Long-term assessment of soil microbial respiration in response to application of PrimAgro fertilizer (NCRS 18-903 and 18-503)

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Introduction

Soil, as a dynamic natural body, is teeming with life that performs numerous ecosystem functions including recycling of dead and decaying organic matter into plant nutrients. Replacing what is taken out of the soil to produce a crop will keep the soil fertile and productive as possible. AgroLiquid strategy is to shift from soils cultivated with marginal inputs to soils economically managed to unlock the soil's potential and make organic carbon, nitrogen, phosphorus, and potassium available to plant uptake.

What is "soil quality"? Soil quality is related to soil functions - or what it does - and the three dimensions of soil health represented by the biological, physical, and chemical compounds. To improve soil quality, the soil's capacity, as a dynamic and biologically active entity must be improved. This serves to sustain multiple ecosystems. So, soil health is a finite and dynamic living resource. Therefore, the AgroLiquid formulated PrimAgro line combines carbon, nutrients, and microbes to improve organic carbon and nutrients release.

Material and methods:

Following the method of Cornell University for CO_2 capture described in 2017- NCRS Annual Report, we have measured the soil microbial respiration in two long-term experimental fields: non-irrigated (18-903) and irrigated (18-503).

Our objective was to continue to validate the microbial content of PrimAgro line in soybean fields, and assessment of CO_2 release due to the soil microbial activity respiration as the indirect impact of the PrimAgro line applied in 2017 in corn fields.

Amounts of applied PrimAgro line with other AgroLiquid products are included in Tables 1 and 2.

Table 1. 18-503 liquid fertilizers application plan in the irrigated field.

Treatments	Application in 2017 with corn	Application in 2018 with soybeans
Trt. 1	Pro-Germ. + Kalibrate + M-500 (4 + 6 + 0.5) + SD: High NRG-N (51)	Pro-Germ. + Kalibrate + M- 500 (1.5 + 1.5 + 0.5 + 1.5)
Trt. 2	Prim-P + Prim-K + M- 500 (4 + 6 + 0.5) + SD: Prim-N (55)	Prim-P + Prim-K + M- 500 (1.5 + 1.5 + 0.5 + 1.5)
Trt. 3	Prim-P + Kalibrate + M-500 (4 + 6 + 0.5) + SD: High NRG-N (51)	Prim-P + Kalibrate + M-500 (1.5 + 1.5 + 0.5 + 1.5)
Trt. 5	Prim-P + Prim-K + M- 500 (4 + 6 + 0.5) + SD: High NRG-N (51)	Prim-P + Prim-K + M- 500 (1.5 + 1.5 + 0.5 + 1.5)

Table 2. 18-903 liquid fertilizers application plan in the non-irrigated field.		
Treatments	Application in 2017 with corn	Application in 2018 with soybeans
Trt. 1	Pro-Germ. + Kalibrate + M-500 (5 + 5 + 0.5) + SD: High NRG-N (10) + 28% + eNhance (48)	Kalibrate + M- 500 (3.0 + 0.5)
Trt. 2	Pro-Germ. + Kalibrate + M- 500 + C-Tech (5 + 5 + 0.5 + 0.5) + SD: High NRG-N (10) + 28% + eNhance (48)	Kalibrate + C-Tech (3.0 + 0.5 + 0.5)
Trt. 5	Prim-P + Prim-K + M- 500 (5 + 5 + 0.5) + SD: High NRG-N (10) + High NRG-N (37)	Prim-K + M- 500 (3.0 + 0.5)

Results and discussion.

On-row comprehensive soil sampling was carried out on May 5, 2018, for (18-903) and on May 18, 2018, for (18-503) to reference the soil nutrients status and for projected measurements of soil BSR (Basal Soil Respiration) by the gel-spectroscopy method recently developed by AgroLiquid.

In 18-903: measurements of CO_2 capture started on May 18, 2018, and continued up to August 8, 2018, with the soybeans planted on May 29, 2018.

In 18-503: measurements of CO_2 capture started on May 15, 2018, and continued up to August 8, 2018, with the soybeans planted on May 18, 2018.

In each process of measurement, 20 ml of 0.5 KOH liquid added in the glass jars in each sealed PVC chamber, left in for the desired period of measurement. After that, the liquid poured back in vials and sent to the Lab., and EC measured to report the changes in EC due to the K_2CO_3 and water formation. CO_2 measurements plotted with weather information (rain and temperature).

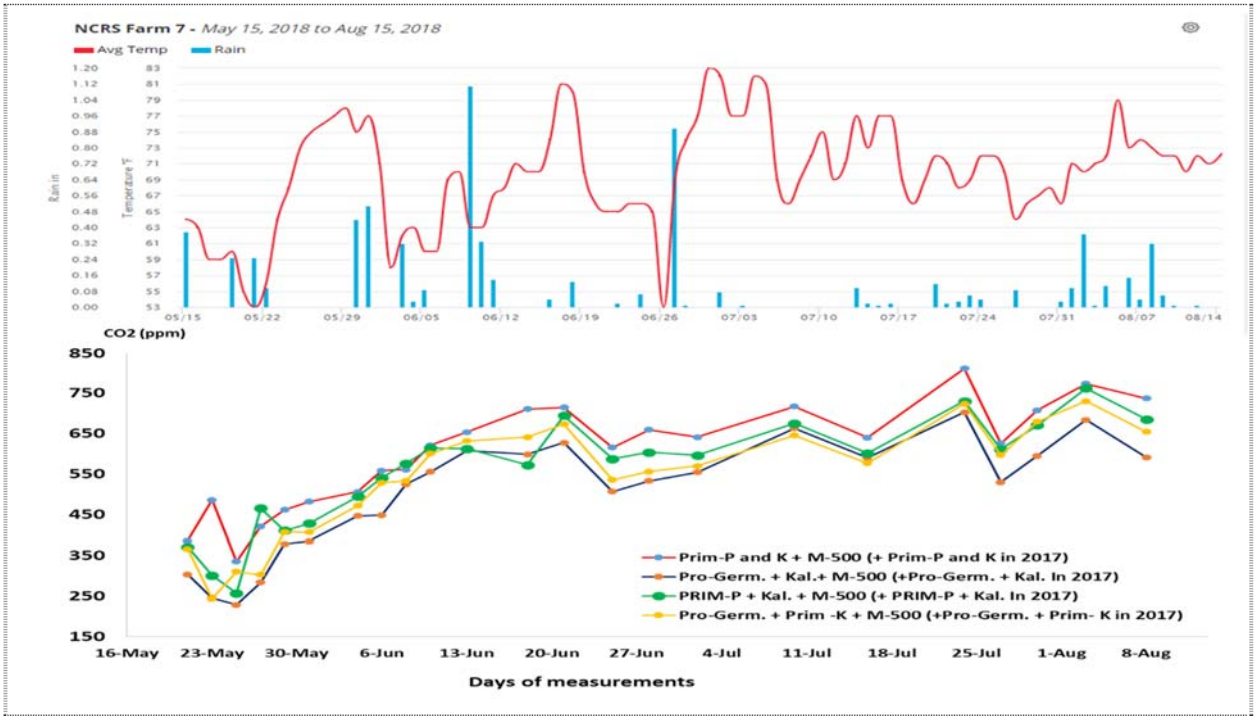

Figure 1. Long-term assessment of CO_2 capture resulted by the soil microbial respiration activity measured over the cropping season of Soybeans (Farm 18- 503) carried by the Cornell University protocol using an alkali trap "passive sampler".

The differences in EC presented the quantity of CO_2 captured in field conditions (details on the EC method of measurements are described in NCRS annual report entitled "Mathematical model for calibration of CO2 released by soil microbial respiration", as we were able to standardize a math equation to calculate the CO_2 released by soil microbial activity respiration in actual quantities.

Figures 1 and 2 are showing a long-term measurement of the soil microbial activity for few days before planting the soybeans across 2018 growing season and up to August 8, 2018, in 18-903 and 18-503. Overall, higher values were reported for CO_2 capture (ppm) in farm 18-503 (irrigated and PrimAgro line applied at planting) compared with farm 18-903 (non-irrigated soybean and no PrimAgro line applied at planting), i.e., 475-525 vs 550-600, respectively.

However, the amounts of CO_2 (ppm) released by the soil microbial activity fits with the increasing pattern of averages of temperature and rain when combined together and requires statistical analyses to work on a detailed report for publication. CO_2 measurements plotted with weather information (rain and temperature) and values of supplemental irrigation (in inches) are shown as red green bars.

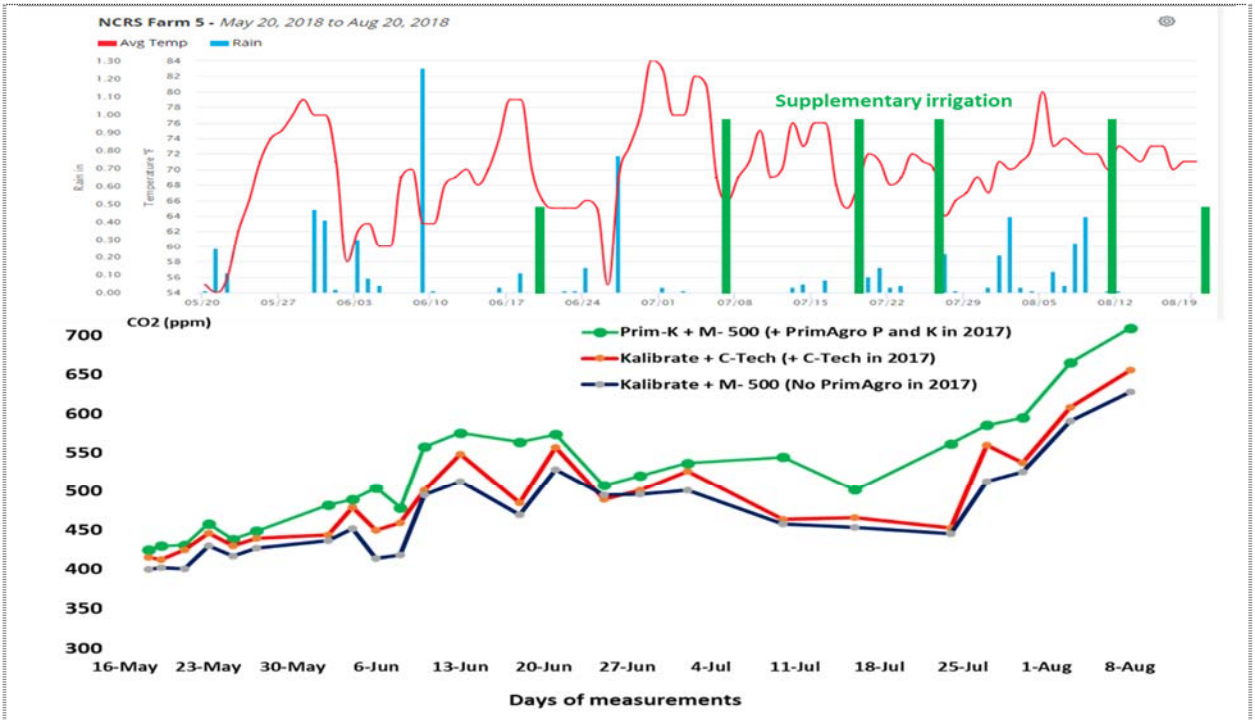

Figure 2. Long-term assessment of CO_2 capture resulted by the soil microbial respiration activity measured over the cropping season of Soybeans (Farm 18- 903) carried by the Cornell University protocol using an alkali trap "passive sampler".

Conclusion:

- The simplified passive sampler of alkali trap respirometer for CO_2 capture released by the soil microbial activity proved to be an innovative, valid tool.
- The PrimAgro line released higher values of CO_2 related to active soil respiration process compared to another non-microbial line.
- Application of the PrimAgro line, likely, has a residual effect of microbial activity and increased the arrays of soil microbes and diversity in soil and sTable sources of nutrients many crops.
- Further advanced studies will let us understand the role of the PrimAgro line in the formation of the soil organic matter and to know much better about the mechanism of PrimAgro line in the soil.