



**UNIVERSITI PUTRA MALAYSIA**

**NUTRITIONAL EVALUATION OF UNTREATED AND UREA-  
TREATED RICE STRAW FOR IMPROVED UTILIZATION BY GOATS**

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NUTRITIONAL EVALUATION OF UNTREATED AND UREA-TREATED  
RICE STRAW FOR IMPROVED UTILIZATION BY GOATS

By

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## ABBREVIATION LIST

A.F.R.C.	= Agricultural and Food Research Council
A.O.A.C.	= Association of Official Analytical Chemist
A.R.C.	= Agricultural Research Council
ADF	= acid detergent fibre
ANOVA	= analysis of variance
ATP	= adenosine triphosphate
Ca	= calcium
Ca(OH) <sub>2</sub>	= calcium hydroxide
CP	= crude protein
CPM	= count per minute
Cr	= chromium
Cu	= copper
DM	= dry matter
DMD	= dry matter digestibility
DMI	= dry matter intake
DOMI	= digestible organic matter intake
F.A.O.	= Food and Agriculture Organisation
GIT	= gastrointestinal tract
GLC	= gas liquid chromatograph
HCl	= hydrochloric acid
HNO <sub>3</sub>	= nitric acid
IVDMD	= in vitro dry matter digestibility
IVOMD	= in vitro organic matter digestibility
LU	= livestock unit(s)
ME	= metabolisable energy



Mg	= magnesium
MJ	= megajoules
MRT	= mean retention time
MSAP	= Malaysian Society of Animal Production
N	= nitrogen
n	= number of observation
Na	= sodium
NaOH	= sodium hydroxide
NDF	= neutral detergent fibre
NH <sub>3</sub>	= ammonia
NH <sub>4</sub> OH	= ammonium hydroxide
OM	= organic matter
OMI	= organic matter intake
P	= phosphorus
S	= sulphur
SAS	= Statistical Analysis System
SE	= standard error
SG	= specific gravity
TCA	= trichloroacetic acid
TT	= transit time
USS	= urea supplemented straw
UTS	= urea treated straw
V <sub>a</sub>	= rate of absorption (of P or Ca)
V <sub>f</sub>	= rate of endogenous faecal excretion (of P or Ca)
V <sub>F</sub>	= rate of faecal excretion (of P or Ca)
VFA	= volatile fatty acid

$V_I$	= rate of intake (of P or Ca)
$V_m$	= rate of excretion via the milk (of P or Ca)
$V_{O+}$	= rate of deposition into stable pool (of P or Ca)
$V_{O-}$	= rate of removal from stable pool (of P or Ca)
$V_u$	= rate of urinary excretion (of P or Ca)
$W$	= liveweight

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STRAW FOR IMPROVED UTILIZATION BY GOATS

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Rice straw is seldom used as goat feed despite reports of higher intake and digestibility of poor quality roughage by this species. Studies were conducted to evaluate local rice straw, define its limitation and investigate means to improve its utilization by goats.

Compositional and degradability studies showed that untreated rice straw is deficient in N and several minerals and is poorly degraded. Calcium hydroxide and sodium hydroxide treatment increased degradability but the treated material was less acceptable to goats compared to rice straw treated with urea or ammonium hydroxide which has relatively lower degradability. Treatment with nitric acid removed all the hemicellulose and was totally unacceptable to goats.

The *ad libitum* intake and *in vivo* digestibility of urea-treated straw was higher than that of urea  
supplemented straw and untreated straw. Studies with



fistulated goats indicated a sustained high level of ammonia and volatile fatty acids in the rumen fluid of goats fed with urea-treated rice straw. There was no significant difference in their rates of passage. It was concluded that the higher intake of urea-treated straw was due to improved rumen function and not due to higher rates of passage.

Radioisotope dilution studies showed that endogenous P secretion into the digestive tract of goats fed urea-treated rice straw was high. As a result goats fed urea-treated straw require more P (76 mg/kg W/d) than goats fed untreated or urea supplemented straw (28 and 30 mg/kg W/d, respectively). Clearly when an improved diet such as urea-treated straw is fed to animals their requirement for mineral is considerably increased.

Mineral supplementation of goats fed urea-treated rice straw increased feed intake, growth rate and Ca and P retention. Further supplementation with urea gave no additional response but growth rate was increased with soya bean meal supplement. This shows that the supply of rumen ammonia to microbes has been met in goats fed urea-treated rice straw. Calcium retention was not improved with either urea or soya bean meal supplement. Phosphorus retention was increased with soya bean meal supplement due to the high concentration of phosphorus in this feed.



It was concluded from these studies that although urea treatment increased the nitrogen content, organic matter intake and digestibility of rice straw by goats, further improvement in animal growth can be obtained by providing adequate minerals and protein.



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PENILAIAN JERAMI PADI YANG TIDAK DIRAWAT DAN YANG DIRAWAT  
DENGAN UREA UNTUK PENGGUNAAN YANG LEBIH CEKAP OLEH KAMBING

oleh

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Jerami padi jarang digunakan sebagai makanan kambing walaupun ada laporan yang mengatakan kambing boleh memakan dan mencernakan bahan bergentian bermutu rendah dengan lebih sempurna. Kajian telah dibuat untuk menentukan had pemakanan jerami padi tempatan dan menyelidik kaedah untuk memperbaiki kegunaan jerami oleh kambing.

Kajian komposisi dan kebolehurstai (degradability) menunjukkan bahawa jerami padi yang tidak dirawat kekurangan nitrogen dan zat galian serta sukar diurair. Prarawatan dengan kalsium dan natrium hidroksida meningkatkan kebolehurstai jerami padi, tetapi jerami yang dirawat itu kurang digemari oleh kambing berbanding dengan jerami yang dirawat dengan urea atau ammonium hidroksida walaupun nilai kebolehurstai nya agak rendah. Prarawatan dengan asid nitrik telah menghilangkan kesemua hemiselulos dari jerami dan jerami yang dirawat itu tidak digemari oleh kambing.



Pengambilan makanan *ad libitum* dan pencernaan *in vivo* jerami yang dirawat dengan urea adalah lebih tinggi berbanding dengan jerami yang ditambah dengan urea atau jerami yang tidak dirawat. Kajian dengan kambing berfistula rumen menunjukkan paras ammonia dan asid lemak meruap yang berkekalan tinggi dalam cecair rumen kambing yang memakan jerami rawatan urea. Perbezaan kadar pemindahan makanan pepejal antara kumpulan perlakuan tidak nyata. Dengan ini boleh disimpulkan bahawa peningkatan pengambilan makanan oleh kambing yang diberi jerami rawatan urea adalah kerana fungsi rumen yang lebih baik dan bukan kerana kadar pemindahan makanan yang lebih cepat.

Kajian pencairan radioaktif menunjukkan rembesan fosforus ke saluran pencernaan kambing yang memakan jerami rawatan urea adalah lebih tinggi. Akibatnya kambing yang memakan jerami rawatan urea memerlukan lebih banyak P (76 mg/h/kg) berbanding dengan kambing yang memakan jerami yang tidak dirawat dan jerami yang ditambah dengan urea (28 dan 34 mg/h/kg masing-masing). Adalah jelas bila makanan yang telah ditingkatkan mutunya, seperti jerami yang dirawat dengan urea, diberi kepada ternakan, keperluan zat galiannya akan bertambah.

Suplementasi zat galian kepada kambing yang memakan jerami yang dirawat dengan urea meningkatkan pengambilan makanan, kadar tumbesaran dan penyimpanan Ca dan P. Suplementasi lanjutan dengan urea tidak membawa apa-apa

