



Direct Enterprises, Inc.



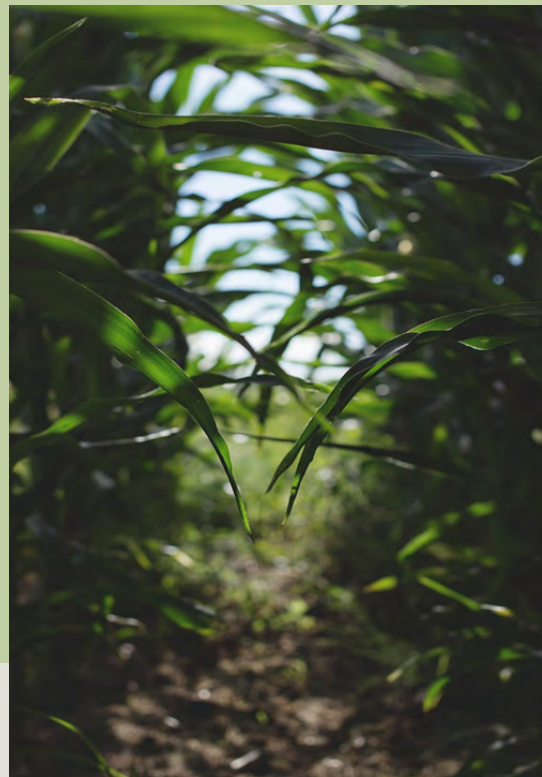
SOIL HEALTH REPORT

- 2022 / 2023 -



BACKGROUND

In the development of our residue breakdown products, we have always known that we were improving the health of the soil. It was clear that year after year we had even better results. We looked at ways to develop testing that would let us track soil health easily and compare year after year. We discovered several types of soil test that could be performed to gauge the health of the soil.



How do we test for soil health?

There are many different tests for soil health. Experts are discovering new ways to evaluate soil health every year. So how can we use soil tests practically? Well, first its important to know the three key tests currently employed. The CO2 Burst Test, The Haney Test, and the DNA test each have benefits and limitations. These limitations include cost, turn around time, ability to compare before and after, and accuracy.

CO2 Burst Tests

The CO2 Burst test is simple. Get a cup of soil, stick a test strip inside, and wait 24 hours. During the 24-hour wait time, the soil will respire and the test strip will change color based on how much respiration occurs. The test gives us evidence that either "Yes, I have good biology" or "No, I need some help with soil biology." It's a great visual that can be done yourself and the tests are fairly inexpensive (~\$25 each). The issue with the CO2 burst test alone is it doesn't allow for easy comparison year to year or side by side. While there's value in knowing a yes or no, we prefer a more indepth test.



DNA Tests

DNA Tests are bleeding edge and provide the most in-depth data. A DNA test takes the entire profile of the soil and shows us the individual known microbes that are present in the soil. Some tests will even tell us what the microbe in the soil does for us (Fix Nitrogen, Solubalize Phosphate, etc).

The issue we have found with DNA tests today are with accuracy. Similar samples sent to labs show different results and comparing before and after tests have not proven to give us good results.

We are excited as the equipment and science behind DNA testing become more robust and most importantly the cost of DNA testing comes down to a more reasonable level. The cost of DNA tests can range from \$200-\$2000. Without the testing being more robust and more people taking advantage of the testing, we do not see DNA testing as practical for the typical grower. Instead, we employ these tests in special cases where a specific biological issue is being tracked.

The Haney Test

We employ the Haney test and believe it is the best tool we have today to evaluate the biology in the soil. Several of the big soil labs can perform this test without changing the way we take a sample. The test evaluates soil health by looking at respiration (CO2 Burst), water-soluble organic carbon, organic nitrogen, and the ratio between organic carbon and nitrogen. Most importantly this test provides us with a soil health calculation as a number between 1-25 that can be compared between tests.

The advantages the Haney test has over the other tests available on the market make it our go-to solution for evaluating soil health. The cost is under \$200, provides us with comparable results and allows us to track improvements or challenges over time. Additionally, the test results are easier to evaluate than either the DNA or CO2 burst tests alone. Lastly, along with the Haney Test, we get levels of nitrate, ammonia, phosphate, aluminum, iron, phosphorus, calcium, magnesium, and sodium.





Picture 1.2 Side by Side Trial Reclaim™

ABOUT OUR PROJECT

We performed soil tests in several corn plots in Black Earth Wisconsin. Our goal was to evaluate the effect of adding beneficial soil microbes to the soil at different concentrations (rates) on soil health at different soil depths. Additionally, we tracked yield, residue weights, and finally extrapolated nutrients cycled from the corn residue that was broken down.

OUR MISSION

- Did our microbial intervention show improved soil health numbers?
- Replication of a study done by Auburn University (referenced on final page) on the weight of residue removed with soil microbe intervention. Did our results differ greatly based on being in the Midwest?
- Did yield improve?

OVERVIEW

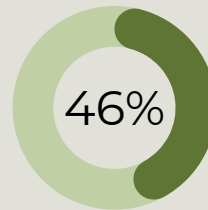
We found that by adding consortia of beneficial soil microbes we were able to replicate the study done by Auburn University and achieve the same and better results. Additionally, we achieved higher soil health calculations and improved yield compared to the untreated check.



"About half of the residue was gone, soil health improved substantially, and yield improved by 22 bushels"

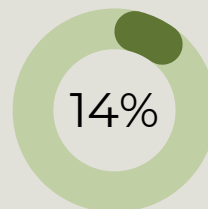
The photo on top shows the untreated residue. The photo below it shows the treated trail. As you can see there's a big visual difference in the amount of residue left after no intervention.

RESULTS SUMMARY



Residue Reduction

The weight of the residue in the untreated check was 7,437lbs. The weight of the treated trial was 4,136lbs.



Yield Increase

Yield went from 152.6 bu/acre in the untreated check to 175 and 177.8 in the treated plots.

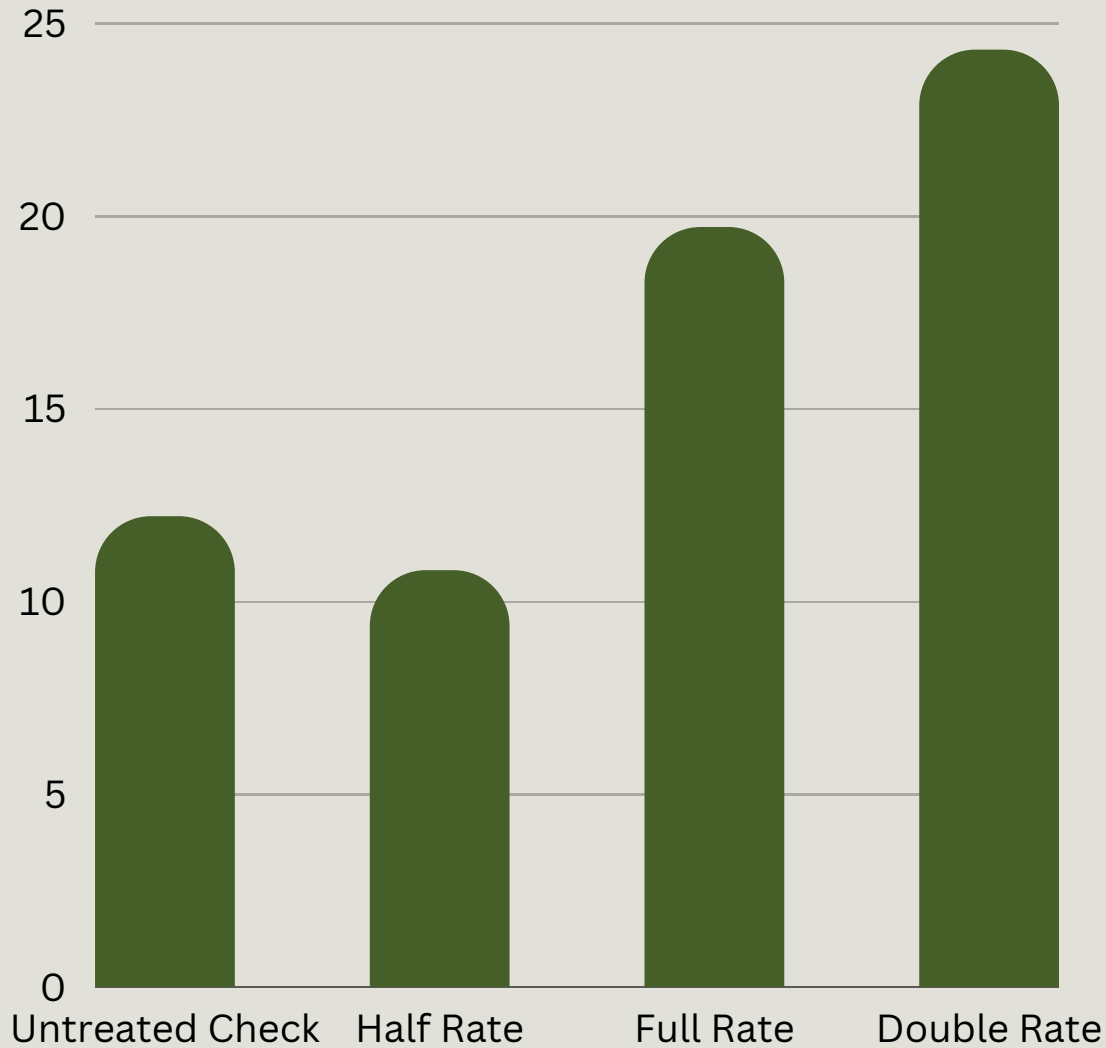
The crop consultant took 20 randomized one-square-meter samples of residue remaining in the field in both treated and untreated plots. She then calculated University pounds of nutrients (NPK) released from the residue breakdown process based on Agronomy Journal 105.1 (2013): 161-170 as presented by Dr. Fred Below.

We believe that growers who use Reclaim™ are getting a yield boost from not only improved stand quality due to less residue during planting, but also from soil health, increased plant available nutrients, and season-long nutrient cycling from the microbial intervention.

Direct Enterprises, Inc.
Soil Tests

RESULTS SUMMARY

SOIL HEALTH CALCULATION BY RATE (MIDWEST LABS)



This graph shows how with microbial intervention we can substantially improve our soil health. This process can be done year after year to build beneficial microbial populations. This graph also shows the importance of using the right rate. If you do not apply enough microbes to the soil, they will not replicate and will ultimately not provide the desired results.

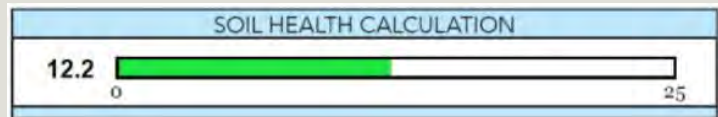
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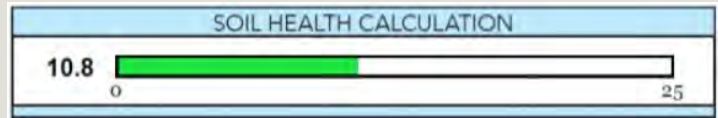
RESULTS SUMMARY



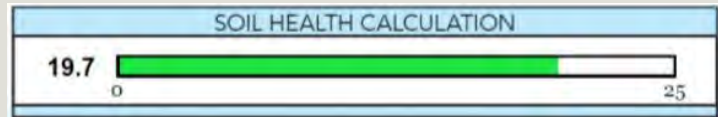
No Reclaim™ Top 6 Inch Depth



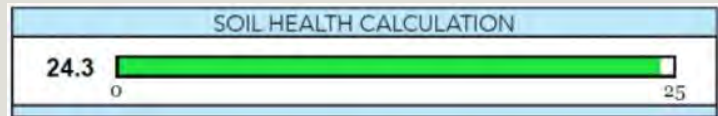
Half Rate of Reclaim™ Top 6 Inches



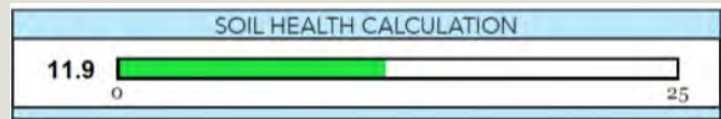
Normal Rate Top 6 Inches



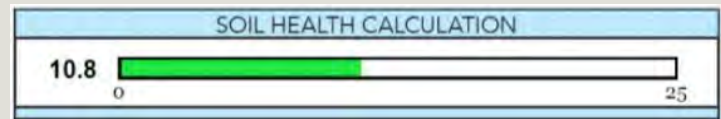
2X Rate Top 6 Inches



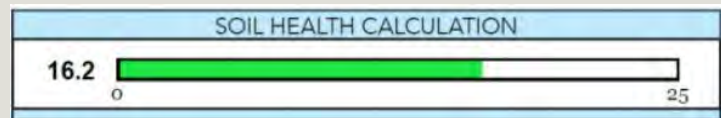
Half Rate of Reclaim™ 6-12 Inch Depth



No Reclaim™ 6-12 Inch Depth



2X Rate 6-12 Inches Depth



REFERENCE STUDY



Below is the study we replicated from Auburn University referenced on page 4.

Treatments	Rates	Corn Residue BIO-RELEASE (% Reduction – 3 Rep Means)	GMO Corn Residue BIO-RELEASE (% Reduction – 3 Rep Means)	Soybean Residue BIO-RELEASE (% Reduction – 3 Rep Means)	Hay Grass Residue BIO-RELEASE (% Reduction – 3 Rep Means)	Wheat Straw Residue BIO-RELEASE (% Reduction – 3 Rep Means)
Untreated Control (Water Only)	Untreated plot	9.8 (f)	6.5 (f)	13.2 (e)	10.4 (f)	10.3 (f)
6% UAN	UAN at 3.5 G/acre	19 (e)	18.7 (e)	19.9 (d)	22.4 (e)	19.8 (e)
Humic Acid 20 +S	2 quarts/acre	26.3 (d)	22.5 (d)	21.9 (d)	25.3 (d)	25.6 (d)
Residue Bacteria	2 quarts/acre	33.3 (c)	34.3 (c)	29.8 (c)	32.4 (c)	34.7 (c)
Treatment "A"	BIO-RELEASE BLEND 1 qt/acre	43.2 (b)	41.8 (b)	38.8 (b)	41.2 (b)	40.9 (b)
Treatment "B"	BIO-RELEASE BLEND 2 qts/acre	52.8 (a)	51.6 (a)	48.9 (a)	50.8 (a)	54.9 (a)

Treatment "A" was half rate Reclaim™ while Treatment "B" was full rate.

