

# In situ dry matter degradability of whole intact grain from whole crop rice silage was negligible

Geumhwi Bang<sup>1,3</sup>, Jayeon Kim<sup>2</sup>, Bharanidharan Rajaraman<sup>4</sup>, Thirugnanasambantham Krishnaraj<sup>3</sup>,  
Tae Hoon Kim<sup>2</sup>, Seol Hwa Park<sup>5</sup>, Kyoung Hoon Kim<sup>2,3</sup>

<sup>1</sup>Department of Animal Science and Technology, KKU; <sup>2</sup>Graduate School of International Agriculture Technology, SNU; <sup>3</sup>Institute of Green Bio Science & Technology, SNU; <sup>4</sup>College of Agriculture and Life Science, SNU <sup>5</sup>Animal Nutritional & Physiology TEAM, NIAS  
(E-mail: khkim@snu.ac.kr)

## Background

There have been debate about the optimum maturity stage of whole crop rice for maximizing feed value. Some opinion is that whole crop rice must be harvested flowering stage that is maximized greenness level for high quality forage source. The opposite opinion is that ripening stage with a high starch is the best stage for replace concentrates. However, there is lack of evidence on degradability in the rumen and digestibility in the total gastrointestinal tract. Therefore, we collected whole grains with hulls and only hulls from the bale silage of the three treatments, and did in situ experiments to measure the degradability in the rumen.

## Materials and Methods

- Whole crop rice was harvested at ripe stage and ensiled in round bales (approximate 500kg) with no additive, lactic acid bacteria inoculant (*Lactobacillus plantarum*  $1.5 \times 10^{10}$  CFU/g fresh forage) and 16% sodium formate (6.6L/ton fresh forage).



- Whole crop rice was collected from three different sites on the paddy field for chemical analysis.



- Exp. 1 : Silage fermentation characteristics
  - After 5 and 7 months, silage samples were taken from 9 locations of each bale using core sampler, irrespectively.
  - Samples were mixed, then analyzed for pH, VFA proportion,  $\text{NH}_3\text{-N}$  and lactic acid contents.
- Exp. 2 : In situ degradability of rice grain
  - In a second trial, the degradability of rice grain with hull and hull alone using in situ nylon bag method.
  - After incubation for 0, 6, 12, 24, 72 hours, nylon bags were taken for the DM degradation rate.



## Results

**Table 1. Chemical composition of whole crop rice harvested at ripen stage**

	Three sites			SEM	p value
	1	2	3		
<b>Fresh grass</b>					
DM, %	31.9	29.6	32.4	2.39	0.694
WSC, % DM	10.6	11.6	11.1	0.24	0.132

**Table 2. Chemical composition of whole crop rice silages**

	Treatment			SEM	p value
	Control <sup>1)</sup>	LAB <sup>2)</sup>	Na-FA <sup>3)</sup>		
DM, %	27.6	27.8	29.2	0.69	0.307
CP, % DM	6.9	7.8	7.9	0.26	0.009
NDF, % DM	49.1	49.7	50.1	0.46	0.475
WSC, % DM	1.2	0.8	0.9	0.09	0.004

1) Without additive, 2) inoculated with lactic acid bacteria, 3) treated with sodium formate.

**Table 3. Fermentation characteristics of whole crop rice silages**

	Treatment			SEM	p value
	Control <sup>1)</sup>	LAB <sup>2)</sup>	Na-FA <sup>3)</sup>		
<b>1st Sampling (Mar, 15)</b>					
pH	5.0	5.0	5.3	0.10	0.073
<b>Volatile fatty acids (% DM)</b>					
Acetic acid	9.1	14.1	10.7	2.35	0.039
Propionic acid	3.7	1.8	0.5	0.72	0.013
Butyric acid	4.2	3.1	1.7	0.65	0.028
$\text{NH}_3\text{-N}$ , % Total-N	14.7	15.4	10.7	1.61	0.005
<b>2nd Sampling (May, 31)</b>					
pH	4.4	4.6	4.7	0.09	0.007
<b>Volatile fatty acids (% DM)</b>					
Acetic acid	10.1	12.7	11.1	0.65	0.021
Propionic acid	2.1	1.4	1.0	0.22	0.001
Butyric acid	2.5	2.7	2.5	0.20	0.878
Lactic acid (% DM)	1.21	0.87	0.86	0.07	<0.001
$\text{NH}_3\text{-N}$ , % Total-N	18.0	16.5	14.9	1.01	0.029

1) Without additive, 2) inoculated with lactic acid bacteria, 3) treated with sodium formate.

**Table 4. In-situ degradabilities of rice grain with hull and hull alone collected from the silages**

	Rice grain with hull			Hull	SEM	p value
	Control <sup>1)</sup>	LAB <sup>2)</sup>	Na-FA <sup>3)</sup>			
<b>0h</b>	4.11	5.55	6.02	7.19	0.298	< 0.0001
<b>6h</b>	4.37	5.22	5.53	7.12	0.327	0.0073
<b>12h</b>	5.17	5.91	6.00	8.67	0.383	0.0002
<b>24h</b>	6.01	6.61	6.63	10.83	0.554	0.0001
<b>72h</b>	7.80	9.59	7.17	15.39	1.074	0.0087

1) Without additive, 2) inoculated with lactic acid bacteria, 3) treated with sodium formate.

## Conclusion

The important variables describing silage fermentation quality indicated that all silages were not affected by not only LAB or Na-FA but also butyric acid bacteria or clostridium even though there were statistical differences in each variable among treatments. Of particular interest was the indication that rumen bacteria degraded negligible amount of dry matter (<2~4%) in whole grain from silage. However, it is not known yet what effect such as chewing and rumination or digestion in hindgut would have on the digestibility of whole grain from silage in the whole intestinal tract.