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UTILIZATION OF RICE STRAW FOR FEEDING RUMINANTS: 2- PRODUCTIVE PERFORMANCE OF LACTATING BUFFALOES FED RICE STRAW SILAGE

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ABSTRACT

Nutritional evaluation of rice straw silage was carried out with Sakha 102 and Giza 177 varieties sprinkled by El-Mufeed liquid and Effective Microorgansmis (EM_1) with or without urea supplementation as well as untreated or ammoniated rice straw using adult Ossimi x Finnish crossbred rams. Also, feeding trial was conducted using twelve lactating buffaloes in the 3rd to the 5th of lactation season, weighing 550-650 kg used after 8 weeks of lactation start in compete switch-back design to evaluate the three experimental rations contained different forms of rice straw. The first ration (R_1) contained concentrate feed mixture (CFM) and untreated rice straw (URS), the second ration (R_2) contained CFM and ammoniated rice straw (ARS), while the third ration (R_3) contained CFM and rice straw silage (RSS).

Giza 177 rice straw silage with EM_1 and urea supplementation had significantly ($P<0.05$) the highest digestibility coefficients of DM, OM and NFE and subsequently TDN, DE and DCP values. Moreover, nutrients digestibility and nutritive values increased significantly ($P<0.05$) with urea supplementation. Rice straw silage recorded significantly the highest digestibility coefficients of all nutrients except EE and subsequently nutritive values followed by ammoniated rice straw.

The digestibility coefficients of DM for R_3 and OM, CP and NFE and (subsequently TDN, DE and DCP values) for R_2 and R_3 were significantly ($P<0.05$) higher compared to R_1. However, CF and EE digestibilities were nearly similar for the different rations.

Buffaloes fed R_1 showed the highest intake of CFM compared with those fed R_2 or R_3. Moreover, lactating buffaloes fed R_1 recorded significantly ($P<0.05$) the highest DM intake and the lowest DCP intake, followed by those fed R_2, while those fed R_3 showed the opposite trend. Buffaloes fed R_3 recorded significantly ($P<0.05$) the highest concentrations of TVFA's and ammonia-N followed by those fed R_2, while buffaloes fed R_1 had the lowest concentrations.

Lactating buffaloes fed R_2 and R_3 showed significantly ($P<0.05$) the higher daily milk yield compared to those fed R_1. However, there were no significant ($P<0.05$) differences in milk composition. Buffaloes fed R_2 and R_3 had better feed conversion for DM, TDN and DE compared to those fed R_1. Average daily feed cost and feed cost / 1 kg 7% FCM were significantly higher, while the output of milk yield, net output and net output improvement were significantly lower for buffaloes fed R_1 compared with those fed R_2 and R_3.

Keywords: Rice straw silage, Ammoniated rice straw, Nutritive values, Effective microorganisms, Lactating buffaloes, Milk yield, Feed and economic efficiencies.

INTRODUCTION

In Egypt, the total planted area of rice crop was about 1.51 million feddan produced about 3.78 million tons of rice straw as an agricultural by-product after harvesting the crop (Agricultural Economics, Egypt, 2003). Few quantities of this residue are used for feeding animals, while the major part of rice straw produced by the farmers is burned or left in the fields resulting in pollution problems.

Recently, grains of some new hybrids and varieties of rice crop (Sakha 101, 102 and 104) which represent about 27% of the cultivated rice crop area are harvested while most of its leaves and stalks are still green and have suitable moisture content for ensiling (Technical Recommendation of Rice Crop, 2005). However, ensiling green rice plants immediately after harvesting the grains is practical importance in animal feeding. Moreover, it may offer a significant reduction in feeding cost (Ghanem *et al.*, 2005).

Little information are known about the chemical characterization, feeding value of rice straw silage made from the local hybrids and varieties of rice crop compared with ammoniated and untreated rice straw. However, the present investigation was undertaken to study the effect of ensiling some local rice hybrids and varieties by different methods on chemical composition, quality and nutritive value of silages produced compared with different forms of rice straw and their effects on productive performance of lactating buffaloes.

MATERIALS AND METHODS

The current work was carried out at Sakha Animal Nutrition Unit and Mehalt-Mousa Animal Production Research Station, belonging to Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture. This work consisted of two parts:

1- Evaluation trials:

1-1- Making rice straw silage:

Two varieties of fresh green rice straw included Sakha 102 and Giza 177 were taken immediately after harvesting grains for making silage in plastic bags (25-30 kg capacity). Fresh rice straw was sprinkled with 50 kg El-Mufeed liquid (El-Mufeed consisted of 91% molasses, 2.5% urea, 1.5% minerals and vitamins mixture and 5% water) and 250 ml of Effective Microorgansmis (EM_1)** with or without 3 kg urea solved in 50 liter of water per ton fresh rice straw. The silages were stored for 8 weeks until starting the digestibility trials.

For feeding trial, rice straw silage of Giza 177 variety was made between feed toughs, where 30 cm layer of rice straw spread on the ground as bed to absorb seepage and to prevent contamination with earth. El-Mufeed liquid was added at a level of 5% to fresh rice straw and Effective Microorgansmis (EM_1) was added by 250 ml / ton fresh rice straw. The materials were compressed by heavy drum filled with sand, then covered with plastic sheet, hard pressed with 30 cm of soil layer and ensiled for eight weeks.

1-2- Ammoniated rice straw:

A stack of rice straw bales is made from Giza 177 variety and sealed with plastic sheet. The delivery pipe from a small anhydrous ammonia cylinder was then inserted into the stack and NH_3 was added at the rate of 3% rice straw (air dry basis). The treatment period lasted 25 days under the temperature of 20 to 30 ^{0}C. The stack was aerated for two days before the straw was fed to animals to lose the excessive and unadsorbed ammonia.

1-3- Digestibility trials:

Seven digestibility trials were carried out to estimate nutrients digestibility coefficients and nutritive values of the four tested silages as well as untreated rice straw (URS), ammoniated rice straw (ARS) and rice straw silage (RSS) used in feeding trial using adult crossbred rams (Ossimi x Finnish) with an average body weight of about 50 kg (3 animal in each). Ninety percent of *ad libitum* intake of the tested rice forms were offered for each ram in equal two meals at 8 a.m. and 5 p.m. Water was available at all times in plastic buckets.

2-Feeding trial:

2-1- Experimental animals:

Twelve lactating buffaloes in the 3rd to the 5th lactation, weighing 550-650 kg were used after 8 weeks of calving in complete switch-back design with three treatments with three successive experimental periods. Each period consisted of 28 days, the first 14 days of each period were considered as transition period followed by 14 days tested period as discribed by Lucas (1956). Lactating buffaloes were individually fed to cover the recommended requirements according to Animal Production Research Institute (1997) for lactating buffaloes. Rations were recalculated every week based on milk yield and body weight of animals.

2-2- Experimental rations and management:

Lactating buffaloes in the first group were fed ration (R_1) consisted of CFM and untreated rice straw (URS), while in the second (R_2) and third (R_3) groups untreated rice straw was replaced either by ammoniated rice straw (ARS) or rice straw silage (RSS), respectively. Concentrate feed mixture was consisted of 35% undecorticated cottonseed cake. 5% linseed cake, 25% ground yellow corn, 20% wheat bran, 10% rice bran, 3% molasses, 1% limestone and 1% common salt. Concentrate feed mixture was given two times daily at 8 a.m. and 4 p.m., also URS. ARS or RSS were offered two times at 9 a.m. and 5 p.m. Buffaloes were watered three times daily at 7, 12 a.m. and 6 p.m.

2-3- Digestibility trials:

Three digestibility trials were carried out during the 2nd period of feeding trial using the experimental buffaloes (four animals in each) to determine nutrients digestibility coefficients and nutritive values of the experimental rations using acid insoluble ash (AIA) as a natural marker (Van Keulen and Young, 1977).

2-4- Rumen liquor samples:

Rumen liquor samples were collected at 3 hours after the morning feeding from the experimental buffaloes during the 2nd period of feeding trial using stomach tube.

2-5- Buffalo milking and milk samples:

Individual morning and evening milk yield of lactating buffaloes were recorded daily and corrected for 7% fat content (FCM) using the formula of 7% FCM = 0.265 x milk yield (kg) + 10.5 x fat yield (kg) as stated by Raafat and Saleh (1962). Milk samples from consective evening and morning milking were taken at the 4th week of each period and mixed in proportion to yield.

Milk fat, protein, lactose and total solids were determined using Milko-Scan (133B Foss Electric).

2-6- Feed conversion:

Feed conversion was calculated as the quantities of DM, TDN (kg), DE (Mcal) and DCP (g) required to produce 1 kg 7% FCM.

2-7- Economic efficiency:

Economic efficiency of milk production was estimated and expressed as average daily feed cost, cost of 1 kg 7% FCM, output of milk yield and the ratio between the output of milk yield and feed cost.

3- Chemical analysis:

The pH values of silage and rumen liquor samples were determined directly using Orian 680 digital pH meter. The concentrations of TVFA's silage and rumen liquor samples according to Warner (1964) and NH_3-N (Bergen *et al.*, 1974). Lactic acid concentration in silage samples was determined according to the method discribed by Analytical Chemisty of Foods (1995). The samples of feedstuffs and feces were composted and representative samples were analyzed according to AOAC (1990).

4- Statistical analysis:

The data of evaluation trials were statistically analyzed using general linear models procedure adapted by SPSS for windows (2004) for user's guide. Duncan test within program SPSS was done to determine the degree of significance between means. While the data of feeding trial (feed intake, milk yield and composition, feed and economic efficincies) were statistically analyzed according to Lucas (1956).

RESULTS AND DISCUSSION

Evaluation of different kinds of fresh rice straw silages:

Fermentation characteristics of different silages presented in Table (1) revealed that pH value and the concentrations of lactic acid, TVFA's and ammonia-N for the two varieties of rice straw silages slightly increased with urea supplementation. The pH value and ammonia-N concentration tended to be lower, while the concentrations of lactic acid and TVFA's tended to be higher for Giza 177 variety compared to Sakha 102 variety. Meanwhile, all fermentation characteristics of fresh rice straw silages except the pH value indicated good quality silage as stated by McDonald *et al.* (1995). Similar results were obtained by Ghanem *et al.* (2005).

Chemical composition of the different fresh rice straw silages are presented in Table (1). The contents of DM, OM, EE and ash were nearly similar for the two varieties of fresh rice straw silages, while the content of CP tended to be higher in Giza 177 than Sakha 102. Also, CF was slightly higher, but NFE tended to lower in Sakha 102 compared to Giza 177. The differences noted in chemical composition of different varieties of fresh rice straw silage are likely to be due to the differences in the proportions of plant tissues (leaf blades, leaf sheaths, rodes and steams) in the straw analysis

(Ramanzin *et al.*, 1986). Ørskov (1987) and Gabr (1997) demonstrated that morphological components of straws vary widely in their chemical composition and varying proportions of them will yield different results not only in chemical composition of straws but also in their degradabilities in the rumen of animals.

Table 1: Quality charactersitics, chemical composition, digestibility and nutritive values of different fresh rice straw silages.

Item	Sakha 102		Giza 177	
	EM1*	EM1* + Urea	EM1*	EM1* + Urea
Quality charactersitics:				
pH value	4.26	4.78	4.18	4.65
Lactic acid % of DM	4.35	4.94	4.56	5.12
TVFA's % of DM	1.64	1.92	1.75	2.13
NH_3-N % of total-N	4.68	5.99	3.26	5.11
Chemical composition:				
DM %	27.51	28.04	26.98	28.35
Composition of DM %:				
OM	80.05	79.98	79.77	78.41
CP	6.53	7.55	7.97	8.22
CF	29.13	27.79	26.51	25.57
EE	1.74	2.13	1.79	2.18
NFE	42.65	42.51	43.50	42.44
Ash	19.95	20.02	20.23	21.59
Digestibility coefficients %:				
DM	51.75^{b}	55.98^{ab}	53.05^{ab}	57.89^{a}
OM	54.99^{b}	59.08^{a}	56.94^{ab}	60.78^{a}
CP	56.01	56.23	56.21	56.40
CF	58.23	58.45	57.14	57.98
EE	64.41^{ab}	68.90^{a}	63.14^{b}	68.85^{a}
NFE	52.04^{b}	57.70^{ab}	55.07^{ab}	60.54^{a}
Nutritive values:				
TDN %	45.34^{b}	48.09^{a}	46.13^{b}	48.53^{a}
DE Mcal/ kg DM	2.00^{b}	2.12^{a}	2.03^{b}	2.14^{a}
DCP %	3.66^{c}	4.25^{b}	4.48^{ab}	4.64^{a}

a, b, c: Means in the same row with different superscripts differ significantly ($P<0.05$).

* Effective Microorgansmis (EM_1) contained photosynthetics bacteria (Rhadopseudomonas plustris and Rhodobacters phacrodes), lactic acid bateria (Lactobacillus Plantaru, Lactobacillus Case and Streptococcus Lactis), Yeasts (Saccharomyces Cerevisiae) and Actinomycetes (Microhiza) (El-Dosyki et al., 2002).

Moreover, the contents of DM, CP, EE and ash tended to increase, while OM, CF and NFE tended to decrease with urea supplementation to rice straw silage. These results might be due to that urea supplementation may supply the nitrogen required for the microorganisms growth, which degraded the fiber and stimulate the silage fermentation consuming soluble carbohydrate and producing organic acids. Similar results were obtained by Ghanem *et al.* (2005) who found that urea supplementation to rice straw silage decreased OM, CF and NFE contents while increased its CP content.

Also, results in Table (1) showed that the digestibility coefficients of DM, OM and NFE for Giza 177 fresh rice straw silage with EM_1 and urea supplementation was higher significantly ($P<0.05$) than those of Sakha 102 fresh rice straw silage without urea supplementation. However, the digestibility coefficients of CP and CF did not significantly differ among the different kinds of rice straw silage. The TDN, DE and DCP values of Giza 177 fresh rice straw silage with EM_1 and urea supplementation was higher significantly ($P<0.05$) than those of Sakha 102 fresh rice straw silage without urea supplementation. Moreover, nutrients digestibility and nutritive values increased significantly ($P<0.05$) with urea supplementation. These results may be attributed to that Giza 177 variety is leafier than Sakha 102 rice straw variety. These results agreed with those obtained by Wanapat *et al.* (1985) who found that main constrains in rice straw are the low contents of CP and the high content of CF. Djajanegara and Doyle (1989) reported that urea supplementation improved the digestibility of rice straw.

Evaluation of different forms of Giza 177 rice straw variety:

Results in Table (2) revealed that comparing the chemical composition of URS with ARS and RSS showed lower CP content (3.97 vs. 7.13 and 7.47%, respectively) and higher CF content (30.17 vs. 26.81 and 26.16%, respectively). While, RSS had higher NFE content (47.76%) and lower ash content (17.16%) followed by URS (45.61 and 19.00%), but ARS had lower NFE content (43.90%) and higher ash content (20.13%). These results are in accordance with those obtained by Caluya (2001) who found that rice straw is poor quality roughage (92% DM, 3.3% CP, 1.5% ether extract and 32.8% crude fiber). Huber *et al.* (1979) reported that addition of ammonia inhibits the breakdown of plant protein and increases ammonia-N bound in the water-insoluble fractions of the treated silage. Tengyun (2000) showed that rice straw treated with ammonia increased CP content. Also, Gabr (1997) showed that CP content of different rice straw varieties was increased from 4.53 to 8.80% (on the average) after ammoniation, and DM, OM, CF and its fractions of straws were slightly decreased after treatment with ammonia. Meantime, Ghanem *et al.* (2005) indicated that ensiling fresh rice straw with molasses and urea increased its protein content.

Rice straw silage (RSS) recorded significantly ($P<0.05$) the highest digestibility coefficients of all nutrients except EE and subsequently nutritive values followed by ARS, however URS had the lowest values (Table 2). But, ARS had the highest EE digestibility. Rice straw in particular is high in silica, with poor digestibility. Pre-treatment with a source of ammonia such as anhydrous ammonium can greatly enhance the digestibility of rice straw (Liu 1995). Yacout (2001) found higher fat digestibility for ammoniated corn silage. The beneficial effect for improving the nutrients digestibilities of straws after ammoniation could be due to the sufficient ammonia which adheres to the straw to give adequate non-protein-N to the microbes for fermenting the straw since untreated straw is generally deficient in degradable protein to allow efficient digestion of lignocellulosic materials by ruminants (Ørskov, 1987). Also, Wanapat *et al.* (1985) reported that ensiling rice straw with urea for 3 weeks significantly increased the digestibilities of DM, OM, CP and CF.

Table 2: Chemical composition, digestibility and nutritive values of different forms of Giza 177 rice straw variety by sheep.

Item	URS	ARS	RSS*
Chemical composition:			
DM %	86.57	82.01	32.26
Composition of DM %:			
OM	81.00	79.87	82.84
CP	3.97	7.13	7.47
CF	30.17	26.81	26.16
EE	1.25	2.03	1.45
NFE	45.61	43.90	47.76
Ash	19.00	20.13	17.16
Digestibility coefficients %:			
DM	45.30^{c}	52.82^{b}	57.05^{a}
OM	47.08^{c}	54.93^{b}	59.10^{a}
CP	49.58^{c}	57.55^{b}	60.92^{a}
CF	61.65^{c}	65.94^{b}	67.12^{a}
EE	50.31^{c}	68.13^{a}	63.99^{b}
NFE	42.81^{c}	51.08^{b}	53.72^{a}
Nutritive values:			
TDN %	41.51^{c}	47.32^{b}	49.85^{a}
DE Mcal/ kg DM	1.83^{c}	2.09^{b}	2.20^{a}
DCP %	1.97^{c}	4.10^{b}	4.55^{a}

a, b, c: Means in the same row with different superscripts differ significantly ($P<0.05$).
URS = untreated rice straw, ARS = ammoniated rice straw and RSS = rice straw silage.
* Sprinkled with El-Mufeed liquid and EM_1.
Silage qulaity characteristics were pH value 4.12, lactic acid 4.32% of DM, TVFA's 1.39% of DM and NH_3-N 3.48% of total-N.

Feeding trials:

Calculated composition of the experimental rations:

Calculated composition of th experimental rations (Table 3) revealed that DM content of R_3 contained RSS was lower (46.07%) compared with R_1 contained URS and R_2 contained ARS. However, the contents of OM and NFE tended to be lower, but CF, EE and ash tended to be higher in R_2 than R_1 and R_3. The CP content tended to be slightly lower in R_1, while it tended to be higher in R_3. Such results are mainly a reflection of the chemical composition of CFM (Table 3) and the different forms of rice straw (Table 2). These results are in accordance with those obtained by Chinh and Ly (2001) who found that the main constrains in rice straw are the low protein content and higher fiber content.

Table 3: Chemical composition of CFM and calculated composition of the different experimental rations.

Item	DM %	Composition of DM %					
		OM	CP	CF	EE	NFE	Ash
CFM	89.22	90.96	16.56	12.70	4.51	57.19	9.04
Experimental rations:							
R1 (CFM + URS)	88.04	86.61	11.06	16.96	3.08	55.51	13.39
R2 (CFM + ARS)	85.21	85.03	11.52	17.45	3.18	52.88	14.97
R3 (CFM + RSS)	46.07	86.65	11.74	17.02	2.88	55.01	13.35

Nutrients digestibility and nutritive values:

Digestibility coefficients and nutritive values of the different rations are shown in Table (4). The digestibility coefficients of DM for R_3 and OM, CP and NFE and (subsequently TDN, DE and DCP values) were significantly (P<0.05) higher for R_2 and R_3 compared to R_1. However, CF and EE digestibilities were nearly similar for the different rations. The TDN and DCP values of R_1, R_2 and R_3 were 57.22, 6.40; 58.92, 7.42 and 59.96, 7.67%, respectively. These results agreed with those obtained by Liu *et al.* (1992) and Liu (1995) who found that ammonia treatment improved the digestibility and nutritive value of rice straw. Ghanem *et al.* (2005) reported that cows fed ration contained fresh rice straw silage showed digestibility coefficients and nutritive value nearly similar to ration contained 25 kg fresh berseem and 1 kg EL-Mufeed.

Table 4: Nutrients digestibility and nutritive values of the different experimental rations by lactating buffaloes.

Item	Experimental rations		
	R1	R2	R3
Digestibility coefficients %:			
DM	60.27^{b}	62.65^{ab}	64.35^{a}
OM	62.59^{b}	64.62^{a}	66.37^{a}
CP	57.87^{b}	64.44^{a}	65.35^{a}
CF	47.40	49.35	48.58
EE	78.25	78.97	78.78
NFE	67.21^{b}	70.36^{a}	70.69^{a}
Nutritive values:			
TDN %	57.22^{b}	58.92^{a}	59.96^{a}
DE Mcal/ kg DM	2.52^{b}	2.60^{a}	2.64^{a}
DCP %	6.40^{b}	7.42^{a}	7.67^{a}

a, b, c: Means in the same row with different superscripts differ significantly (P<0.05).
R1= CFM + URS, R2= CFM + ARS and R3= CFM + RSS.

Feed intake:

Average daily feed intake by lactating buffaloes are presented in Table (5). Buffaloes fed R_1 showed the highest intake of CFM compared with those fed R_2 and R_3. Ammoniation of rice straw increased the intake of rice straw by 2 kg. Moreover, lactating buffaloes fed R_1 recorded significantly (P<0.05) the highest DM intake and the lowest DCP intake, followed by those fed R_2, while those fed R_3 showed the opposite trend. However, the intake of TDN and DE were nearly similar for the different rations. Pre-treatment with a source of ammonia can greatly enhance the intake of straw (Liu, 1995). Ghanem *et al.* (2005) showed that DM intake by cows fed ration contained fresh rice straw silage was lower than for those fed ration contained fresh berseem.

Rumen liquor parameters:

Rumen liquor parameters of lactating buffaloes fed the different forms of rice straw are shown in Table (5). The pH value was nearly similar for the different groups, however buffaloes fed R_3 recorded significantly (P<0.05) the highest concentrations of TVFA's and ammonia-N followed by those fed R_2, while buffaloes fed R_1 had the lowest concentrations. These results agreed with those obtained by Bassuny *et al.* (2003) who found that ammonia treared rice straw improved rumen fermentation efficiency.

Table 5: Average daily feed intake and rumen liquor parameters of lactating buffaloes fed the different experimental rations.

Item	Experimental rations		
	R1	R2	R3
Feed intake:			
CFM* (kg)	10.00	8.00	8 00
Untreated rice straw* (kg)	8.00	-	-
Ammoniated rice straw* (kg)	-	10	-
Rice straw silage* (kg)	-	-	25
DM (kg)	15.85^{a}	15.34^{ab}	15.20^{b}
TDN (kg)	9.07	9.04	9 11
DE (Mcal)	39.94	39 88	40.13
DCP (kg)	$1\ 01^{b}$	1.14^{a}	1.17^{a}
Rumen liquor parameters:			
pH	7.05	7 15	7 05
TVFA's (meq / 100 ml)	16.45^{c}	$19\ 32^{b}$	22.24^{a}
NH_3-N (mg / 100 ml)	12.60^{b}	14.47^{ab}	$15\ 87^{a}$

a, b, c: Means in the same row with different superscripts differ significantly (P<0.05).
* as fed.
R1= CFM + URS, R2= CFM + ARS and R3= CFM + RSS.

Milk yield and composition:

Average daily milk yield and composition for lactating buffaloes fed the different rations are shown in Table (6). Average daily yield of actual milk and 7% FCM were significantly (P<0.05) higher for lactating buffaloes fed R_2 and R_3 compared to those fed R_1. The yield of 7% FCM for R_2 and R_3 increased by 9.83 and 12.77% compared with R_1, respectively. However, there were no significant (P<0.05) differences detected in milk composition among buffaloes fed the different rations.

Table 6: Average daily milk yield and composition of lactating buffaloes fed the different experimental rations.

Item	Experimental rations		
	R1	R2	R3
Actual milk yield (kg)	7.90^{b}	8.62^{a}	8.94^{a}
7% FCM yield (kg)	7.83^{b}	8.60^{a}	8.83^{a}
Milk composition %:			
Fat	6.92	6.98	6.88
Protein	4.41	4.48	4.49
Lactose	5.32	5.40	5.39
Solids not fat	10.37	10.48	10.50
Total solid	17.29	17.46	17.38
Ash	0.64	0.60	0.62

a, b: Means in the same row with different superscripts differ significantly (P<0.05).
R1= CFM + URS, R2= CFM + ARS and R3= CFM + RSS.

These results agreed with those obtained by Erying *et al.* (1995) who found that feeding ammoniated wheat straw increased milk yield of cows. While, Ghanem *et al.* (2005) found that milk yield of Friesian cows fed ration contained fresh rice straw silage was nearly similar to that of those fed ration contained fresh berseem.

Feed conversion:

Data in Table (7) showed that buffaloes fed R_2 and R_3 had better feed conversion than those fed R_1. The quantities of DM, TDN and DE required to produce 1 kg 7% FCM were significantly higher ($P<0.05$) for buffaloes fed R_1 compared with those fed R_2 and R_3. However, the quantity of DCP required to produce 1 kg 7% FCM was nearly similar for buffaloes fed the different tested rations. These results are in agreement with those obtained by Ying *et al.* (1993) who reported that ammoniated rice straw improved feed conversion. Ghanem *et al.* (2005) found that cows fed ration contained fresh rice straw silage showed better feed conversion.

Table 7: Feed conversion and economic efficiency of lactating buffaloes fed the different experimental rations.

Item	Experimental rations		
	R1	R2	R3
Feed conversion:			
DM kg / kg FCM	2.02^a	1.78^b	1.72^b
TDN kg / kg FCM	1.16^a	1.05^b	1.03^b
DE Mcal / kg FCM	5.10^a	4.64^b	4.54^b
DCP g / kg FCM	128.99	132.56	132.50
Economic efficiency:			
Average daily feed cost (LE)	11.20^a	9.98^b	9.48^b
Feed cost (LE)/ kg FCM	1.43^a	1.16^b	1.07^b
Output of daily milk yield (LE)	19.75^c	21.55^a	22.35^a
Average daily net output (LE)	8.55^b	11.57^a	12.87^a
Net output improvement %	100.00^b	135.32^a	150.53^a

a, b, c: Means in the same row with different superscripts differ significantly ($P<0.05$).
R1= CFM + URS, R2= CFM + ARS and R3= CFM + RSS.
The prices in Egyptian pound (LE) per ton were 1060 for CFM, 75 for URS, 150 for ARS, 40 for RSS and 2500 for buffalo milk.

Economic efficiency:

Concerning economic efficiency, average daily feed cost and feed cost / 1 kg 7% FCM were significantly ($P<0.05$) higher, while the output of average daily milk yield, net output and net output improvement were significantly ($P<0.05$) lower for buffaloes fed R_1 compared with those fed R_2 and R_3 (Table 7). Average daily feed cost for buffaloes fed R_2 and R_3 decreased by 10.89 and 15.36% compared with those fed R_1. Moreover, the average daily net output for buffaloes fed R_2 and R_3 increased by 35.32 and 50.53% compared with those fed R_1. These results may due to decreasing CFM intake by 2 kg (20%) and increasing average daily milk yield by 0.72 and 1.04 kg (9.11 and 13.16%) for buffaloes fed R_2 and R_3 compared with those fed R_1 as shown in

Tables (5&6). Since feed costs are the major part of production costs, an increase in the use of indigenous feed resources is an important way of helping farmers to reduce their costs. These results are in accordance with those obtained by Ying *et al.* (1993) and Liu *et al* (1995) who found that ammoniated rice straw diet markedly reduced the need for concentrates and decreased the feed cost. Ghanem *et al.* (2005) reported that cows fed ration contained fresh rice straw silage revealed the lowest feed cost and the highest economic efficiency.

Conclusion:

From these results it could be concluded that using ammoniated rice straw or rice straw silage for feeding lactating buffaloes led to reduced CFM intake by 20% daily, decreased daily feed cost by 10-15%, increased daily milk yield by 9.11-13.16%, economic efficiency and limitation of the environemntal pollution as a result of accumulation of rice or burn rice straw in the fields.

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الإستفادة من قش الأرز فى تغذية المجترات:
٢ – الأداء الإنتاجى للجاموس الحلاب المغذى على سيلاج قش الأرز

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أجرى التقييم الغذائى لسيلاج قش الأرز على صنفين هما سخا ١٠٢ و جيزة ١٧٧ مع إضافة المولاس والمنشط الحيوى (EM_1) مع أو بدون إضافة اليوريا وكذلك قش الأرز الغير معامل أو المعامل بالأمونيا وسيلاج قش الأرز المضاف إليه المفيد والمنشط الحيوى باستخدام الكباش الخليط (أوسيمى & فنلندى). كذلك أجريت تجربة تغذية على ١٢ جاموسة حلابة فى مواسم الحليب من الثالث الى الخامس متوسط وزنها ٥٥٠-٦٥٠ كجم بعد ٨ أسابيع من الولادة باستخدام تصميم العودة إلى بدء لثلاث معاملات وثلاث فترات تجريبية. غذيت حيوانات المجموعة الأولى على عليقة المقارنة والتى تتكون من مخلوط العلف المركز وقش الأرز غير المعامل، أما حيوانات المجموعة الثانية غذيت على مخلوط العلف المركز وقش الأرز المعامل بالأمونيا بينما غذيت المجموعة الثالثة على مخلوط العلف المركز وسيلاج قش الأرز.

توضح النتائج أن سيلاج قش الأرز مع إضافة المنشط الحيوى واليوريا لصنف جيزة ١٧٧ أظهر زيادة معنوية فى معاملات هضم لكل من المادة الجافة والمادة العضوية والمستخلص الخالى من الأزوت وبالتالي محتوى كل من المركبات الغذائية المهضومة والطاقة المهضومة والبروتين المهضوم. علاوة على ذلك أدت إضافة اليوريا إلى ارتفاع معاملات الهضم والقيم الغذائية معنويا لسيلاج قش الأرز. أظهر سيلاج قش الأرز معنويا أعلى معاملات لهضم العناصر الغذائية فيما عدا المستخلص الاثيرى وبالتالى القيم الغذائية يليه قش الأرز المعامل بالأمونيا.

إرتفاع معاملات هضم كل من المادة الجافة للعليقة الثلثة والمادة العضوية والبروتين الخام والمستخلص الخالى من الأزوت وبالتالى محتوى كل من المركبات الغذائية المهضومة والطاقة المهضومة والبروتين المهضوم معنويا للعليقتين الثانية والثالثة بالمقارنة بالعليقة الأولى. بينما معاملات هضم كل من الألياف الخام والمستخلص الاثيرى متماثلة تقريبا للعلائق المختلفة.

زيادة المأكول من العلف المركز والمادة الجافة وإنخفاض المأكول عن البروتين المهضوم بواسطة الجاموس الحلاب المغذى على العليقة الأولي عن العليقتين الثانية والثالثة. بينما المأكول من المركبات الغذائية المهضومة والطاقة المهضومة متماثل تقريبا للمجاميع المختلفة. أظهرت الدراسات على سائل الكرش إرتفاع تركيز كل من الأحماض الدهنية الطيارة الكلية و نيتروجين الأمونيا معنويا فى المجموعة الثالثة تلتيا المجموعة الثانية بينما حققت المجموعة الأولى أقل تركيزات.

إرتفاع انتاج اللبن للجاموس المغذى على العليقتين الثانية والثالثة معنويا عن تلك المغذاة على العليقة الأولى. بينما لا توجد اختلافات معنوية فى تركيب اللبن بين المجموعات المختلفة. أظهر الجاموس الحلاب المغذى على العليقتين الثانية والثالثة تحسن فى معدل التحويل الغذائى لكل من المادة الجافة والمركبات الغذائية المهضومة والطاقة المهضومة مقارنة بتلك المغذاة على العليقة الأولى. إرتفاع تكلفة التغذية اليومية تكلفة التغذية لإنتاج ١ كجم لبن معدل الدهن ٧% وانخفاض العائد من إنتاج اللبن والعائد الصافى ومقدار تحسن العائد معنويا للجاموس الحلاب المغذى على العليقة الأولى بالمقارنة بتلك المغذاة على العليقتين الثانية والثالثة.

نستخلص من هذه الدراسة أن استخدام قش الأرز المعامل بالأمونيا أو سيلاج قش الأرز فى تغذية الجاموس الحلاب يقلل كمية مخلوط العلف المركز بمعدل ٢٠% يوميا لكل حيوان وبالتالى تقل تكلفة التغذية اليومية بمعدل ١٠-١٥%، بينما أدى إلى زيادة متوسط إنتاج اللبن اليومى بمعدل ٩,١١-١٣,١٦% والكفاءة الاقتصادية، علاوة على تقليل التلوث البيئى الناتج عن تراكم قش الأرز أو حرقه فى الحقل.