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Effect of Supplementation with Non-Conventional Feeds on Feed Intake and Body Weight Change of Washera Sheep Fed Urea Treated Finger Millet Straw

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ABSTRACT

This study was conducted at Bure Agricultural college during 2010. The objectives of the study were to evaluate the effect of supplementation with noug seedcake (NSC), wheat bran (WB) and their mixtures on feed intake and live weight change of growing lambs. Twenty five growing Washera lambs with initial live weight of 17.8 ± 1.72 (mean $\pm$ SD) were used in feeding trial were used. The lambs were blocked based on their initial live weight and randomly assigned to one of the five treatments, giving five animals per treatment. The treatments consisted of feeding of sole urea treated finger millet straw as control (T1) and supplementation of the basal diet with mixtures of NSC & WB at 100:0, 70:30, 30:70 and 0:100% for T2, T3, T4 and T5, respectively. The level of supplementation was 300 g/d on dry matter (DM) basis. Supplementation of NSC, WB and their mixtures significantly increased the intake of total DM (743-843 g/d) and total CP (99-134.34 g/d) when compared to control (589.49g/d) and (49.4 g/d) respectively. Lambs in control group consumed higher urea treated millet straw DM (589.49g/d) as compared to the supplemented treatments (443-543 g/d). Supplementation of urea treated millet straw with concentrates (T2-T5) promoted higher daily weight gain which ranged between 50.2-71.3 g/day. Among the supplemented treatments, lambs supplemented with the higher proportion of WB (70%) in T4 and sole WB (100%) in T5 gained more weight than the lambs in T2 and T3. Therefore, it could be concluded that supplementation of sole WB (T5) and mixtures of 70% WB + 30% NSC (T5) could be recommended as optimal level for better utilization of nutrients and animal performance on a given basal diet.

INTRODUCTION

In the highlands of Ethiopia, natural pasture forms the major source of livestock feed and crop residues and industrial by-products are considered as dry season supplements. Even during years of good rainy season, range forage is not sufficient to feed livestock in the highlands for reasons associated with restricted grazing land and poor management. Crop residues, weeds, foliage and fodder fill the gap between the feed supply and demand for livestock production (Tsige-yohannes, 1999).

Almost all crop residues are harvested after the plants reach physiological maturity. As a result, they are high in cell wall and lignin and low in protein and digestible DM (Kossila, 1984). However, as production costs is increasing, livestock producers become more interested in the use of crop residues. It can usefully be incorporated into the diets of sheep and other ruminants by adding supplements of energy, protein and minerals to meet micro-organisms and animal requirements (Ensminger et al., 1990). Thus, it is essential to attempt alternative and relatively cheaper sources of supplements such as agricultural and industrial by-products, and effective roughage treatment techniques.

In the study area, cereal crop residues including finger millet (*Eleusine coracana*) straw and agro-industrial by-products especially wheat bran and noug seedcake (*Guizotia abyssinica*) are easily accessible. However, most of the crop residues, particularly finger millet straw are used indiscriminately by livestock with parts of it trampled by the animals. This indicates that it has not been fully exploited as feed for ruminant production particularly for sheep production due to little or no knowledge of storing, processing, treating or improving its feeding value through incorporation of concentrate supplements.

Therefore, this study was carried out to evaluate the effect of supplementation with noug seedcake, wheat bran and their mixtures on feed intake and live weight change of growing Washera lambs.

MATERIALS AND METHODS

Description of the study area

The study was conducted at Bure Agricultural College in West Gojjam Zone of Amhara Regional State, Ethiopia. As per the information obtained, the study area is located at an altitude range of 700-2350 m.a.s.l. and has annual rainfall range of 1000-1500

mm and the mean minimum and maximum annual temperatures are 17°C and 21°C, respectively.

Experimental feeds preparation and feeding

Finger millet straw was chopped to a size of approximately 2 to 5 cm and stored properly. Urea and concentrate supplements, noug seedcake and wheat bran, were purchased. Two pits were prepared to use alternatively for ensiling purpose. As recommended by Sundstøl (1988) urea solution was prepared in proportions by dissolving 40 g urea in one litre of water and used for treating 1 kg of air dried straw. A polyethylene plastic sheet was used to line the floor and sides of the pit. The uniformly treated and mixed straw was placed sequentially in the pit and compacted batch by batch. Finally, the pit was sealed with plastic sheet and loaded by soil and sand on top to make it airtight for about three weeks. After the ensiling process was completed, the treated stock was aerated for at least 24 hours before it was provided to the animals to eliminate volatile ammonia that causes toxicity.

Experimental animals and their management

Twenty-five male growing Washera lambs were purchased and quarantined for two weeks. During this period, they were treated against internal and external parasites and vaccinated against common sheep diseases. Thereafter, the lambs were weighed and blocked into 5 blocks of five animals per block and kept in individual pens. They were offered urea treated millet straw and concentrate supplements as corresponded (Table 1) to gradually adapt them to the experimental feeds during the 15 days of adaptation period before growth trial was started. After the completion of adaptation period, the growth trial was followed with the mean initial weight of animals 17.8 $\pm$ 1.72 (mean + SD).

Experimental design and treatments

Randomised Complete Block Design was used to conduct the experiment. The initial body weight of lambs was determined after overnight fasting at the beginning of the acclimatization period. The five-treatment diets were randomly assigned to each animal in the block. Dietary treatments were explained in Table 1. The basal diet was offered *ad libitum*, while supplements were offered twice a day in two equal portions at 0800 and 1600 hrs.

Table 1: Experimental treatments

Treatments	Feeds				DM
	UTFMS	NSC (%)	WB (%)	Amount of Daily offer (g)	
Treatment 1	<i>Ad libitum</i>	0	0	0	
Treatment 2	<i>Ad libitum</i>	100	0	300	
Treatment 3	<i>Ad libitum</i>	70	30	300	
Treatment 4	<i>Ad libitum</i>	30	70	300	
Treatment 5	<i>Ad libitum</i>	0	100	300	

DM= Dry matter; NSC = Noug seedcake; UTFMS = Urea treated finger millet straw; WB = Wheat bran

MEASUREMENTS

Feed intake

The evaluation of feed intake was done for about 13 weeks. The amount of feed offered and refused corresponding to each treatment diet from each lamb was recorded daily. Daily feed intake of the experimental animals was calculated on DM bases as the difference between the feeds offered and refused.

Body weight change and feed conversion efficiency

The body weight of each lamb was registered at 10 days interval in the mornings before the beginning of the meal. Average daily body weight change was calculated as the difference between the initial and final live weights of the lambs divided by the number of experimental days. Feed conversion efficiency (FCE) of the animal was determined as the proportion of daily weight gain (g) to the total DM intake (g).

Chemical analysis

Samples of feeds offered and refused were dried in draft oven to a constant weight at 60°C for partial DM determination and milled using laboratory mill to pass through 1 mm screen. Finally, dry matter (DM), ash

and crude protein (CP) were determined according to the procedure of AOAC (1990). Neutral detergent fibre (NDF), acid detergent fibre (ADF) and acid detergent lignin (ADL) were analysed according to the procedure of Van Soest and Robertson (1985).

Statistical analysis

The data obtained on feed intake, body weight change and feed conversion efficiency were subjected to analysis of variance (ANOVA) using the general linear model procedure of SAS (1999) V8. Differences among treatment means were tested using Duncan's multiple range tests.

RESULTS AND DISCUSSION

Chemical composition of experimental feeds

The chemical composition of experimental feeds (Table 2) varied depending on feed type, in which the contents of CP in concentrate feeds were higher than the basal feed, but the fibre fractions (NDF, ADF, and ADL) in concentrate feeds were clearly lower than in the basal feed. The relatively higher content of CP in the concentrate feeds revealed their higher nutritional value to supplement animals on poor quality roughages.

Table 2: Chemical composition of experimental feeds

Feed samples	Chemical composition						
	DM%	OM	ASH	CP	NDF	ADF	ADL
					% DM		
UFMS	93	88	12	4.3	68.8	40.2	15.2
UTFMS (T1)	93.7	88.5	11.5	7.4	65.6	37.8	13.8
NSC (100%) (T2)	92.4	93.1	6.9	32	37.4	30.2	10.8
70% NSC + 30% WB (T3)	91.5	93	7	21.1	35.3	23	8.2
30% NSC + 70% WB (T4)	92.7	89.6	10.4	18.7	40.1	15	7.6
WB (100%) (T5)	92.7	88.7	11.3	17.7	40.4	12.1	5.6

ADF = Acid detergent fibre; ADL= Acid detergent lignin; CP = Crude protein; DM=Dry matter; NDF= Neutral detergent fibre; NSC=Noug seedcake; OM= Organic matter; T= Treatment; UFMS = Untreated finger millet straw; UTFMS = Urea treated finger millet straw; WB=Wheat bran.

The laboratory analysis of basal feed sample showed that the application of urea treatment in the current study resulted in nearly doubling in the percentage units of CP value from 4.3% (untreated) to 7.4% (treated) of the millet straw and tended to decrease the fibre content. The increased CP value of millet straw due to urea treatment was highly comparable with the increased CP value from 4.5% (untreated) to 7.8% (urea treated) for rice straw reported by Abebe (2008). Generally, the chemical compositions (DM, OM, CP, NDF, ADF, ADL and ash) of the experimental feeds used in the current study were within the ranges of chemical compositions of Ethiopian feeds reported by Seyoum et al. (2007).

Dry matter and nutrient intake

Significant differences were observed among treatments in the mean daily DM and nutrient intakes (Table 3). This result was in agreement with the response of sheep fed urea treated wheat straw that improved DM intake from 323 to 566.7 g/d (Getahun, 2006).

The urea treated straw DM intake in the control group (T1) was higher than the treatment groups. This might be associated with the fact that sheep offered with low CP and high NDF content of

UTFMS were attempting to meet their nutrient requirements through the intake of relatively more basal diet. Conversely, sheep supplemented with concentrates had higher total DM intake as compared to control ones (T1) due to the effect of supplementation allowing them to have options for selection and limit intake of the basal diet.

In line with the result of the current study, Butterworth and Mosi (1985) reported higher total DM intake in sheep supplemented with noug seed cake, but decreased intake of the basal diet because of the substitution effects of the concentrate supplements. Among the treatments, T4 had higher DM intake followed by T5, with high proportion of WB supplement. This may indicate that in urea treated crop residues supplementation with feed containing higher energy source is more beneficial than those with high protein content.

In this study, substitution rate of UTFMS with the concentrate supplement was observed at the rate of 0.46, 0.49, 0.15 and 0.23 for T2, T3, T4 and T5, respectively. Type and amount of supplement can affect substitution rate, and it has been generally found that substitution rate increases with the level of supplementation indicating an increased density of nutrient intake above the level that basal diet alone can support (Ponnampalam et al., 2004).

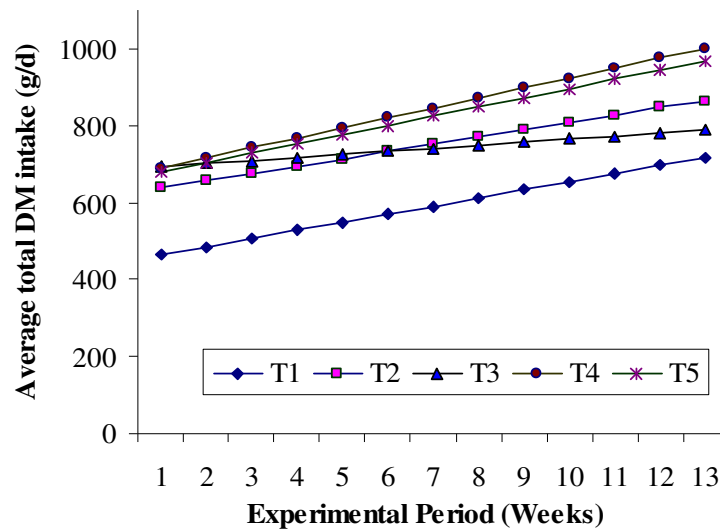


Figure 1: Evaluation of daily dry matter intake of Washera lambs

The total DM intake as percent of body weight (3.3-3.97%) in the current study was significantly different among treatments in a similar manner as DM intake per unit metabolic body weight (Table 3). This result was within the range of total DM intake as percent of body weight (2-6%) recommended by the ARC (1980). Generally, the total daily DM intake in the current study increased with duration of feeding period (Figure 1).

The estimated ME intake (Table 3) indicated that the energy intake in all treatments was above the maintenance ME requirement range of 3.7-4.1 MJ/d estimated for a 20 kg lamb (ARC, 1980). The calculated value was higher in supplemented group (6.6-7.8 MJ/d) as compared to control group (5.04 MJ/d), but among supplemented groups T5 had greater ($P < 0.05$) energy intake (7.8 MJ/d). This might be associated with the relatively higher digestibility and energy content of supplement in T5.

In this study, significantly higher OM and CP intakes were observed in T2, T3, T4, and T5, as compared to the control treatment. These CP and OM intake increments in supplemented lambs could be attributed to increased total DM intake and higher CP and OM contents of NSC, WB and their mixtures. The control diet provided also relatively adequate CP intake to meet the maintenance requirements, this holds true since UTFMS basal diet contained relatively better amount of CP (7.4%) than untreated.

The values of the CP intake in this study were comparable to the CP intake values that ranged from 31.4 to 78.7 g/d reported by Getahun (2006). According to Ranjhan (1997), the average daily protein and energy requirement for maintenance of the sheep weighing 30 kg was reported to be 36 g CP and 4.017 MJ ME, respectively. This indicated that the supplemented sheep in this study had CP intake more than their maintenance requirement and the achieved body weight gain was expected.

Live weight change and feed conversion efficiency

The results of live weight change of experimental animals (Table 5) indicated that Lambs supplemented with concentrate feeds having different CP content had higher daily live weight gains as compared to lambs on the control diet. However, lambs in the control treatment maintained their live weight with a slight gains (5.56 g/d), which agreed with that reported by Masimbiti (2001), where feeding of animals on treated Stover tended to improve their growth rates or weight gains. In agreement with this result, Donovan et al. (1997) reported that the 2-4% CP content of untreated cereal straws was improved to a "potential" CP level of 7-12%, which was sufficient for maintenance of live weight.

Table 3: Live weight change, average live weight gain and feed conversion efficiency in Washera lambs

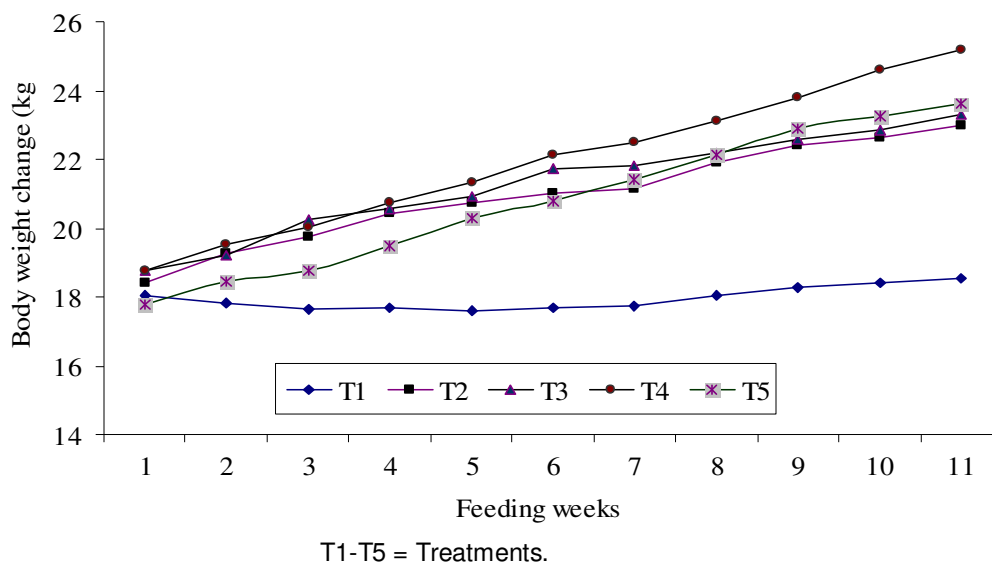
Parameters	T1	T2	T3	T4	T5	SEM	SL
IBW (kg)	18.5	18.4	18.8	18.8	18.3	0.45	NS
FBW (kg)	19 ^b	23 ^a	23.3 ^a	25.2 ^a	24.1 ^a	0.83	***
ADG (g/d)	5.6 ^c	51.1 ^b	50.2 ^b	71.3 ^a	64.7 ^{ab}	5.98	***
FCE	0.01b	0.07a	0.07a	0.08a	0.08a	0.001	***

Means within rows with different superscripts (a-c) are significantly different. * = $P<0.05$; ***= $P<0.001$; NS=Not significant; SEM = Standard error of mean; SL = Significance level; IBW = Initial body weight; FBW = Final body weight; ADG = Average daily gain; FCE = Feed conversion efficiency, T1-T5 = Treatments.

The increased daily weight gain for concentrate supplemented groups of lambs in the present study could be attributed to the higher protein and energy intakes from the supplements. Supplementation improved daily live weight gain, perhaps through providing nutrient available for absorption and/or by enhancing microbial protein synthesis. There was also significant ($P<0.05$) difference between the supplemented groups. Accordingly, the average daily live weight gain recorded by T4 (71.33 g) was higher than that in T2 and T3, but similar with that recorded in T5. This could be attributed to the increased intake of energy and an accompanying improvement in the utilisation of non-protein nitrogen in the urea treated finger millet straw. In line with this study, early work by Munthali et al (1992) showed that soluble carbohydrate enhance microbial growth in the rumen and induced better utilization of non- protein nitrogen, than any

other nutrients, which finally resulted in improvement in body weight gain of growing steers and heifers fed on urea treated maize Stover based diet.

Ensminger (2002) showed that low energy intake that results from either feed restriction or low ration component digestibility prevents sheep from meeting their requirements and from attaining their genetic potential. As documented in Vanes (1979), the quantity of protein together with the energy utilized will determine growth rate of animals. Moreover, Kellems and Church (2002) also documented that supplementation of nitrogen sources will aid to optimize rumen ammonia concentration, but to enhance microbial growth and utilize rumen ammonia efficiently, there is a need to supplement with readily soluble carbohydrate simultaneously so that supplementation strategy synchronizes the rate of ammonia and rate of energy release.

**Figure 2: Evaluation of body weight change across the feeding period**

The trend of weight changes across feeding weeks (Figure 2) revealed that feeding for three months trial time continued to increase the live weight gain of the supplemented groups progressively. The linearly increased body weight change graph also indicated the fact that sole urea treated finger millet straw supported the maintenance and minimal body weight gain of lambs.

Feed conversion efficiency (FCE) obtained in this study was significantly improved in supplemented lambs than control ones. The observed higher FCE in the supplemented group of lambs might be due to the higher CP and energy contents of supplements in providing absorbed nutrients and/or by enhancing the treated straw nutrients utilization. However, no significant difference in FCE among supplemented

diets was observed indicating the fact that nearly similar quantities of feed nutrients might have been utilized for a unit of live weight gain. In agreement with this result, Abebaw & Solomon (2009) reported higher ($P<0.01$) FCE in Sheep supplemented with NSC and its mixtures with Rice bran than the controlled once.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of this research it is concluded that lambs on the controlled diet consumed significantly higher quantity of basal DM than supplemented groups of lambs. However, supplementation of NSC, WB and their mixtures significantly improved the total DMI and total CPI. Feeding with sole urea treated millet straw (T1) fulfilled the nutrient requirements of animals with a slight mean daily live weight gain of 5.56 g/d. However, supplementation (T2-T5) promoted significantly higher daily weight gain (50.2-71.3 g/d) with higher feed conversion efficiency (FCE). Generally, supplementation of NSC, WB, and their mixtures in different proportions to the urea treated basal diet improved total DM and nutrients intake, and it also improved the growth performance and feed conversion efficiency of Danigla lambs over the control group. But, T4 and T5, which had better daily weight gain and feed utilization, could be the primary choices than other supplemented groups. Therefore, it is recommended that supplementation of sole WB (T5) and mixtures of (70% WB + 30% NSC) (T4) could be as optimal levels than other treatments for better utilization of nutrients and animal performance in Washera lambs fed on urea treated millet straw basal diet.

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REFERENCES

Abebaw Nega & Solomon Melaku, (2009). Feed intake, digestibility and body weight change in Farta sheep fed hay supplemented with rice bran and/or noug seed (*Guizotia abyssinica*) meal. *Trop Anim Health Prod* 41:507–515

Abebe Hailu (2008). Supplementation of graded levels of concentrate mix on Feed Intake, Digestibility, Live Weight Change and Carcass Characteristics of Washera Sheep Fed Urea Treated Rice Straw. MSc. Thesis, Haramaya University, Dredawa, Ethiopia.

AOAC (1990). Methods of analysis, 15th ed.; Association of Official Analytical Chemists, AOAC. INC., Arlington, Virginia, USA.

ARC (Agricultural Research Council), (1980). The Nutrient Requirements of Ruminant Livestock. Technical Review by an Agricultural Research Council Working party published on behalf of the Agricultural research council by the commonwealth Agricultural bureaux.

Butterworth MH and Mosi AK, (1985). The voluntary intake and digestibility of oat straw and maize Stover by sheep supplemented with different levels of noug (*Guizotia abyssinica*) meal. *Animal Feed Science and Technology*. 24: 14-17.

Donovan PBO, Soomro FM, Wagenaar JP, Shafiq-ur-Rehman and Bukhari FA, (1997). Urea treatment of straw: a farmer - friendly system improved upon in Balochistan. *Livestock research for rural development*. V 9, # 5.

Ensminger ME, Oldfield JE and Heinemann WW, (1990). Feeds and nutrition, 2nd ed. The Ensminger publishing company, USA.

Ensminger, ME, (2002). Sheep and Goat science, 6th ed. Interstate publishers, inc, USA. 693p.

Getahun Kebede, (2006). Effect of urea-treatment and leucaena (*Leucaena leucocephala*) supplementation on the utilization of wheat straw as feed for sheep. MSc. Thesis, Haramaya University, Dredawa, Ethiopia.

Kellems RO and Church DC, (2002). Livestock feeds and feeding 5th ed. Pearson Educational limited. Upper Saddle River, New Jersey.

Kossila, VL, (1984). Location and potential feed use. In F. Sundstol and E. Owen (editors), *Straw and other fibrous by-products as feed*. Elsevier, Amsterdam.

Masimbiti W, (2001). utilization of urea treated maize Stover in rations for dairy cows in Zimbabwe. M.Sc. thesis. Swedish university of agricultural sciences department of animal nutrition and management.

Munthali JTK, Jayasuriya CN and Bhattacharya AN, (1992). Effects of urea treatment of maize Stover and supplementation with maize bran or urea-molasses block on the performance of growing steers and heifers. pp. 279-286. IN: proceeding of first biennial conference of the complementary of feed resource for animals production December 1990 Ilca, Lilongwe, Malawi.

Ponnampalam EN, Dixon RM, Hosking BJ and Egan AR, (2004). Intake, growth and carcass characteristics of lambs consuming low digestibility hay and cereal grains. *Animal Feed Science and Technology*. V 114: 31-41.

Ranjhan SK, (1997). *Animal Nutrition in the Tropics*. 4th ed. Vikas publishing house Pvt. Ltd., New Delhi, India.

SAS (Statistical Analysis System), (1999). V8. SAS Institute Inc., Cary, NC, USA.

Seyoum Bedye, Zinash Sileshi and Dereje Fekadu, (2007). Chemical composition and nutritive value of Ethiopian feeds. Ethiopian Institute of Agricultural Research (EIAR), Research Report 73.

- Sundstøl, F, (1988). Improvement of poor quality forage and roughages. In: E.R., Ørskov (ed.), World Animal Science, (Elsevier, Amsterdam).
- Tsigeyohannes Habtie, (1999). Livestock feed security and associated impacts on sustainable agriculture development. pp. 51-61. Proceedings of the 7th annual conference of the Ethiopian society of animal production (ESAP) on livestock production and the environment implications for sustainable lively hoods. Addis Ababa, Ethiopia, 26-27 May 1999.
- Vanes, AJH., (1979). Evaluation of feeds overall application. pp. 15-24. Pigden, W.J., Balch, C.C. and N.Graham (eds). Standardization of analytical methodology for feeds. Ottawa, Canada.
- Van Soest PJ and Robertson JB, (1985). Analysis of forages and fibrous feeds. Laboratory Manual for Animal Science, Vol. 613. Cornell University, New York.

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