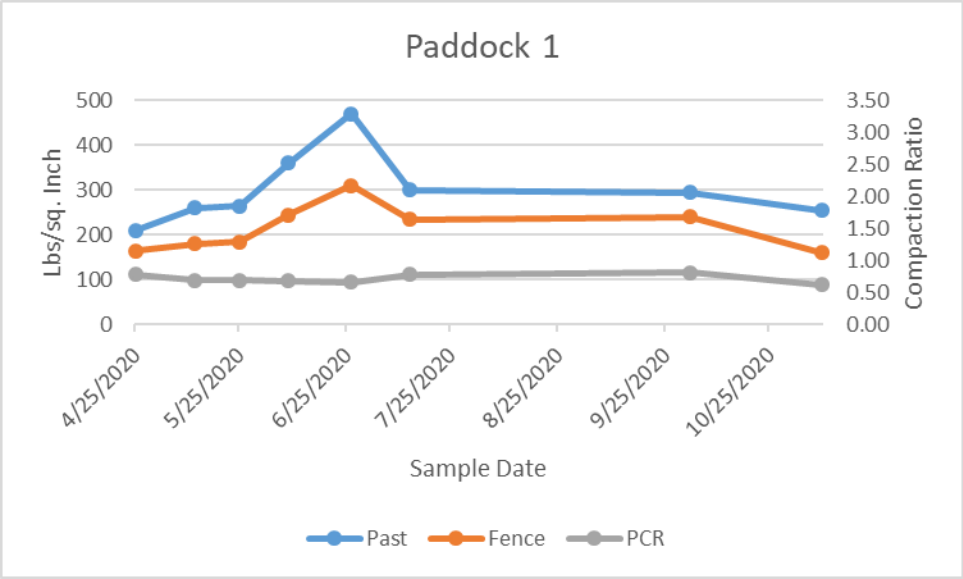


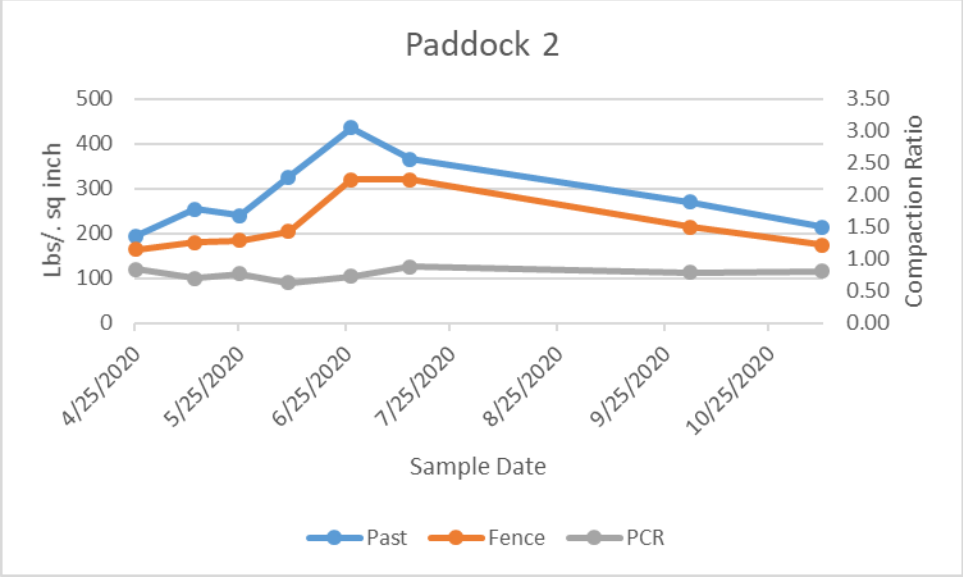
This graph shows the average soil compaction readings for the season of the enclosure and the pasture. The readings were taken with in a 20-foot radius of each other. The enclosure readings show that there is a 28% reduction in compaction after one year.

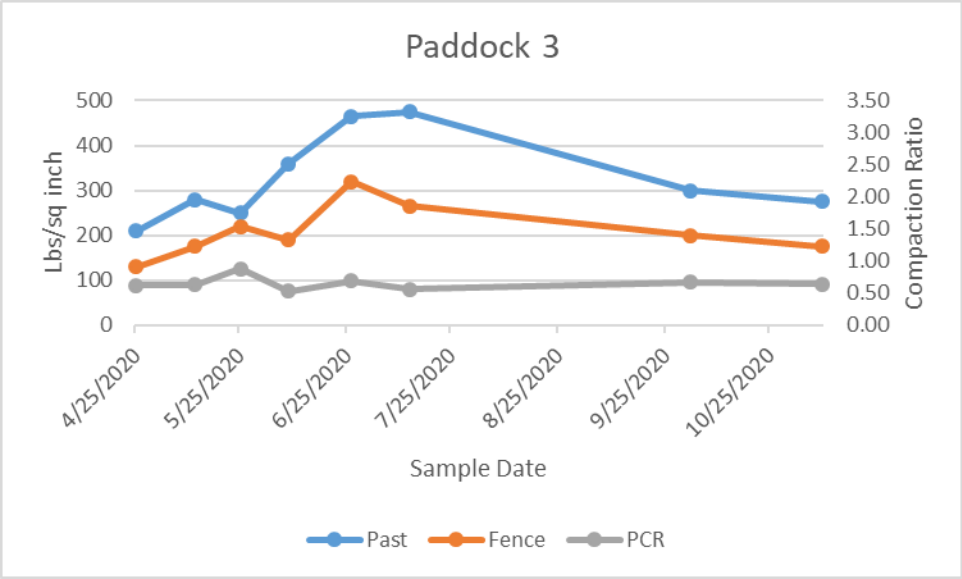
Scheffler Pasture and Fenceline Data – The Scheffler pasture is used for dairy heifers. The rest period between the animal's occupancy was between 30 and 45 days. This paddock had the longest rest period of the nine paddocks studied.

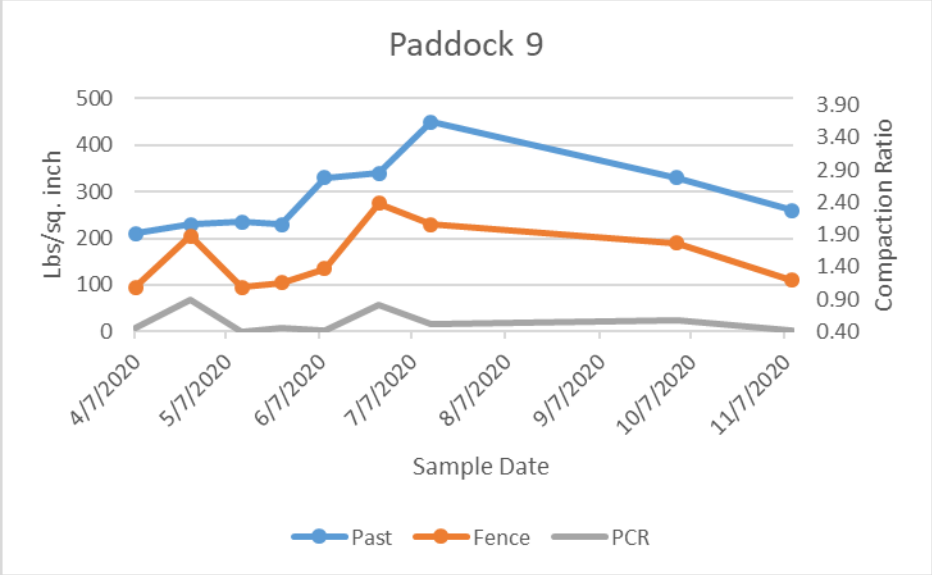


Carey Paddocks The Carey dairy farm consist of 300 milking animals. The milking herd is broken in to two groups based on stage of lactation. Each group receives a new paddock after each milking. The Carey's have been graziers since the 1990's and have settled on a pasture management that uses 120 acres of permanent pasture which is used for initial grazing starting in early May. The two groups cycle though 10 paddocks which are further divided into six 12 hour paddocks. The sixty 12 hour paddocks allow a 15-day rest period before the animals return. In late June the Careys add another 140 acres of pasture to their grazing system. These 140 acres had the first cutting harvested in early June and then fences are put up so that it is divided into another sixty paddocks. The additional paddocks allow for a 30 day rest period during the slower grass growing season. This farm was added to the study because of the practice of dividing it into two groups of paddocks: one set of paddocks being harvested only by grazing animals and the other group is not grazed during the spring when the wet soil can receive the most impact of animal compaction.

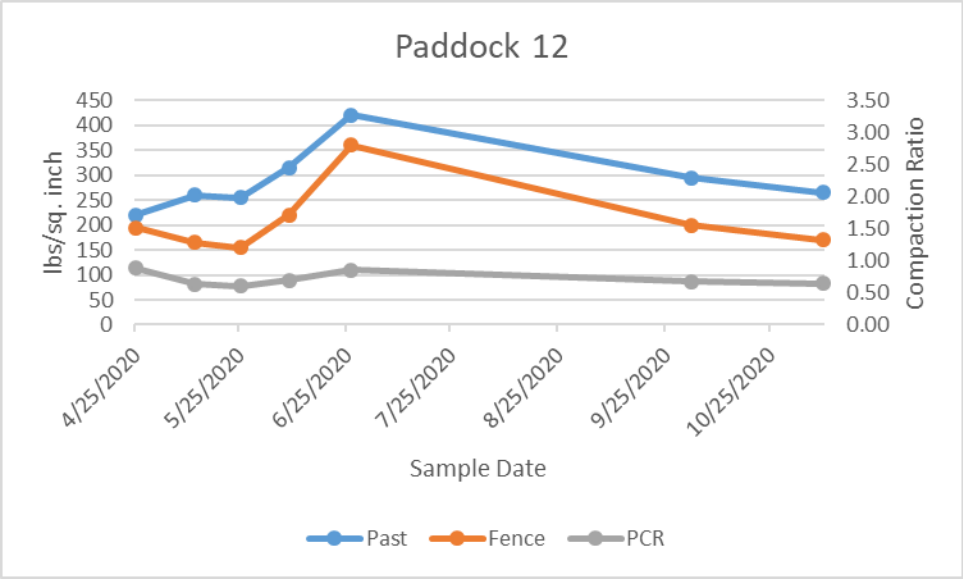

Paddock 1
Lbs/sq. Inch
Compaction Ratio
500
400
300
200
100
0
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
4/25/2020
5/25/2020
6/25/2020
7/25/2020
8/25/2020
9/25/2020
10/25/2020
Sample Date
Past
Fence
PCR

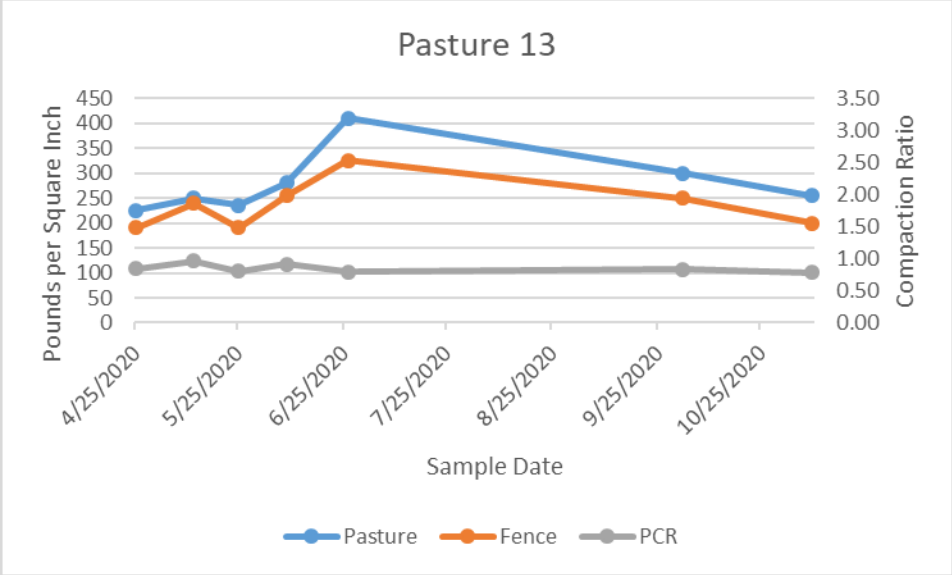

Paddock 2
Lbs/. sq inch
Compaction Ratio
500
400
300
200
100
0
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
4/25/2020
5/25/2020
6/25/2020
7/25/2020
8/25/2020
9/25/2020
10/25/2020
Sample Date
Past
Fence
PCR





Paddocks 1-9 are part of the permanent pasture system, meaning they are grazed throughout the season. Paddocks 12 and 13 are part of the system that has its first cutting removed in early June and the paddocks are added to the farm's grazing system in late June. It was theorized that the permanent paddocks would have more compaction pressure since they are grazed in early spring when the soil is moist and more prone to compaction. The PCR supported this theory because the average PCR for 1-9 was 0.68 and the average for 12&13 was 0.79. The closer the PCR is to 1.0 the less compaction there is. The compaction difference is visible in the graphs. Notice the distance between the Fence and Pasture lines in 1-9 paddocks and then the distance between the lines in paddocks 12 &13.





Overall we are pleased with the relatively flat line graphed showing the PCR of the fence and the pasture readings. In order to gauge the PCR's usefulness as a tool the following are the Standard Deviations for the PCRs in the different paddocks. To calculate this the following method was used.

1. For each of the nine paddocks the PCRs will be used to determine the Mean PCR.
2. To find the standard deviation, subtract each result from the mean and square the difference to ensure to have only positive numbers.
3. Sum up these squared differences and divide by the number of results minus one,
4. We then take the square root of that quotient.

After performing these calculations, we arrived at 0.07679 for a standard deviation. We have decided to complete another year of data collections to test the repeatability of the PCR.