Hi All

This is a recent email exchange I (Henry Swayze) had with David Johnson.  I was inviting him to join us on WFVR.org 's GreenZine which so far has not worked but here are my questions for his consideration and some quick answers he gave.  I feel his work has provided a very productive focus for ag going forward.  Much of the detail of his work is documented in presentations on YouTube and through scientific papers.

Henry Swayze

Question 1. Vermont's local food production is largely grown with bacteria dominated compost.  What benefits could be expected by adding a strong fungal component?  Productivity, nutrient density of produce, carbon sequestration rate.

The fungal component is critical but it is better to understand that it is a full living system that we are trying to restore. It is the fungi that we lose first, mostly due to plowing and biocides. The fungi function in both logistics and communication in healthy soil systems.

2. Much of Vermont's ag lands are used for dairy production and much of that is in confinement operations with corn as the major land use.  Lake Champlain is receiving phosphorus causing blue green algae and app 1/3 of that is from dairy farming.  This leads to two questions:     A) What would adding fingual tea at planting time due to retention of phosphorus on the land? and the second one B) is probably not your specialty but in case you have thoughts. The manure systems are anaerobic lagoons which lead to soil life receiving excessive nutrients available followed by starvation.  Is there a way to improve the soil health by bringing in a fungal component.

What we have observed in our first year field scale research is the ability to replace fertilizers with multi species cover crop and a broad spectrum microbiome with fungi being key, since that is the component being destroyed first in ag soil. Our application rates, for the compost, are 2# of compost/acre applied as an extract injected into the furrow at planting. We matched conventional corn production with an 85% reduction in nitrogen, and observed a 2% reduction in yield with no N fertilizers and only 2# of compost/acre. Profitability was $120/acre more with the 15% N and $86/acre more profitable with no synthetic N. We followed the same experiment with a pinto bean crop and both the compost+15%N and the compost only outperformed the conventional with full recommended N. Cover crop was planted during off season.

Nutrient density has not been studied but a rancher in Australia noticed the cattle will preferentially graze areas that have been treated with the compost extract.

Carbon sequestration in soils will only be possible if we improve the photosynthetic capacity (efficiency) of our system on the front end, along with an improvement in carbon use efficiency on the backend (reduced respiration). Properly grazed systems do both, higher biomass production and improved carbon use efficiency. We have observed up to a 5x increase in net primary productivity in farming systems and a 35% reduction in soil respiration rates.

Regarding phosphorus, we have approximately 40+ years of phosphorus in the soils of our agroecosystems that is unavailable due to the soil physical chemistry. The restoration of the soil microbiome re-instates phosphorus solubilizers that free up the phosphorus for plant use when needed. The application of phosphorus becomes unnecessary creating less flow to your rivers and lakes. A complete living functional microbiome ties up all the mobile elements in biomass (living and dead) and it is released when needed when you have a functional soil Foodweb that cycles these nutrients with no flow to water systems.

The anaerobic lagoons produce toxic fatty acids and as well the application rates of these effluents are too high for the broken soil microbiomes in current systems. I have read of some aerobic pre-treatments that can remedy many of these problems and offer a potential solution (Circul8 is one), but it all comes back to the right microbes to do the job and a regenerated soil microbiome.

3. Vermont continues to receive fairly high rainfall levels but it comes in bigger storms followed by bigger droughts.  We know that increasing organic matter in the soil will allow it to hold substantially more water thus reducing flood and drought.  Will bringing a larger fungal component onto the states land offer a marked change?  How do we accomplish this?

On the water holding component, yes the fungi are key, but again it is about restoring a healthy and balanced living system. The necessity to build up soil carbon and stable soil aggregates promote systems that infiltrate water quicker, hold water longer and release it slower, all fixes for many of the flooding issues we are observing in many areas….

Hope these answers are helpful,

David & Hui-Chun

***David C. Johnson Ph.D.***

***Research Scientist, Senior***

***NMSU College of Engineering***

[**davidcjohnson@nmsu.edu**](mailto:davidcjohnson@nmsu.edu)

**575.646.4163**

***Adjunct Professor***

***California State University, Chico***

***Center for Regenerative Agriculture and Resilient Systems***

<https://www.csuchico.edu/regenerativeagriculture/>

***Research Scientist/Molecular Biologist***

***Institute for Sustainable Agriculture Research, NMSU***