

# Evaluation of Compost Tea for Managing Foliar Diseases in Tomato

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## ABSTRACT

A bacterial-dominant compost tea applied at least weekly to foliage was evaluated for control of naturally-occurring diseases in tomato grown in a research field dedicated to organic production. Tea was tested alone or with other products in 2003 and 2004. Tea was applied starting 32 and 27 days after transplanting, respectively, for a total of 14 and 10 applications. Tomatoes were transplanted no-till into a hairy vetch-rye mulch. An additional treatment was a side-dressing of nitrogen applied as a band of peanut meal to some plots. Disease incidence and severity were not significantly reduced by compost tea, the biofungicide Sonata, the two used together, or compost tea followed by rescue treatments of Champion and JMS Stylet-oil made after disease detection. Diseases were powdery mildew, Septoria leaf spot, and bacterial speck. Possible reasons compost tea was ineffective include lack of appropriate organisms in compost, unsuitable recipe or brewing conditions, applications made at the wrong time of day, and treatment needed earlier in crop development, perhaps including a seed treatment.

## INTRODUCTION

Compost teas have been used for disease control for years with limited research. Interest in compost tea has increased with increase in organic crop production. Evaluations are needed for specific diseases using teas made from defined recipes.

## MATERIALS AND METHODS

'Paragon' or 'Red Sun' tomato seed were hot water treated (25 min at 122 F) to control seed-borne bacterial pathogens, then placed in trays with an organic soil-less mix on 2 May 03 or 5 May 04, respectively. The hairy vetch-rye cover crop was flail chopped on 16 Jun 03 and 1 Jun 04 to form a mulch. Seedlings were no-till transplanted 26 Jun 03 and 11 Jun 04 with fish hydrolysate fertilizer (approx. 2.8 ml/plant of Organic Gem Liquid Fish 3-3-3 diluted in water 1:64). A tractor equipped with a fluted coulter and an S-tine was used to cut 4-in. deep strips through the field. Seedlings were placed in these holes by hand. There were 10 plants spaced 2-ft apart in each single-row plot. Drip irrigation tube was laid on the soil surface next to the plants. Plants were watered as needed. Plants were pruned then trellised to maintain up-right growth habit. Weeds were managed by mowing between plots and hand-weeding in the planted rows. Straw was placed around the base of plants (1/2 bale/plot) because the straw from the vetch cover crop was not sufficient to suppress weeds.

*Treatments.* Peanut meal was applied at 625 lb/A (equivalent to 50 lb/A of N) to the high nitrogen treatment plots on 17 Jul 2003 and 23 Jun 2004 to supplement the nitrogen provided by the vetch mulch and starter fertilizer. Foliar disease management treatments were applied using a CO<sub>2</sub>-pressurized backpack sprayer with a single nozzle boom. Each plot side was treated with the boom held sideways to obtain thorough coverage. Compost tea was applied separately from the other treatments. Fungal-based compost (4 lb dairy manure-based vermicompost and 4 lb grape pumice compost in 2003 or 4 lb leaf-based compost in 2004) was brewed aerobically with 12 oz Fertrell Liquid Kelp, fish hydrolysate (7 oz Fertrell Omega Grow in 2003 and 4 oz Organic Gem Liquid Fish 3-3-3 or Neptune's Harvest Benefits of Fish 2-4-1 in 2004), and humic acid (7 oz Humate International Humate in 2003 and 16 oz Fertrell Bio-Hume in 2004) for about 24 hour in a 60-gal Sotillo brewer. Compost tea was filtered and applied at full strength (no dilution)

with Nu-Film-P (6 oz/A) to foliage on 18 and 30 Jul; 1, 5, 12, 19, 22, and 28 Aug; and 5, 9, 12, 17, and 24 Sep in 2003. Additionally, tea was applied as a soil drench using a watering can on 23 Jul due to wet conditions. The tea used on 5 Sep was brewed for 48 hr because rainy weather on 4 Sep prevented application. To minimize potential damage to organisms in the compost tea, it was applied at low pressure (40 psi) using a nozzle with a large orifice that causes little resistance (FloodJet). Most applications were made before 10 am. In 2004, fish hydrolysate (1 oz/30 gal) was also added before the tea was applied on 8, 16, 23, and 29 Jul; 4, 11, 17, and 25 Aug; and 1 and 8 Sep.

Sonata (2 qt/A) was applied on 12, 19, and 26 Aug; and 6, 15, 22, and 26 Sep with a TwinJet (TJ110-8003) nozzle at 50 psi and 50 gpa. In 2004, Sonata was applied on 11, 17, and 25 Aug; and 1, 8 and 17 Sep immediately after compost tea. An additional treatment in 2004 was compost tea applied preventively followed by rescue treatments applied after disease detection, which were JMS Stylet oil applied for powdery mildew on 25 Aug and 1 Sep and the copper fungicide Champion applied on 3, 12 and 17 Sep.

Samples of tea, compost, and leaves were submitted to the Soil FoodWeb Laboratory in Port Jefferson, NY, for analysis of the organismal content. Samples of tea were collected on 5 Aug 03 and 8 Sep 04 from the brewer and from the spray nozzle. The two samples were collected to determine if the spray nozzle had a detrimental impact on the microbes. In 2004, compost samples were submitted on 28 Apr and 8 Sep. Leaves were collected before and after tea was applied on 8 Sep to assess the delivery and deposition of microbes.

*Disease assessment.* Incidence, severity and defoliation for the major diseases occurring were rated as percent leaves and leaf area affected on 22 Sep, 29 Sep and 6 Oct 2003 and 1, 9, 16, and 24 Sep and 1 Oct 2004.

*Harvest.* Red fruit and those turning red were harvested weekly from the center 8 of 10 plants in each plot from 27 Aug through 15 Oct 2003 and from 26 Aug through 7 Oct 2004. Fruit were graded by size, counted, and weighed.

*Statistical analysis.* Means were separated using Fisher's protected least significant difference test ( $P \leq 0.05$ ).

## RESULTS AND DISCUSSION

Powdery mildew, bacterial speck and Septoria leaf spot developed naturally. In 2003, symptoms of powdery mildew were first observed in one plot on 3 Sep. Septoria leaf spot was seen on 8 Sep. These diseases became widespread in the field by 22 Sep causing severely affected leaves to die. A few spots due to early blight and leaf mold were seen; incidence was too low to rate. In 2004, powdery mildew was first observed on 20 Aug. Septoria leaf spot and bacterial speck were seen on 1 Sep.

No significant differences ( $P \leq 0.05$ ) were detected among treatments in disease incidence, severity or defoliation (Tables 1 and 2). However, in 2003 disease severity and defoliation were numerically lowest where Sonata and compost tea were applied. Based on the organismal analysis, the compost tea used in these two experiments was primarily bacterial, although the ingredients used were anticipated to produce a fungal-dominant tea and the recipe was adjusted in an effort to obtain more fungi. Active and total bacterial biomass for tea from brewer were rated by the Soil FoodWeb Laboratory as good and excellent in 2003 (33.8 and 576 ppm, respectively) and good in 2004 (16 and 288 ppm, respectively). Values were higher for compost tea sample from the nozzle, likely reflecting that Nu-Film-P can be a food source for bacteria. Active and total fungal biomass was rated low, being only 1.28 and 1.73 ppm, respectively, in 2003 and 0.91 and 2.78 ppm, respectively, in 2004. These teas were described as bacterial with good fungal biomass. The leaf-based compost used in 2004 had very high fungal activity before the experiment was started (99.8 ppm on 28 April); it was only 36.8 ppm on 8 Sep. Active

bacterial biomass increased from 47.8 ppm in Apr to 69.4 ppm in Sep. The leaf organism assay revealed that leaf coverage with bacteria and fungi was inadequate on leaves collected immediately before tea application. Leaves collected about 1 hour after tea was applied were 76% covered by bacteria and 17% covered by fungi, which is considered very good. There are several possible reasons the compost tea was ineffective, including lack of appropriate organisms in compost, unsuitable recipe or brewing conditions, applications made at the wrong time of day (perhaps late in the day better than morning), and treatment needed earlier in crop development, perhaps including a seed treatment.

Neither compost tea nor the peanut meal nitrogen treatment significantly affected yield. High nitrogen plants, those that had received peanut meal, were observed to be larger and greener than those that had not (low nitrogen treatment) in 2003 but not in 2004. Compost tea applications, which can be a source of nutrients, did not have a detectable impact on plant appearance. High nitrogen plants not receiving a foliar treatment produced numerically more marketable fruit (at least 2.5 inch in diameter) than low nitrogen nontreated plants (16 vs 10 per plant in 2003 and 21 vs 19 in 2004), but these differences were not statistically significant.

Table 1. Effect of compost tea, biofungicide Sonata, and nitrogen fertilization on disease severity and subsequent defoliation due to disease in 2003.

Treatment	Disease severity (% leaf area affected)				Defoliation(%)
	Powdery mildew		Septoria leaf spot		
	29 Sep	6 Oct	22 Sep	6 Oct	6 Oct
Low Nitrogen, Nontreated	7.1	13.0	6.8	20.0	17.3
Low Nitrogen, Compost tea	5.4	18.0	8.0	21.3	22.5
High Nitrogen, Nontreated	5.5	17.6	5.5	20.0	18.8
High Nitrogen, Compost tea	2.4	10.8	5.5	18.8	12.3
High Nitrogen, Compost tea + Sonata AS 2 qt/A	0.9	5.6	3.8	18.8	11.3
<i>P</i> value	0.81	0.78	0.83	0.99	0.88

Table 2. Effect of compost tea, OMRI-approved fungicides, and nitrogen fertilization on disease severity and subsequent defoliation due to disease in 2004.

Treatment	Disease severity or incidence (%) *					
	Powdery mildew		Septoria leaf spot		Bacterial speck	
	1 Sep	24 Sep	24 Sep	1 Oct	24 Sep	1 Oct
Low Nitrogen, Nontreated	11	53	30	41	28	44
Low Nitrogen, Compost tea	3	35	35	51	36	46
High Nitrogen, Nontreated	11	43	28	34	35	44
High Nitrogen, Compost tea	10	46	56	53	18	43
High Nitrogen, Sonata AS 2 qt/A	9	62	36	48	33	44
High Nitrogen, Compost tea + Sonata	8	40	45	48	38	55
High Nitrogen, Compost tea + JMS Stylet-oil 5 qt/100 gal + Champion WP 4 lb/A	9	40	39	41	38	48
<i>P</i> value	0.82	0.61	0.29	0.74	0.72	0.97

\* Powdery mildew was assessed as proportion of leaf tissue affected. Septoria leaf spot and bacterial speck were assessed as proportion of leaflets affected.