

EFFECTS OF RICE STRAW SILAGE WITH MICROBIAL ADDITIVES ON GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF HANWOO STEERS

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Abstract—This experiment was conducted to determine the effect of rice straw silage treated microbial additives on growth performance and carcass characteristics of Hanwoo steers. Twenty four Hanwoo steers were randomly allocated to two groups, fed rice straw (control) and rice straw silage with microbial additives (treatment). In the result, there was a tendency to improve ADG by rice straw silage treated microbial additives group (0.78kg/d) rather than rice straw group (0.86kg/d). Also, feed intake of Hanwoo steers was higher treatment group (9.52kg/d) more than control group (8.98kg/d), but was not significantly different. In carcass characteristics, Fasting weights were 769.2kg and 750.0kg for treatment and control, there was no significant difference between two groups. Dressing percentage was a tendency to improve treatment group, but was not significantly different. Quantity grade (A:B:C) was resulted 8:3:1 and 6:5:1 for treatment and control groups, respectively. The result of quality Grade (1⁺⁺:1⁺:1:2:3) was showed higher treatment(1:1:5:6:0) group more than control(0:1:6:4:1) group in Hanwoo steers. In conclusion, the result of this experiment was shown insignificant difference from growth performance and carcass characteristics of Hanwoo steers, but there was a tendency to improve by rice straw silage with microbial additives.

Index Terms— Carcass traits, Growth performance, Hanwoo steers, Microbial additives

I. INTRODUCTION

The number of Hanwoo reached about 2.6 million head nationwide at the recent, 2010. In Korea, majority of livestock subsist on poor quality native grasses such as rice straw and reed, crop residues and agro-industrial by-products. Specially, Rice straw is a main by-product produced in East and Southeast Asia area and utilized as roughage resources for ruminants. It is well known that rice straw shows low in crude protein content, digestible energy and mineral content as a consequence, total available nutritive values are low. The past decades have seen enormous approaches in overcoming these problems such as physical treatments (chopping, grinding, steam and pressure), chemical treatments (enzymes, sodium hydroxide, ammonia and urea) and biological (lactic bacteria, yeast and fungi) treatments (Abe, H., Yamakawa, M. & Okamoto, M., 1999; Liu, J. X., Ørskov, E. R. & Chen, X. B., 1999; Liu, J. & X., Ørskov, E. R., 2000). In the present, microbial additives have been used during ensiling procedure, enhanced degradation of cell wall structure by producing cellulase and xylanase (Mould, F.L., Kliem, K. E., Morgan, R., & Mauricio, R. M., 2005). In the reason, many farms are using various additives as growth promoters for improving economic and effective animal production. It has reported that microbe supplementation could improve the growth of rumen bacteria (Harrison, G. A., Hemken, R. W., Dawson, K. A., Harmon, R. J. & Barker, K. B., 1988; Frumholtz, P. P., Newbold, C. J. & Wallace, R. J. 1989) and enhance the nutrient digestibility (Newbold., 1990; Lee, S. S., Ha, J. K. & Cheng, K. -J., 2000).

Therefore, this experiment was conducted to improve nutritional value of rice straw, to determine the effect of microbial additives on growth performance and carcass traits of Hanwoo steers.

II. MATERIALS AND METHODS

Twenty four finishing Hanwoo (Korea native cattle) steers with an initial body weight (BW) of 473.7kg (age 22month) were randomly allocated to two groups, fed rice straw (control) and rice straw silage with microbial additives (treatment).

Table 1. Chemical composition of the experimental diets (%, DM basis)

Ingredient	Concentrate	Rice straw	Rice straw silage
Dry matter	86.71	85.70	31.86
Crude protein	10.51	3.31	5.22
Ether extract	3.71	1.27	1.78
Crude fiber	5.00	27.46	32.12
Crude ash	6.21	8.85	12.31
NDF	20.58	70.45	64.92
ADF	8.99	42.50	40.08
pH	-	-	4.70
NH ₃ -N (mg/100 mL)	-	-	2.38
Lactic acid	-	-	3.59
Acetic acid	-	-	1.58

Concentrate was fed 2.5% of BW in two equal proportions at 09:00 and 16:00 h, and forage was fed 0.6% of BW at 09:00 h daily during experimental period (180 days). Feed allowance was adjusted on the basis of the BW. Chemical composition and formula of feedstuff used this experiment were shown Table 1, 2. Microbe strains used this experiment were *Candida glabrata* var. *thermoidea*, *Fibrobacter succinogenes* and anaerobic fungi (isolated in our laboratory). Daily feed intake was calculated from the feed offered and the feed refused. Hanwoo Steers were weighed every 4wk on full feed, and these BW were used to calculate average daily gain (ADG). The carcass traits (quality grades and yield grades) were evaluated following a chill postmortem by four carcass graders of APGS(2007). Analyses of variance were carried out, and means were compared by t-test using a SAS(1996) program. Differences with $p < 0.05$ were considered to be statistically significant.

Table 2. Ingredient of commercial concentrate

Ingredient	%
Corn grain	46.50
Wheat ground	10.00
Cane molasses	6.80
Wheat flour	5.00
Wheat bran	5.00
Corn gluten feed	1.50
Coconut meal	10.00
Palm meal	8.00
Mixed fiber	3.00
Capok seed	1.00
Salt	0.60
Tricalcium phosphate	0.20
Limestone	2.20
Vitamin premix ¹	0.10
Mineral premix ²	0.10
Total	100.00

¹ Vitamin premix contains following nutrients per kg: Vit. A, 6000 IU; Vit. D3, 1200IU.

² Mineral premix: K, 0.08%; S, 0.05%; Fe, 30ppm; Zn, 50ppm, Mn, 40ppm; Cu, 10ppm; Co, 0.5ppm; I, 0.53ppm; Se, 0.13ppm; Mg, 0.03% per kg

III. RESULTS AND DISCUSSION

The result of growth performance, DM intake and feed conversion from Hanwoo steers fed rice straw and rice straw silage with microbial additives was shown Table 3. BW gain was higher rice straw silage with microbial additives (treatment) group more than rice straw (control) group. Average daily gain (ADG) of control group and treatment group were recorded as 759.8g/d and 778.8 g/d, respectively. Feed intake ratio was higher treatment group (9.52kg/d) more than control group (8.98kg/d), but was not significantly different. DM intake was also increased from 8.98 kg/d to 9.52 kg/d, without statistical differences. Feed conversion ratio was improved in treatment group. This increase in the growth performance (BW gain, ADG) may be due to the effect of microbial additives, which substantially increases nutrients by microbial fermentation in rice straw silage.

Table 3. Effects of rice straw and rice straw silage with microbial additives on growth performance, DM intake and feed conversion of Hanwoo steers

Item	Control	Treatment	SEM ¹
Initial body weight (kg)	465.2	482.3	25.62
Final body weight (kg)	605.0	625.3	11.34
Average daily gain (g/d)	759.8	778.8	38.54
DM intake (kg/d)			
Concentrate	7.07	7.47	-
Rice straw	1.91	-	-
Straw silage	-	2.05	-
Total	8.98	9.52	0.270
Feed conversion ratio	8.35	8.17	0.455

¹SEM, standard error of means.

A comparison of carcass traits within each group is presented in Table 4. In the result of carcass traits, live weight (kg) of Hanwoo steers fed rice straw and rice straw silage with microbial additives were 769.2kg and 750.0kg for treatment and control, there was no significant difference between groups. Also, Dressing percentage (%) was not significant, but was a tendency to improve treatment group. Rib-eye area and back fat thickness were 87.6cm², 3.42mm and 87.9cm², 3.68mm for control and treatment. In the yield grades of control, incidence of A, B and C grades were 50, 42 and 8%, respectively, whereas, in treatment were there grades 67, 25, and 8%, respectively.

In quality traits, Marbling scores, Meat color and Fat color were similar between treatment group and control group. Quality Grade (1⁺⁺:1⁺:1:2:3) was showed higher treatment (8:8:42:42:0%) group more than control (0:8:50:34:8%) group. The appearance of desirable high quality grade was similar between control and treatment, but the best quality grade (1⁺⁺) was found in treatment.

Table 4. Effects of rice straw and rice straw silage with microbial additives on carcass traits of Hanwoo steers

Item	Control	Treatment	SEM ¹
Live weight (kg)	750.0	769.2	44.301
Dressing percentage (%)	62.7	63.1	1.592
Quality traits			
Marbling score	3.21	3.57	1.166
Meat color	4.67	4.77	0.501
Fat color	2.67	2.46	0.643
Quality Grade (1 ⁺⁺ :1 ⁺ :1:2:3, head)	0:1:6:4:1	1:1:5:5:0	-
Yield traits			
Rib-eye area (cm ²)	87.6	87.9	8.089
Back fat thickness (mm)	3.42	3.68	0.385
Yield Grade (A:B:C, head)	6:5:1	8:3:1	-

¹SEM, standard error of means.

IV. CONCLUSION

In conclusion, the results were not significant difference in growth performance and carcass characteristics of Hanwoo steers, but there could be improved with ADG, marbling score(quality grade) by rice straw silage with microbial additives. However, microbial additives used in this study needs to be characterized in detail study for the evaluation of growth performance, nutrient digestion and production response of ruminants.

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