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A Potential New Tool for Phosphorus Management: Phosphorus Solubilizing Bacteria

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The phosphorus that cranberries take up serves many important roles in cranberry plants. Phosphorus is an important part of holding together cells, storing, and using energy, and forming part of the backbone that holds DNA together. Phosphorus plays a key role in photosynthesis, sugar metabolism, cell division, cell enlargement and it also promotes root growth and cold hardiness. However, annually applied phosphorus is not usually very available to vines and can build up in unavailable forms in the soil over time. Because cranberry soils are acidic, phosphorus is more likely to react with iron and aluminum to precipitate and become unavailable to the plants, a phenomenon similar to hard water leaving precipitated calcium on a faucet (Parent and Marchand, 2006). There are also likely to be some organic forms of phosphorus that build up in the soil with leaf drop and other organic matter but don't decay readily into usable forms, and some calcium phosphate in high pH cranberry soils.

Iron, aluminum, calcium, and organic phosphates can dissolve into the soil and feed plants, but this reaction is typically very, very slow. However, some bacteria will dissolve these forms of phosphorus, making them available to the plant more quickly. Applying these bacteria directly to the soil could help reduce the need to add phosphorus fertilizer by making available phosphorus that is already present.

We have isolated 90 different types of soil bacteria that can perform this reaction in petri dishes and test tubes. We confirmed and measured this using a malachite green dye (BioAssay Systems, 2021), which changes color from yellow to green at a measurable rate when phosphorus is dissolved in water, pictured below (Figure 2). We are preparing to test their ability to dissolve unavailable phosphorus precipitates in greenhouse trials.

After amending the soil with precipitated phosphorus chemicals, we will confirm that the plant is utilizing more phosphorus than what liquid fertilizer alone could explain.

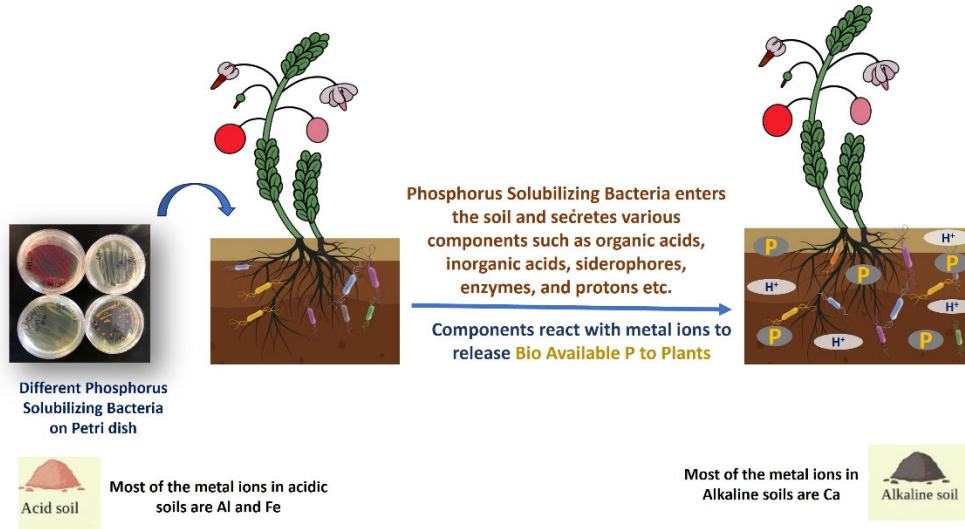


Figure 1: Phosphorus solubilization process in soil with the help of phosphorus solubilizing bacteria (Modified from Pan and Cai 2023)

We hope to use these bacteria, as well as the information we gain from them, to add more tools for managing soil phosphorus to the cranberry grower's toolbelt.

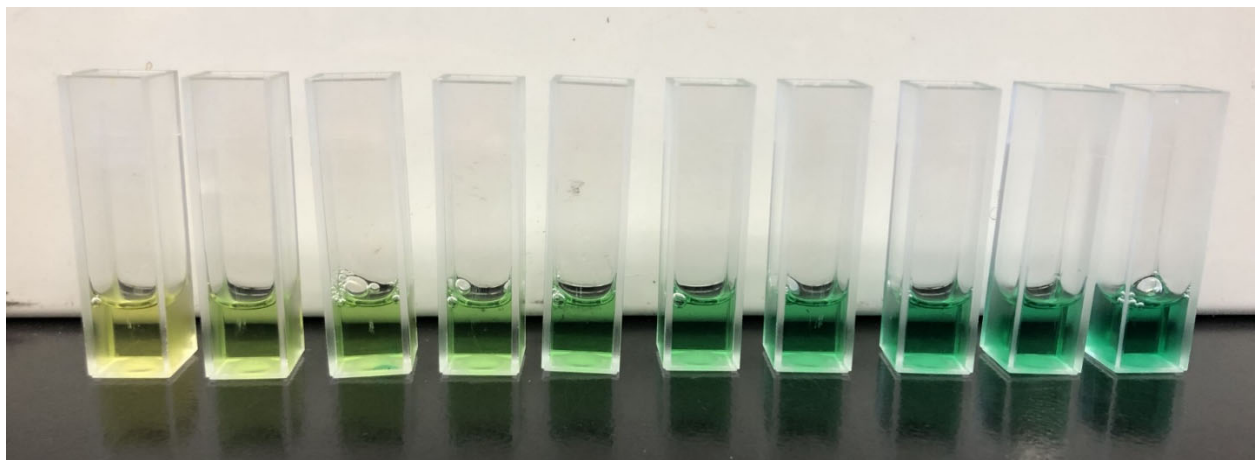


Figure 2: Gradient of phosphorus solutions, mixed with malachite green dye to measure concentration. We measure the green color using a spectrophotometer to measure phosphorus in solution.

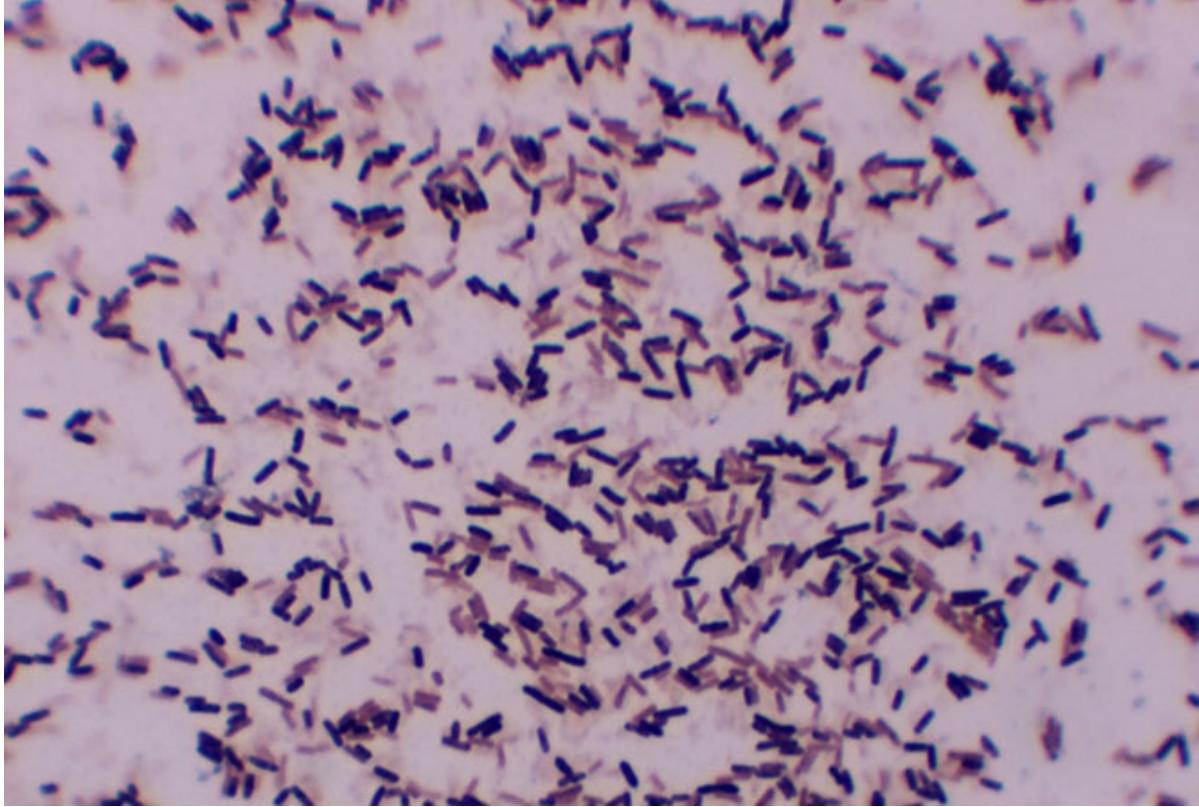


Figure 3: An example of a phosphorus solubilizing bacteria in our collection, *Bacillus amyloliquefaciens*, at 1000x magnification under microscope. Other strains of this bacteria are very promising biofertilizers (Chen et al 2007) and this strain was collected from a wild small cranberry.

Citations:

BioAssay Systems, Malachite Green Phosphate Assay Kit, 2021.

Chen, X.H., Koumoutsis, A., Scholz, R., Eisenreich, A., Schneider, K., Heinemeyer, I., Morgenstern, B., Voss, B., Hess, W.R., Reva, O. and Junge, H., 2007. Comparative analysis of the complete genome sequence of the plant growth-promoting bacterium *Bacillus amyloliquefaciens* FZB42. *Nature biotechnology*, 25(9), pp.1007-1014.

Parent, L.E. and Marchand, S., 2006. Response to phosphorus of cranberry on high phosphorus testing acid sandy soils. *Soil Science Society of America Journal*, 70(6), pp.1914-1921.

Pan, L. and Cai, B., 2023. Phosphate-Solubilizing Bacteria: Advances in Their Physiology, Molecular Mechanisms and Microbial Community Effects. *Microorganisms*, 11(12), p.2904.

Scouting Notes (False Blossom, BNLH Range, Spongy Moth)

Pamela Verhulst, PJ Liesch, Allison Jonjak

False Blossom Identification

As bloom approaches, False Blossom disease is becoming “text-book” obvious. Be on the lookout for floral abnormalities and erect (instead of hooked) pedicels, and witches’ broom symptoms. The phytoplasma is present throughout the entire plant (leaves, stems, and roots) and so complete roguing-out of infected plants is the only way to remove the disease from your bed. If you would like assistance with identification, or if you find false blossom and would like to participate in research (anonymized), contact leslie.holland@wisc.edu.



Floral abnormalities and erect pedicels commonly associated with cranberry false blossom disease. Photos via Pam Verhulst, Lady Bug IPM.

BNLH Range

The [Blunt-Nosed Leaf Hopper](#), an insect pest which is the vector of False Blossom Disease, has the potential to be found in sweeps in ALL Wisconsin growing ranges. Even if your marsh has not found BNLH in past years, be on the lookout for this pest. If you find a specimen that you would like assistance in identifying, please contact allison.jonjak@wisc.edu. Blunt-Nosed Leaf Hoppers are easier to control in their nymphal form. As bees come in, any treatments of BNLH will need to wait until blossom is over. Check with your handlers before making applications.



Figure 1. Nymph (left) and adult (right) blunt nosed leafhopper. Photo credit: Elvira de Lange, Rutgers

Spongy Moth

While you may be familiar with [Spongy Moth](#) (*Lymantria dispar*, formerly known as Gypsy Moth) from homeowner or forestry fact sheets, this caterpillar is beginning to show up in moderate numbers in cranberry IPM sweeps. According to PJ Liesch, "These probably spilled over from nearby wooded areas—just out of the egg, the small caterpillars can "balloon" and be moved around by the wind."

The Spongy Moth is already established in most counties in Wisconsin. The DNR only requests reports of Spongy Moth if it is found in counties that don't already have established populations. Currently, only cranberry growers in Sawyer, Washburn, Burnett, and Rusk counties would need to report sightings, by emailing spongymoth@wisconsin.gov. You can always check for the most recent map under item 6 at <https://spongymoth.wi.gov/Pages/home.aspx>.

Spongy moths are not a traditional cranberry pest, but they are a non-discriminatory feeder, so they bear watching if populations are abundant. Research-based threshold levels have not yet been established in cranberry.

The recommended product for homeowners is BT kurstaki strain: for example DiPel and Crymax. The DiPel formulation from Valent does have a supplemental label for use in cranberry. ([link to supplemental label from CDMS](#)). BTs in general must be ingested to work against caterpillars. BTs are most effective against small caterpillars. As caterpillars grow in size, efficacy will decline.

Cranberry growers may also choose to use conventional products in accordance with the label (that is, labeled for the crop of cranberries and the pest of spongy moth/gypsy moth). Because the name change for *Lymantria dispar* from gypsy moth to spongy moth is recent, many labels will still list "gypsy moth" as the target pest. Growers who were treating for BHFWS or other prebloom insects with flooding, Fanfare, Cormoran, Delegate, and Orthene all found that spongy moth caterpillars were controlled as well.

Always make applications in accordance with the label, as the label is the law, and check with your handler before purchasing product in case handlers have additional restrictions on top of those on the label. Any products listed are for illustrative purposes and are not an endorsement of one product over another.



Spongy moth caterpillar, photo via Pam Verhulst, Lady Bug IPM.

Citations

<https://fruit.wisc.edu/2021/04/27/watching-for-leafhoppers-this-spring-and-summer/>

https://hort.extension.wisc.edu/files/2022/04/Spongy_Moth_2022.pdf

<https://njaes.rutgers.edu/fs1248/>

<https://wood.extension.wisc.edu/files/2019/05/Issue-5.pdf>

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<https://spongy moth.wi.gov/Pages/home.aspx>

Wisconsin Cranberry Research Station Update

Wade Brockman & Beth Ann Workmaster

The new beds planted beginning of May are really starting to push a lot of growth, while the established beds are just starting to get into blossom with 5%~10% the average. Now if we can start a warmer dry period that would be great!

Researchers have started making their regular visits to the station. Two more projects, one on the contributions of both bee and non-bee insect pollinators and the other on the range of pollen carried by honeybees, have been added to our lineup of projects. All of the beds except one are involved in a research project of some kind this growing season.



Photo by Wade Brockman

Flying Dollar Cranberry Update

Seth Rice

Hello everybody! Things are moving along fast here in central Wisconsin. Early varieties are seeing bloom while Stevens are just starting to see scattered bloom. Our bees will be arriving or already arrived this week for a lot of growers. Some growers use honeybees while others use bumblebees. I think it's best to use both! Why not? Both have advantages but it's ultimately up to each grower. We are seeing our weed pressure come back especially the ones that escaped the herbicide shots with the boom. Our bug report came back good and so did a lot of other growers. Fanfare is becoming popular, especially since it's so easy to use. We've had some growers struggle to plant because of Mother Nature and the rain, but most growers tend to try to be done

planting around Father's Day—but that's just a guideline. Fungicide applications will be going on soon as the bloom continues to progress especially in those early varieties. Stay safe!

Vilas Cranberry Update

Jeremiah Mabie

Hello everyone, what a wild spring Mother Nature has been dealing us this year. We have certainly made up for loss of precipitation over the winter this spring with rain pretty much every other day. With that being said growers have been busy trying to time applications for herbicides and insecticides. Bug pressure has not been horrible with the cooler weather but everyone has done some type of control by now. Vines are moving along (starting to see hooks on all hybrids and some others) but with the cooler nights they seem to be slow, I'm sure when we get a few warm days we will catch right up. Getting beds ready to plant has also been a challenge but everyone is either planted or getting very close. It won't be long and our favorite little pollinators will be arriving and the booms will be moving again.



Photo by Jeremiah Mabie