

Can improvement of Soil Health lead to Disease Suppression?



**Sustainable Pest
Management Lab**
University of Hawai'i at Mānoa,

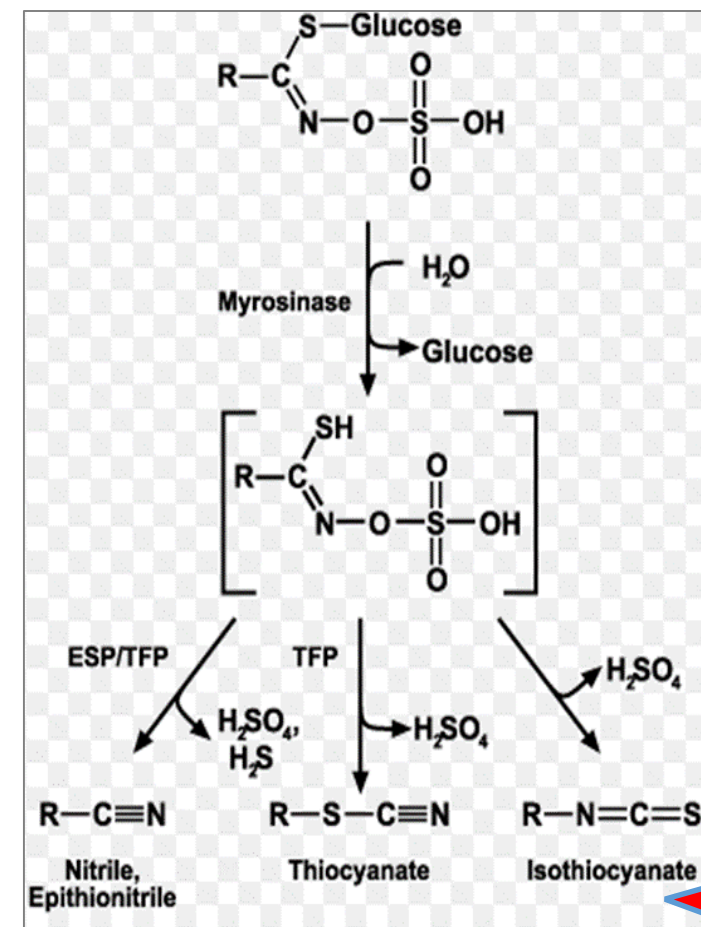
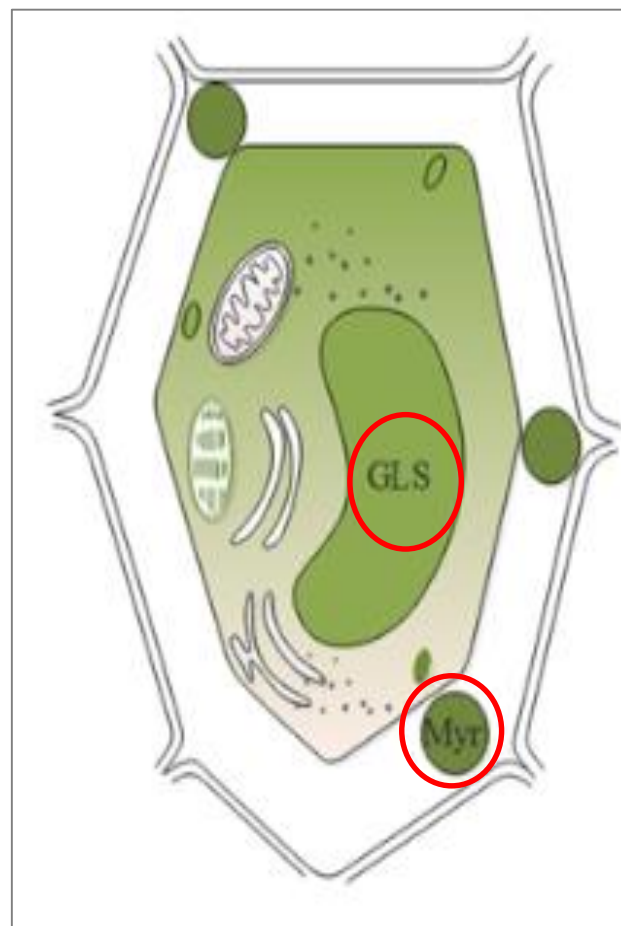
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Biofumigation

- The use of **glucosinolate** (GL)-derived **isothiocyanate** (ITC) from brassica cover crops to suppress soil-borne pests and pathogens (Kirkegaard et al., 1993)



Biofumigation by MTBP

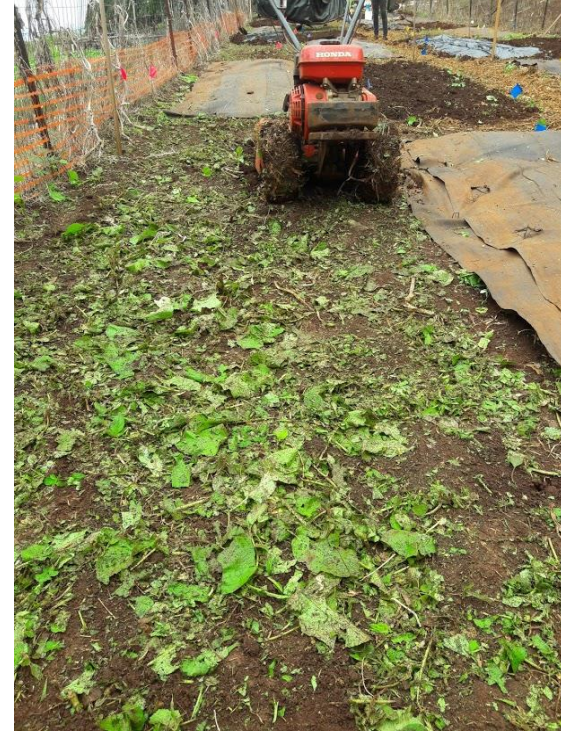
(Macerated, Till, cover with Black Plastic)

Seeding: 10 lb/acre



5 weeks

Flail mower



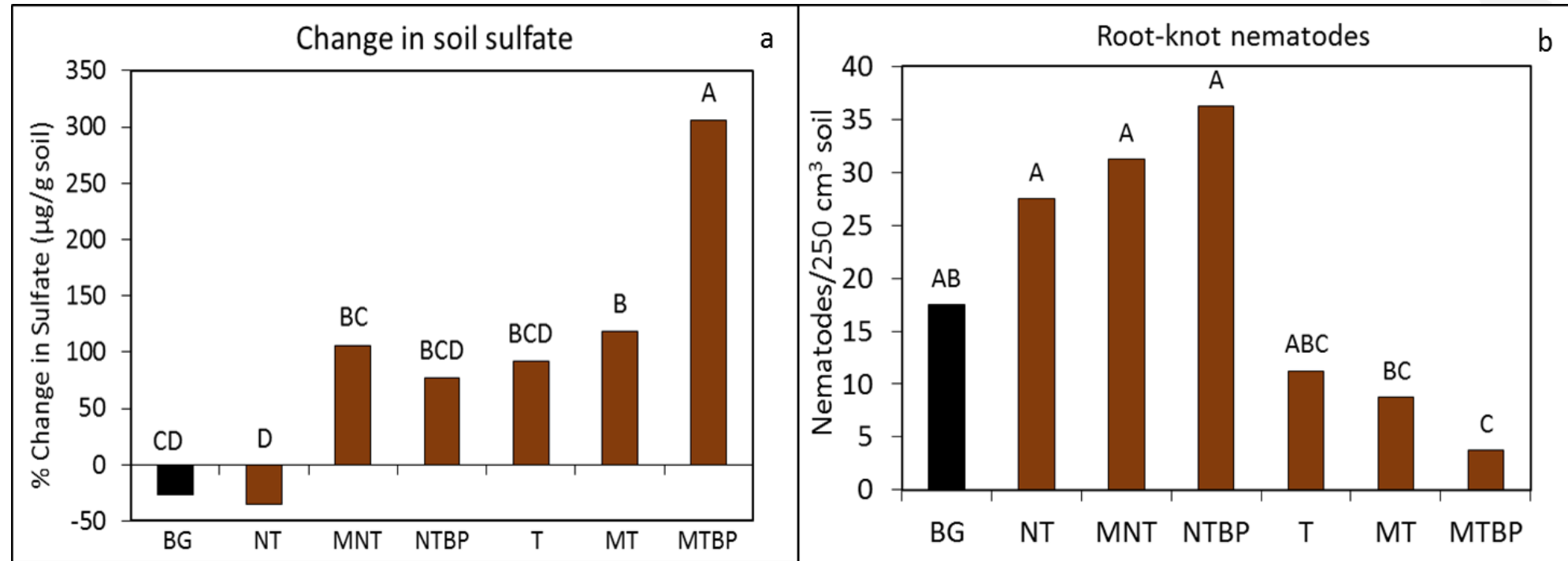
Till



Cover with plastic
(1 week)



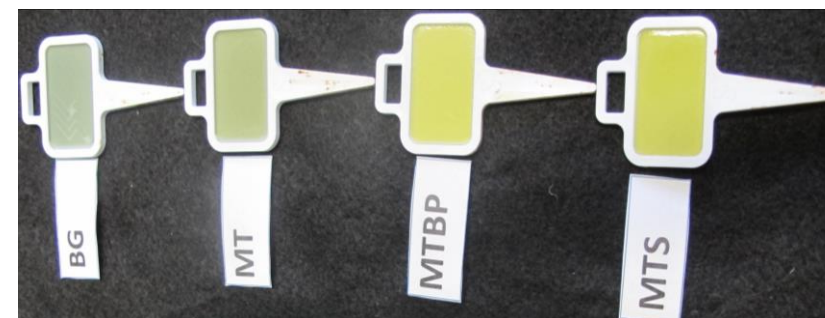
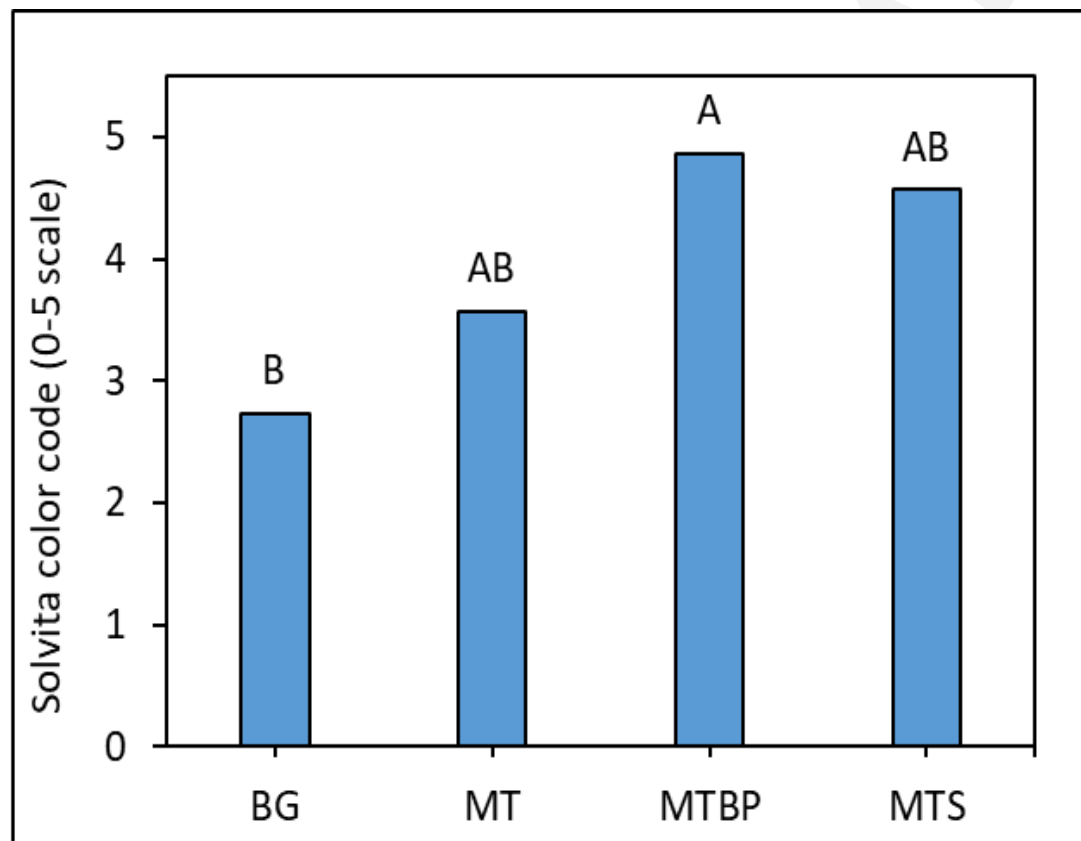
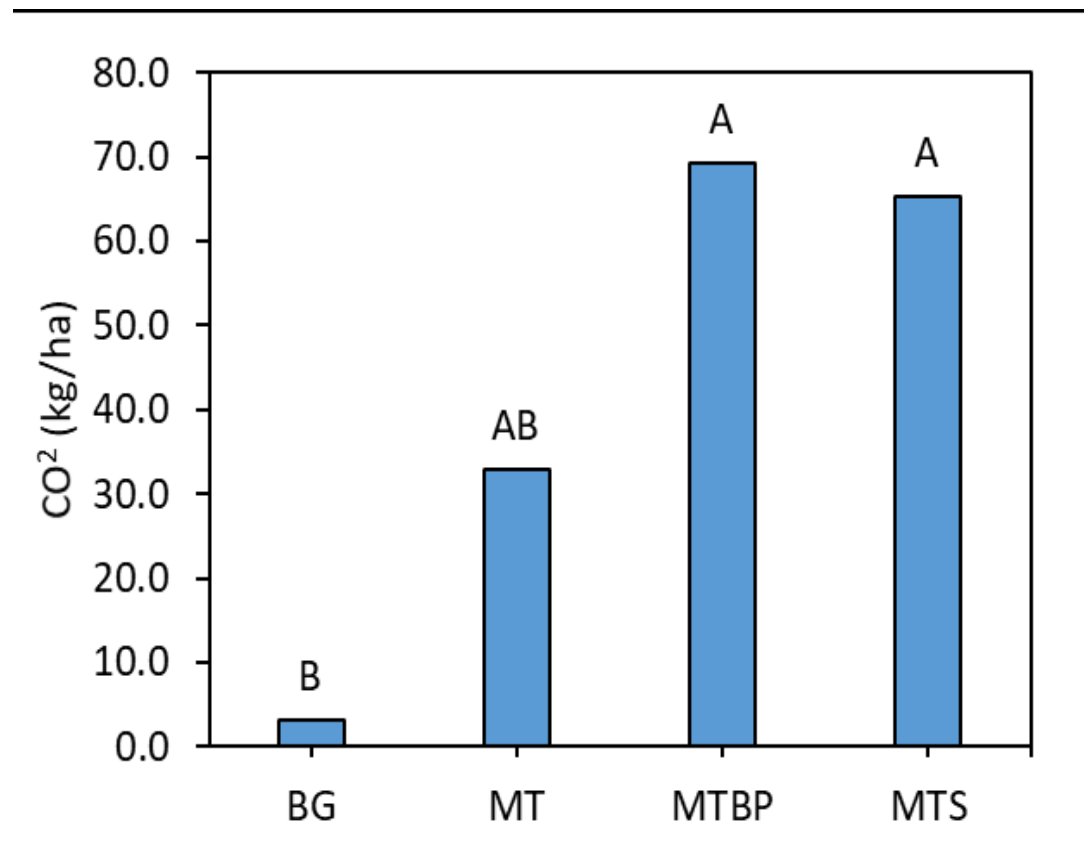
Suppression of root-knot nematodes by MTBP-Biofumigation



- Higher soil sulfate concentration one week after MTBP indicated higher efficacy of biofumigation of glucosinolate compounds compared to bareground (BG), no-till (NT), macerated no-till (MNT), no-till with black plastic (NTBP), till (T), and (macerated till).
- Efficacy of MTBP was observed on population of root-knot nematodes in the soil after a zucchini crops following the mustard treatment.



Solvita Test



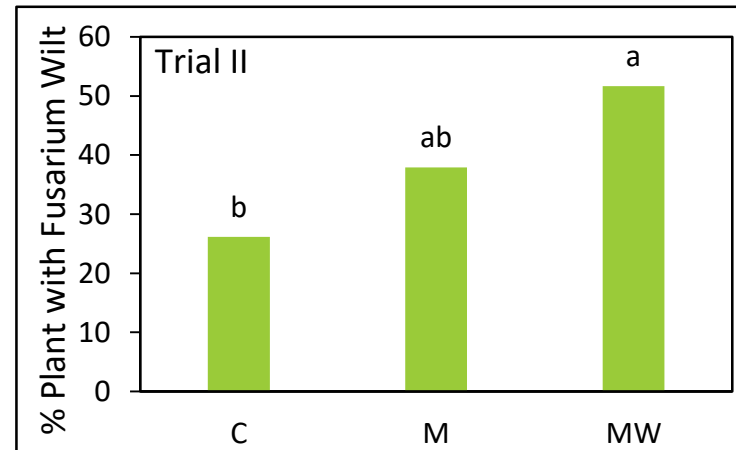
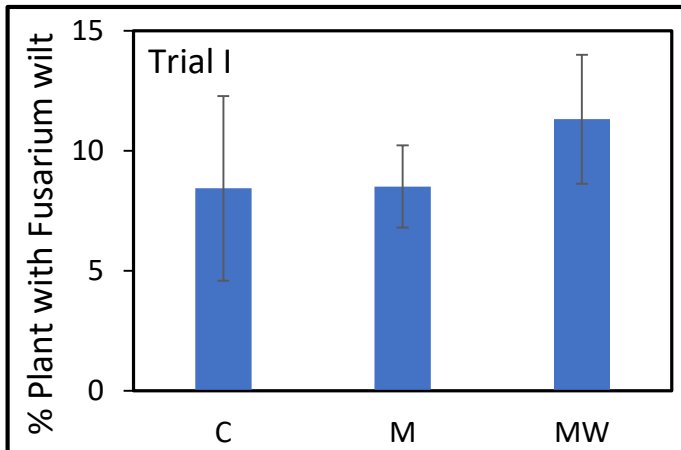


Lettuce Biofumigation Test

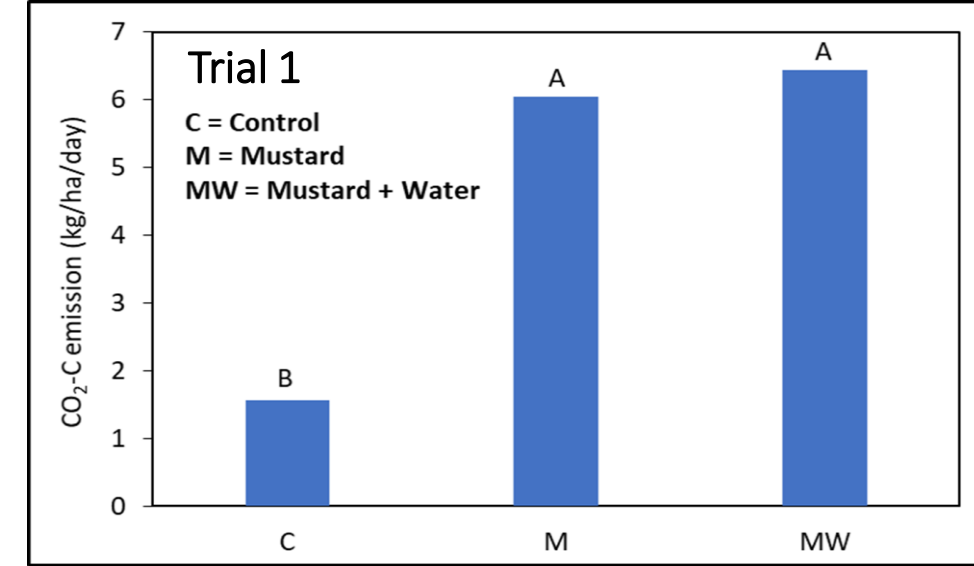
- Biofumigation with brown mustard (M) or brown mustard plus water (MW) increased soil microbial activities as indicated by higher CO₂ burst. Thus, biofumigation increased soil microbial activities.
- But biofumigation did not reduce Fusarium wilt disease incidence on lettuce.



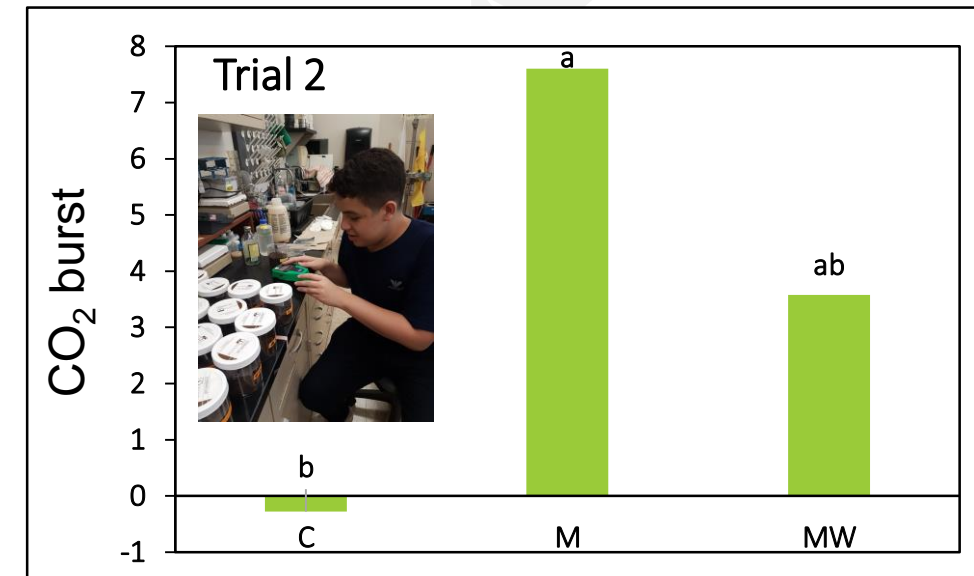
Disease Incidence



Solvita Test (Soil Respiration)



7 days after biofumigation

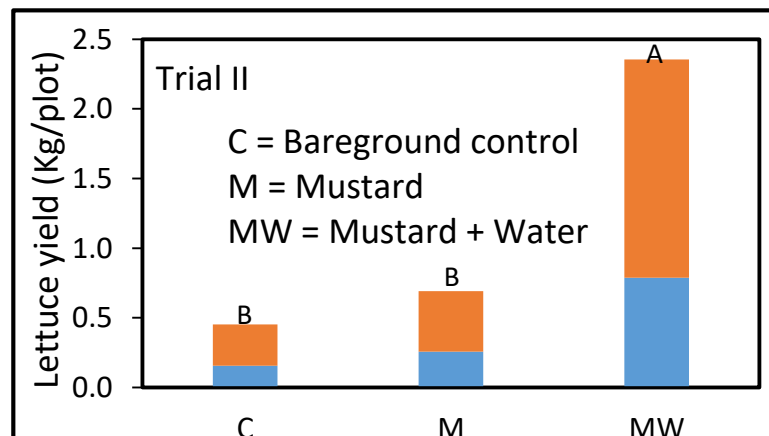
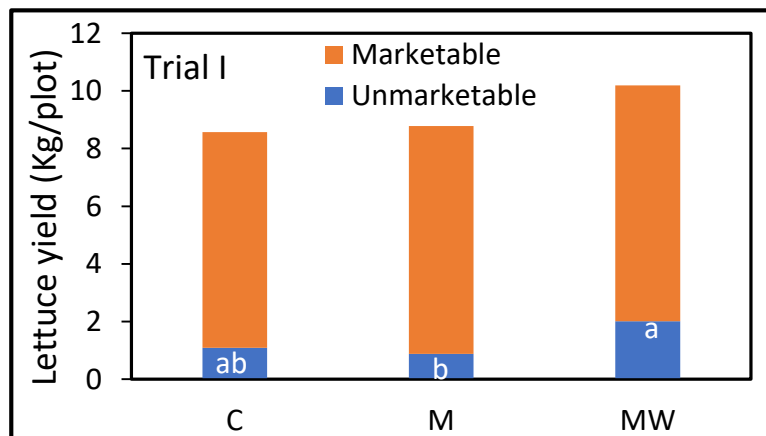




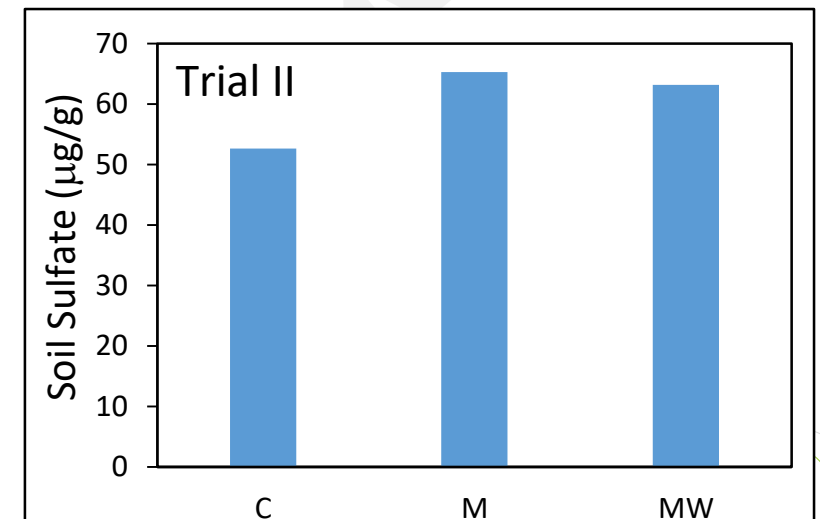
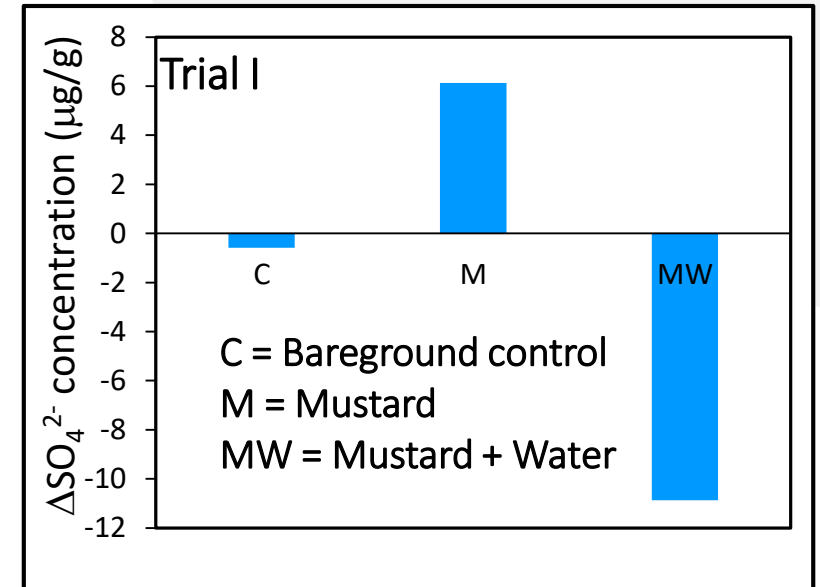
Lettuce Biofumigation Test

- Biofumigation with brown mustard (M) was more efficient in performing biofumigation than MW.
- Biofumigation with brown mustard + water (MW) achieved better green manure effect in Trial II ($\theta = 30\%$) than in Trial I ($\theta = 37\%$).
- Soil sulfate concentration was negatively related to Fusarium wilt incidence in Trial I, and positively related to number of lettuce plants that survived in Trial II.

Lettuce Yield



Sulfate as an indicator of biofumigation (7 days after initiation of biofumigation)

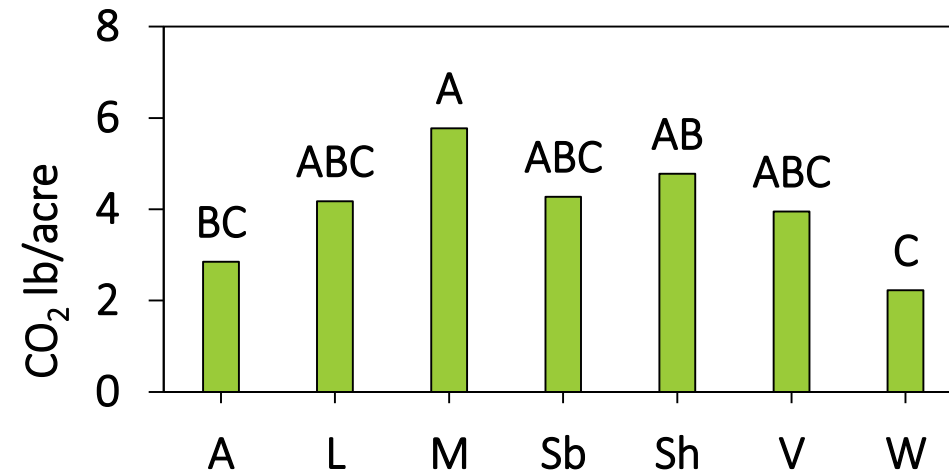




Soil Drenching of Solution from Organic Materials against Banana Fusarium Wilt

Treatments: (5 gal water / plant)

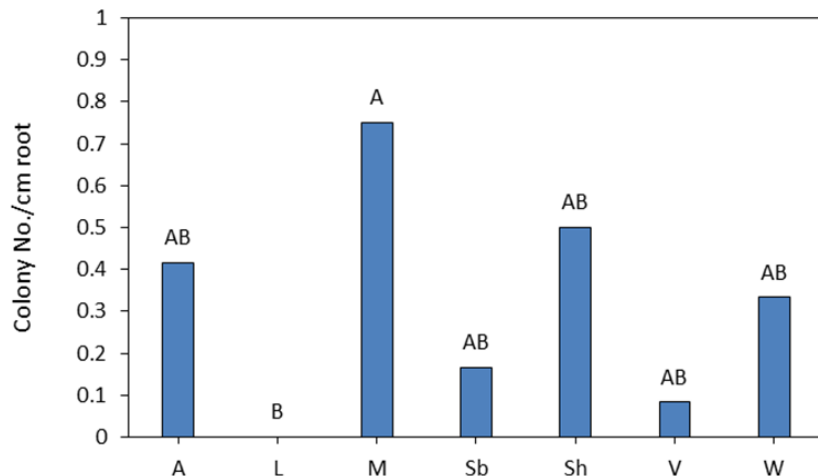
- A = Actinovate (*Streptomyces lydicus*),
- L = Lobster meal,
- M = Mustard (ground),
- Sb = Subtilex (*Bacillus subtilis*),
- Sh = Shrimp shell meal,
- V = Vermicompost tea,
- W = Water



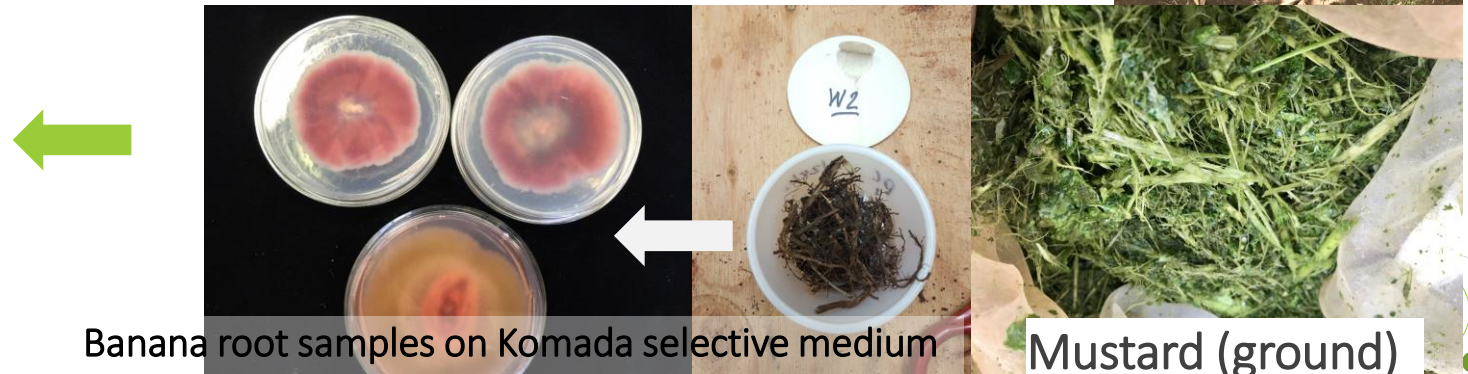
Lobster meal suppressed Foc, mustard meal increased soil microbial activities.



FOC Purple Colonies on Komada Medium



Purple colonies were Fusarium colonies.

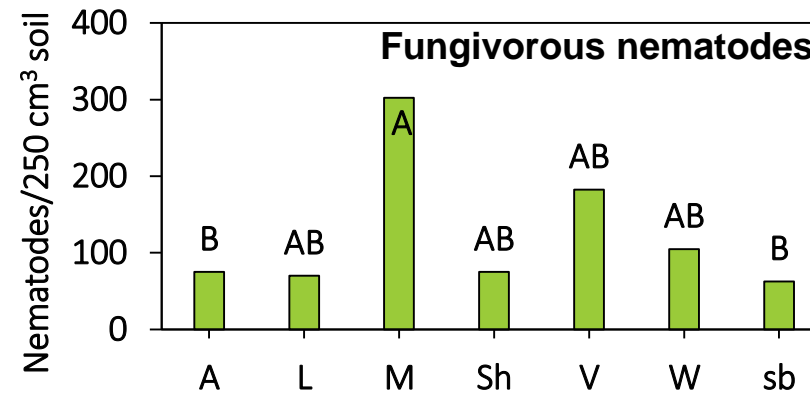
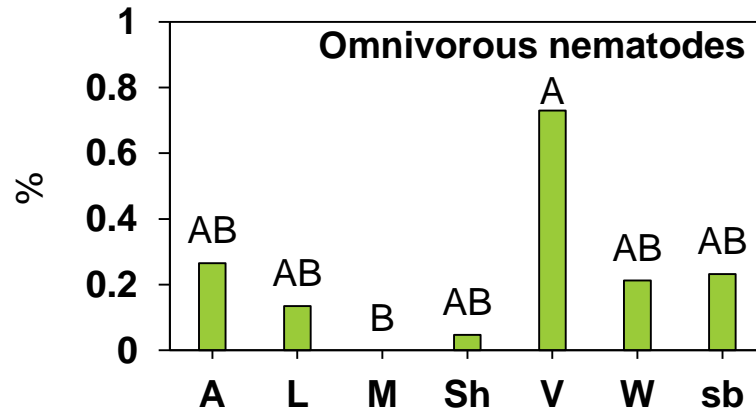
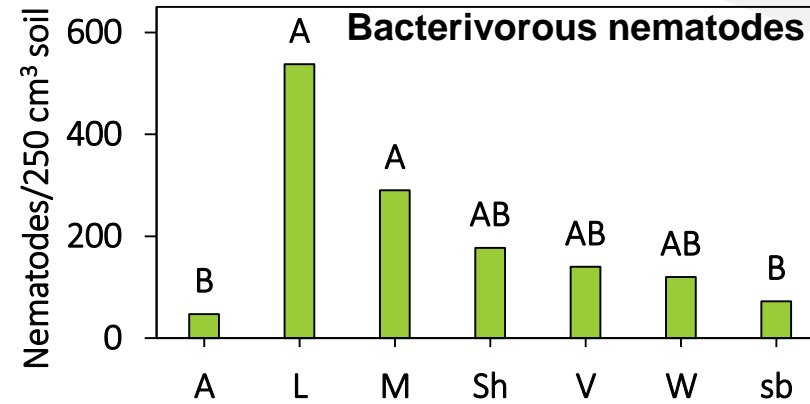
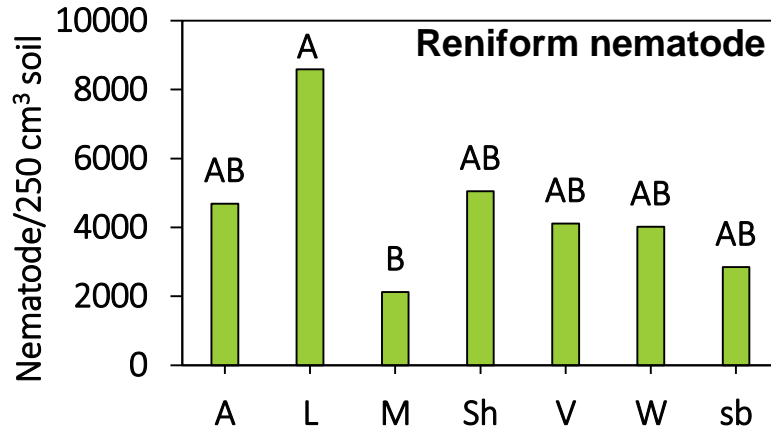


Banana root samples on Komada selective medium

Mustard (ground)

Soil Drenching of Solution from Organic Materials on plant-parasitic nematodes and soil health

(8 weeks after treatment)

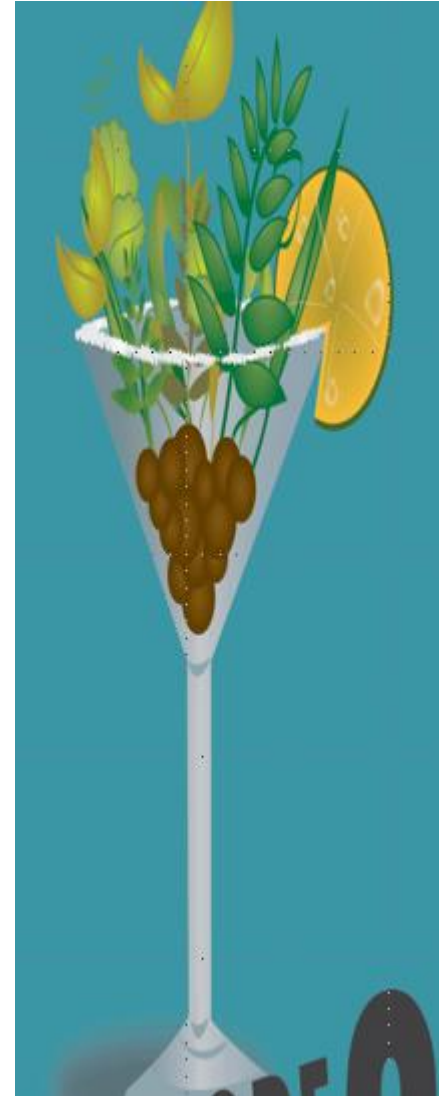


- Mustard resulted in lowest abundance of reniform nematodes.
- Lobster and mustard increased bacterivorous and fungivorous nematodes, vermicompost tea increase % omnivorous nematodes.
- Lobster enhanced bacteria decomposition, mustard enhanced fungal decomposition.





Cocktail Mix against Soil-borne Pathogens in banana field



Nematode Suppression

Biofumigation by macerating mustard residues (17lb FW/plant) followed by drenching H₂O to achieve 30% gravimetric soil moisture (we use 5 gal/plant).

Foc Suppression

Lobster meal mix into water at 35 lb/1000 ft² soil (here we mix 0.32 lb with 5 gal water per plant).

Lobster meal contains chitin, thus enhance beneficial soil chitin-feeding microbes, that can dissolve cell wall of pathogenic fungi.

Soil Health

Brew uncured vermicompost tea >12 hours at 1:100 water, delivered 5 gal/plant.

