New technologies for improving strawberry plant health and yield

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Under the soil is a complex and dynamic world of moisture, pH, salinity, nutrients, microorganisms, and plant roots along with pests, pathogens, weeds and more. A good balance of essential nutrients, moisture, and beneficial microorganisms is critical for optimal plant growth and yield. Healthy plants maintain a good balance of nutrients and natural plant defense compounds that help them withstand stress caused by biotic and abiotic factors.

There are some products that promote plant growth and improve health, yield potential and quality. Some have mycorrhizae while others have a blend of micro and/or macro nutrients that are utilized by plants as well as beneficial microorganisms in the soil that promote plant health. In addition to the macro nutrients such as nitrogen, phosphorus, and potassium, several micro nutrients are critical for optimal growth and yield potential. Understanding the plant-microbe-nutrient interactions and how different products help crop production are important for making appropriate decisions.

Mycorrhizae or fungi of roots establish a symbiotic relationship with plants and serve as an extended network of the root system. They facilitate improved uptake of moisture and nutrients resulting in better plant growth and yield. Mycorrhizae can absorb certain nutrients more efficiently than plants and make them more readily available for the plant. With increased moisture and nutrient absorption, plants become more drought tolerant. Healthy root system can fight soil diseases and weed invasion. Additionally, mycorrhizae increase organic matter content and improve soil structure.

Study 1 - Beneficial microorganisms for improved strawberry plant health:

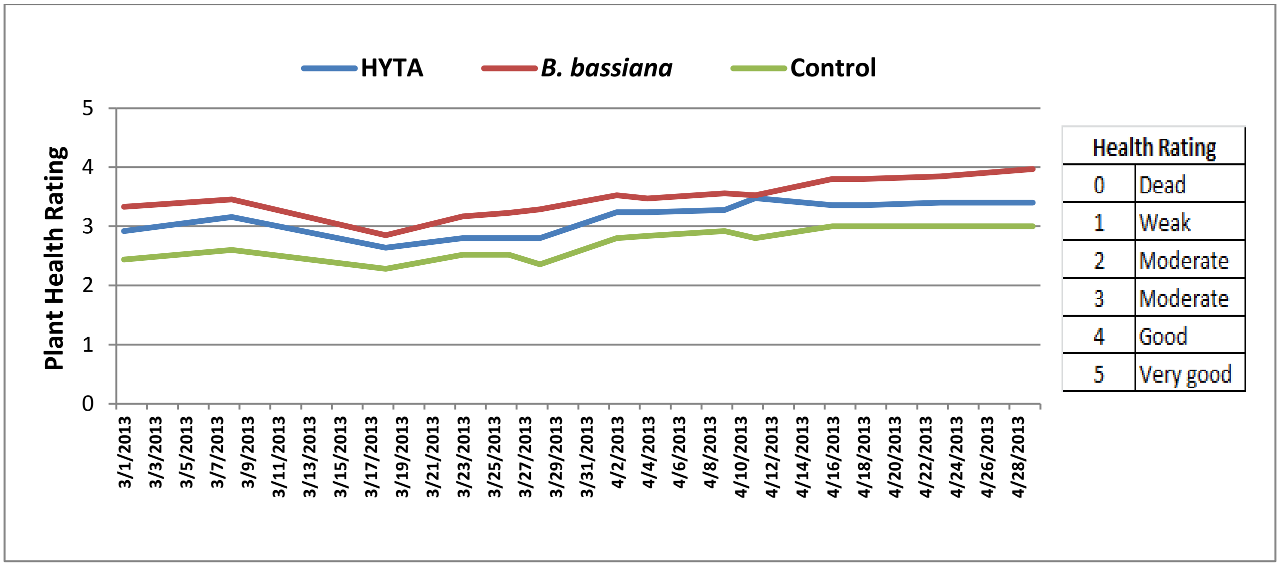
This study was conducted using strawberry plants grown in raised beds (20X5X2'). Strawberry transplants (cultivar Monterey) were treated by applying treatment materials to the plant base. Transplants were planted in beds after 48 hours and regularly watered and fertilized (with fish emulsion). Plant growth, health conditions, and yield were periodically monitored.

HYTA: HYTA contains soil-based microorganisms that fix atmospheric and applied nitrogen, solubilize nutrients, and build soil organic matter.

Beauveria bassiana: *B. bassiana* is a soil inhabiting fungus which is pathogenic to several arthropod pests. It is known to colonize some plants as an endophyte (symbiont that lives inside a plant without causing a disease) and provide protection against arthropod pests feeding on those plants. Some isolates are also known to be antagonistic to plant pathogens.

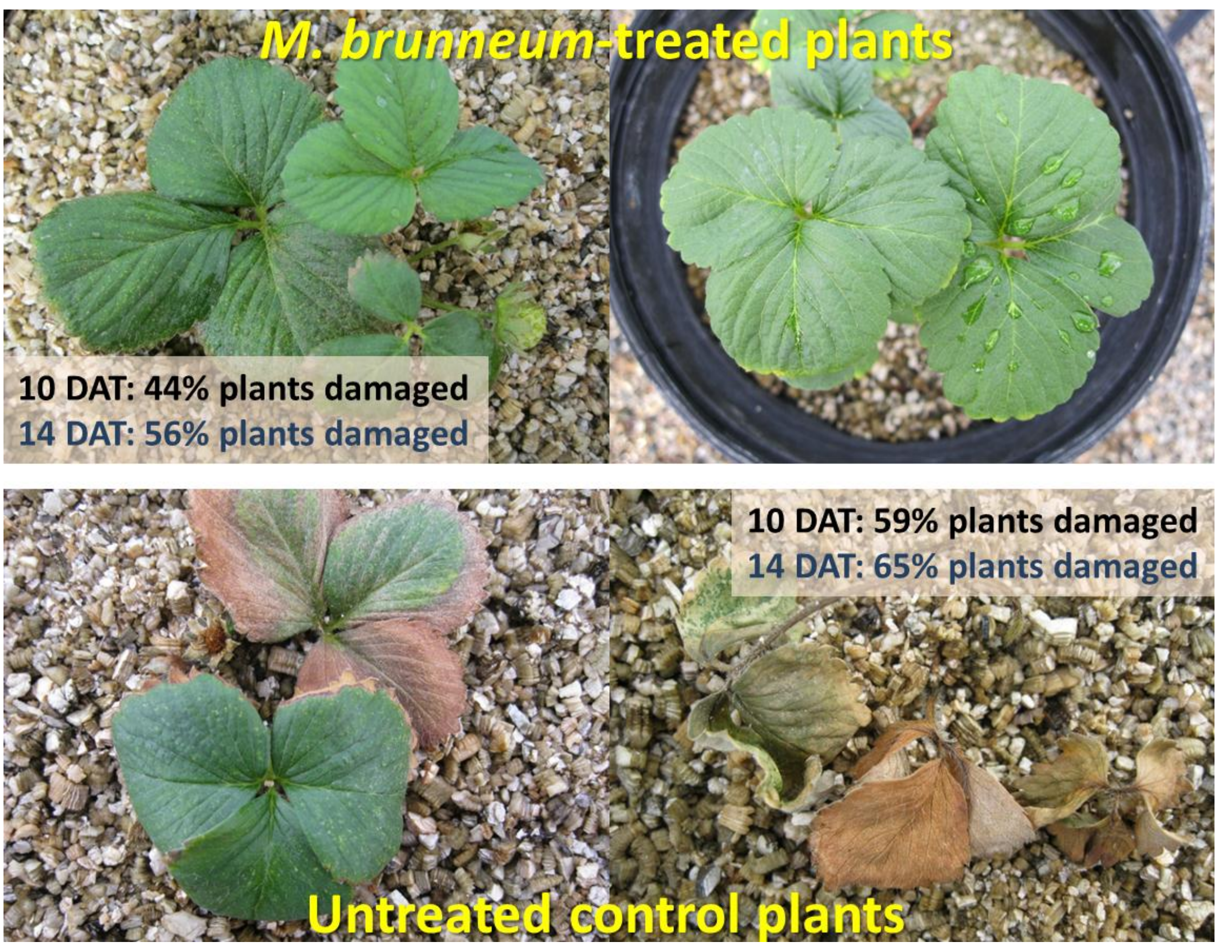
Untreated control: Plants were not inoculated with any material.

Results: Plant health appeared to be superior for plants treated with *B. bassiana* (3.5/5.0) followed by those treated with HYTA (3.1/5.0) and untreated control (2.7/5.0) although differences were not statistically different.



<u>Study 2 - Impact of endophytic *Metarhizium brunneum* on spider mites:</u>

In a greenhouse study for evaluating the ability of *Metarhizium brunneum* to colonize strawberry plants, there was an unexpected infestation by twospotted spider mites. Plants inoculated with *M. brunneum* appeared to withstand mite infestation and resulting damage better than untreated controls. Like *B. bassiana, M. brunneum* is a soil inhabiting fungus which is pathogenic to various arthropods.



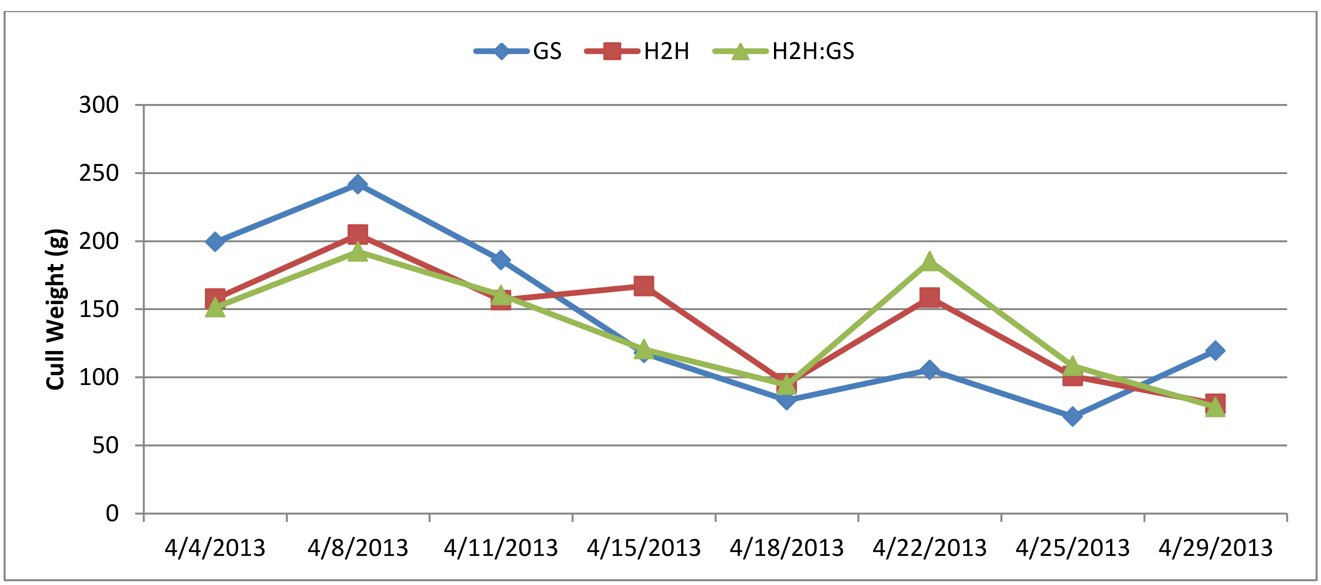
Study 3 - Recycled food-based fertilizer for improved strawberry yields:

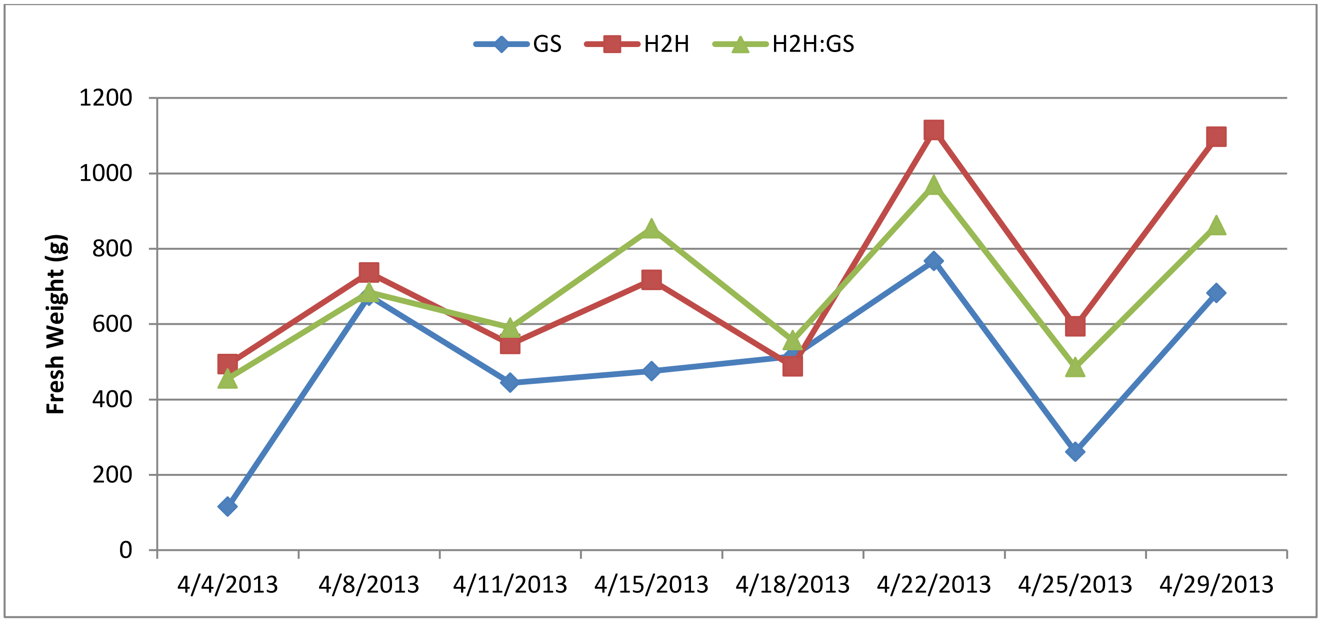
Research is under way using a liquid fertilizer called Harvest-to-Harvest (H2H) made from recycled produce, meat, and other food items. Food waste is enzymatically digested and made into a liquid fertilizer that contains nitrogen, phosphorous and potassium (1-1-0), 18 amino acids (5-7%), lipids (6-8%), carbohydrates (8-10%), and organic matter (20-25%). H2H also contains small amounts of aluminum, calcium, copper, iron, magnesium, manganese, sodium, sulfur, and zinc. A large field study is in progress to evaluate the efficacy of H2H alone (73 gpa) and in combination with the grower standard (H2H:GS 50:50) to compare with the standard fertilization program (GS) followed by the grower. Treatments were applied on 3/28, 4/9, and 4/18.

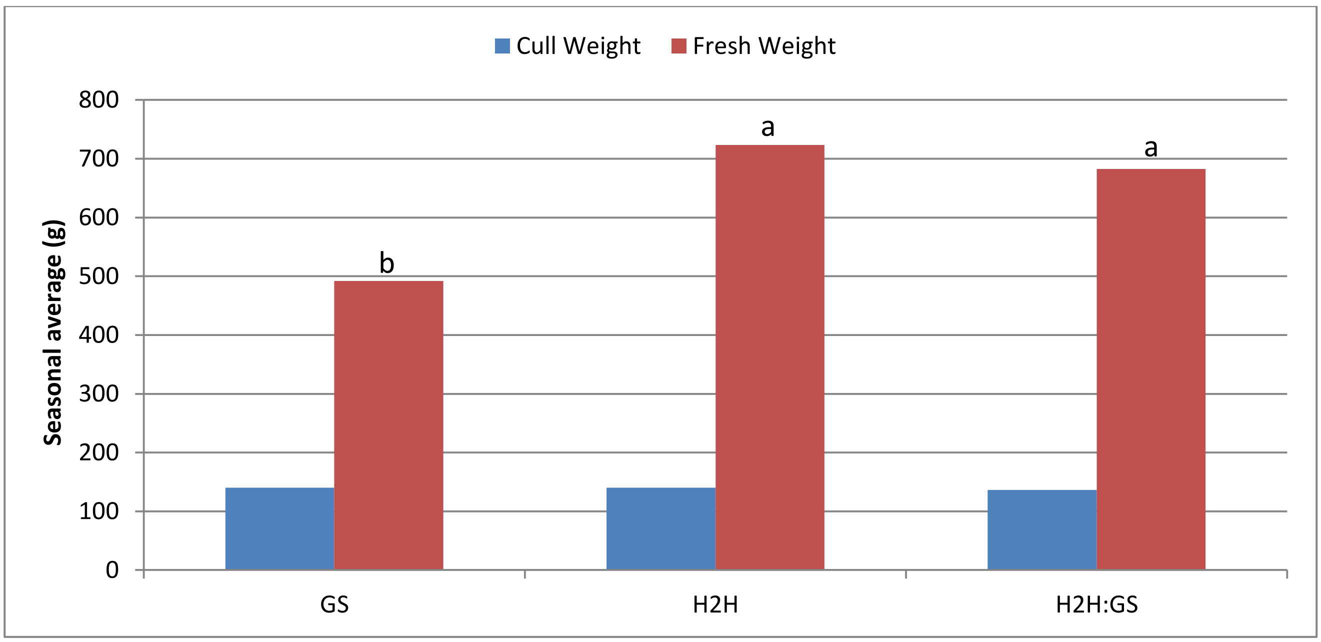
Results: So far, H2H alone and in combination with the grower standard produced 32-40% higher yields compared to the grower standard alone. There was no difference in the unmarketable fruit yield among treatments.

Treatment	4/4/13	4/8/13	4/11/13	4/15/13	4/18/13	4/22/13	4/25/13	4/29/13	Average	Total	Cull - Ratio with GS	Fresh - Ratio with GS
	Cull weight (g)											
GS	199.3	241.7	186.0	117.7	83.0	105.3	71.0	119.5	140.4	1064.6		
H2H	157.7	204.7	156.7	167.0	95.3	158.3	100.8	80.5	140.1	1103.5	1.04	1.40
H2H:GS	151.3	192.2	160.3	120.5	94.5	185.2	108.3	78.2	136.3	1075.5	1.01	1.32
	Fresh Weight (g)											
GS	115.3 b	674.7	444.3	475.0 b*	514.8	767.3	260.8 b	682.0 b	491.8 b	4310.8		
H2H	493.5 a	736.3	546.8	716.8 ab	487.8	1114.7	593.5 a	1096.7 a	723.3 a	6015.9		
H2H:GS	455.5 a	684.7	590.5	853.5 a	557.0	969.2	485.7 a	862.0 ab	682.3 a	5684.8		

*Means followed by the same or no letter within each column are not significantly different (*P* =0.05)







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