

# Influence of temperature and time on pathogens survival in biosolids compost

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## Introduction

- The increase in the generation of biosolids has led to the search for new alternatives and technologies that meet the increasingly demanding environmental and public health requirements.
- The fertilizer and conditioner potential of biosolids is a promising feature for the use of this residue in the agroforestry sector. In addition to being a rich source of organic matter, biosolids have macro and micronutrients that help to maintain soil fertility.
- Sanitary wastewaters generally contain four groups of microorganisms that have a considerable degree of pathogenicity: bacteria, fungi, parasites and viruses. During the treatment these microorganisms precipitate, concentrating in the sludge (biosolids).
- In composting, the elevation of the temperature during the fermentation process sanitizes the substrate, with the inactivation of pathogenic microorganisms and parasites, being this one of the most efficient processes for stabilization of sanitary sludges.

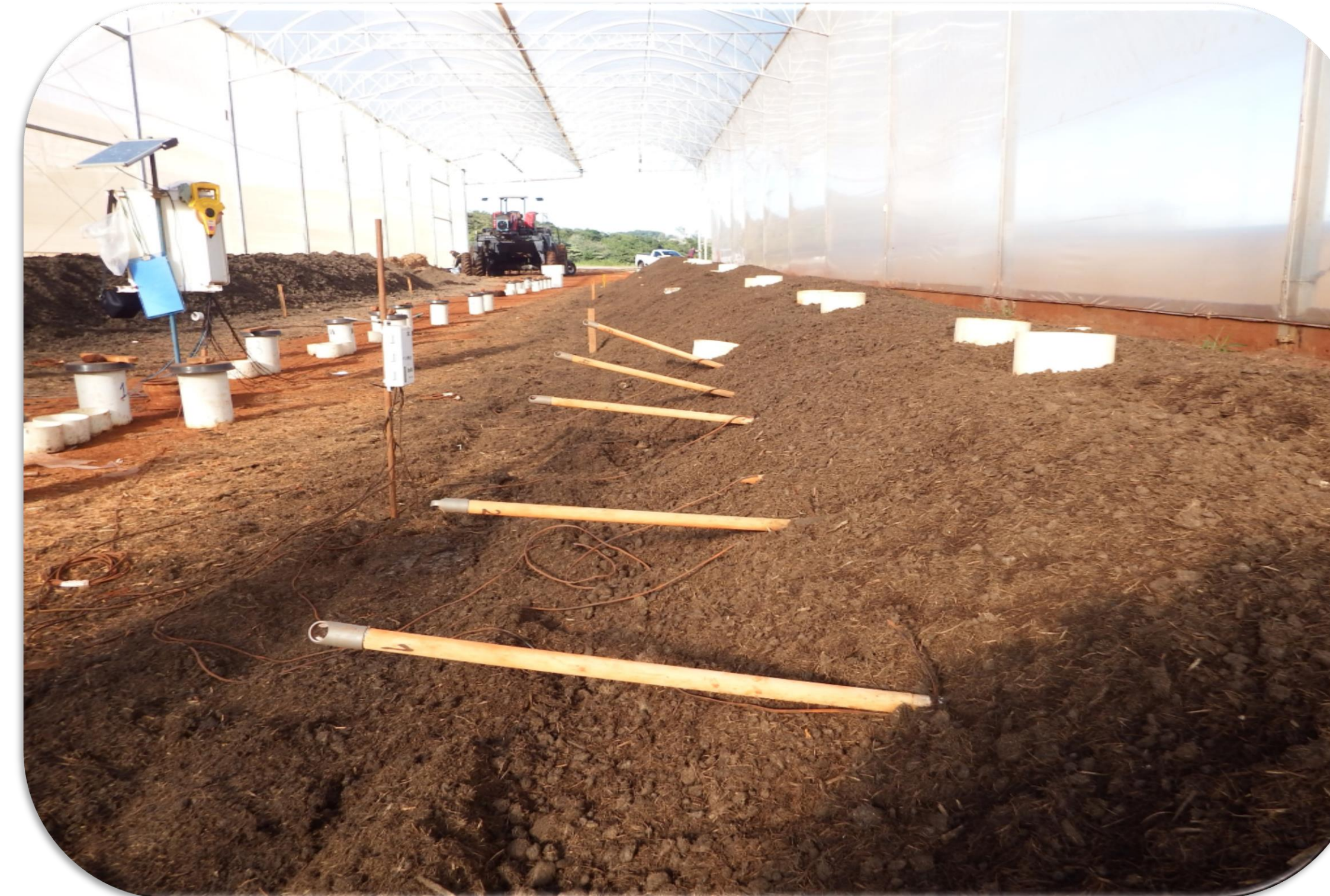
## Material and Methods

- Composting #1 (60 days): Biosolids + Sugarcane Bagasse.
- Composting #2 (45 days): Biosolids + Eucalyptus Bark.
- 2 piles of 16m x 3m x 1.5m (36m<sup>3</sup> each pile).
- 3 replicates.
- Moisture of compost: verified weekly.
- Temperature inside piles: verified hourly.
- Sampling: 5 random points in different depths in each of the 3 replicates.
- Sampling frequency according to temperature levels: < 35°C; 35 – 45°C; 45 – 55°C; 55 – 65°C; > 65°C; 20 days; 45 days; and 60 days (for Composting #1).



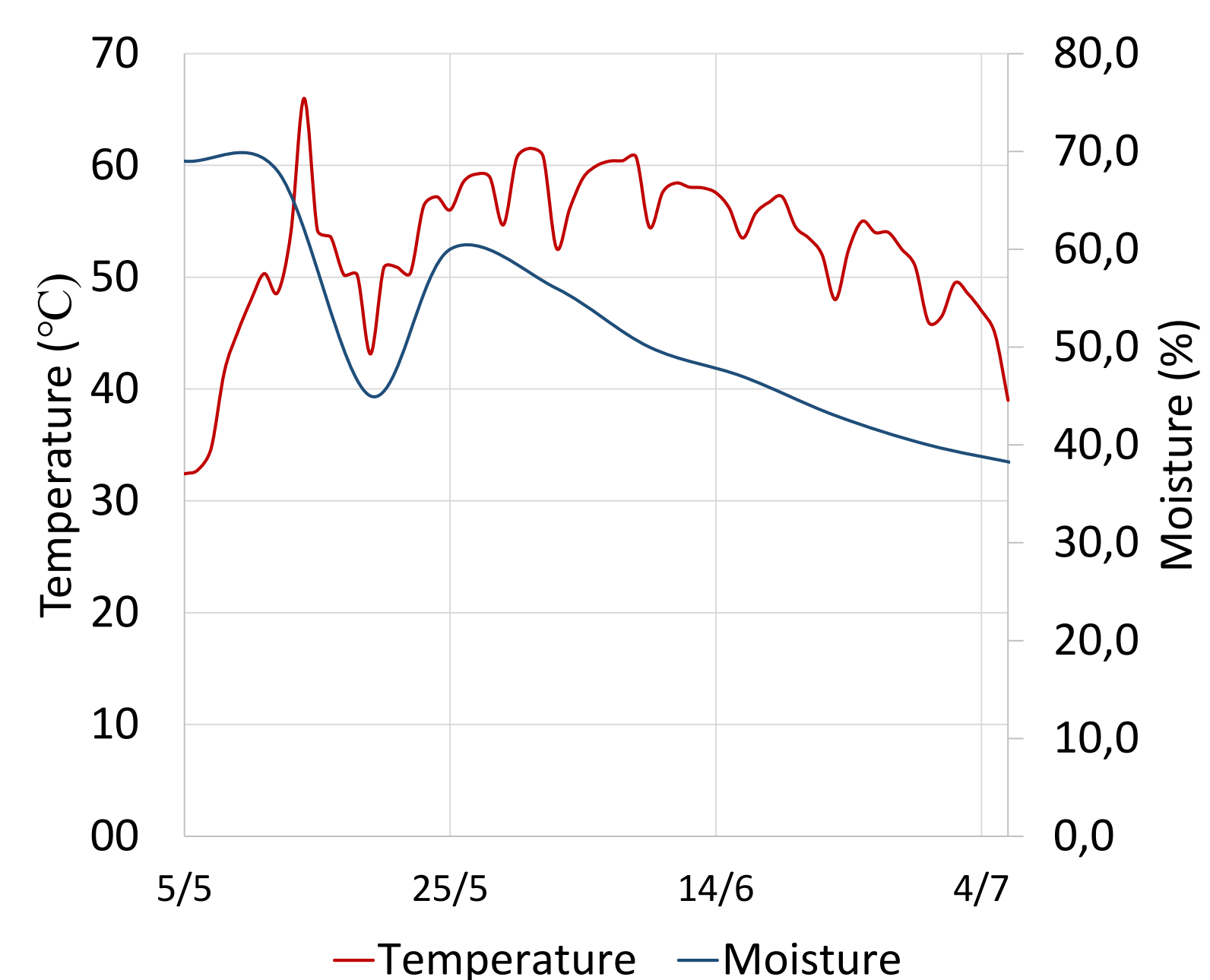
## Objectives

Evaluate the density of thermotolerant coliforms, *Salmonella* spp. and viable ova of *Ascaris* spp. throughout the composting process in biosolids mixtures with eucalyptus bark and sugarcane bagasse, verifying if temperature is effective in the elimination of pathogens.



## Results

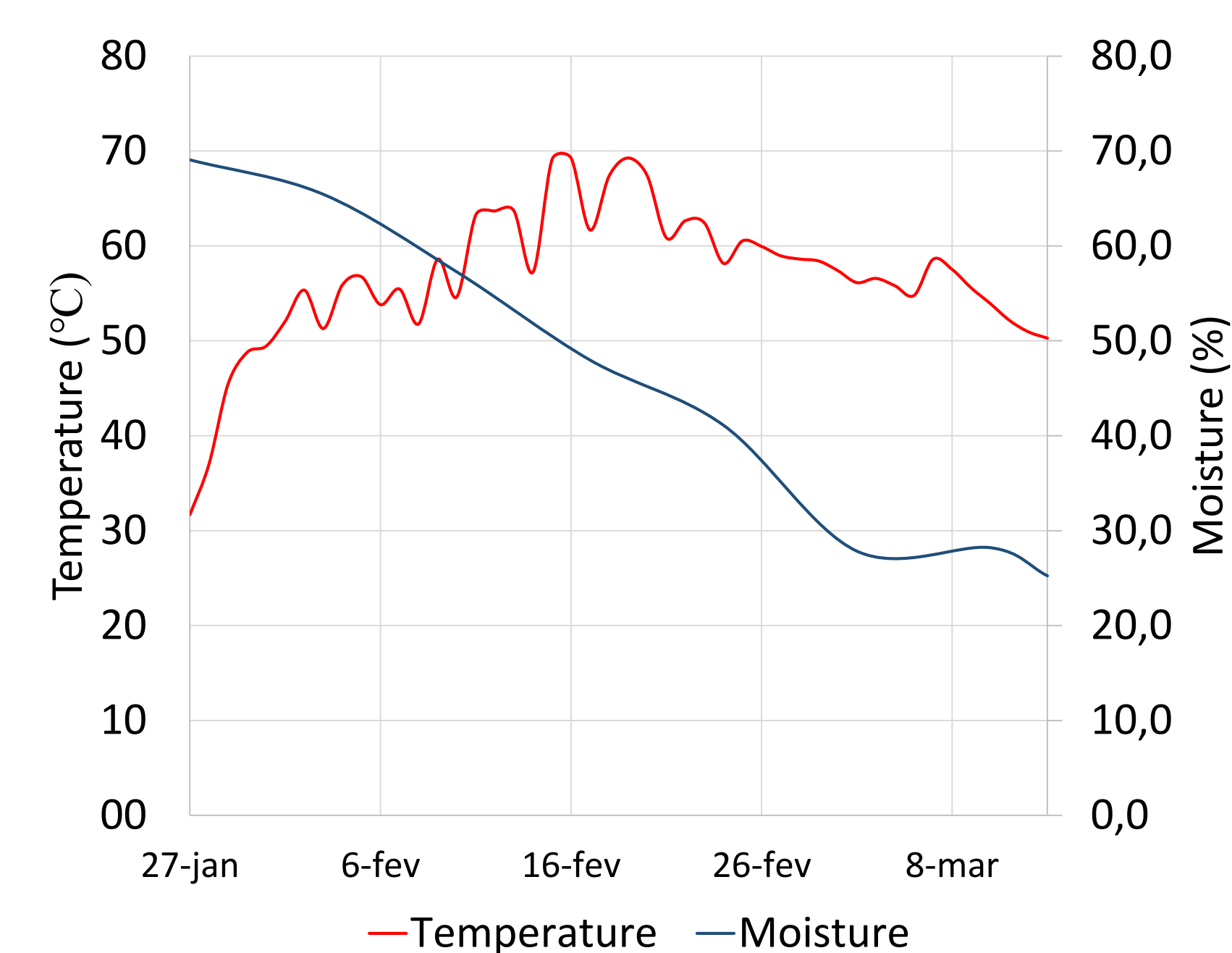
### Composting #1: Biosolids + Sugarcane Bagasse



\* Most Probable Number - NMP mL<sup>-1</sup>  
\*\* Absence or Presence in 25mL  
\*\*\* number of ova g ST<sup>-1</sup>

Temperature / days	Pathogen	R1	R2	R3
< 35°C (day 0)	Thermotolerant Coliform*	4.6 10 <sup>8</sup>	9.8 10 <sup>8</sup>	4.3 10 <sup>7</sup>
	Salmonella spp.**	Absence	Absence	Absence
	Viable ova Ascaris spp.***	4.5	8.4	6.6
35,1 – 45°C (4th day)	Thermotolerant Coliform*	4.3 10 <sup>7</sup>	7.5 10 <sup>6</sup>	3.9 10 <sup>6</sup>
	Salmonella spp.**	Absence	Absence	Presence
	Viable ova Ascaris spp.***	4.1	3.9	5.5
45,1 – 55°C (5th day)	Thermotolerant Coliform*	4.6 10 <sup>7</sup>	2.3 10 <sup>5</sup>	1.1 10 <sup>8</sup>
	Salmonella spp.**	Absence	Absence	Absence
	Viable ova Ascaris spp.***	2.6	3.3	3.8
55,1 – 65°C (9th day)	Thermotolerant Coliform*	23.0	3.6	< 3.0
	Salmonella spp.**	Absence	Absence	Absence
	Viable ova Ascaris spp.***	2.9	2.8	2.3
> 65°C (12th day)	Thermotolerant Coliform*	23.0	9.1	4.3
	Salmonella spp.**	Absence	Absence	Absence
	Viable ova Ascaris spp.***	1.0	0.6	0.4
20 days	Thermotolerant Coliform*	7.5 10 <sup>5</sup>	9.3 10 <sup>5</sup>	2.4 10 <sup>7</sup>
	Salmonella spp.**	Absence	Absence	Absence
	Viable ova Ascaris spp.***	0.4	0.1	0.3
45 days	Thermotolerant Coliform*	1.5 10 <sup>5</sup>	2.4 10 <sup>5</sup>	4.5 10 <sup>2</sup>
	Salmonella spp.**	Absence	Absence	Absence
	Viable ova Ascaris spp.***	<0.1	<0.1	<0.1
Final (60 days)	Thermotolerant Coliform*	23.0	3.6	<3.0
	Salmonella spp.**	Absence	Absence	Absence
	Viable ova Ascaris spp.***	<0.1	<0.1	<0.1

### Biosolids + Eucalyptus Bark



Temperature / days	Pathogen	R1	R2	R3
< 35°C (day 0)	Thermotolerant Coliform*	1.5 10 <sup>7</sup>	4.3 10 <sup>5</sup>	1.5 10 <sup>4</sup>
	Salmonella spp.**	Absence	Absence	Absence
	Viable ova Ascaris spp.***	6.3	5.8	6.2
35,1 – 45°C (2nd day)	Thermotolerant Coliform*	1.5 10 <sup>5</sup>	1.1 10 <sup>3</sup>	2.4 10 <sup>2</sup>
	Salmonella spp.**	Absence	Absence	Absence
	Viable ova Ascaris spp.***	3.6	2.1	6.0
45,1 – 55°C (4th day)	Thermotolerant Coliform*	9.1	3.6	3.6
	Salmonella spp.**	Absence	Absence	Presence
	Viable ova Ascaris spp.***	5.0	4.4	4.5
55,1 – 65°C (7th day)	Thermotolerant Coliform*	1.1 10 <sup>8</sup>	2.4 10 <sup>8</sup>	4.3 10 <sup>9</sup>
	Salmonella spp.**	Absence	Absence	Absence
	Viable ova Ascaris spp.***	6.9	6.0	6.0
> 65°C (20th day)	Thermotolerant Coliform*	9.1	< 3.0	< 3.0
	Salmonella spp.**	Absence	Absence	Absence
	Viable ova Ascaris spp.***	1.6	0.9	0.2
Final (45th day)	Thermotolerant Coliform*	21.0	43.0	<3.0
	Salmonella spp.**	Absence	Absence	Absence
	Viable ova Ascaris spp.***	<0.1	<0.1	<0.1

\* Most Probable Number - NMP mL<sup>-1</sup>  
\*\* Absence or Presence in 25mL  
\*\*\* number of ova g ST<sup>-1</sup>

**Acknowledgements:** SABESP, Fundação de Amparo à Pesquisa do Estado de São Paulo – FAPESP, Faculdade de Ciências Agrônômicas – UNESP/Botucatu and University of Washington.

## Conclusions

- Thermotolerant coliforms: showed unexpected increases under certain temperature and moisture bands.
- Salmonella* spp.: Present in 35 - 45°C of Composting #1 and in 45 - 55 °C of Composting #2.
- Viable ova of *Ascaris* spp.: showed decreasing curves in both processes.