

EFFECT OF REPLACING HEXAMINE BY SODIUM FORMATE IN NITRITE-BASED ADDITIVES FOR PALISADE GRASS SILAGE

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Introduction

Silage additives based on sodium nitrite and hexamine improve fermentation in tropical grass silage. However, due to cost and regulatory issues, there is growing interest in replacing hexamine with alternative substances. A recent meta-analysis suggested that sodium formate may replace hexamine in temperate silages without compromising fermentation. However, its effectiveness has not been tested in tropical grass silages. This study aimed to examine if sodium formate can replace hexamine in an additive based on sodium nitrite to improve fermentation and reduce dry matter DM loss in palisade grass silage.

Material and methods

- Palisade grass (*Urochloa brizantha* cv. Marandu) was cut (10 cm stubble height) after 56 d of regrow and chopped by a stationary forage chopper (10 mm of theoretical length of cut);
- Chopped forage was divided into 20 piles (5 kg per pile) to prepare small-scale silos (7-L plastic buckets).
- Treatments (15 mL/kg FM):
 - CON**: Control (distilled water, without additive);
 - NHM**: Sodium nitrite (0.6 g kg FM⁻¹) combined with hexamine (0.4 g kg FM⁻¹);
 - NHH**: Sodium nitrite (0.9 g kg FM⁻¹) combined with hexamine (0.6 g kg FM⁻¹);
 - NFM**: Sodium nitrite (0.6 g kg FM⁻¹) combined with sodium formate (0.4 g kg FM⁻¹);
 - NFH**: Sodium nitrite (0.9 g/kg FM⁻¹) combined with sodium formate (0.6 g/kg FM⁻¹).
- 4 replicates per treatment;
- Storage period: 90 days;
- Data were analyzed as a completely randomized design using the MIXED procedure of SAS;
- Means were compared by orthogonal contrasts:
 - CON** vs. **ADT** = Control vs. (NFM+NFH+NHM+NHH), **NH** vs. **NF** = (NFM+NFH) vs. (NHM+NHH);
- Significance was declared at $P \leq 0.05$.



Results

Table 1. Microbial counts, fermentation profile and dry matter loss of palisade grass silages stored for 90 days

	Treatment ¹					SEM ²	P-contrast ³			
	CON	NHM	NHH	NFM	NFH		CON vs. ADT	NH vs. NF	NHM vs. NHH	NFM vs. NFH
Dry matter, %FM	22.4	25.2	25.3	25.1	25.5	0.17	<0.01	0.77	0.68	0.11
Clostridia, log cfu g FM ⁻¹	3.37	2.08	2.23	2.00	1.82	0.109	<0.01	0.04	0.37	0.26
pH	4.62	4.43	4.74	4.57	4.40	0.084	0.36	0.26	0.02	0.17
NH ₃ -N, %N	29.4	16.5	11.9	16.3	13.9	0.74	<0.01	0.23	<0.01	0.03
Lactic acid, %DM	0.573	3.41	3.67	2.55	3.33	0.160	<0.01	<0.01	0.28	<0.01
n-Butyric acid, %DM	2.30	0.005	<0.001	0.020	0.023	0.063	<0.01	0.77	0.96	0.98
Acetic acid, %DM	2.19	0.893	0.629	2.43	1.64	0.152	<0.01	<0.01	0.23	<0.01
Propionic acid, %DM	0.525	0.011	0.009	0.176	0.074	0.013	<0.01	<0.01	0.79	<0.01
DM loss, %DM	9.17	2.60	2.12	2.74	2.22	0.046	<0.01	0.02	<0.01	<0.01

¹CON: Control (without additive), NHM: Sodium nitrite (0.6 g kg FM⁻¹) + Hexamine (0.4 g kg FM⁻¹), NHH: Sodium nitrite (0.9 g kg FM⁻¹) + Hexamine (0.6 g kg FM⁻¹), NFM: Sodium nitrite (0.6 g kg FM⁻¹) + Sodium formate (0.4 g kg FM⁻¹), NFA: Sodium nitrite (0.9 g kg FM⁻¹) + Sodium formate (0.6 g kg FM⁻¹).

²Standard error of the mean.

³Contrast: CON vs. ADT = Control vs. (NFM + NFH + NHM + NHH), NH vs. NF = (NFM + NFH) vs. (NHM + NHH).

Conclusion

Sodium formate was effective in replacing hexamine in a sodium nitrite-based additive for palisade grass silage.