

INTRODUCTION

Compost tea is increasingly being used in South Africa to repair soil health. It is claimed that compost tea will stimulate root and shoot growth, will increase production and shelf life and will generally lead to less pest and disease. In November 2006 a statistical trial was designed and laid out in a Fuji apple orchard at Twaalfontein in Vyeboom (Western Cape). The aim of the trial is to ascertain if these claims are true and to determine what impact mulch and chemical soil treatments will have in conjunction with and without compost tea.

MATERIALS AND METHODS

Statistical trail design

The site selected was a 0.72 hectare Fuji (on M793 rootstock) orchard planted in 1999. The trial is designed as a randomised complete block design and the treatment design as a split-plot design with the main plot being with (CT+) and without (CT-) compost tea randomly replicated in 10 blocks. The subplot treatments were control, chemical and mulch which were randomly replicated within each of the main plots. Standard split-plot analyses of variance were preformed on the data and the Shapiro-Wilk test was performed to test for non-normality. Student's least significant difference (LSD) was calculated at a 5% significance level to compare treatment means for significant effects.

Legend

Main Treatments	Sub Treatments		
	Control	Chemical	Mulch
With Compost tea (CT +)	1	2	3
No Compost Tea (CT -)	4	5	6

For example: In the diagram below, row number 1 consists of the control, then the mulch and then the chemical, all receiving compost tea. Row number 2 consists of the chemical, the control and then the mulch, not receiving any compost tea.

Block Number	1		2		3		4		5	
Row Number	1	2	3	4	5	6	7	8	9	10
Main treatment	CT +	CT -	CT -	CT +	CT +	CT -	CT +	CT -	CT -	CT +
Sub Treatments	4	2	2	5	5	3	6	3	1	6
	6	1	3	6	4	2	5	2	2	4
	5	3	1	4	6	1	4	1	3	5
Block Number	6		7		8		9		10	
Row Number	11	12	13	14	15	16	17	18	19	20
Main treatment	CT +	CT -	CT +	CT -	CT -	CT +	CT -	CT +	CT +	CT -
Sub Treatments	4	3	6	1	2	5	2	4	4	3
	5	2	5	3	1	4	1	6	5	1
	6	1	4	2	3	6	3	5	6	2

TREATMENTS

Main treatment – Compost tea

Compost tea was brewed at Ecosoil's premises (Dennebos Farm, Vyeboom) and transferred to a spray cart. Using the spray cart, the compost tea is pumped into the micro irrigation system at the orchards mainline. A volumetric flow valve was fitted on the spray cart for correct dosing. The rows that did not receive compost tea were closed with an in-line valve. See table below for time schedule for the compost tea.

Schedule of compost tea applications

Year	Month	Litres of Compost Tea applied (per hectare)
2006	November	200
	December	200
2007	January	100
	February	100
	March	100
	September	200
	October	200
	November	200
	December	200
	2008	January
February		200
March		200

Sub treatments – control, chemical and mulch

The chemical treatment consisted of three commonly used agricultural chemicals. In November 2006, NemaCur® 10 GR (systemic nematicide - Bayer (Pty) Ltd. Reg. num: L2056) and Confidor® 350 SC (systemic insecticide - Bayer (Pty) Ltd. Reg. num: L5691) was applied at the recommended concentrations. In December 2007, Rugby® 10 ME (contact nematicide – FMC Corporation USA. Reg. num: L6368) and Confidor® 350 SC (systemic insecticide - Bayer (Pty) Ltd. Reg. num: L5691) was applied in the recommended concentrations.

The mulch consisted of a 5cm thick wood chip layer placed under the trees in November 2006. No mulch was added in 2007.

PARAMETERS

The parameters used to assess the effect of the treatments were fruit size, yield, fruit maturity analysis and fruit mineral analysis. In 2007 no parameters were assessed as the trial was begun in November 2006 and the yield was already determined by the set of 2006.

In 2008 the above parameters were assessed and data used to determine if there were any statistical differences.

The following parameters were used to determine the effect of the different treatments (primary and secondary) on Fuji apples.

- Fruit size: Once a week, for a five week period beginning February 2008, the circumferences (in millimetres) of sample apples were determined using a Cranston Gauge. The difference in circumference is used as a measure of fruit size growth.

- Fruit Yield: One tree per sub plot was randomly selected and harvested and weight using an industrial scale. Fuji apples are harvested according to colour and thus harvested twice. The first harvest was on 29/03/2008 and the second on 09/04/2008.
- Fruit maturity analysis: 10 apples per sub plot (600 apples in total) were sent to Hortec (Pty) Ltd in Grabouw, Western Cape, for fruit maturity analysis. They determined fruit size, fruit weight, fruit firmness, fruit colour, Red Colour, % TSS, % acid and starch.
- Mineral analysis: 10 apples per sub plot (600 apples in total) were sent to Bemlab in Somerset-West, Western Cape, for mineral analysis. They determined the levels of micro and macro elements in the apples.

RESULTS AND DISCUSSION

NOTE: Only the data and analysis that have a statistical difference were represented here. Complete data available on request.

The data is categorised to determine the effect of the main and sub treatments on their own and in combination with each other.

FRUIT GROWTH

Fruit circumferences of Fuji Apples were measured for a five week period, before harvesting, using a Cranston Gauge. The averages were determined and a statistical difference observed. (Note: Treatments with same letters do not differ statistically)

Table 1.1 – Main treatment effect

INCREASE IN FRUIT CIRCUMFERENCE (mm per week)	
Treatment	Mean
CT+	1.46 a
CT-	1.35 b
Least significant difference	0.09

Table 1.2 – Sub treatment effect

INCREASE IN FRUIT CIRCUMFERENCE (mm per week)	
Treatment	Mean
CHEMICAL (B)	1.35 b
CONTROL (AB)	1.39 ab
MULCH (A)	1.48 a
Least significant difference	0.11

Table 1.3 – Interaction effect

INCREASE IN FRUIT CIRCUMFERENCE (mm per week)	
Treatment X compost tea	Mean
CHEMICAL x CT+	1.411 abc
CHEMICAL x CT-	1.281 c
CONTROL x CT+	1.449 ab
CONTROL x CT-	1.326 bc
MULCH x CT+	1.513 a
MULCH x CT-	1.442 ab
Least significant difference	0.16

Compost tea treated plots showed a higher fruit growth rate per week than those not treated with compost tea. The mulch treated plots showed a significant difference with the chemically treated plots, but did not show a significant difference over the control. When looked in combination, the plots treated with mulch and compost tea showed the best result and was significantly more than the chemical and control treated plots without compost tea.

YIELD

The average yield was used to determine the yield in ton per hectare [formula: (average yield per tree x 2000 trees per hectare) / 1000 kg per ton]. (Note: Treatments with same letters do not differ statistically)

Table 2.1 – Main treatment effect

YIELD (ton per hectare)	
Treatment	Mean
CT+	150.75 a
CT-	136.63 a
Least significant difference	22.29

Table 2.2 – Sub treatment effect

YIELD (ton per hectare)	
Treatment	Mean
CHEMICAL	146.15 a
CONTROL	140.94 a
MULCH	143.98 a
Least significant difference	24.00

Table 2.3 – Interaction effect

YIELD (ton per hectare)	
Treatment X CT	Mean
CHEMICAL x CT+	132.28 ab
CHEMICAL x CT-	160.02 a
CONTROL x CT+	161.76 a
CONTROL x CT-	120.12 b
MULCH x CT+	158.22 a
MULCH x CT-	129.74 ab
Least significant difference	33.94

From the results above it can be seen that compost tea did have a positive effect on soil with no organic layer. The control plots with compost tea had a yield of 162 tons/ha in comparison with the untreated area with 120 tons/ha. The compost tea and mulch plot also had a statistical higher yield than the control without compost tea. The chemical treatment's results are a bit strange, but these results were not statistically different and should not be seen that compost tea with chemical treatments are detrimental.

There were no statistical differences in maturity, fruit colour and mineral analysis. Perennial crops like apples take longer to show positive results than annuals, because of the trees nutritional reserves that play a role. We expect better results in the coming season.