

Essential oils as additives for sugarcane ensiling

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Introduction

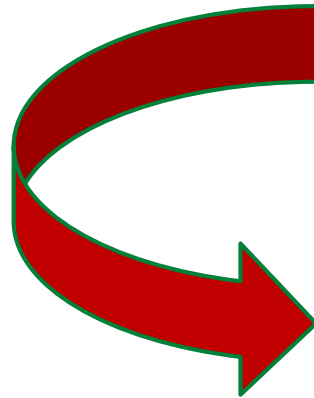
- Sugarcane has been used as a feedstuff for ruminants - ↑ DM production;

High WSC content



Population of epiphytic yeasts

Yeasts



WSC

Ethanol

Reduced quality and
low dry matter recovery

Additives at sugarcane ensiling are required

Additives

- Chemical additives
 - Urea
 - Sodium benzoate
 - Calcium oxide
- Microbial additives
 - *L. buchneri*

Essential oils

- GRAS: Generally Recognized As Safe (FDA, 2013)
- Antimicrobial activity
- Thymol and carvacrol
 - *Debaryomyces hansenii* (Curtis et al., 1996)
 - *Saccharomyces cerevisiae* (Knowles & Roller, 2001)
 - *Candida albicans*, *Candida krusei*, *Candida tropicalis* and *Candida glabrata* (Ahmad et al., 2011)

Objective



This work aimed to evaluate the effect of two essential oils (thymol and carvacrol) as additives at sugarcane ensiling on fermentative losses and microbial counts

Material and methods

- Federal University of Paraná – Forage Research Center (CPFOR);
- Sugarcane variety clone RB03-6066, 24.2°Brix and 31.1% DM;
- Treatments;

Control
(no additives)

Thymol
(600 mg.kg⁻¹)

Carvacrol
(400 mg.kg⁻¹)

Combined
(250 mg.kg⁻¹
thymol +
250 mg.kg⁻¹
carvacrol)

Material and methods

- The experimental silos (20L plastic buckets) were equipped to allow determination of fermentative losses (gas and effluent);
- Density of 650 kg.m^{-3} (fresh basis)
- Epiphytic LAB – 5.5 log cfu/g ; Yeasts – 5.46 log cfu/g
- 90 days storage;

Results - pH

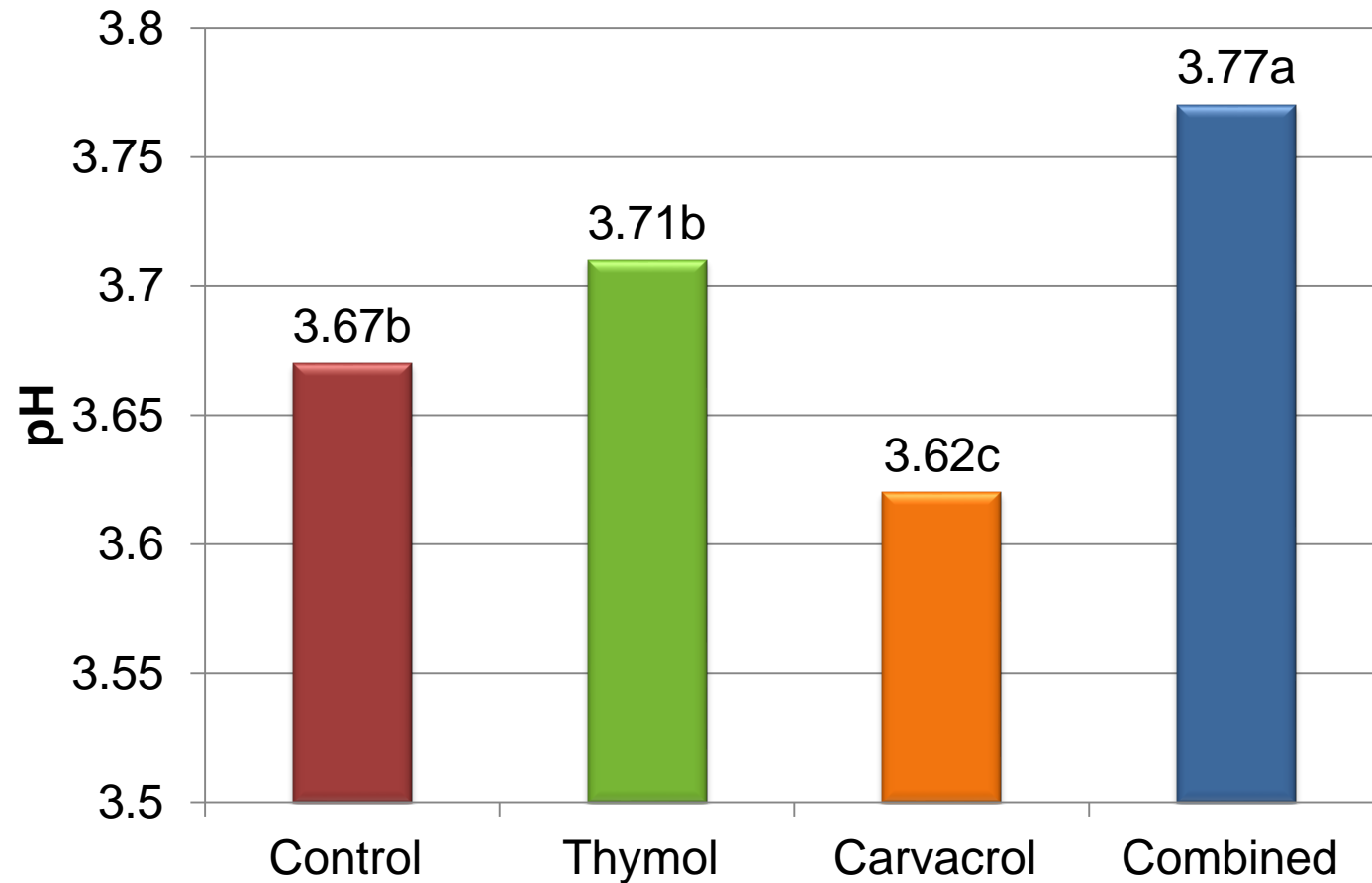


Figure 1. pH of sugarcane silages treated with essential oils

Results – DM and gas losses

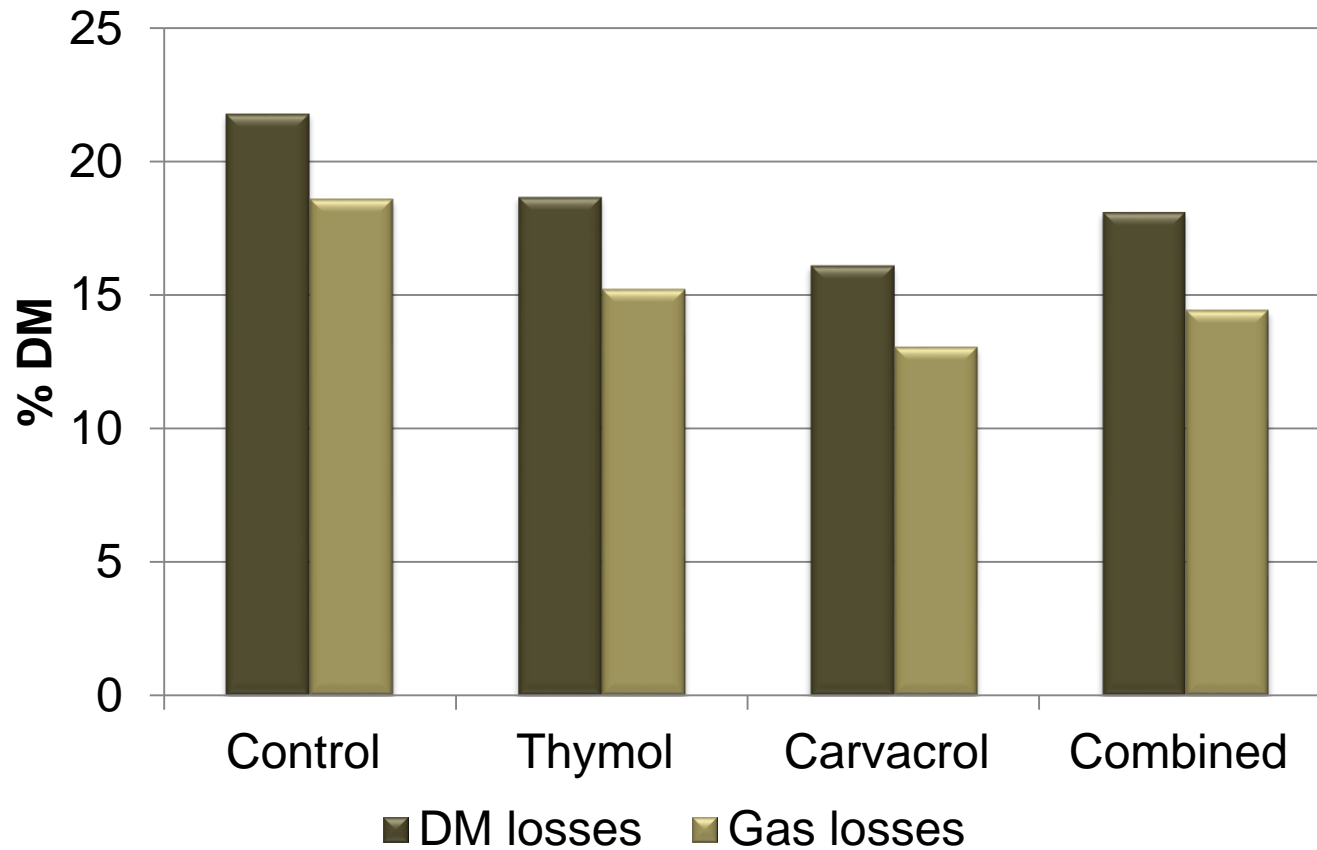


Figure 2. Dry matter and gas losses of sugarcane silages treated with essential oils

Results – Effluent losses

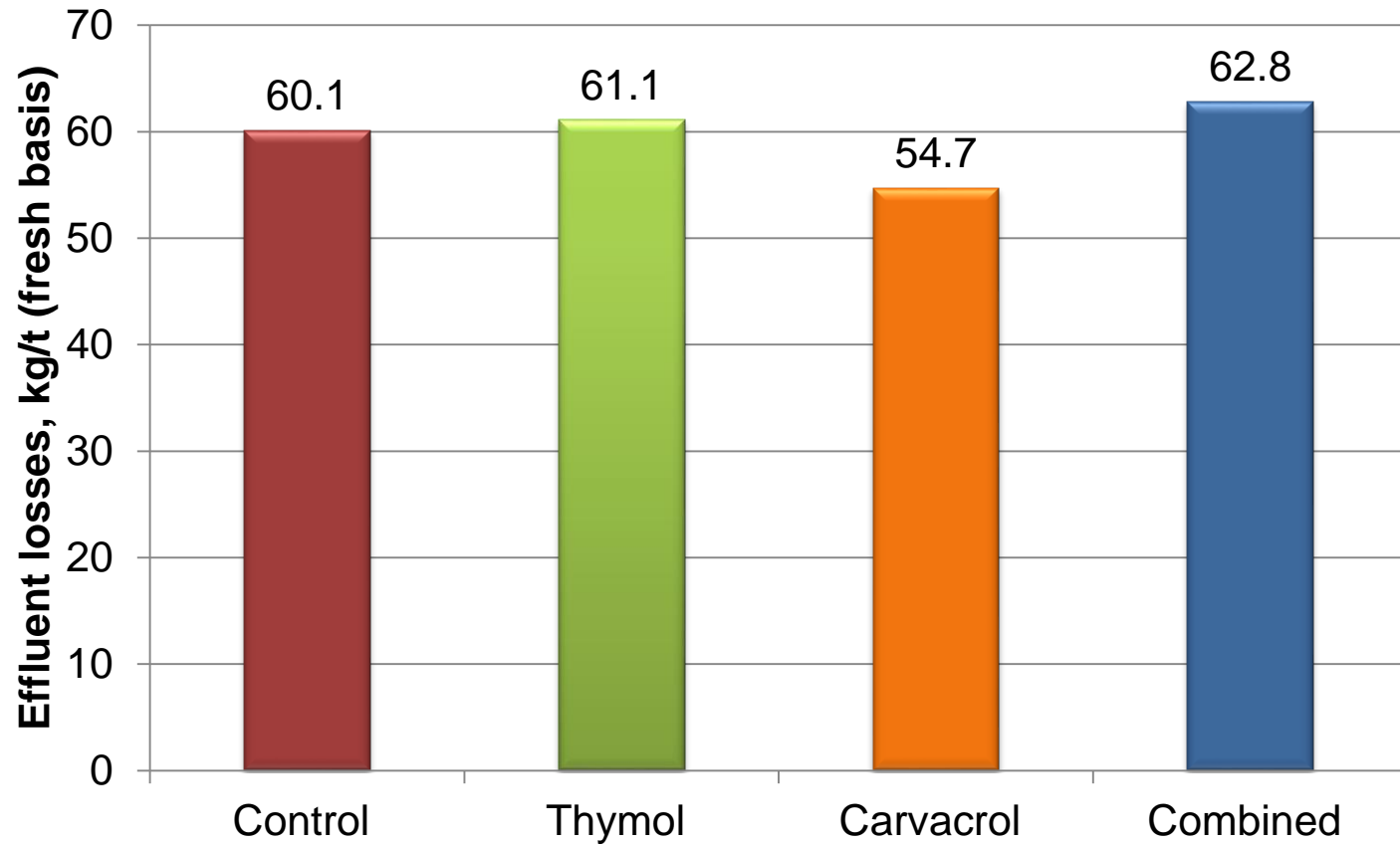


Figure 3. Effluent losses of sugarcane silages treated with essential oils

Results

Table 1. Effluent characteristics in sugarcane silages

Variables	Treatments ¹				SEM
	Control	Thymol	Carvacrol	Combined	
Effluent DM, %	13.9 ^b	15.6 ^a	15.2 ^a	14.6 ^{ab}	0.7
Effluent °Brix	15.0 ^b	16.0 ^a	16.3 ^a	15.9 ^a	0.45
Effluent pH	3.3	3.3	3.3	3.4	0.01

Means within a row with different superscript letters are different ($P < 0.05$).

¹ Control – without essential oils; Thymol – 600 mg/kg fresh basis; Carvacrol 400mg/kg fresh basis; Combined - 250 mg/kg of thymol + 250 mg/kg of carvacrol.

Results

Table 3. Microbiology of sugarcane silages after 90 days.

Variables	Treatments ¹				SEM
	Control	Thymol	Carvacrol	Combined	
LAB ² , log cfu.g ⁻¹ , fresh basis	6.2 ^a	3.7 ^b	5.4 ^{ab}	5.9 ^a	1.14
Yeast, log cfu.g ⁻¹ , fresh basis	6.0	5.7	5.6	5.5	6.2
Molds, log cfu.g ⁻¹ , fresh basis	1.2	1.6	3.0	2.2	23.8

Means within a row with different superscript letters are different ($P < 0.05$).

¹ Control – without essential oils; Thymol – 600 mg/kg fresh basis; Carvacrol 400mg/kg fresh basis; Combined - 250 mg/kg of thymol + 250 mg/kg of carvacrol.

²LAB: lactic acid bacteria.

Conclusion



- The variable mode of action of essential oils may affect microbial population dynamic in sugarcane silages;
- The essential oils are not recommended in these doses for sugarcane ensiling.

Thank you for your attention!



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