Title: Can calcite dissolving bacteria promote peanut pod growth?

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Brief & concise statement of objectives in UGA-48-19/21

We work on a group of calcite dissolving bacteria (CDB). We aim to examine their impact on calcium availability in soil and on peanut development.

1. Determine the species of CDB strains isolated from Blackshank Farm, Tifton.
2. Test the efficacy of CDB strains to increase calcium availability in soil.
3. Test the efficacy of CDB strains to promote seed development.

2020-2021 results & plan of investigation

1. Determine the species/genus of CDB strains isolated from Blackshank Farm, Tifton.

We have completed this objective. We isolated 65 CDB strains. After sequencing their 16s rRNA regions, we identified 17 unique strains, belonging to 10 different genera (**Table. 1**).

2. Test the efficacy of CDB strains to increase calcium availability in soil.

We tested 13 out of the 17 CDB strains for their ability to alter calcium levels in field soil. Six CDB strains increased calcium levels ranging from 11% to 91% in multiple tests (**Table. 1**). Six strains did not change calcium level in soil. One strain reduced calcium level. *We will complete testing the additional four strains before the end of the current funding period.*

CDB ID	Genus/Species	Change of Calcium
95A	*Cellulomonas hominis*	91%
70A	*Paenibacillus timonensis*	31%
62A	*Buttiauxella warmboldiae*	21%
73A	*Lelliottia aquatilis*	16%
27A	*Paenibacillus etheri*	12%
130A	*Acinetobacter lactucae*	11%
72A	*Enterobacter soli*	8%
93A	*Bacillus megaterium*	5.60%
141A	*Paenibacillus phocaensis*	5.30%
100A	*Streptomyces malaysiense*	-2%
87A	*Bacillus circulans*	-8%
82A	*Bacillus cucumis*	-10%
188A	*Staphylococcus pasteuri*	-17%
83A	*Bacillus luciferensis*	to test
115A	*Buttiauxella noackiae*	to test
133A	*Desertihabitans auraciacus*	to test
54A	*Paenibacillus xylanexedens*	to test

Table 1: CDB strains and their ability to change soil calcium level. Red: >10%; Gray: no change, >-10% or <10%; Blue: <-10%.

3. Test the efficacy of CDB strains to promote seed development.

This objective was interfered with by the pandemic. Currently, two experiments are undergoing. One experiment is to test the influence of CDB on seedlings growth with Ga06G seeds coated with CDB. The second experiment is to assay seed development with individual pods growing in soils supplemented with CDB. *We expect to complete these experiments before the end of the current funding period.*

4. Survey the distribution of CDB in soils with different crop history.

This experiment was not proposed in the original grant. We sampled soils from five fields with different crop history in the Blackshank Farm, Tifton (**Fig. 1**). The ratio of CDB in population was determined by the number of CDB colonies divided by the number of total culturable colonies on plates. We found that soils from peanut and vegetable fields had low calcium level but high CDB ratio. On the opposite, soils with high calcium level (onion or cotton fields) had low CDB ratio. The field rotated with peanut and cotton had medium level of calcium and CDB ratio. These observations indicate that soil CDB abundancy is associated with a soluble calcium level. It could be that a low calcium soil favors the growth of CDB due to their ability to utilize mineral calcium, or plants grown in a low calcium soil actively select CDB in order to obtain soluble calcium.

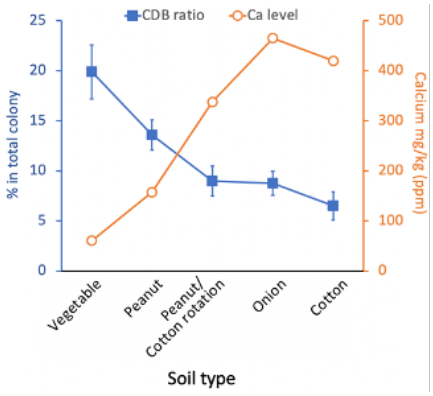

Figure 1: The ratio of CDB and calcium level in various soil types.