Effect of Addition of Baker's Yeast Saccharomyces Cerevisae and Source of Nitrogen on Fermentation of Reed Silage and Its Nutritive Value

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Abstract:

This study was conducted at the Animal resource Department- College of Agriculture -Alqasim Green University aiming to improve nutritive value of common reed by ensiling and addition of nitrogen (N) sources, 3% urea or soybean meal (SBM) on basis of N content and addition of commercial baker's yeast (BY) at level of 10%. Debis was added at level of 5% as a source of soluble carbohydrates (CHO) to stimulate silage fermentation. Results revealed that addition of BY increased ($P<0.01$) dry matter (DM) content of reed silage (RS) by 6.17%. Results also showed that samples of RS made by addition of BY without N source or with addition of SBM had odor of fermented fruits. Contamination with Fungi was noticed in RS made by addition of urea. Results also revealed that pH of RS was decreased ($P<0.01$) by addition of BY, whereas, it was increased ($P<0.01$) by addition of urea from 4.56 and 4.54 in RS samples made without addition of N source and addition of SBM respectively to 4.93. Addition of BY led to decrease ($P<0.01$) percentage loss of DM from 11.58% to 9.81%. Less percentage loss was recorded in RS samples made by addition of SBM (7.69%). Fleig point (FP) was increased ($P<0.01$) by addition of BY from 60.19 to 69.40. Higher and lower values were associated with addition of SBM and urea respectively. Addition of BY increased ($P<0.05$) IVDMD (from 40.77% to 43.42%) and IVOMD (from 45.25% to 47. 88%) of RS. Higher values ($P<0.05$) were associated with addition of urea. Parameters concerning silage quality and its nutritive value were significantly affected by the interaction between addition of BY and N sources.

تاثير أضافة خميرة الخبز Saccharomyces cerevisae و المصدر النتروجيني في تخمرات سايلج القصب وقيمته الغذائية

علي امين سعيد

الخلاصة :

اجريت الدراسة في قسم الثروة الحيوانية- كلية الزراعة- جامعة القاسم الخضراء بهدف تحسين القيمة الغذائية للقصب بالسيلجة واضافة المصدر النتروجيني، اليوريا بمستوى 3% او كسبة فول الصويا على اساس المحتوى

ISSN 2072-3875

النتروجيني و اضافة خميرة الخبز التجارية بمستوى 10%. وقد استخدم الدبس بنسبة 5% كمصدر للسكريات الذائبة لتشجيع تخمرات السايلج. وقد اظهرت النتائج ان اضافة الخميرة ادت الى رفع (P<0.01) محتوى سايلج القصب من المادة الجافة بنسبة 6.17%. كما بينت النتائج اكتساب نماذج سايلج القصب المصنعة باضافة الخميرة بدون مصدر نتروجيني او مع الكسبة رائحة الفواكه المتخمرة. ولوحظ زيادة انتشار الاعفان في نماذج السايلج المصنعة باضافة اليوريا. و اوضحت النتائج ايضا ان اضافة الخميرة ادت الى خفض قيم الأس الهيدروجيني للسايلج معنويا (P<0.01)، فيما ادت اضافة اليوريا الى رفع (P<0.01) تلك القيم من 4.56 و 4.54 في النماذج المصنعة بدون اضافة المصدر النتروجيني واضافة كسبة فول الصويا على التوالي الى 4.93. كما ادت اضافة الخميرة الى انخفاض (P<0.01) نسبة الفقد في المادة الجافة من 11.58 الى 9.81. وسجل اقل فقد في نماذج السايلج المصنعة باضافة كسبة فول الصويا (7.69%). كما ادت كذلك الى رفع (P<0.01) قيمة فليغ من 60.19الى 69.40، و قد ارتبطت اعلى قيمة مع اضافة الكسبة فيما ارتبطت اوطأ قيمة مع اضافة اليوريا (76.03 مقابل 52.86). وقد ادت اضافة الخميرة الى رفع (P<0.05) الهضم المختبري للمادة الجافة في سايلج القصب (من 40.77% الى 43.42%) و الهضم المختبري للمادة العضوية في سايلج القصب (من 45.25% الى 47.88%). وقد ارتبطت اعلى القيم (P<0.05) باضافة اليوريا. وتأثرت المعايير الخاصة نوعية السايلج وقيمته الغذائية معنويا بالتداخل بين اضافة الخميرة والمصدر النتروجيني.

Introduction :

In Iraqi circumstances there is a real gap between available feed and nutritional requirements of farm animals, particularly of protein and energy. Since there will be increased demand of different animal products due to increased population, any efforts to find nutritional substitutes and improve utilization of the available sources of roughages, becomes critical point in order to reduce this gap and use of concentrates in feeding practices. In that context, Santos, et.al (2010) reported that prices of cereals, its need by man and producing biofuel lead to limit the use of these rich materials in high quantities .

Generally, most roughage available for ruminant, such as, straws, crop by-products and common reed are characterized with low nutritive value due to its low digestibility caused by low content of soluble sugars and proteins with high content of structural carbohydrates. This in turn led to reduce availability of these fragments as energy sources. Therefore, ruminants are unable to utilize these roughages efficiently; hence, production will retard (Chaudhry, 1998). Consequently, improve performance and productivity of ruminants depending on such these sources requires increase rate of its utilization (Chaudhry, 2008). Sakhawat (2011) demonstrated that producing healthy, high quality feeds is very important factor affecting the quality of animal products and its economic value.

Common reed (Phragmites Communis) is considered the most wide separated plant. It grows in both arable and non-arable lands and equipped branches of rivers, lakes and irrigation canals. Green tops of reed plants have encouraged level of protein and may reach 9.5% (Al-Saady, 2009). Shehata, et.al. (2006) indicated that reed offered as silage had good palatability and adequate feeding value, and was parallel to maize silage and better than berseem

ISSN 2072-3875

hay. Moreover, reed silage had the highest digestion estimates, followed by berseem hay then fresh reed and lastly reed hay (Ahmed, et.al. 2011). In accordance with previous issues, this experiment was conducted to investigate the possibility of improve nutritive value of common reed, particularly, its palatability as ruminant diets using ensiling to get advantage of desirable flavor that good silages characterized with, as well as, improve digestibility due to degradation of cell wall structure. Effect of addition of baker's yeast on consuming oxygen may remain in stored mass of reed was taken in account.

Materials and Methods :

Common reed plants were harvested from a dense grown in both banks of the small river passing near the animal field. Reed plants were chopped using blades and scissors into 2-3 cm length cuts. Low quality debis was added to the chopped plants at level of 5% on DM basis as a source of soluble CHO after dilution with a quantity of tap water to ensure DM content of about 45-50%. Commercial baker's yeast (Saccharomyces cerevisae) (BY) was added to debis solution at level of 10.%

Regarding N sources, 3% urea or SBM were tested on basis of urea N content. 10 replicates of each silage were individually packed in nylon sacs and compressed manually; accordingly there were 60 samples carried to the animal field in order to burry in a bit which filled up with soil to ensure compression needed and stilled as it is for 60 days. Sacs of silage were then opened successively to determine pH and chemical analysis. Component of silages made in this study was shown in table (1).

Table 1- Components of reed silage samples (%)

Silages	**Reed**	**Debis**	**Yeast**	**Urea**	**SBM**
Reed silage (RS)	**95.00**	**5**	**-**	**-**	**-**
Reed silage- Yeast (RS-Y)	**85.00**	**5**	**10**	**-**	**-**
Reed silage-Urea (RS-U)	**92.00**	**5**	**-**	**3**	**-**
Reed silage-Urea-Yeast (RS-U-Y)	**82.00**	**5**	**10**	**3**	**-**
Reed silage-SBM (RS-SBM)	**75.83**	**5**	**-**	**-**	**19.17**
Reed silage-SBM-Yeast (RS-SBM-Y)	**65.83**	**5**	**10**	**-**	**19.17**

Determination of sensory characteristics of silage samples in this study depended on the descriptive parameters including color, odor, texture and presence of fungi. Regarding odor, description was determined soon after the opening of each sample. Diluted or concentrated were used to descript the odor detected from samples. Texture was descripted according to extent of clinging of sample mass. Sign of (+) was used to refer to

ISSN 2072-3875

presence of fungi, extent of fungi presence was represented by number of this sign. Sign of (–) was used representing absence of fungi.

Silage quality was determined depending on determination of pH and estimation of Fleig point and percentage loss in DM. pH of silages was determined according to the method described by Levital, et.al., (2009) in silage extract that prepared by mixing 50g of silage with 500 ml of distilled water for 10 minutes. Mi 180 Bench Meter was used for that purpose. Fleig points (FP) were estimated using equation of Kilic (1984) as follows:

$FP = 220 + (2 \times \% DM - 15) - 40 \times pH$.

Percentage loss in DM was estimated as a percentage difference in a total content of DM of silages before and after ensiling, depending on weight of samples before and after ensiling and content of DM .

Chemical analysis included determination of DM content that obtained by drying samples using electric oven on 60 C° for 48 hours (Levital, et.al., 2009). Contents of organic matter (OM), crude fiber (CF), crude protein (CP), ether extract (EE) were determined according to AOAC (1997). In vitro DM digestibility (IVDMD) and in vitro OM digestibility (IVOMD) of silage samples was determined as described by Tilley and Terry (1963 .(

Data obtained was analyzed using SPSS analysis program (SPSS, 2006) according to factorial experiment 2×3 in complete randomized design (CRD). 6 treatments were formed due to the effect of two factors. The first factor was addition of BY and the second was addition of N source. Effect of interaction between these factors was also obtained. There were 10 replicates for each treatment. Duncan's multiple range tests was used to determine the significance of differences between treatments means (Duncan, 1955 .(

Results and discussion :

The basic idea of this study depends on is that improving storage condition of common reed silage (RS) due to exhaustion of oxygen may remain in samples by silage microbes at the beginning of ensiling and supply these species with N source as well as addition of BY. Then the following discussion will be concentrated on chemical composition of RS and parameters of quality and nutritive value as affected by the above changes.

-1Changes in chemical composition:

Table (2) shows the effect of addition of BY and N source on chemical composition of RS. Results revealed that addition of BY led to significant increase ($P<0.01$) in DM content by about 6.17%. This may due to improve ensiling condition as a result of exhaustion of oxygen that may remain in the sample. Newbold, et.al. (1996) referred to the ability of BY to consume oxygen. This will help providing better anaerobic condition and stimulate silage fermentation. CF content of RS has also been affected by addition of BY. It was decreased ($P<0.01$) by about 8.39%.

ISSN 2072-3875

Similar effect of addition of BY on CF content was reported by Saeed, et.al. (2013) in samples of silage made from residual of whole plant corn. This beneficial effect may be explained by the enhancement occurred due to addition of BY in the vitality of cellulolytic bacteria (Guides, et al., 2008).

Table 2- Effect of addition of BY and N source on chemical composition of RS (% ± SE)

Items	Addition of BY		Source of N		
	Nil	10%	Nil	Urea	SBM
DM	30.44 ± 0.35^{B}	32.32 ± 0.40^{A}	29.88 ± 0.41^{b}	30.17 ± 0.46^{b}	34.08 ± 0.43^{a}
OM	87.05 ± 0.61	86.44 ± 0.62	87.11 ± 0.66	86.77 ± 0.62	86.36 ± 0.60
CP	12.97 ± 0.25	14.08 ± 0.22	9.32 ± 0.25^{b}	14.97 ± 0.26^{a}	16.45 ± 0.24^{a}
CF	21.68 ± 0.31^{A}	19.86 ± 0.28^{B}	21.93 ± 0.30^{a}	19.36 ± 0.29^{b}	21.02 ± 0.29^{a}
EE	2.85 ± 0.07	2.89 ± 0.08	2.85 ± 0.09	2.87 ± 0.09	2.95 ± 0.11
NFE	49.55 ± 0.45	49.61 ± 0.42	53.01 ± 0.46^{a}	49.57 ± 0.41^{a}	45.91 ± 0.44^{b}

Horizontally, capital and small letters refer to significant differences at 0.01 and 0.05 respectively

Regarding the effect of N source, results showed that higher ($P<0.05$) increase in DM content was recorded in samples of RS made by addition of SBM as compared to those made by addition of urea or without addition of any N sources. DM content of RS made by addition of SBM was about 12.95% and 14.05% higher than that of other silages respectively. This may be due to additional DM that RS gained during ensiling by addition of SBM which contains about 90.78% of DM (Saeed, 2011) as compared to urea which is completely degraded in water and was not expected therefore to participate in any increase in DM content of RS.

As expected, addition of N sources resulted in higher ($P<0.05$) increase in CP content. It was increased from 9.32% in RS to 14.97 and 16.45% in RS made by the addition of urea and SBM respectively. The higher increase in CP content of RS made by addition of SBM as compared to RS made by addition of urea, though insignificant, may be attributed to degradation mode of these N sources. Urea is completely degraded during ensiling (Saeed and Latif, 2008 a, b; Saaed. 2012) as compared to SBM which is less degraded (Saeed, 2011; Al-Mallah, 2012) due to their solubility characteristics .

Results also showed that addition of urea decreased CF content of RS

ISSN 2072-3875

significantly ($P<0.05$). Similar finding was reported by Saeed and Latif (2008a) in wheat straw silage. There were a significant percentage depression of 11.71 and 7.89% in that structural carbohydrate due to addition of urea to RS in comparison with RS made without addition of N source or with the addition of SBM. This may be attributed to the partial breakdown of cell wall components that probably occurred due to the effect of ammonia produced from quick degradation of urea during ensiling. The released ammonia helps breakdown of linkages that linked cellulose and hemicellulose to lignin in a cell wall structure and increased N content (Celic, et.al.2003). Shahsavani, et.a. (2014) reported that most of the indigestible parts of the cell walls are made of lignin linked to and cellulose and hemicellulose.

Effect of interaction between addition of BY and N sources on chemical composition of RS is shown in table (3). Results revealed that higher DM content was recorded in RS made by the addition of SBM with the addition of BY (35.19%) or without its addition (32.98%) as compared to RS made by addition of urea or that made without addition of any N source. This may be due to participation of SBM in increasing RS content of DM.

Statistical analysis of interaction data revealed that RS made with the addition of BY gained higher ($P<0.01$) DM content as compared with RS made without addition of BY regardless to addition of N or its sources. RS made with addition of BY and SBM (RS-SBM-Y) gained lower ($P<0.05$) OM content as compared with other silages. This may be attributed to role of BY in stimulation silage fermentation leading to higher loss in OM .

Results of interaction also showed that there was a significant differences ($P<0.01$) in content of CP and CF ($P<0.05$) in RS samples. Reed silages made with addition of N sources gained higher ($P<0.01$) CP content. This is expected since a part of added N may attach to plant in storage condition (Saeed and Latif, 2008a, b). As shown CP content increased by 5.12 and 5.82% due to addition of urea, whether with addition of BY (RS-U-Y) or without (RS-U) respectively, as compared with RS made without addition of N sources, whether, with addition of BY (RS-Y) or without (RS) respectively. Differences in CP content due to addition of N source were increased in regard with SBM, where, CP content increased by 7.29% in RS-SBM-Y as compared with RS-Y and 6.79% in RS-SBM as compared with RS. Higher differences in CP content of RS samples in preference to those made with addition of SBM may due to lower loss of N related to lower degradability during ensiling as compared with urea .

Regarding CF content there were insignificant depression of about 1.84% and 1.22% in RS-U as compared with RS and RS-SBM respectively. This may be attributed to the effect of exposure of reed to ammonia produced from quick degradation of urea during ensiling. Similar findings were noticed by Saeed

ISSN 2072-3875

and Latif, 2008, a,b; Saeed, 2012). However, these differences were increased significantly (P<0.05) when a comparison were taken in accordance with the interacted effect of addition of urea and BY. Consequently, lower (P<0.05) CF content was detected in RS-U-Y as compared with other silages. This can be explained by the additive effect of ammonia that probably helped breakdown of complex structure of cell wall (Celic, et.al.2003), and BY that may improve fermentation condition by consuming oxygen (Newbold, et. al., 1993). Then shifting condition of storage of reed plant to be more anaerobic may enhance cell wall degradation as a result of preparing convenient condition that stimulate cellulase activity (El-Waziry and Ibrahim, 2007.(

Table 3- Effect of interaction between addition of BY and N source on chemical composition of RS (% ± SE)

Silages	DM	OM	CP	CF	EE	NFE
RS	**29.10 ±0.32^{C}**	**87.07 ± 0.68^{a}**	**8.94 ± 0.19^{C}**	**22.50 ± 0.31^{a}**	**2.77 ± 0.05**	**52.86 ± 0.48^{a}**
RS-Y	**30.66 ±0.30^{D}**	**87.14 ± 0.66^{b}**	**9.71 ± 0.22^{C}**	**21.36 ± 0.32^{a}**	**2.93 ± 0.12**	**44.14 ± 0.42^{b}**
RS-U	**29.23 ± 0.23^{C}**	**86.98 ± 0.63^{a}**	**14.06 ± 0.23^{B}**	**20.66 ± 0.29^{a}**	**2.69 ± 0.09**	**49.57 ± 0.46^{a}**
RS-U-Y	**31.11 ± 0.29^{C}**	**86.56 ± 0.63^{a}**	**15.53 ± 0.25^{B}**	**18.06 ± 0.27^{b}**	**3.05 ± 0.05**	**49.92 ± 0.45^{a}**
RS-SBM	**32.98 ± 0.35^{B}**	**87.10 ± 0.68^{a}**	**15.91 ± 0.21^{B}**	**21.88 ± 0.31^{a}**	**2.94 ± 0.11**	**46.37 ± 0.43^{b}**
RS-SBM-Y	**35.19 ± 0.38^{A}**	**85.63 ± 0.64^{a}**	**17.00 ± 0.26^{A}**	**20.16 ± 0.30^{a}**	**2.95 ± 0.04**	**45.52 ± 0.44^{b}**

Vertically, capital and small letters refer to significant differences at 0.01 and 0.05 respectively

RS = reed silage, RS-Y = reed silage plus yeast, RS-U = urea treated reed silage, RS-U-Y = urea treated reed silage plus yeast, RS-SBM = SBM treated reed silage, RS-SBM-Y = SBM treated reed silage plus yeast

Higher (P<0.05) content of NFE was estimated in RS. This may be attributed to the addition of soluble sugar (debis), which played a unique role in this silage in comparison with other silages because there was no other factor affecting fermentation rather than addition of debis. Similar finding was reported by Shahsavani, et.al., (2014) in RS. NFE content of RS was not significantly differed with that of urea treated reed silage (RS-U and RS-U-Y), (52.68% vs.

ISSN 2072-3875

49.57% and 49.92% respectively). Increased NFE content of urea treated silages can be explained by degradation of cell wall component as a result of exposure to the alkaline effect of ammonia released from degradation of urea .

-2Changes in sensory characteristics

Sensory characteristics of RS as affected by addition of yeast and N sources are shown in table 4. Observations concerning color indicated that the color of RS samples was ranged from greenish yellow in RS to dark brown in RS-U. Caluya (1995) reported that silage colored with greenish yellow during 60 days of ensiling. This may be attributed to the dissociation of chlorophyll during ensiling (Catchpool and Henzell, 1971). Whereas, RS samples made with addition of SBM, whether, with addition of BY (RS-SBM-Y) or without (RS-SBM) were colored yellowish green. This may be explained by the lower effect of ammonia produced from degradation of SBM during ensiling as compared with readily degraded and completely water soluble urea (Sarwar, et.al.2006), then green satin may not exposed to severe dissociation during ensiling.

Table 4- Effect of addition of yeast and nitrogen source on quality characteristics of reed silage

Silages	Color	Odor	Texture	Fungi
RS	**greenish yellow**	**diluted vinegar**	**inconsistent**	**+**
RS-Y	**yellowish green**	**fermented fruits**	**consistent**	**–**
RS-U	**dark brown**	**stinky**	**inconsistent**	**+ +**
RS-U-Y	**light brown**	**diluted ammonia**	**weak consistent**	**+**
RS-SBM	**yellowish green**	**diluted vinegar**	**consistent**	**+**
RS-SBM-Y	**yellowish green**	**fermented fruits**	**consistent**	**–**

RS = reed silage, RS-Y = reed silage plus yeast, RS-U = urea treated reed silage, RS-U-Y = urea treated reed silage plus yeast, RS-SBM = SBM treated reed silage, RS-SBM-Y = SBM treated reed silage plus yeast

Regarding odor, results revealed that RS-Y and RS-SBM gained fermented fruits like odor, referring to completeness of their fermentation and increase level of lactic acid (Ostling and Lindgren, 1993). Similar finding was reported by Saeed (2012) in wheat straw and attributed that to the role of addition of molasses. Since

ISSN 2072-3875

similar level of soluble sugars (5%), then rise of this odor from these silages only may points out to the role of addition of BY. Diluted vinegar like odor was released from RS and RS-SBM. Whereas, odor indicated to exist of ammonia was detected in RS-U and RS-U-Y. Odor of ammonia refers to degradation of urea during ensiling (Sarwar, et.al, 2006).

Result also revealed that low exist of fungi was detected in RS samples made with addition of BY. This can be explained by the role of yeast that consume oxygen may remain in samples (Newbold, et.al. 1993, 1996). However, exist of fungi had somewhat increased in RS samples made with addition of urea. This may be due to increase pH caused by quick degradation of urea. Glewen and Young (1982) demonstrated that addition of urea at ensiling time led to a delay reaching specific stability of silage due to its degradation to ammonia and increase pH. Increased pH enhances growth and activity of fungi and clostridia (Levital, et.al.2009). Shahsavani, et.al. (2014) reported that RS made with addition of molasses had suitable color and pleasant smell. Furthermore, no mold contamination was seen. The control group in which RS was ensiled without addition, however, had unpleasant smell and dark brown color.

3- Quality and nutritive value

Nutritive value of common RS as affected by addition of BY an N source is shown in table (5). Where, it was determined in the current study based on pH values, loss of DM, FP and in vitro digestibility of both DM and OM. As it is appeared from the table, addition of BY led to a significant decrease ($P<0.01$) in pH of RS. Similar finding was reported by Saeed, el.al (2013) in samples of whole plant corn silages.

Table 5- Effect of addition of yeast and nitrogen source on nutritive value of reed silage (% or unit ± SD)

Items	Addition of yeast		Source of nitrogen		
	Nil	10%	Nil	Urea	SBM
pH	4.76 $\pm 0.27^{a}$	4.60 $\pm 0.17^{b}$	4.56 $\pm 0.08^{b}$	4.93 $\pm 0.14^{a}$	4.54 $\pm 0.06^{b}$
DM loss (%)	11.58 $\pm 0.45^{a}$	9.81 $\pm 0.78^{b}$	13.90 $\pm 0.45^{a}$	10.46 $\pm 0.74^{b}$	7.69 $\pm 0.45^{c}$
FP	60.19 $\pm 2.84^{B}$	69.40 $\pm 2.06^{A}$	65.50 $\pm 2.98^{B}$	52.86 $\pm 2.24^{C}$	76.03 $\pm 1.76^{A}$
IVDMD (%)	40.77 $\pm 0.27^{b}$	43.42 $\pm 0.27^{a}$	40.20 $\pm 0.27^{b}$	44.41 $\pm 0.27^{a}$	41.67 $\pm 0.27^{b}$
IVOMD (%)	45.25 $\pm 0.27^{b}$	47.88 $\pm 0.27^{a}$	44.76 $\pm 0.27^{b}$	48.27 $\pm 0.27^{a}$	46.74 $\pm 0.27^{a}$

Horizontally, capital and small letters refer to significant differences at 0.01 and 0.05 respectively

ISSN 2072-3875

Ability of BY to remove oxygen from samples of RS seemed to participate in preparation of better condition for fermentation processes enhancing production of organic acids responsible on depression of pH, especially, lactic acid. Saeed, et.al (2013) and Levital, et.al (2009) referred to the critical importance of securing anaerobic condition in making good quality silage.

Regarding effect of N sources, results showed that there was a significant ($P<0.01$) drop in pH values of RS made with addition of SBM or without as compared with that made with addition of urea. Higher pH of the later can be explained by increased level of ammonia releasing from quick degradation of urea (Saeed, et.al. 2013; Saeed, 2012 and Sarwar, et.al. 2006). Percentage drop in pH of RS-U as compared with that of RS-SBM and RS were 7.91% and 7.50% respectively.

Results have also revealed that loss in DM was decreased ($P<0.01$) due to addition of BY. Saeed, et al., (2013) reported same finding in silage samples of whole plant corn silages. This may be attributed to role of BY in minimizing period of aerobic conditions and subsequent probable domination of anaerobic fermentations at a point that remained oxygen in sacs of samples was completely exhausted (Saeed, et.al., 2013 and Newbold, et.al., 1993, 1996).

Concerning N source, statistical analysis showed that less ($P<0.01$) loss in DM was achieved in RS samples made with addition of SBM (7.69%). This may due to participation of SBM in additional DM added to chopped reed-debis mixture in comparison with addition of urea as N source or without.

Fleig point was determined in this study to evaluate silage quality. As can be seen from table 5, addition of BY increased ($P<0.01$) this widely used criteria from 60.19 to 69.40. This may be due to its positive role in improving silage fermentations. Higher ($P<0.01$) value was related to addition of SBM, whereas, lower value was related to addition of urea (76.03 vs. 52.86). Lower rate of protein degradation of SBM as compared with urea and pH are probable reason for that result.

Results also showed that in vitro digestibility of DM (IVDMD) was increased ($P<0.05$) by 2.65 units due to addition of BY. Similar results were reported by other workers (Dawson and Hopkins, 1991 and Saeed, et.al., 2013). This may be attributed to stimulation of the proliferation of microorganisms, which in turn was associated with enhancement of cell wall digestion (Kamel, et. al., 2000). El-Waziry and Ibrahim (2007) concluded that BY enhanced cell wall degradation as a result of its direct enhancement of cellulase activity. Shahsavani, et. al. (2014) considered high CF content of reed as the most difficult problem reducing digestibility. However,

ISSN 2072-3875

Cellulase enzyme can degrade lignocellulosic bonds which results in better digestion (Beauchemin, et.al. 1995).

Regarding effect of N sources, it was shown that addition of urea has secured higher ($P<0.05$) IVDMD values. Similar result was recorded by Saeed and Latif (2008a, b) in vivo DMD of wheat straw silage as affected by addition of urea at rate of 3% or even 1.5%. As shown in table (5), there was a percentage increase in IVDMD of RS of 6.57 % due to addition of urea as compared with addition of SBM as N sources. This can be explained by the higher concentration of ammonia associated with higher degradation of urea (Celik, et. al. 2003; Sarwar, et. al., 2006 and Saeed, 2012) in comparison with that of SBM (Saeed, 2011 and Al-Malah, 2012). Percentage increase of IVDMD of RS due to addition of urea was increased to 10.47 as compared with that of RS without addition of any N source. Similarly, in vitro digestibility of OM (IVOMD) tended to increase significantly ($P<0.05$) due addition of BY as in IVDMD. Percentage increase was about 4.47%. Higher IVOMD was also recorded due to addition of urea. Percentage increase was 3.27% and 7.84% as compared with that of RS made with addition of SBM or without addition of any N sources.

Al-saady (2009) reported lower IVDMD and IVOMD of RS made without addition of N source than that determined in a current study (40.20% vs. 36.3 and 44.76% vs. 41.80% respectively). Since level of soluble carbohydrates was similar in both studies (5%), difference in IVDMD and IVOMD may then be attributed to the source (debis vs. molasses) rather than level. Another probable reason for these differences is the particle size of reed plant that exposed to fermentation processes. Reed plant was chopped to 2-5 cm length in a current study, while it was ensiled without chopping in the other (Al-saady, 2009). However, ensiling common reed silage according to this worker has increased IVDMD and IVOMD by 7.4% and 10.5% respectively as compared with fresh reed. IVDMD and IVOMD were unfortunately not determined in a current study.

Effect of interaction between addition of urea and N source is illustrated in table (6). Data appeared in this table revealed that lower pH values were recorded in RS-Y, RS-SBM and RS-SBM-Y. It was 4.40, 4.50 and 4.60 respectively. Role of addition of BY in lowering pH was clearly noticed, particularly, in RS samples made with addition of urea (from 5.07 in RS-U to 4.80 in RS-U-Y). This can be attributed to the role of ammonia produced from degradation of urea during ensiling in increasing basicity of silage (Saeed, 2012 and Sarwar, et.al. 2006). Except that of RS-U, all silages are somewhat accepted in regard with pH. Several factors may be involved including addition of soluble sugar which is thought to be less than exactly required. Shahsavani, et. al. (2014) added molasses to common reed silage at rate of 15% and indicated to a

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significant (P<0.05) decrease of pH to 4.85.

Table 6- Effect of interaction between addition of yeast and nitrogen source on nutritive value of reed silage (% or point ± SD)

Silages	pH	DM loss	FP	IVDMD	IVOMD
RS	**4.72 ± 0.08 acef**	**13.03 ± 0.37 ABD**	**59.36 ± 3.72 AE**	**38.50 ± 2.12d**	**43.41 ± 2.48c**
RS-Y	**4.40 ± 0.13 cd**	**8.28 ± 0.92 E**	**71.65 ± 3.91 DF**	**41.91 ± 2.40b**	**46.12 ± 2.51b**
RS-U	**5.07 ± 0.03b**	**14.77 ± 0.74 D**	**45.50 ± 1.57 B**	**43.65 ± 2.52ab**	**47.13 ± 2.65b**
RS-U-Y	**4.80 ± 0.07 e**	**8.99 ± 0.45 CF**	**60.22 ± 2.61 E**	**45.18 ± 2.27a**	**49.27 ± 2.88a**
RS-SBM	**4.50 ± 0.08 cf**	**12.64 ± 0.65 B**	**75.73 ± 3.05 CDF**	**40.16 ± 2.19c**	**45.22 ± 2.43c**
RS-SBM-Y	**4.60 ± 0.04 def**	**6.93 ± 0.46F**	**76.34 ± 1.94F**	**43.18 ± 2.31b**	**48.27 ± 2.79a**

Vertically, capital and small letters refer to significant differences at 0.01 and 0.05 respectively

RS = reed silage, RS-Y = reed silage plus yeast, RS-U = urea treated reed silage, RS-U-Y = urea treated reed silage plus yeast, RS-SBM = SBM treated reed silage, RS-SBM-Y = SBM treated reed silage plus yeast

Results of interaction effects also revealed that less loss in DM was accomplished with addition of BY, where, percentage loss was decreased due to addition of BY from 13.03% to 8.28% and from 14.77% to 8.99% and from 12.64% to 6.93% in samples of RS, RS-U and RS-SBM respectively. Ensiling condition may be improved by supplying silage microbes with additional (Saeed, 2012). This may be occurred with the association of yeast by securing better anaerobic condition (Saeed, et.al. 2013, Newbold, et.al.1993, 1996.(

Results also showed that higher (P<0.01) Fleig point was estimated in samples of RS-SBM-Y, RS-SBM and RS-Y (76.34, 75.73 and 71.65, respectively.(

Regarding IVDMD and IVOMD, statistical analysis of interaction data showed that higher and lower (P<0.05) in vitro digestion coefficient of DM were achieved in RS-U-Y and RS respectively. In both of these parameters of nutritive value, effect of interaction between addition of urea and BY is very clear. However, greater effect may associate with effect of addition of urea because addition of BY did not affect IVDMD and IVOMD as much as the effect of addition of urea. Shahsavani, et. al. (2014) observed that OM digestibility

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of RS estimated by gas production technique was increased from 46.99 to 58.58% as a result of addition of molasses. Higher digestion coefficient of OM as compared with that determined in a current study (43.41%) may be attributed to the source of soluble carbohydrates (molasses vs. debis), level of addition (15% vs. 5%) and way of determination.

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