Role of compost on processing tomato production

Location / address:	10km north of Rochester, VIC and 10km north west of Mathoura, NSW
Organisation:	Australian Processing Tomato Research Council Inc.
Contacts:	Liz Mann and Nick O'Halloran
Fund source:	Goulburn Broken CMA through the Australian Government's National Landcare Program
Year/s of trial:	2016-2017
Objectives of the demonstration	The trial aimed to evaluate the effects of compost, applied at three different rates, on processing tomato crop yield, quality and soil properties. The same trial was carried out at two different locations.
Basis of trial	Both sites consisted of raised beds of 1.52m, irrigated by sub-surface drip. Details of the sites are in the below table

	Geltch	Hibma
Type of planting	Transplant	Transplant
Planting/seeding date	22/10/16	11/10/16
Fruit sample date	7/3/17	19/2/17
Harvest date	9/3/17	27/2/17
Variety	H3402 Mix	H1015
Row length (m)	297	342
Row width (m)	1.52	1.52
Row area (ha)	0.045	0.052
Compost Application	3/5/16	6/5/16

Table 1. Site characteristics.

What did you do /soil treatments

Each plot consisted of three whole rows. At harvest, each row was divided into four, with yield data obtained from each quarter of the row. The yield and fruit quality results were taken from the middle row of each of these plots. The reason for this was to effectively create a buffer zone between wash treatments. Compost was applied in early May 2016, with a Seymour spreader. The spreading plates were removed, and the compost as deposited in the middle of each bed to a width of 75cm. Following this application the final bed preparation occurred which lightly incorporated the compost into approximately the top 10cm of the bed. The spreader was calibrated using plastic covering one square meter of the bed. This sample was then weighed to work out the actual application rate. Compost was applied at 10, 20, and 30t/h to the banded area, which equated to 5, 10t/ha across the entire area. Treatments are detailed in Table 2 below.

The trial design for both sites was identical, with each plot consisting of 3 beds, but all measurements were taken from the middle bed.

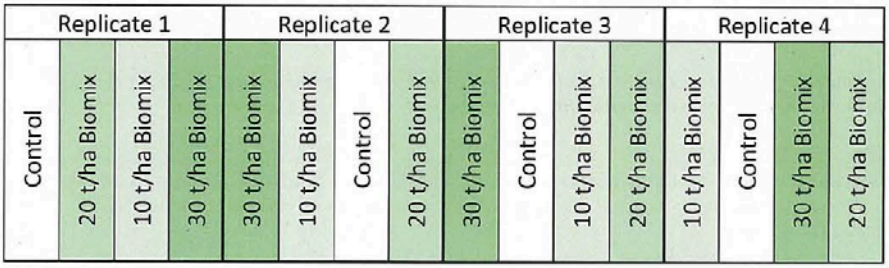

Figure 1. Experimental design for both sites

Measurements When/how/method	A sample of the compost (from Biomix at Stanhope, Vic) was collected on 3 may 2016, upon delivery to the Geltch property and sent to SWEP Pty. Ltd. for analysis.

Soil samples were taken from both sites on 14 May 2016 from the control plots. Soil samples were again taken in May 2017 from the control and 30t/ha plots each site to a depth of 20cm. Soil samples were sent to AgVita for an express Soil Laboratory Analysis. The soil collected in May 2017 from both was also sent to A & L Laboratories, Canada for soil pathogen testing of the following pathogens that are known to affect tomatoes *Collletotrichum coccodoes, Fusarium oxysporum, Phytophthorsspp, Pythium spp, Rhizoctona solani, Verticillium spp.*

Soil bulk density and strength were also measured across the site at Rochester. Bulk density was measured by collecting a known volumn of soil using a metal ring pressed into the soil. The weight of the soil was then determined after drying. Soil strength measured using a cone penetrometer.

Fruit was sampled by hand one to two days prior to machine harvest (Geltch) and eight days prior to machine harvest (Hibma). Twenty pieces of fruit were randomly tested from each plot and given to the Kagome laboratory to test pH and Brix for each sample. In the laboratory, each sample was blended for the same period of time. Brix was then measured with a refractometer and pH with a pH meter on the raw blended sample.

Yields were determined at the time of machine harvest. Plot yields were recorded using Kagome load cells on the bulk trailers.

All results were statistically analyzed using the ARM 9 program, with significant difference determined using Tuley's HSD p +0/05.

Results

The results of the compost test conducted by SWEP Pty. Are shown in the following table.

Nutrient	% w/w (dry basis)	% w/w (wet basis or as applied)	kg per tonne
N	1.57	1.24	12.36
P	0.266	0.21	2.09
K	1.34	1.05	10.55
S	0.245	0.19	1.93
Ca	3.27	2.57	25.73
Mg	0.528	0.42	4.16
Na	0.378	0.30	2.97
Fe	1.12	0.88	8.81
Total Organic C	19.4	15.27	152.68
Moisture Content	21.3%		
C/N ratio	12.36		

Table 2. Compost analysis results

Based on nutrient availability rates (Eghball, et al. 2002, C.J and Bierman), it could be assumed in the first year following a compost application 10% of the nitrogen, 40% of the phosphorus, 80% of potassium, 50% of the Sulphur and 50% of the calcium and magnesium would be available for plant growth. Considering that availability rates and that half of the total surface was treated, hence an application rate of 10t/ha to the banded areas equated to 5t/ha of entire surface area of the paddock, the nutrients applied in the compost equated to an application rate of the following nutrients:

Nutrient	10 t/ha treatment		20 t/ha treatment		30 t/ha treatment	
	entire area (kg/ha)	banded area (kg/banded ha)	entire area (kg/ha)	banded area (kg/banded ha)	entire area (kg/ha)	banded area (kg/banded ha)
N	6.2	12.4	12.4	24.7	18.5	37.1
P	4.2	8.4	8.4	16.7	12.6	25.1
K	42.2	84.4	84.4	168.7	126.5	253.1
S	4.8	9.6	9.6	19.3	14.5	28.9
Ca	64.3	128.7	128.7	257.3	193.0	386.0
Mg	10.4	20.8	20.8	41.6	31.2	62.3
Total Organic C	763.4	1526.8	1526.8	3053.6	2290.2	4580.3

Table 3. Available nutrients in each treatment

The soil pathogen tests did not find any detectable pathogens in either the control or 30t/ha treatment samples. Data not shown.
Soil strength and bulk density were measured at the Geltch site, with results shown in Figure 2 and 3. There was no significant variation between any of the treatments for either soil strength or bulk density, although the soil strength in the control plots seemed to be at the lower end of the spectrum at depth. There was also no obvious correlation between fruit yield and bulk density (0-10cm).

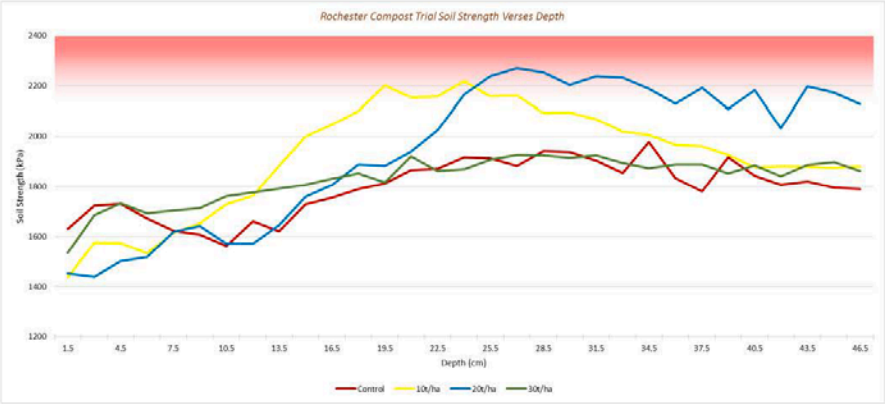

Figure 2. Average soil strength down the soil profile at Rochester (Geltch) site.

No significant difference was observed at either site in either fruit yield or °Brix (Table 4 and 5). It was observed however at both sites that the 10 t/ha treatment resulted in a lower yield than all other treatments, although this was not a significant decrease. Statistical analysis has also indicated that the yield at the Geltch site showed a greater level of variation between replicates than between treatments (based on the Replicate F being greater than the Treatment F). At the Hibma site statistical analysis indicated that there was more variation in treatments than between replicates (based on the Replicate F being less than the Treatment F).

During harvest the rows were divided into quarters to further determine if yield varied along the length of the row. These results are shown in Table 6. From this table, it appears that at the Geltch site the top half of the block yielded better than the bottom half, with yield variation across the entire site and treatments being less than the variation along the row. At the Hibma site perhaps there is some evidence that the bottom three quarters of each row in the bottom right are yielding better than the rest of the block, and in particular the top left corner.

This variation across the site does indicate that there is something else impacting upon crop yield rather than the compost treatments.
Overall, very few significant differences have been found as a result of the compost treatments in this experiment.

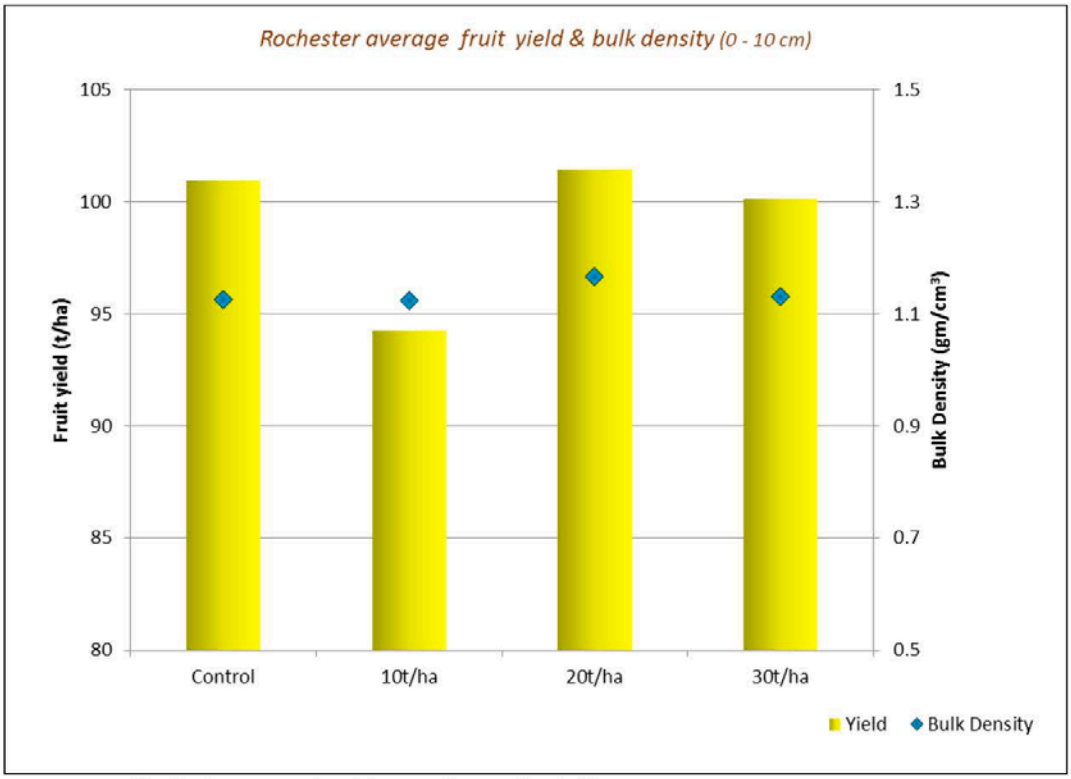

Figure 3. Soil bulk density and yield at Rochester (Geltch) site.

Treatment	Yield (t/ha)		°Brix		pH	
Control	100.93	a	5.83	a	4.45	a
10t/ha	94.24	a	5.85	a	4.50	a
20t/ha	101.43	a	5.85	a	4.49	a
30t/ha	100.11	a	5.95	a	4.43	a
Tukey's HSD (P=.05)	34.01		0.35		0.14	
Treatment F	0.187		0.501		1.171	
Treatment Prob (F)	0.9026		0.6906		0.3736	
Replicate F	0.634		0.501		0.779	
Replicate Prob(F)	0.6113		0.6906		0.5348	

Table 4. Geltch harvest results

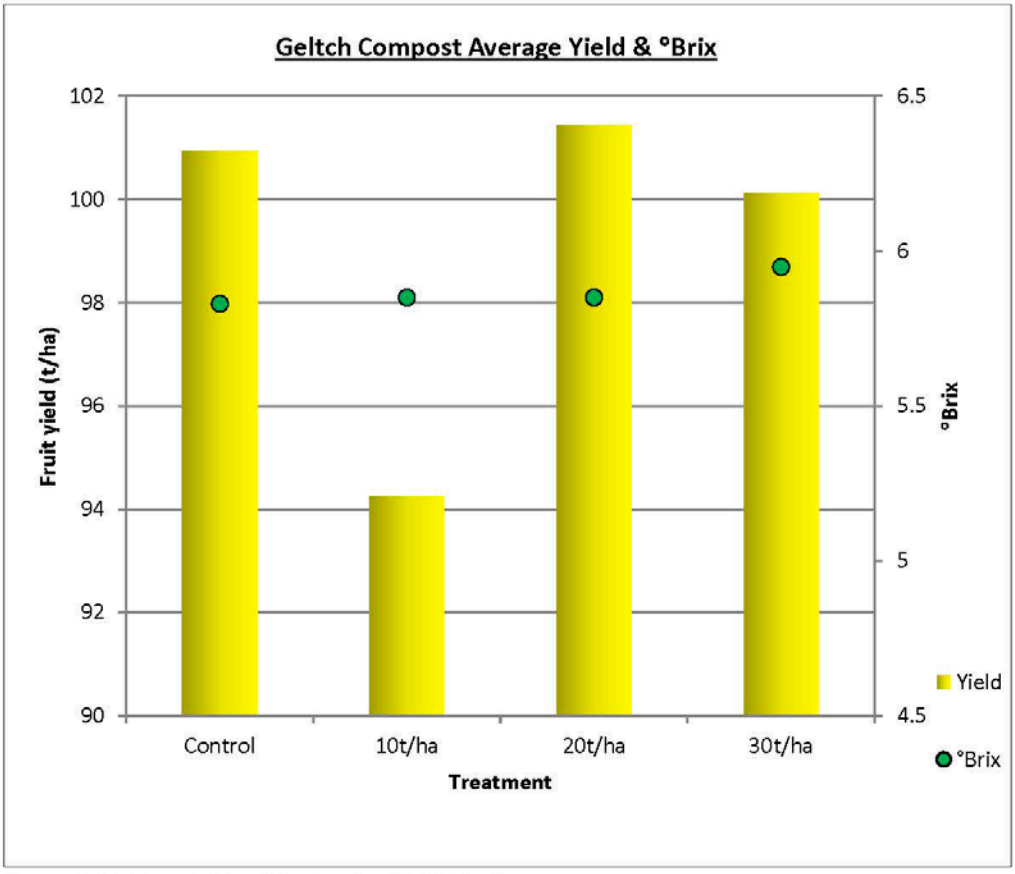

Figure 4. Yield and Brix at Rochester (Geltch) site.

Treatment	Yield (t/ha)		°Brix		pH	
Control	113.8	a	5.80	a	4.41	b
20t/ha	116.7	a	5.93	a	4.48	ab
10t/ha	105.4	a	5.88	a	4.54	a
30t/ha	117.7	a	6.05	a	4.48	ab
Tukey's HSD (P=.05)	28.872		0.327		0.109	
Treatment F	0.734		2.013		5.013	
Treatment Prob (F)	0.5575		0.1827		0.0259	
Replicate F	0.263		3.152		9.467	
Replicate Prob(F)	0.8505		0.0791		0.0038	

Table 5. Hibma harvest results

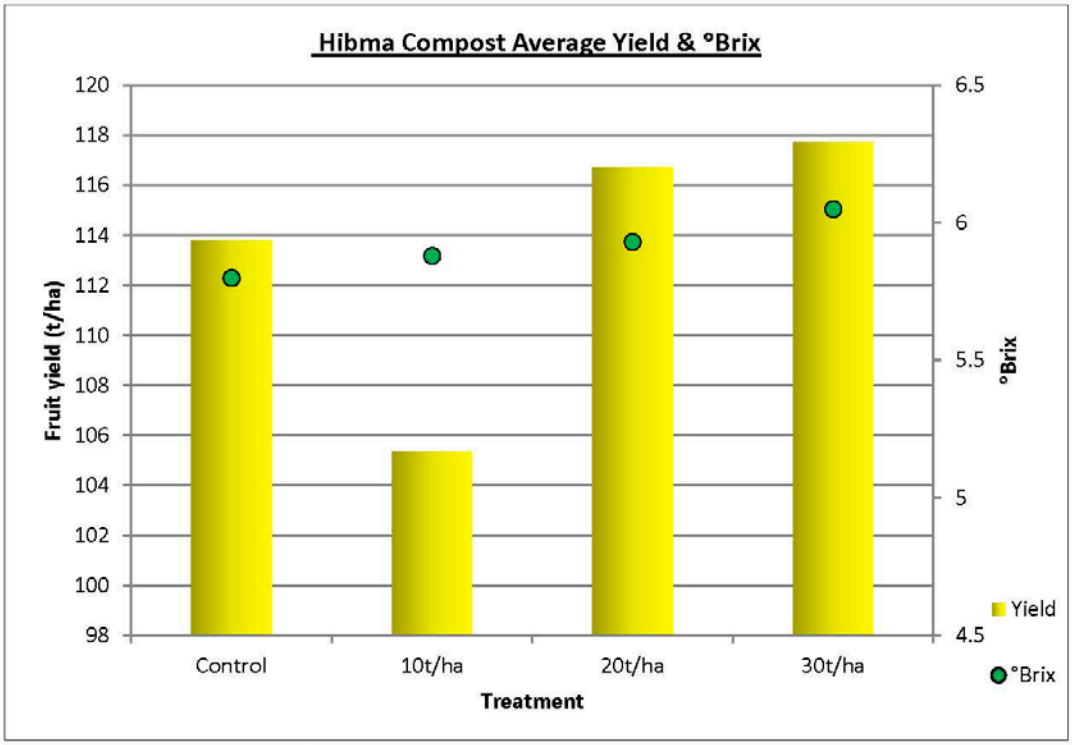

Figure 5. Yield and Brix at Hibma site.

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																Yield Range
	Geltch	t/ha						N↑								
	116.8	117.5	131.6	85.1	108.8	98.2	106.1	113.2	120.2	117.5	78.2	110.6	110.6	103.5	116.7	123.7	120-140
	124.6	98.2	121.9	79.8	114.0	79.3	95.6	107.9	93.8	119.3	64.9	93.8	107.9	111.4	120.2	127.2	110-120
	112.3	107.0	111.4	98.2	107.9	85.1	88.6	97.4	86.0	108.8	80.7	91.2	112.3	90.4	113.2	118.4	100-110
	79.8	55.3	96.5	72.8	98.7	65.8	77.2	93.0	78.9	107.9	62.3	81.6	106.1	56.1	111.4	86.8	90-100
Treatment	1	3	2	4	4	2	1	3	4	1	2	3	2	1	4	3	80-90
Row Average	108	95	115	84	106	81	92	103	95	113	71	94	109	90	115	114	70-80
																	<70
	Hibma	t/ha						N←									>140
	119.3	127.7	94.6	119.3	147.0	116.2	107.0	86.9	119.3	54.6	86.9	107.7	61.6	124.7	83.9	100.8	120-140
	113.9	126.2	95.4	113.9	94.6	127.0	125.4	97.0	133.9	117.0	118.5	140.8	100.0	132.3	115.4	118.9	110-120
	93.9	108.5	89.3	104.6	107.7	111.6	116.2	90.0	122.3	108.5	121.6	127.7	122.3	145.4	123.1	141.6	100-110
	114.7	128.5	102.3	121.6	113.1	111.6	112.3	100.0	133.9	116.4	117.7	123.9	109.3	120.0	130.0	141.6	90-100
			spray row					spray row					spray row				80-90
Treatment	1	3	2	4	4	2	1	3	4	1	2	3	2	1	4	3	70-80
Row average	110	125	95	115	116	116	115	93	127	99	111	125	98	131	113	126	<70

Table 6. Yield variation across the two trial sites

Compost applied to trial site

Hibma trial 16/2/17

Australian Government | National Landcare Program

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