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EFFECT OF BIOLOGICALLY TREATED DATE SEEDS ON SHEEP PERFORMANCE

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ABSTRACT*: This study was carried out to investigate the effects of utilizing date seeds, either un-treated or biologically-treated and urea-treated on sheep performance. Thirty two growing lambs were randomly assigned to one of the following rations: diet 1 (T1) consisted from 40% wheat straw (WS) plus 60% concentrate feed mixture (CFM); diet 2, 3 and 4 (T2, T3 and T4) consisted from 40% WS plus 60% CFM from which partially (25%) was replaced by date seeds (either un-treated, DS; biological-, BDS or urea-treated, UDS). The results revealed that treating date seeds with urea or biologically led to a marked increase in CP contents form 7.31 in DS to 15.61 and 21.72% in UDS and BDS, respectively. Average final body weight was 42.37, 43.23, 45.04 and 43.41kg for the groups T1, T2, T3 and T4, respectively. Digestibility of CP was higher for the treated DS (with either treatment) than both control and untreated DS groups. The TDN value was almost equal in all the diets containing DS both treated (67.66 and 65.92%) or untreated (67.54%) in comparison with the control diet (64.31%; without DS).*

***Key words**:* **Date seed, Biological treatments, Sheep, Digestibility, Performance.**

INTRODUCTION

The local limited supply of good quality feedstuffs such as corn and soybean meal for the animal feeding has resulted in a continuous increase in the cost of production. Therefore, owing to the shortage and high cost of feedstuffs, it became necessary to use the agriculture by-products as substitution feedstuffs. Date production in Egypt has been steadily increased over the last 30 years. In 1997, there were about 8 million palm trees producing almost 740 thousand tons date per year (Ministry of Agric., 1997). Date seeds, called stones, pits, kernels or pips as part of the integral date fruit compose about 30% of the date fruit and that represented about 222 thousand tons which are wasted annually. Four million metric tons of palm kernel cakes were produced in the world in 2002 with annual growth of 15% within the last two decades (FAO, 2002). Several research workers have described the value of date waste as feedstuff and detailed information has been reported by different authors (Aduku *et al*., 1988; Gualtieri and Rapaccini, 1990; Agunbiande *et al*., 1999; Chin, 2000; Sundu and Dingle, 2004).

Biological treatment is a new method for improving the nutritive value of lignocelluloses materials which are the most abundant in agricultural residues (El-Sayed *et al*., 2002). The biological treatments include bacterial, fungal and enzymatic additives. Each microbial species possesses a unique combination of characteristics, including substrates utilized, types and ratios of fermentation products, and growth yield (Falcon *et al*., 1995; Weimer, 1996).

The present study was conducted in order to evaluate the effect of biological treatment on digestibility, nutritive value and N- balance of date seeds containing diets. Growth performance of growing lambs fed the treated diets was also studied.

MATERIALS AND METHODS

Thirty two growing Ossimi lambs with 27 kg average body weight were used in this study. Animals were divided randomly into four comparable groups according to their live body weight, each group contains eight animals. Sheep were fed to meet their requirements of DM according to (NRC, 1980). The experiment lasted 5 months (150 days). Lambs were weighed monthly in the morning before feeding; and fasting weights were recorded. Animals were randomly assigned to one of the experimental rations (Table 1). Allowance of the rations was offered to all animals twice a day at 8 a.m. and 2 p.m. in equal portions. Daily feed allowances were changed quantitatively according to the change in body weight. Daily feed allowances were completely consumed by lambs during the experimental period. Feed conversion ratio (kg feed/kg gain) was calculated monthly. Water was offered freely all the day.

The biological treatment (microorganisms; *Trichoderma reesei* F-616, *T. harzianum* F-416, *T. viride* F-614 and *saccharomyces cerevisiae* F-25) were obtained from Microbial Chemistry Department, National Research Center, Giza, Egypt. The organisms were maintained on Potato Dextrose Agar (PDA) medium. Fungal strains were cultured in a medium contained (g/l): yeast extract, 3.0, malt extract, 3.0, peptone, 5.0 and glucose 10.0. Fifty ml of the previous medium were introduced in 250 ml conical flask; the flasks were autoclaved at 121°C for 15 minutes. Sterilized flasks were inoculated with a loop of 3 day old cultured fungus. The flasks were incubated on a rotary shaker (150 rpm) at 28±2°C for 48 hrs. The growing fungal mycelia were used to inoculate the diets of experiment 1, at 10% (v/w). Five liter capacity conical flasks, each containing 200g sterilized by-product (crushed date seeds) were moistened at 1:2 (solid: liquid) with the nutrient solution containing (g/l): urea, 10; ammonium sulphate, 10; potassium di-hydrogen phosphate, 0.5 and magnesium sulphate, 1; initial *p*H value of the salt solution were adjusted to be 5.5. The flasks inoculated with the previously prepared by-products inoculums at 10% (w/w). The flasks were incubated at room temperature for 5

days. Ten kg of the tested by-product was moistened at solid: liquid ratio of 1:2 with the nutrients (g/l): urea, 15; ammonium sulphate, 15; phosphoric acid, 10 and magnesium sulphate 5. The previous amount was mixed with the above prepared inoculums at 10% (w/w). The inoculated by-product was introduced in polyethylene bags (60×90cm) and left for 7 days in room temperature. After the 7 days, the above fermented by-product was mixed with other 90 kg of moistened by-product and left in closed room for 7 more days, then added to 150 kg material by-product and incubated in the same room for other 10 days. At the end of the preparation period, the treated by-product was air dried until the moisture content reached less than 10%.

Table 1: Composition of the experimental diets

Ingredient[1]	Dietary treatments			
	T1	T2	T3	T4
WS	40	40	40	40
CFM	60	45	45	45
DS	-	15	-	-
BDS	-	-	15	-
UDS	-	-	-	15
Total	100	100	100	100

***WS, wheat straw; DS, untreated date seed; UDS, urea-treated date seed; BDS, biologically-treated date seed; CFM, concentrate feed mixture**

Three rams from every group were used in the digestibility trial. The rams were fed individually in digestion metabolic cages as described by Maynard *et al.* (1979) for separate collection of feces and urine. Diets offered twice daily at 8.00 am and 2.00 pm, water was available at all times throughout the experimental period. The experimental period consisted of 7 days preliminary period and another 6 days for quantitative collection of feces and urine. Feces were oven-dried overnight; samples of feces of 6 days collections were composited and stored in polyethylene bags until analysis. Urine was collected in containers containing 50 ml of HCl (10%) and composited for the 6 days collection period and refrigerated till analysis of total nitrogen.

The proximate analysis of the feedstuffs and feces samples was determined according to the official methods of analysis of the association of official agricultural chemists AOAC (1990).

Data were statistically analyzed using SPSS (1999) analysis program version 11. The significant differences among individual means were analyzed by Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Table (2) presents the proximate analysis of the ingredients used in the formulation of the experimental diets. Treating date seeds with urea or biologically led to a marked increase in CP contents form 7.31 in the untreated DS to 15.61 and 21.72% in urea- or biologically-treated date seeds (UDS and BDS), respectively. The treatments also caused a decrease in the CF, NFE and ash contents; CF decreased from 14.12% in DS to 10.02 and 13.22% in BDS and UDS, respectively. The corresponding values for NFE were 67.65, 59.01 and 62.60%; and 5.89, 2.69 and 3.03% for ash contents. Many investigators reported almost similar proximate analysis of date seeds (Abou El-Nasr, 1985; Khamis *et al*., 1989; Abou-El-Nor et al., 1995; Allam *et al*., 1997).

The chemical composition of the experimental diets is presented in Table (3). The diets were almost equal in all contents except for the CP which was higher in BDS (10.15%) and UDS (9.21%) than the controls either without DS (T1, 8.8%) or with untreated DS (T2, 8.10%). The increase in the CP contents was mainly due to the treatments of DS.

Table 2: The proximate analysis of the ingredients used in this study (On DM basis)

Item	Ingredients*				
	WS	DS	BDS	UDS	CFM
DM	100	100	100	100	100
OM	84.03	94.11	97.31	96.97	90.92
CP	4.01	7.31	21.72	15.61	11.72
EE	1.11	5.03	6.56	5.54	1.79
CF	40.01	14.12	10.02	13.22	12.81
NFE	38.9	67.65	59.01	62.60	64.60
Ash	15.97	5.89	2.69	3.03	9.08

***WS, wheat straw; DS, untreated date seed; BDS, biologically-treated date seed; UDS, urea-treated date seed; CFM, concentrate feed mixture.**

Table 3: The proximate analysis of the experimental diets

Item	Dietary treatments*			
	Control T1	DS T2	BDS T3	UDS T4
DM	100	100	100	100
OM	88.20	88.65	88.70	89.10
CP	8.80	8.10	10.15	9.21
EE	1.52	1.55	2.22	2.08
CF	23.70	23.95	23.35	23.80
NFE	54.18	55.05	52.98	54.01
Ash	11.80	11.35	11.30	10.90

***T1, control diet; T2, diet containing untreated DS; T3, diet containing biologically treated DS; T4, diet containing urea-treated DS.**

The effect of feeding the experimental rations on the change in live body weight of growing Ossimi lambs is illustrated in Fig (1). Average initial body weights were 27.5, 26.75, 25.68 and 27.12kg in groups T1, T2, T3 and T4, respectively. The corresponding average final body weight was 42.37, 43.23, 45.04 and 43.41kg. Differences did not reach a significant level. Al-Dabeeb (2005) reported that incorporation of dates at 10 or 20% of the concentrate diet did not show an improvement in body weight or growth rate when compared with control group. However, Awadalla *et al*. (2002) indicated that the control lambs reached higher body weight (P<0.05) by the end of the experiment by 9 and 11.9% than lambs fed on 25% or 50% date seeds diets, respectively. Similar trends were observed for average daily gain and relative growth rate.

The overall sheep performance is presented in Table (4). Total feed intake during the 5 month experimental was 179.9, 184.9, 200.4 and 184.8 kg DM. It is worthy to note that feed intake was restricted to the allowance reported in NRC (1980) . Total body weight gain was higher (19.36kg) for group T3 than the other groups (14.87, 16.48 and 16.29 kg for T1, T2 and T4, respectively). The feed conversion ratio was better with BDS group (10.35) than with the other groups being 12.1 (group T1), 11.22 (T2) and 11.34 (T4). Differences at the whole experimental period were significant.

Fig. 1: Change in body weight of growing lambs as affected by dietary treatment

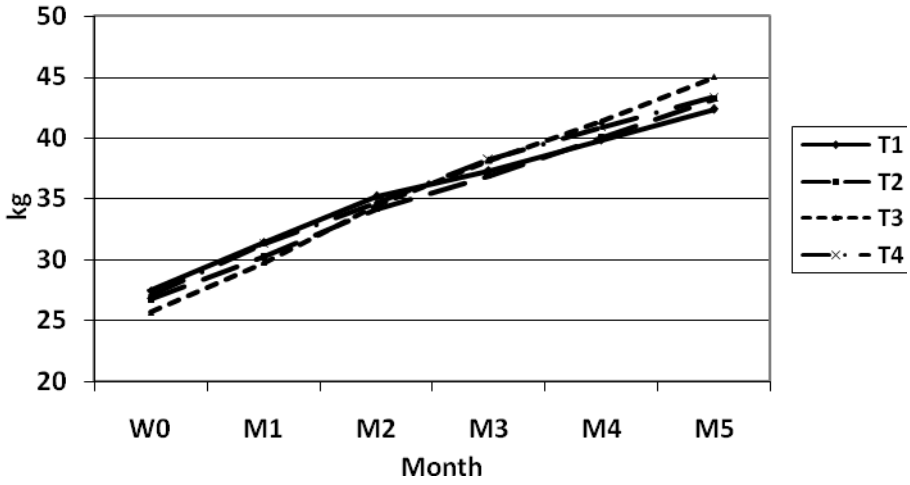

Table 4: Average productive performance of growing lambs as affected by the dietary treatments (mean ± SE)

Item	Control T1	DS T2	BDS T3	DSU T4	Sig.
No of animals	8	8	8	8	
Experimental period, d	150	150	150	150	
Feed intake, kg	179.9	184.9	200.4	184.8	
Body weight gain, kg	14.87^{a} ± 1.41	16.48^{ab} ± 1.27	19.36^{b} ± 1.11	16.29^{ab} ± 1.33	0.05
Average daily gain g/d	99^{a} ± 9.40	109.9^{ab} ± 8.47	129.1^{b} ± 7.04	108.6^{ab} ± 8.87	0.05
Feed conversion, kg feed/kg gain	12.10	11.22	10.35	11.34	

**T1, control diet; T2, diet containing untreated DS; T3, diet containing biologically treated DS; T4, diet containing urea-treated DS.

[a,b], means having different superscripts within each row are significantly different (P<0.05)

Similar results were obtained by Younis and Alwash (1981) who reported that the daily gain of Awassi lambs were improved when 50% crushed date seeds were incorporated into a concentrate mixture supplemented with urea and molasses in rations containing a concentrate mixture and alfalfa. On the other hand Umunna *et al*. (1994) reported that average daily gain was not significantly affected by increasing levels of date seeds meal (0, 33, 66 and 100%) to substitute maize as a source of energy in diets of sheep. Salem (1998) reported that average daily gains were 151.3 and 142.0 g/h/d for sheep fed date stone with 2 levels of broiler litter in comparison with 129.3g/h/d for the control. The highest ADG was obtained with lambs fed the biologically treated DS (group T3); it was reported during the whole period of growth. This means that lambs under the BDS feeding system continue to grow at a faster rate than the other groups. The treatment may have a growth promotion effect due to, at least in part, the biological treatments.

It should be reminded that feed intake was fixed at the allowance specified by NRC (1980) therefore; it was expected for feed intake to vary between treatment groups as the body weight changes. Salem (1998) showed that the dry matter intake of lambs in the rations containing date seeds was significantly higher than the others. Abd El-Rahman (2001) found an increase in average feed intake in ground date seeds-fed group than control ones and attributed such increases to the physical form of the diet. On the other hand, Awadalla *et al*. (2002) indicated that feed and nutrients intake as DM, TDN or DCP decreased ($P<0.05$) due to date seeds feeding. Al-Ani *et al*. (1991) found that feed conversion (kg DM/kg gain) were improved as result of feeding sheep on ration containing 15% dried date pulp compared to the control diet. The performance of crossbred ewes and does fed a mixture of 40% DS, 40% olive pulp and 20% concentrate mixture as a supplementary ration after grazing, compared with the control group which received 65% Berseem hay (BH) and 35% concentrate mixture was studied by Salama *et al*. (1993). They reported better feed conversion with date seed containing diets.

Table (5) reveals the effect of dietary treatments on digestion coefficient of the experimental rations fed to Ossimi sheep. Differences were statistically significant ($P<0.05$). Digestibility of DM was almost equal in the date seed diets (T2, T3 and T4) and being higher than the control (without DS). Digestibility of OM followed the same pattern. However, digestibility of CP was higher for the treated DS (with either treatment) than both control and untreated DS groups. Digestibility of EE was better ($P<0.05$) for the three date diets than the control. The NFE digestibility was higher for untreated DS than the other three groups. Digestion coefficients reported herein are within those reported by many other investigators (Abou El-Nasr, 1985; Khamis, 1988; El-Sayed, 1994). Abou El-Nor et al., (1995) found that digestion coefficient of DM, OM, CP, CF, EE and NFE were higher in rations composed of berssem hay (BH) 40% + 30% date seeds (DS)+ 30% concentrate mixture

(CM) than those contained 100% BH or 70% BH + 30% DS. Allam *et al*. (1997) found no differences in OM, CP, CF, EE and NFE digestibility among cows fed corn, 50% date seed, 50% ammoniated date seeds and 100% ammoniated date seed ration. Salem (1998) shown that the digestibility of crude protein, crude fiber, ether extract and nitrogen-free extract were significantly higher in rations containing date seeds compared to others. On the other hand, El–Kedrawy *et al*. (1998) observed no significant differences in digestibility of nutrients, or nutritive value when ground date seeds (GDS) represented 5 or 10% of the diet in fattening Najdi sheep; these values decreased significantly with 15% GDS.

Table 5: Nutrient digestibility of the experimental diets as affected by the dietary treatments (mean ± SE)

Item	Control T1	DS T2	BDS T3	DSU T4	Sig.
DM	69.55^{a} ± 3.45	73.07^{ab} ± 5.66	75.42^{b} ± 4.56	75.33^{b} ± 7.61	0.05
OM	72.03^{a} ± 7.23	77.21^{b} ± 6.75	76.72^{b} ± 5.67	73.93^{a} ± 7.21	0.05
CP	68.32^{a} ± 5.48	69.96^{a} ± 6.98	75.56^{b} ± 7.12	73.29^{ab} ± 5.40	0.05
EE	66.53^{a} ± 5.66	72.39^{b} ± 6.75	72.09^{b} ± 5.90	70.34^{ab} ± 6.78	0.05
CF	58.48^{a} ± 4.67	62.09^{ab} ± 6.54	64.71^{b} ± 6.01	60.72^{a} ± 5.72	0.05
NFE	77.84 ± 7.76	80.79 ± 7.68	77.92 ± 7.56	76.72 ± 6.57	NS

****T1, control diet; T2, diet containing untreated DS; T3, diet containing biologically treated DS; T4, diet containing urea-treated DS.**

^{a,b}, means having different superscripts within each row are significantly different (P<0.05)

NS, not significant

Data in Table (6) presents the feeding value of the tested diets (TDN and DCP) as affected by the biological- and urea- treatments. It is obvious that the TDN value was almost equal in all the diets containing DS both treated (67.66 and 65.92%) or untreated (67.54%) in comparison with the control diet (64.31%; without DS). The treated DS had higher DCP being 7.67 and 6.75% in BDS and UDS than the control (6.01%) and diet containing untreated DS. The biological treatment improved DCP by 35% while the urea treatment improved DCP by only 19%; that was mainly due to the increase in CP content and digestibility due to both treatments along with the increase in the digestibility. Wanapat *et al*. (1983) stated that the nutritive value of rice straw was significantly enhanced by treating it with solution containing 5% urea. Urea improved the nutritive value of cereal straws (Khorshed, 2000; Kholif, 2001; Bassuny *et al*., 2003). Chemical and biological treatments using urea and fungi are the most common procedures used for improving the nutritive value of poor quality roughages and by-products by increasing the crude protein content (Kholif, 2001; El-sayed *et al*., 2002). Therefore, Brumi *et al*. (1996) reported that, the addition of carbohydrate to protein source (urea) in diets led to prevention of toxicity of ammonia and consequently improvement of urea protein utilization in animal body.

Table 6: Nutritive value of the experimental diets as affected by the dietary treatments (mean ± SE)

Item	Control T1	DS T2	BDS T3	DSU T4	Sig.
TDN	64.31[a] ± 6.45	67.54[b] ± 5.69	67.66[b] ± 5.59	65.92[ab] ± 6.26	0.05
DCP	6.01[a] ± 0.63	5.66[b] ± 0.51	7.67[b] ± 0.61	6.75[a] ± 0.72	0.05
Improvement, %	-	-	35	19	
NR 1:	7.72[a] ± 0.81	10.91[b] ± 0.92	7.82[a] ± 0.23	8.77[ab] ± 0.74	0.05

****T1, control diet; T2, diet containing untreated DS; T3, diet containing biologically treated DS; T4, diet containing urea-treated DS.**

NR 1:, nutritive ratio (the ratio between DCP to TDN-DCP)

[a,b], means having different superscripts within each row are significantly different (P<0.05)

Data in Table (7) show the nitrogen balance of the experimental diets as affected by the dietary treatments. Due to the higher feed intake along with the higher CP content of diets T3 (BDS) and T4 (UDS), the nitrogen intake (NI, g/d) was higher (22.82 for BDS and 19.97 for UDS) than the control (17.44) and untreated DS (16.71) diets. Differences were significant (P<0.05). The biologically treated group (T3) secreted more N in the feces (5.58 g/d); the other groups secreted 5.52, 5.01 and 5.25g/d for diets T1, T2 and T4, respectively. Both treated diets (BDS and UDS) released more N in the urine being 11.06 and 9.49g/d, respectively, comparing to 7.16 for control (T1) and 6.52 DS (T2). Differences were significant (P<0.05). The net nitrogen balance was then reported to be higher (P<0.05) with BDS-fed sheep (6.18 g/d) than groups T1, T2 and T4, being 4.76, 5.18 and 5.23 g/d, respectively. The trend of NB was almost similar to the growth rate of the experimental animals (Table 6). Abou El-Nasr (1985) found that sheep, goats and camels consumed comparable amounts from nitrogen (expressed as mg $N/W^{0.75}$ kg) when these animals were fed rations formulated from 100% berseem hay; 75% date seeds plus 25% hay; 75% olive plus 25% hay, respectively. On the other hand, nitrogen retention expressed as mg $N/W^{0.75}$ kg) was increased as a result of replacing 75% berseem hay by date seeds in rations of the three animal species.

Al-Ani *et al*. (1991) reported that when lambs were fed diets containing 0, 15, 30 or 45% dried date pulp (DDP), the highest daily nitrogen intake was recorded with 30% DDP. Urinary nitrogen (g/day) did not differ between 0 and 15% DDP, but it was higher as DDP increased from 30 to 45%. Nitrogen retention as % of nitrogen intake was 41.8, 43.3, 33.6 and 30.5 for the four diets. On the other hand, nitrogen balance of lambs and also apparent N utilization (N balance% of N intake) were the highest for the control diet compared to the other rations containing 25 or 50% date seeds (Awadalla *et al*., 2002). Al-Dabeeb (2005) revealed that replacing the concentrates with 10 or 20% date flesh resulting in deceasing the nitrogen balance insignificantly in the diets containing date flesh compared to the control ration.

Table 7: Nitrogen balance of the experimental diets as affected by the dietary treatments (mean ± SE)

Item	Control T1	DS T2	BDS T3	UDS T4	Sig.
NI	17.44[a] ± 1.51	16.71[a] ± 2.61	22.82[c] ± 2.91	19.97[b] ± 2.20	0.05
FN	5.52[ab] ± 1.63	5.01[a] ± 1.53	5.58[b] ± 1.46	5.25[ab] ± 1.37	0.05
UN	7.16[a] ± 0.81	6.52[a] ± 0.92	11.06[b] ± 2.23	9.49[b] ± 0.74	0.05
NB	4.76[a] ± 0.32	5.18[a] ± 0.41	6.18[b] ± 0.45	5.23[a] ± 0.45	0.05

*** T1, control diet; T2, diet containing untreated DS; T3, diet containing biologically treated DS; T4, diet containing urea-treated DS.**

[a,b,c], means having different superscripts within each row are significantly different (P<0.05)

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تأثير المعاملة الحيوية لنوى البلح على أداء الأغنام

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الملخص العربي

أجريت هذه الدراسة بهدف تقييم امكانية استخدام نوى البلح المجروش المعامل حيويا أو باليوريا على الأداء الإنتاجي للحملان النامية. استخدم في التجربة ٣٢ حمل أوسيمي نامي قسمت إلى ٤ مجموعات غذيت على ٤ علائق تجريبية الأولى منها (المقارنة مكونة من ٤٠% قش أرز + ٦٠% من المركزات) والتي استبدل فيها ٢٥% من المركزات بنوى البلح إما غير معامل (عليقة ٢) أو معامل حيويا (عليقة ٣) أو باليوريا (عليقة ٤). تم قياس التغير في وزن الجسم والغذاء المستهلك والكفاءة الغذائية وكذلك معاملات الهضم والقيمة الغذائية والاتزان النيتروجيني. أشارت أهم نتائج الدراسة إلى ارتفاع المحتوى البروتيني للعلائق المحتوية على النوى المجروش المعامل بيولوجيا والمعامل باليوريا من ٨,١ في العليقة المقارنة إلى ٨,٨ ، ٩,٢١ و ١٠,١٥% في العلائق التجريبية الثلاثة على التوالي. بلغ وزن الاغنام في نهاية التجربة إلى ٤٢,٣٧، ٤٣,٢٣، ٤٥,٠٤ و ٤٣,٤ كجم في المجموعات الأربعة على التوالي. أدت المعاملة إلى تحسن معاملات هضم المادة الجافة والبروتين. كانت القيمة الغذائية في صورة مركبات مهضومة كلية لعليقة النوى غير المعامل ٦٧,٥٤ بينما كانت في العلائق المعاملة حيويا وباليوريا ٦٧,٦٦ و ٦٥,٩٢ مقارنة بالعليقة الخالية من النوى والتي بلغت ٦٤,٣١%. تحسن محتوى العلائق المعاملة حيويا أو باليوريا من البروتين الخام المهضوم ٧,٦٧ و ٦,٧٥% مقارنة بغير المعاملة والتي بلغت ٦,٠١. يمكن استخلاص إمكانية استخدام نوى البلح المجروش سواء غير المعامل أو المعامل حيويا أو باليوريا كأحد مكونات علائق الأغنام النامية حتى مستوى ١٥% من العليقة الجافة (٢٥% من المركزات) دون حدوث أية أضرار على الأداء الإنتاجي للحيوانات.