Muhamad Bata

THE USE OF FIBROLYTIC ENZYMES TO IMPROVE QUALITY OF RICE BRAN AND COTTONSEED MEAL AND ITS EFFECT ON NUTRIENT UTILIZATION AND PERFORMANCE OF FATTENING WEANER HOLSTEIN BULLS IN INDONESIA

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by

Muhamad Bata
born in Ende, Indonesia

GEORG-AUGUST-UNIVERSITY, GÖTTINGEN, GERMANY
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Abbreviation

µmol	Micromol
°C	Degree of Celsius
A	Degree of Celsius
AA	Amino acid
ADF	Acid detergent fibre
ADG	Average daily gain
ANCOVA	Analysis of covariance
ANOVA	Analysis of variance
ATP	Adenosine Triposphate
BM	Blood meal
BPS	Biro pusat statistik
BW	Body weight
C_2	Acetate
C_3	Propionate
C_4	Butirate
Ca	Calcium
CBHS	Cellobiosehydrolases
CF	Crude fibre
CH_4	Methane
CM	Carboxymethyl
CMC	Carboxymethylcellulose
CMC-ase	Carboxymethylcellulose-ase
Co	Cobalt
CO_2	Carbon dioxide
cp	centy poach
CP-ase	Cellulase pectinase
CP	Crude protein
CRBD	Completely Randomise Block Design
CSM	Cottonseed meal
Cu	Copper
DIP	Degradable intake protein
DM	Dry matter

DMD	Dry matter digestibility
DMI	Dry matter intake
DNS	Dinitrosalicylic acid
DOM	Digestibility of organic matter
DP	Degree of polymerisation
EE	Ethyl extract
FA	Ferulic acid
FCR	Feed conversion ratio
Fe	Ferro
FP	Filter paper
FP-ase	Filter paper-ase
g	gram
GE	Gross energy
H	Hemicellulase
Ha	Hectare are
HC	Hemicellulase cellulase
HCP	Hemicellulase cellulase pectinase
HE	Hydroxyethyl
iC_4	IsoButyrate
iC5	IsoValerate
K	Potasium
Kg	Kilogram
M	Molar concentration
ME	Metabolisable energy
Mg	Magnesium
Mg/dL	milligram per decilitre
min	Minutes
MJ	Mega Joule
ml	Millilitre
mM	Milli Molar
Mn	Mangaan
Mo	Molybdenum
N	Normalitas

NM	Nanometer
Na	Sodium
NADPH	Nicotimide adenine dinucleotide phosphate
NDF	Neutral detergent fibre
NE*l*	Net energy for lactation
NFE	Nitrogen free extract
Ni	Nickel
NH_3-N	Ammonia nitrogen
NPN	Non protein nitrogen
NSPs	Non starch polysaccharides
OM	Organic matter
P	Phosphor
pa	Proportion of acetic acid
pb	Proportion of butyric acid
pp	Proportion of propionic acid
R^2	Coefficient of correlation
RB	Rice bran
RDP	Rumen degradable protein
RL-M	Rumen liquor-medium
Rp	Rupiah (Indonesian monetary unit)
S	Sulphur
SBH	Soybean hulls
SBM	Soybean meal
Se	Selenium
SEM	Standard error of means
T	*Trichoderma*
TCA	Trichloroaceticacid
TMR	Total mixed ration
U/g	Unit per gram
UIP	Undegradable intake protein
VFA	Volatile fatty acid
WCM	Whole cottonseed meal
Zn	Zinc

I. INTRODUCTION

High ambient temperature and humidity together with low quality feedstuff leads to a conflict between production and adaptation for domestic animals in the tropics. Generally, endogenous breeds (local animals) have adapted to those conditions, but exotic breeds with high growth rate like the Holstein breed imported from temperate areas will have problems. High growth rate will cause an increased heat production, which it is difficult for the animals to dispose of. Therefore, the animals will reduce heat production by decreasing feed intake and finally, the growth rate will also decrease. To anticipate this phenomenon, Holstein weaner bulls in fattening regimes must be fed more concentrate to manipulate rumen fermentation to increase propionate and/or to decrease acetate production and thereby reduce heat production and prevent heat stress.

Farmers in Indonesia use rice bran (RB) and cottonseed meal (CSM) in ruminant diets as energy and protein sources, respectively. Their high crude fibre content limits utilisation of these feedstuffs. Their fermentation in the rumen of feeds with high crude fibre content leads to a predominance of acetate production. Efficiency of utilisation of metabolizable energy (ME) from acetate is lower compared to propionate or butyrate (AMSTRONG and BLAXTER, 1957). Utilisation of acetate for fat synthesis requires an adequate supply of NADPH (AMSTRONG, 1965). NADPH will be more readily available if ample supplies of absorbed amino acids or glucose are present (ANNISON and BRYDEN, 1999). Improving feed quality especially concentrate by reducing crude fibre or optimalization of rumen condition is one alternative to overcome this problem.

Utilisation of specific fibrolytic enzymes to treat these by-products for ruminant animals is a newer technique for improving the feeding value of high fibre concentrates (BEAUCHEMIN *et al.*, 1997). Generally, enzyme treatment have been extensively used in diets for monogastrics but positive effects of adding exogenous fibrolytic enzymes added to ruminant diets have also recently been reported. Enzyme additives have been shown to enhance colonization of feed by ruminal microorganisms and increase the rate of degradation in the rumen (HRISTOV *et al.*, 1998 and MORGAVI *et al.*, 2000) and to survive passage to the duodenum, suggesting that exogenous enzymes may function ruminally and postruminally. Addition of fibrolytic enzyme mixtures to forage diet has led