2011 Strip-till Cover Cropping and Vermicompost Tea Workshop

Date: 19 May, 2011
Location: Twin Bridges Farm, Waialua
Presenter: Koon-Hui Wang, Leyla Kaufman, Theodore Radovich, Jari Sugano

Sunn hemp (SH)

SH+CC

Crimson Clover (CC)

Bare ground (BG)

Subplots:

- Chicken pellets (F) =60lb N/acre
- Vermicompost tea (T) =200 gal/acre
- F+T
- None
- 3 replications
- Twin Bridges Farm, Waialua

A field trial was conducted at Twin bridges Farm, Waialua to demonstrate the benefits of strip-till cover cropping with sunn hemp (SH) (*Crotalaria juncea*) and crimson clover (CC) (*Trifolium incarnatum*) in a zucchini (*Cucurbita pepo*) agroecosystem. The objectives of this experiment were to examine the effects of:

1. integrating cover cropping system with compost tea drenching,
2. using cover crop to attract pollinators,
3. maintaining living mulch as trap crops against whiteflies, thrips, aphids,
4. applying entomopathogenic nematodes (EPN) to manage pickleworms,
5. practicing strip-till cover cropping system for soil or plant health management.

				
Pickleworms on cucumber fruits	EPN infected pickleworms	Leaf cutter bees on *Crotalaria* sp.	Silverleaf symptom	Fruitflies damage

Main plot treatments: (plot size 50'×21', 12 plots, 3 replications)

SH = Sunn hemp (30 lb/acre, planted on 12/2/2010)
CC = Crimson clover (40 lb/acre, planted on 12/2/2010)
SHCC = alternate SH + CC planting rows, SH rows will be the subsequent cash crop rows.
BG = Bare ground with no irrigation, sprayed with glyphosate to control weeds.

Subplot treatments: (12.5'×21' per plot, i.e. 9 plants/plot)

Orange = F = Fertilizer using chicken pellets (4-2-2) at 6 oz/plant.
Blue = T = Vermicompost tea (brewed for 2 days), 120 ml/plant weekly until flower.
Yellow = F+T.
White = None = no fertilizer and vermicompost tea treatment.

12/2/10	Cover crop planted.
3/2/2011	Alternate rows of cover crops were flail mowed. Mowed cover crop rows were tilled with a hand held tiller. In SHCC plots, only SH rows were tilled in. The remaining cover crops served as living mulch. SH living mulch was trimmed to 3-feet tall, and the residues served as surface mulch. Weeds were flushed and sprayed with glyphosate prior to planting.
4/7/2011	Transplant 2-week old zucchini 'Elite F1' at 6'-row spacing, 4' within row. Each main plot was split into 4 subplots (F, T, F+T, or None).
4/27/2011	Entomopathogenic nematodes (*Steinernema feltiae*) collected from Poamoho Station were sprayed on zucchini flowers in all cover crop plots at 200 nematodes /flower (4.5 ml) at 3-day interval until end of harvesting.
5/5/2011	Begin fruit harvesting. Stop vermicompost tea treatment.

Results

Table 1. Dry biomass, total C and N of cover crop at termination of cover cropping.

Plot	Dry biomass (tons/acre)	Total C (lb/acre)	Total N (lb/acre)
SH 1	5.29	4280	177.85
SH2	3.61	2990	121.40
SH3	2.50	2066	83.87
CC1	1.94	1561	98.45
CC2	1.36	1098	69.24
CC3	1.25	1012	63.83

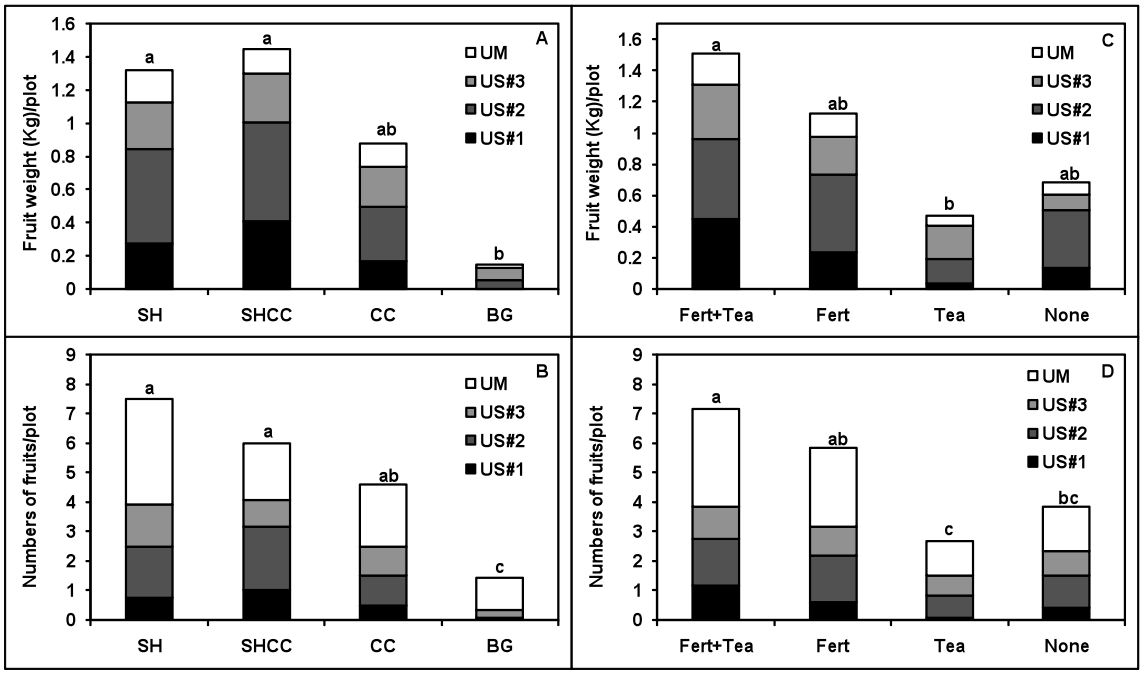

Fig. 1. Accumulated A) fruit weight and B) fruit numbers at 37 DAP (n=12). US#1 = firm, tender, no damage; US#2 = firm, tender, no major damage; US#3 = off shape, multiple damages; UM = unmarketable, serious damage mainly due to fruitflies, some pickleworms, and viruses. Columns followed by same letters were not different based on Waller-Duncan k-ratio (k=100) t-test.

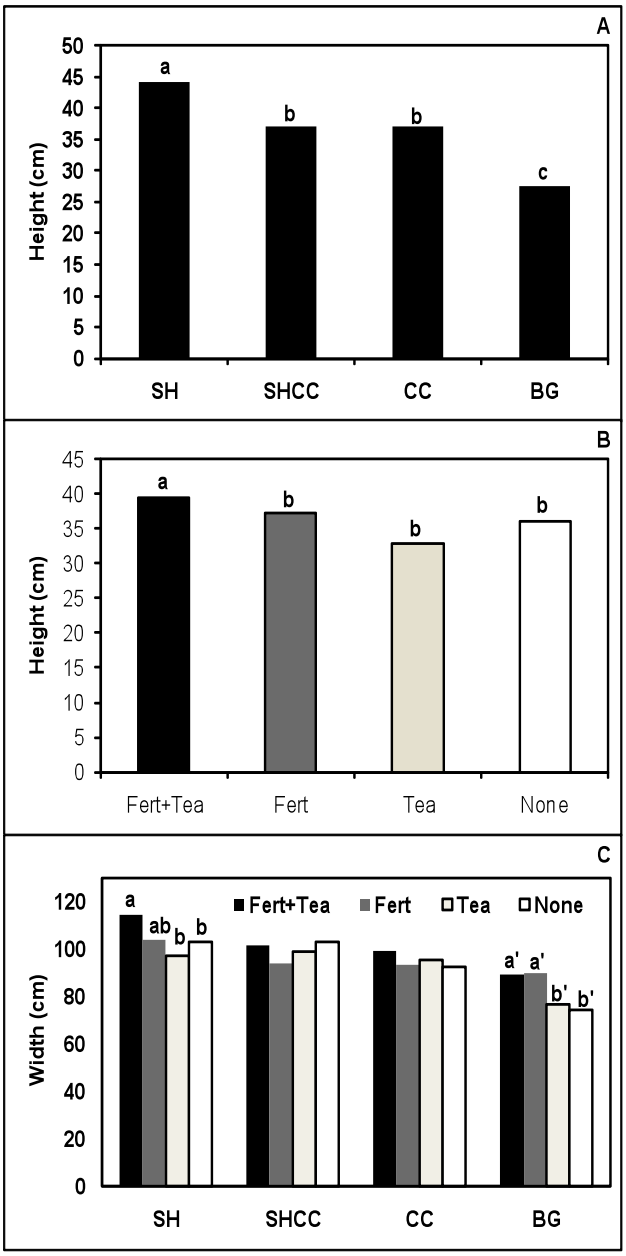

Fig. 2. Zucchini plant height and canopy width measured at 35 DAP. Columns followed by the same letter(s) were not different based on Waller-Duncan k-ratio (k=100) t-test (n = 48).

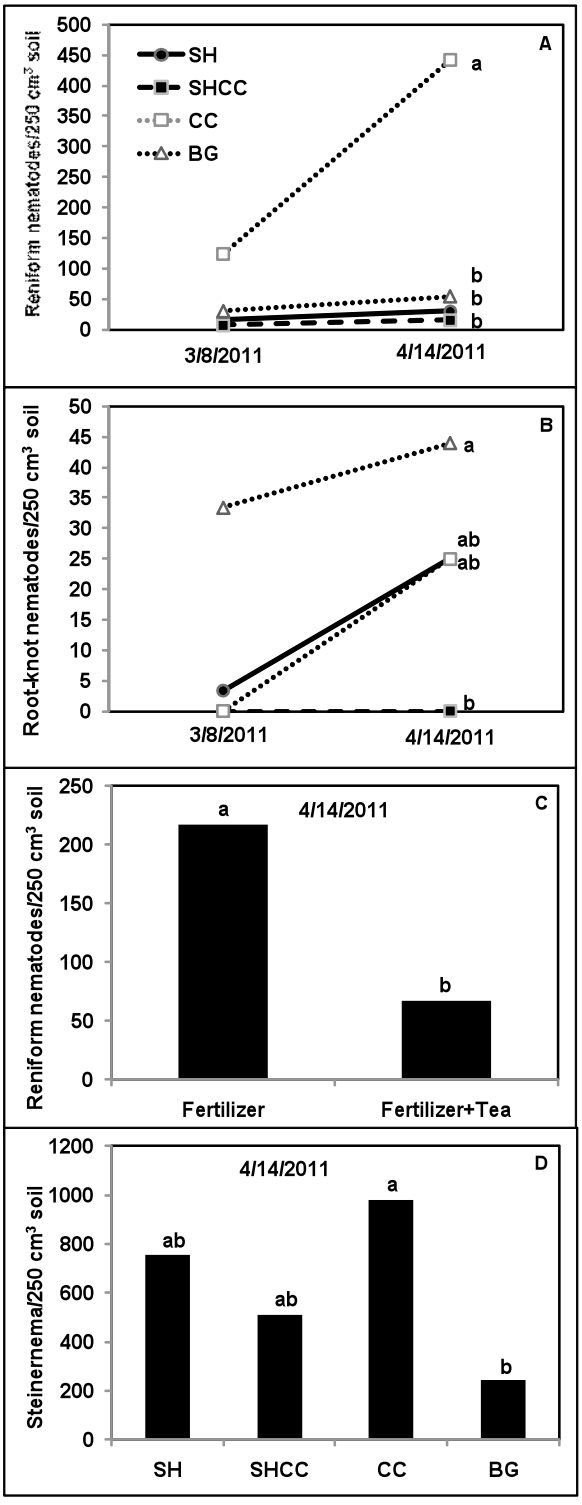

Fig. 3. Number of A) reniform and B) root-knot nematodes in SH, CC, SHCC and BG (n=6). C) Number of reniform nematodes in fert and fert + tea subplots (n=12). D) Numbers of *Steinernema* in SH, CC, SHCC and BG (n=6).

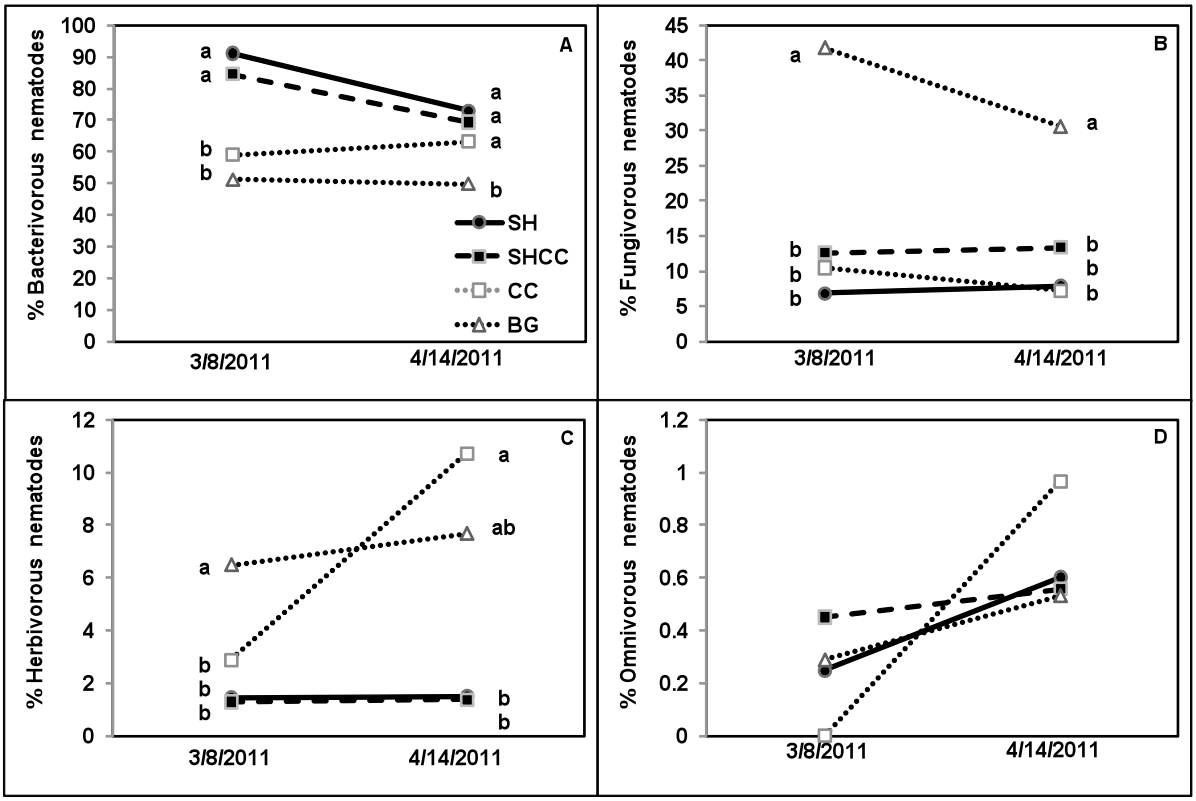

Fig. 4. Effect of cover crop treatments on A) % bacterivorous, B) % fungivorous, C) % herbivorous, and D) % omnivorous nematodes up to one week after zucchini transplanting (n=3 and 6 at 3/8/2011 and 4/14/2011, respectively.

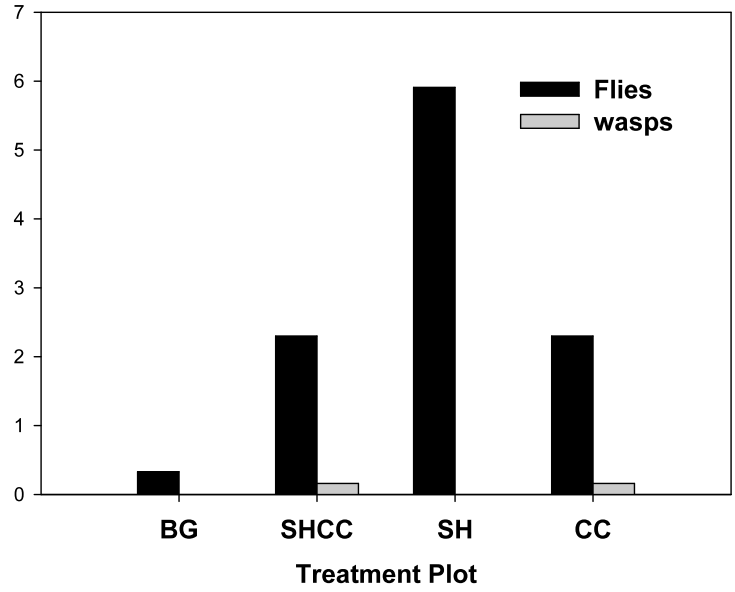

Figure 5. Insect pollinators in zucchini flowers

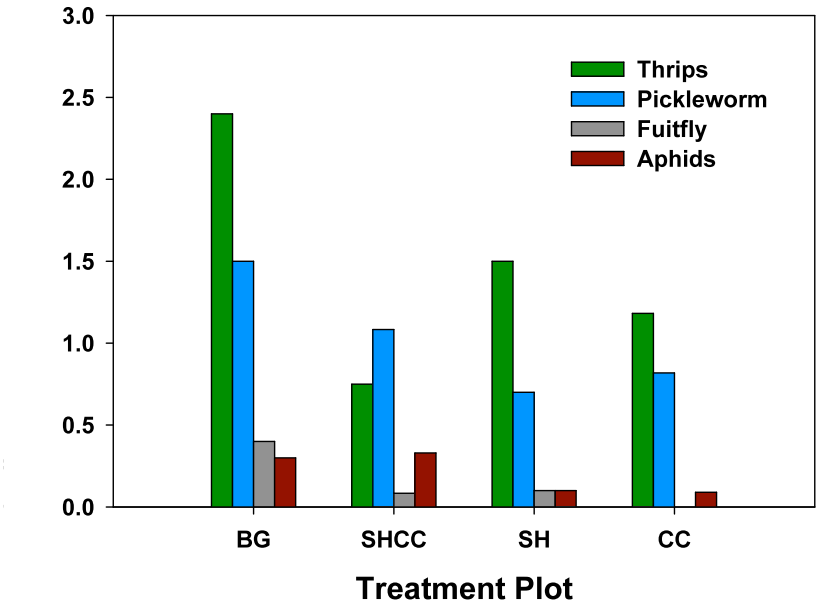

Fig 6. Density of insect pests in zucchini flowers.

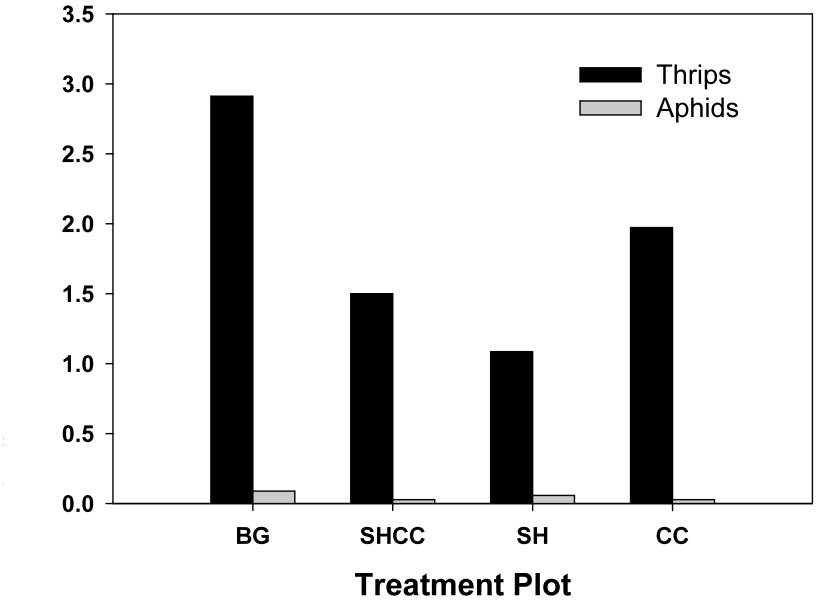

Fig 7. Density of thrips and aphids in leaves (2nd fully emerged leaf).

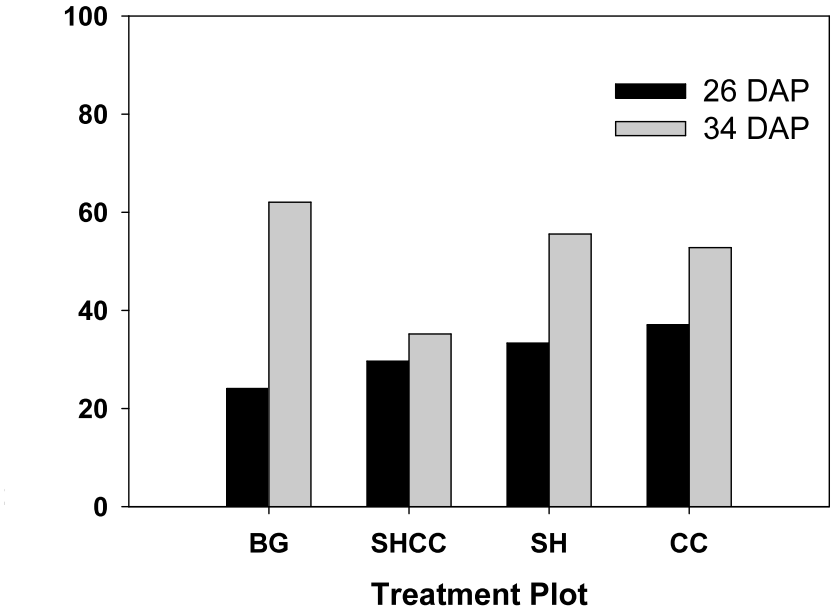

Figure 8. Percentage of virus infected plants26 and 34 days after planting (DAP)

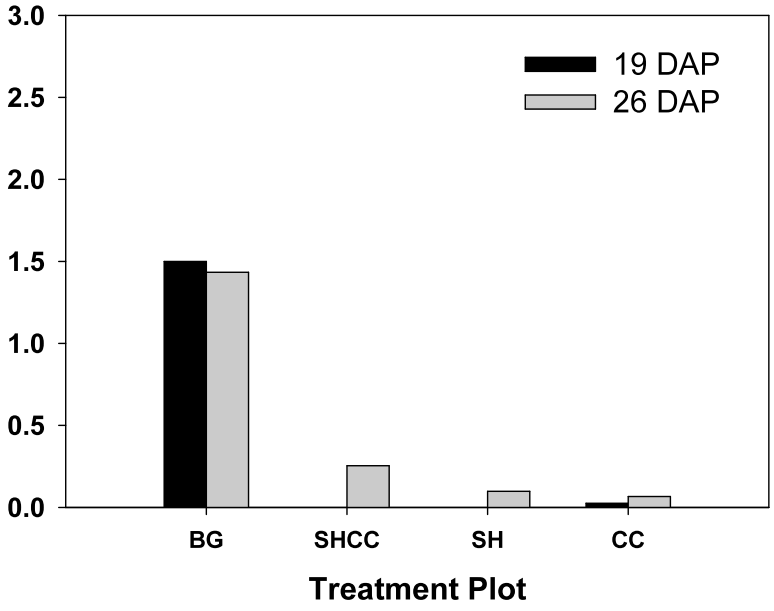

Figure 9. Mean silver leaf (infestation rate 19 and 26 days after planting (DAP)

Silver leaf rating system used (rating on new leaves only): scale 0 = no silver leaf (SL) damage in new leaves, scale 1 = 1-33 % of new leaves with SL symptoms; scale 2 = 34-66 % of new leaves with SL symptoms; scale 3 = > 66 % of new leaves with SL symptoms

Summary

1. **Effects of integrating cover cropping system with compost tea drenching:**
   - Strip-till cover cropping (STCC) of SH or SHCC produced higher zucchini yield than CC or BG (Fig. 1 A, B).
   - Adding vermicompost tea (T) to chicken pellets fertilizer (F) only increased zucchini yield slightly (Fig. 1C, D).
   - However, zucchini plants in F+T were more vigorous than that in F only treatment ($P < 0.05$, Fig. 2B). Effect of F+T on canopy width was most obvious in SH plots (Fig. 2C).
   - STCC of SH, SHCC, and CC had lower reniform nematodes than BG at 1-wk after zucchini planting, thus protect the plants from early nematode infection (Fig. 3A, B).
   - Adding vermicompost tea (T) to chicken pellets significantly reduced initial population densities of reniform nematodes at zucchini planting (Fig. 3C).

2. **Effect of using cover crop to attract pollinators:**
   - Both cover crops attracted more flies, whereas crimson clover also attracted more wasps than BG (Fig. 5).

3. **Effects of maintaining living mulch as trap crops against whiteflies, thrips, and aphids:**
   - Numbers of thrips were lower on zucchini planted in cover crop plots (Fig. 6, 7).
   - Numbers of plants with silverleaf were lower in cover crop plots than BG (Fig 9).
   - Numbers of virus symptomatic plants were similar among all treatments (Fig 8).

4. **Effects of applying entomopathogenic nematodes to manage pickleworms:**
   - Indigenous population densities of *S. feltiae* in the soil were higher in all the cover crop plots than BG (Fig. 3D).
   - Numbers of pickleworms and fruitflies on zucchini flowers tend to be lower in cover crop plots than BG (Fig. 6).

5. **Effects of practicing strip-till cover cropping system for soil or plant health management:**
   - STCC of SH or SHCC enhanced bacterivorous nematodes (Fig. 4A), indicating a nutrient enriched soil.
   - BG had highest % fungivorous nematodes (Fig. 4B), indicating a more stressful soil condition.
   - STCC of SH or SHCC significantly reduced plant-parasitic nematodes (Fig. 4C).
   - Cover crop treatments did not affect % omnivorous nematodes (Fig. 4D).
   - Adding vermicompost tea to chicken pellets did not affect the nematode communities at one week after treatment, more samplings are in progress.

Acknowledgement
- Twin Bridges Farm
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- Sharadchandra Marahatta, Roshan Manandhar, Amber Tateno, Sean Gerchaneck

Evaluation Form for Strip-till Cover Cropping and Compost Tea Field Day

Please circle Yes or No for the following questions.

1. Is the information presented at this field day of interest to you? Yes No _____
2. Are you growing cover crops in your farm? Yes No _____
   a. Yes. Is the cover cropping practice demonstrated here provides you new information? Yes No
   b. No. Are you going to adopt some cover cropping practice in your farm now? Yes No
3. If you provide consultation to farmers, will you recommend cover cropping practice to your clients? Yes No
4. What information presented is of most interest to you? Comments?

   _____

   _____

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