



University of Kentucky
UKnowledge

International Grassland Congress Proceedings

XXI International Grassland Congress / VIII
International Rangeland Congress

Fermentation Quality of Silage Prepared with Bacteriocin-Producing Probiotic Lactic Acid Bacteria

Yimin Cai

National Institute of Livestock and Grassland Science, Japan

Saïd Ennahar

Université Louis Pasteur, France

Ramli Mohd Noor

Malaysian Agricultural Research and Development Institute, Malaysia

Chuncheng Xu

National Institute of Livestock and Grassland Science, Japan

Ryuichi Uegaki

National Institute of Livestock and Grassland Science, Japan

See next page for additional authors

Follow this and additional works at: <https://uknowledge.uky.edu/igc>



Part of the [Plant Sciences Commons](#), and the [Soil Science Commons](#)

This document is available at <https://uknowledge.uky.edu/igc/21/15-1/46>

The XXI International Grassland Congress / VIII International Rangeland Congress took place in Hohhot, China from June 29 through July 5, 2008.

Proceedings edited by Organizing Committee of 2008 IGC/IRC Conference

Published by Guangdong People's Publishing House

This Event is brought to you for free and open access by the Plant and Soil Sciences at UKnowledge. It has been accepted for inclusion in International Grassland Congress Proceedings by an authorized administrator of UKnowledge. For more information, please contact UKnowledge@lsv.uky.edu.

Presenter Information

Yimin Cai, Saïd Ennahar, Ramli Mohd Noor, Chuncheng Xu, Ryuichi Uegaki, and Norio Yoshida

Fermentation quality of silage prepared with bacteriocin-producing probiotic lactic acid bacteria

Yimin Cai¹, Saïd Ennahar², Ramli Mohd Noor³, Chuncheng Xu¹, Ryuichi Uegaki¹ and Norio Yoshida¹

¹ National Institute of Livestock and Grassland Science, Nasushiobara, Tochigi 329-2793, Japan, E-mail: xcai@affrc.go.jp. ² Université Louis Pasteur, 74, route du Rhin, 67400 Illkirch, France. ³ Strategic Livestock Research Centre, MARDI, P.O. Box 12301, 50774 Kuala Lumpur, Malaysia

Key words: bacteriocin, lactic acid bacteria, silage

Introduction Bacteriocin-producing lactic acid bacteria (LAB) have a bactericidal effects against foodborne pathogens, and they inhibit the outgrowth of bacterial spores of clostridia and bacilli. Most bacteriocins produced by LAB are degradable in human tract and thermoresistant. In the present experiment, the application of bacteriocin-producing LAB with strong antimicrobial activity against undesirable microorganisms as probiotics for silage preparation were studied.

Materials and methods Rice straw, forage paddy rice and Italian ryegrass (*Lolium multiflorum*) were chopped into 10-mm lengths and three replicates of the same forage were used for microbiological analysis. Silages were prepared using a small-scale system of silage fermentation (Ennahar *et al.* 2003, Cai *et al.* 1999). *Lactococcus lactis* RO50 was added at a rate of 1.0×10^5 colony forming unit (cfu) g⁻¹ of lactic acid bacteria (LAB) on a fresh matter basis.

Results Strain RO50 was found to display anti-microbial activity against a variety of bacteria, including clostridia, bacilli and LAB, but showed respectively wide and narrow spectra of activity.

Table 1 Fermentation quality and microorganism composition of silage*.

	Rice straw		Forage paddy rice		Italian ryegrass	
	Control	R050	Control	R050	Control	R050
Dry matter (%)	31.9	32.10	25.90	26.10	19.56	18.92
pH	5.40 ^a	4.35 ^b	5.40 ^a	4.14 ^b	4.60 ^a	3.95 ^b
Lactate %FM	0.32 ^b	0.87 ^a	0.46 ^b	1.14 ^a	0.55 ^b	1.41 ^a
Acetate %FM	0.53	0.35	0.53	0.55	0.33	0.35
Butyrate %FM	0.67	nd	0.35	nd	0.37	nd
Ammonia-N g/kg FM	0.62 ^a	0.38 ^b	0.57 ^a	0.40 ^b	0.55 ^a	0.28 ^b
Lactic acid bacteria log cfu/g FM	6.70 ^b	6.80 ^a	5.40 ^b	6.80 ^a	5.83 ^b	6.40 ^a
RO 50, log cfu/g FM	nd	6.50	nd	4.30	nd	5.80
Mould log cfu/g FM	4.20	nd	nd	nd	nd	nd
Clostridia log cfu/g FM	3.20	nd	3.60	nd	4.30	nd

* Silage stored for 60 day, FM: fresh matter, nd: not detected.

a, b, : means with edum of same silage with different letter differ (P<0.05).

Rice straw, forage paddy rice and Italian ryegrass silages inoculated with strain RO50 were well preserved and exhibited lower pH, butyric acid and ammonia-nitrogen, and higher lactic acid content, as compared to the control silage. During the silage fermentation process, the inoculated silages exhibited increased numbers of LAB and reduced clostridia compared to that of control (Table 1).

Conclusions The use of such bacteriocinogenic LAB inoculants to improve the silage fermentation is highly recommended. The addition of strain RO50 at ensiling is intended to ensure rapid and vigorous fermentation resulting in a faster accumulation of lactic acid, lower pH values at earlier stages of ensiling, and inhibition of growth of some pathogenic bacteria. Therefore, the bacteriocin-producing *Lactococcus lactis* RO50 are very beneficial as potential silage inoculants.

References

- Ennahar S, Cai Y, Fujita Y (2003) Phylogenetic Diversity of Lactic Acid Bacteria Associated with Paddy Rice Silage as Determined by 16S Ribosomal DNA Analysis. *Appl. Environ. Microbiol.* 69(1): 444-451.
- Cai, Y, Kumai S, Ogawa M, Benno Y, Nakase T (1999) Characterization and identification of *Pediococcus* species isolated from forage crops and their application for silage preparation. *Appl. Environ. Microbiol.* 65: 2901-2906.