Application of a New Inoculant "Chikuso-1" for Silage Preparation of Forage Paddy Rice

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The XX International Grassland Congress took place in Ireland and the UK in June-July 2005. The main congress took place in Dublin from 26 June to 1 July and was followed by post congress satellite workshops in Aberystwyth, Belfast, Cork, Glasgow and Oxford. The meeting was hosted by the Irish Grassland Association and the British Grassland Society.

Proceedings Editor: D. A. McGilloway

Publisher: Wageningen Academic Publishers, The Netherlands

Presenter Information
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Keywords: forage paddy rice, lactic acid bacteria, inoculant, silage

Introduction Forage paddy rice is currently one of the most important silage crops in Japan. In fact, the use of paddy rice culture for silage production has been steadily increasing in recent years, not only because this represents a new way towards achieving self-sufficiency in animal feed, but also because of the interest of combining crop cultivation and livestock farming as a more effective use of idle paddy fields that often remain unused. However, the preparation of quality silage from paddy rice and its long-term storage are often challenging (Cai *et al*., 1999, 2003). In this study, a new bacterial inoculant was developed and its application for silage preparation of forage paddy rice was examined.

Materials and methods Two paddy rice cultivars grown in a farm field (Saitama, Japan), were harvested at the ripe stage. A new lactic acid bacterial inoculant Chikuso-1 (*Lactobacillus plantarum*, Brand seed Ltd., Sapporo, Japan) was used at $1.0x10^5$ cfu/g of fresh matter (FM) for silage fermentation. Silage was prepared by using a round bale system. Untreated controls and Chikuso-1-inoculated samples from three round bale silages per treatment were then monitored for silage quality through microbiological and chemical analyses. Data were subjected to one-way analysis of variance and treatment means were compared by Tukey multiple range test SAS Institute Inc. 1988.

Table 1 Fermentation quality and microbiological analysis of silage

	Hamasari cultivar		Kusahonami cultivar	
	Control	Chikuso-1	Control	Chikuso-1
Ferementation quality				
pH	5.35[b]	3.72[a]	5.28[b]	4.05[a]
DM (%)	31.37	30.32	31.11	32.24
Lactic acid(% FM)	0.35[a]	1.33[b]	0.24[a]	0.95[b]
Acetic acid(% FM)	0.44	0.32	0.46	0.40
Butyric acid(% FM)	0.38	nd	0.56	nd
Propionic acid(% FM)	0.06	nd	0.08	nd
Ammonia N(g/kg FM)	0.66	0.27	0.82	0.33
Microorganism composition (log colony-forming units per gram of FM)				
Lactic acid bacteria	4.56[b]	6.86[a]	5.20[b]	7.05[a]
Aerobic bacteria	4.55[b]	3.20[a]	5.24	nd
Clostridia	3.22	nd	3.67	nd
Bacilli	4.50	4.02	4.80	3.20
Yeast	3.80	4.20	4.20	4.80
Mould	3.32	nd	4.60	nd

FM, fresh matter; nd, not detected. Chikuso-1: *Lactobacillus plantarum* ; Silage ensiled for 300-days, [a, b] Values are means of three silage samples.

Results Results overall showed counts of 10^6 (cfu/g of FM) aerobic bacteria, 10^3 coccus-shaped lactic acid bacteria, 10^5 molds and 10^4 yeasts in the two sets of silage samples. *Lactobacilli* were too few to be detected in any of the samples analysed. The silages treated with Chikuso-1 were well preserved; had significantly lower pH values, butyric acid, propionic acid and ammonia N concentrations, gas production, and dry matter losses; and higher contents of lactic acid compared with the control silages after 300 d of fermentation. During silage fermentation, the control silages displayed growth of clostridia and molds, whereas in Chikuso-1-inoculated silages, these were at or below the detectable levels (Table 1).

Conclusions These results suggest that the inoculation of paddy rice silage with the inoculant Chikuso-1 results in beneficial effects by promoting the propagation of lactic acid bacteria and inhibiting the growth of clostridia, aerobic bacteria and molds, as well as improving the overall fermentation quality.

References

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