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Evaluating a Recycled Food Waste-Based Liquid Compost in Conventional California Strawberries

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Abstract

A study was conducted in 2013 on a commercial strawberry field using a new formulation of a liquid compost based on recycled food waste from grocery stores. Liquid compost alone, grower's propriety regimen of synthetic fertilizers, and their combination (50:50) were applied through drip irrigation system on three dates. Marketable strawberry yields from 10 harvest dates showed that liquid compost alone and in combination with the grower standard improved the yields compared to the grower standard regimen.

Keywords: Strawberry; Nutrient management; Liquid compost

Introduction

Synthetic or chemical or inorganic fertilizers are commonly used in many conventional crop production systems providing essential nutrients necessary for optimal plant growth and yields. While they provide the plants with readily available nutrients, excessive application could lead to leaching into the ground water, promote vegetative growth, or increase the attractiveness of plants to pests and diseases. Organic fertilizers, on the other hand, are generally made from plant or animal sources. Compared to synthetic fertilizers where nutrients are readily available, nutrients are slowly released from organic fertilizers and have a lower risk of nutrient leaching. Organic fertilizers add organic matter to the soil, which improves soil structure, water holding capacity, and root growth. Organic matter also supports beneficial microbial communities in the soil that improve nutrient availability to the plant and protect plants from plant pathogens and other stress factors.

Organic fertilizers, especially those made from food waste, have a significant environmental benefit by recycling valuable nutrient and energy resources that would have, otherwise, been wasted [1]. Several studies emphasized the importance of soil organic matter and its positive impact on soil fertility, crop productivity, and environmental sustainability [2-4]. However, a balanced use of both synthetic and organic fertilizers is a good strategy both to meet plant needs and environmental sustainability [5].

In the United States, food waste at consumer and retail levels was estimated to be about 30% of the food supply, which is equal to 133 billion pounds valued at $161 billion [6]. Converting this food waste into a fertilizer will have a major impact on the agriculture as food waste is the largest part of the landfills and is the third largest source of methane in the United States. To evaluate the efficacy of a recycled food waste-based liquid compost on strawberry yield, a study was conducted during the spring of 2013 on a conventional strawberry field at DB Specialty Farms, Santa Maria.

Materials and Methods

Harvest-to-Harvest (H2H), made by hydrolysis of freshly expired produce, meat, and other food items collected from grocery stores, was evaluated alone and in combination with the grower standard. The formulation of H2H used in the study had NPK at 1-1-0, 5-7% of amino acids, 6-8% of lipids, 8-10% carbohydrates, and 20-25% organic matter according to the label. Treatments included

i) Grower standard or GS (proprietary fertilizer regimen).

ii) H2H at 73 gallons/acre, and

iii) H2H: GS at 50:50. H2H was administered through the drip irrigation system 28 March, 9 and 18 April. Each treatment had a block of about 1.6 acre that were adjacent to each other.

On six randomly selected beds within each block, a 40-plant section was marked as a sampling plot. Yield data were collected from these plots from 4 April to 20 May on 10 sampling dates following grower's harvest schedule.

Results and Discussion

Compared to the yield in GS plots, marketable strawberry yield was significantly higher (P< 0.05) for H2H treatment on four of the harvest dates and for GS: H2H combination on two of the harvest dates (Table 1). The average marketable berry yield was significantly higher (P= 0.0003) in both H2H and GS: H2H treatments compared to the GS treatment (Figure 1). There was no difference (P= 0.283) in the weight of unmarketable berries and their proportion of the total yield was 18.7, 15.5, and 16.2 for GS, H2H, and GS: H2H, respectively.

Table 1: Marketable strawberry yields on 10 harvest date.

Treat- ment	Marketable Strawberry Yield Per Plot(g)									
	4-Apr-13	8-Apr-13	11-Apr-13	15-Apr-13	18-Apr-13	22-Apr-13	25-Apr-13	29-Apr-13	2-May-13	20-May-13
GS	115.3±19.1b*	674.7±59.6a	444.3±65.1a	475.0±66.9b	514.8±89.7a	767.3±151.2a	260.8± 43.8b	682.0±71.7b	265.2+34.8b	490.2+30.7b
H2H	493.5±70.9a	736.3±44.5a	546.8±59.5a	716.8±52.0ab	487.8± 58.7a	1114.7± 103.3a	593.5±64.1a	1096.7±103.4a	793.8±71.1a	724.0±193.7ab
GS:H2H	455.5±70.5a	684.7±123.1a	590.5±82.9a	853.5± 79.8a	557.0±61.4a	969.2± 115.6a	485.7± 66.6a	862.0±103.0ab	629.0±56.4a	1026.8±112.9a
P value	0.014	0.884	0.489	0.004	0.791	0.177	0.004	0.023	<0.00001	0.035

*Means followed by the same letter are not significantly different based on Tukey's HSD test.

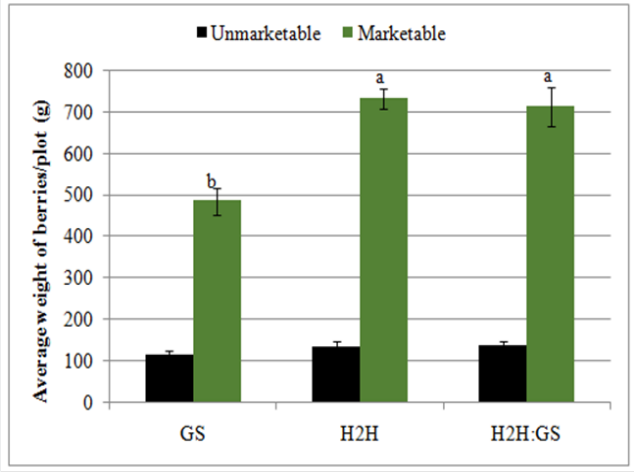

Figure 1: Average marketable and unmarketable strawberry yields for the observation period.

Results are promising in this first commercial field study with H2H. Although the nutritional value of H2H was negligible low, the organic matter in the product might have supported the soil microbe colonies and indirectly improved the nutrient absorption. Significant amounts of applied nutrients can be lost in the environment resulting in negative impacts [7-9] and certain microbes can improve their uptake [10]. *Bacillus* spp., *Pseudomonas* spp. *Glomus* spp. and other bacteria and fungi promoted nutrient absorption in corn, cotton, wheat and other crops [11-13].

The manufacturer of H2H later found several species of beneficial microbes in their formulation (Dan Morash, personal communication). Microbial activity and their impact on nutrient absorption was not within the scope of this study, but beneficial microbes in the formulation and/or in the soil might have played a role in nutrient absorption in H2H treatments. H2H formulation and recommendation rates have changed after the study was conducted. Additional studies in different fields with different application rates are essential to make valid conclusions as soil conditions and nutrient management practices vary among various fields.

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