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Nutritive Improvement of Some Low Quality Roughages for Ruminants. II. The Effect of Spraying Urea vs. Microbial Treatment on the Quality of Sugar Cane Bagasse*

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SUGAR-CANE bagasse was treated with NaOH or sodium hypochlorite. Both treated bagasse were fermented with **Trichoderma viride** (T. V.) fungi. Sodium hypochlorite treated bagasse was sprayed with urea solution (4%).

The three treatments used increased greatly CP content and decreased CF, NDF, ADL, NFE and hemicellulose contents of bagasse. Cellulose and ADF contents, however, of untreated bagasse were nearly similar to those of almost all treatments used. Fungal treatments increased ash content of bagasse.

The three treatments used greatly increased ($P < 0.01$) IVDMD values and **In Situ** DM degradability at almost all incubation periods used (4, 8, 12, 24 and 48 hr.) of bagasses. No significant differences were observed among the three treatments used. Highest values, however, were recorded for bagasse treated with sodium hypochlorite followed by fermentation with T. V. fungi.

The present study suggests that the chemical composition and nutritive value of bagasse can greatly be improved by fungal fermentation. A similar improvement can be achieved by spraying sodium hypochlorite treated bagasse with urea solution (4%).

The gap between available and required amounts of animal feed in Egypt is estimated to be about 3.1 million tons of total digestible nutrients (Abou Akkada, 1984). This has emphasized the need for improving both the quality and intake of poor quality roughages or agricultural by-products by ruminant animals. This can be achieved by physical and chemical treatments such as alkali treatments or microbial treatments.

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Studies have been done to use bagasse as a new non-conventional roughage source in rations for ruminants (El-Torky, 1979, El-Hag and George, 1982 and Ahmed, 1984). The results of these studies showed that the nutritive value of untreated bagasse was very low. Previous work (Shoukry *et al.*, 1985-b) showed that the chemical composition, *In Vitro* and *In Situ* DM disappearance of bagasse can greatly be improved by fungal or chemical treatments. However, the magnitude of improvement was greater for fungal treatments than chemical ones. This may have been related to the higher CP content of fungal treatment.

Recent work suggested that spraying poor quality roughages with urea solution can be an alternative method to alkali treatments. (Soliman *et al.*, 1983 and 1984, Abou Ward, 1984 and Shoukry *et al.*, 1985-a).

The present study was carried out to examine the effect of two different fungal treatment methods on the chemical composition and nutritive value of sugar cane bagasse. The effect of spraying sodium hypochlorite treated bagasse with urea solution on its nutritive value was also studied.

Material and Methods

Fungal strain

The *trichoderma viride* 253 M-16 employed (T. V.) was used as experimental organism.

Treatment of bagasse

The crude sugar-cane bagasse was treated with sodium hydroxide and sodium hypochlorite (Shoukry *et al.*, 1985-b). The sodium hypochlorite treated bagasse was thoroughly washed by water till free from chlorine.

Fermentation

Either sodium hypochlorite or NaOH treated bagasse were fermented with T. V. fungi. Fermentation was carried out into the nylon bags for 30 days as described before (Shoukry *et al.*, 1985-b).

Urea treatment

Ground sodium hypochlorite treated bagasse were sprayed with a solution of urea (50 ml/100 g DM of bagasse), calculated to provide 4 g urea/100 g DM of bagasse. This amount of urea was used for obtaining nitrogen content in sodium hypochlorite treated bagasse similar to that of fungal treated bagasse. The materials were then stored for 2 weeks in a plastic container then dried in an oven at 60°C to about 90% DM.

In Vitro DM disappearance (IVDMD)

In Vitro DM disappearance was determined for untreated bagasse and treated bagasse with different treatments according to method of Tilley and Terry (1963). Fermentation media used was that described by Norris *et al.,* (1976) with a modification that the buffer and the urea solutions were those described by Naga and El-Shazly (1963). Rumen liquor was collected from cannulated Ossimi sheep maintained on all berseem hay diet (150% maintenance level).

Determination of IN Situ DM disappearance

Degradability of DM of bagasse untreated or treated with different treatments in the rumen of sheep was determined at 4, 8, 12, 24 and 48 hr using dacron bags (Mehrez and Orskov, 1977).

Three mature male Ossimi sheep (about 60 kg live weight) fitted with rumen cannula were used in this study, for determination of DM disappearance of untreated and treated bagasse. The animals were maintenance on a ration consisted of berseem hay given at the rate of 150% maintenance in two equal meals mainly at 08.00 and 17.00. Water was always available in front of the animals.

About 3 g of dried, finely ground (less than 0.5 cm length) samples were weighed in each dacron bag. The required number of bags (3/each incubation period) for each sample was incubated in the rumen of each sheep and one bag was withdrawn from the rumen of each sheep at each incubation period (4, 8, 12, 24 and 48 hr). The bags were washed under running tap water until water become clear from any colour. They were then dried in an oven at 60°C for 48 hr and DM disappearance was calculated.

Chemical analysis

Finely ground sample of each treatment was chemically analysed for dry matter (DM), crude protein (CP), crude fibre (CF), ether extract (EE), ash and nitrogen free extractives (NFE) according to the A.O.A.C. (1970) procedures. Neutral detergent fibre (NDF), acid detergent fibre (ADF) and acid detergent lignin (ADL) were determined according to Goering and Van Soest (1970) procedure.

Statistical analysis

Data concerning IVDMD and *In Situ* DM disappearance were statistically analyzed according to Snedecor and Cochran (1967).

Results and Discussion

Results concerning chemical composition of bagasse untreated or treated with different treatments are presented in Table 1. The obtained results showed that the three treatments used increased CP content of bagasses. Highest CP content was observed for urea treated bagasse. Crude protein content for bagas-

Table (1) : Chemical composition of bagasse untreated or treated with different methods.

Treatment	Composition , % DM					
	DM	CP	CF	EE	Ash	NFE
Untreated (control)	92.1	1.8	56.7	1.2	3.0	37.3
Sodium hypochlorite+urea	96.4	13.3	53.3	2.4	2.9	28.1
NaOH+T.V.	91.4	11.4	56.1	1.3	9.3	21.9
Sodium hypochlorite+T.V.	87.6	11.3	49.3	2.9	9.8	26.7

se treated with sodium hypochlorite + T. V. and NaOH + T. V. treated bagasse was nearly the same. As expected spraying bagasse with 4% urea solution increased its CP content to the same CP content of T. V. treated bagasse. Similar results have been reported by Soliman *et al.* (1983 and 1984) and Shoukry *et al.* (1985-a), who found that spraying poor quality roughages with urea solution increased greatly its CP content. The results obtained agreed well with those reported by Shoukry *et al.* (1985-b) who found that treating bagasse with fungi greatly increased its CP content.

All treatments used decreased CF content of bagasse. Highest decrease was recorded for sodium hypochlorite + T. V. treatment followed by that of urea treatment. NaOH + T. V. treatment slightly decreased CF content of bagasse. These results were in a good agreement with those reported by Shoukry *et al.* (1985-b) who found that treating bagasse with sodium hypochlorite decreased its content of CF. Also Soliman *et al.* (1983 and 1984) and Shoukry *et al.* (1985-a) found that spraying poor quality roughages with 3% urea solution decreased its CF content.

Ether extract content of urea treatment was similar to that of sodium hypochlorite + T. V. treated bagasse and both were higher than that of bagasse untreated or treated with NaOH + T. V., which were nearly the same.

Fungal treatments either with sodium hypochlorite or NaOH increased ash content of bagasse. Ash content of untreated bagasse was similar to that of sodium hypochlorite + urea treated bagasse. These results agreed well with those obtained by Shoukry *et al.* (1985-b), who found that ash content of bagasse increased by fungal treatment.

Nitrogen free extract of bagasse decreased by the three treatments used. Lowest value was recorded for NaOH + T. V. treatment. NFE content of urea + sodium hypochlorite treated bagasse was nearly similar to that of sodium hypochlorite + T. V. treated bagasse. This may have been related to the losses of soluble nutrients during washing the material used after treating it with NaOH or sodium hypochlorite. Similar results have been reported by many workers with different alkali treated poor quality roughages (Abou-Raya, 1967, El-Talty 1973, Jackson, 1977, Salem, 1980 and Abou Raya *et al.*, 1984).

Results concerning CF fraction of bagasse untreated or treated with sodium hypochlorite + urea or different fungal methods are presented in Table 2. The results obtained showed that both fungal treatments decreased NDF and ADL contents of bagasse. The magnitude of reduction was greater for sodium hypochlorite + T. V. treatment than that for NaOH + T. V. treatment. Sodium hypochlorite + T. V. treatment decreased ADF of bagasse, while NaOH + T. V. treatment increased slightly ADF of bagasse.

Table (2) : Crude fiber fraction and IVDMD of bagasse untreated or treated with different methods.

Treatment	Crude fiber fraction, % DM					IVDMD	SE
	NDF	ADF	ADL	Hemicellulose	Cellulose		
Untreated(control)	91.9	63.7	15.6	28.2	48.1	24.1 A	±1.2
Sodium hypochlorite + urea	74.1	56.5	7.3	17.6	49.2	44.9 B,b	±1.2
NaOH + T.V.	78.2	64.7	15.1	13.5	49.6	49.3 B,b	±0.9
Sodium hypochlorite + T.V.	74.1	59.0	7.0	15.1	52.0	53.7 B,a	±1.0

A, B Means with different superscripts are significantly ($P < 0.01$) different

a,b Means with different superscripts are significantly ($P<0.05$) different

SE = Standard error of the mean

Sodium hypochlorite + urea treatment decreased NDF, ADF and ADL contents of bagasse.

All treatments used decreased greatly hemicellulose and slightly increased cellulose contents of bagasse.

The results obtained for CF fraction of NaOH + T. V. treatment are in a good agreement with those obtained by Shoukry *et al.* (1985-b) for T. V. treated bagasse, while values obtained for NDF, ADF and ADL of sodium hypochlorite + T. V. treatment were lower than those reported by Shoukry *et al.*, (1985-b). This difference in CF fraction between the two fungal treatments used may have been related to differences in the effect of sodium hypochlorite and NaOH on the chemical composition of bagasse.

The results of CF fraction of urea treated bagasse agreed well with that reported by Shoukry *et al.*, (1985-a) for spraying poor quality roughages with urea solution.

Nutritive values of untreated bagasse or bagasse treated with different treatments in terms of IVDMD are shown in Table 3. The lowest value was recorded for untreated bagasse. All treatments used increased significantly ($P < 0.01$) IVDMD values of bagasse. This may be due to the higher CP content and lower CF content and its fraction contents of these treatments compared with those of untreated bagasse. Highest value was recorded for sodium hypochlorite + T. V. ($P < 0.05$). No significant difference was observed among other two treatments. Similar results have been reported by El-Hag (1983), who found that treated straws with NH_3 solution (1%) + *Coprinus Cinereus* fungi or *Coprinus Cinereus* only increased IVDMD values.

The results obtained for DM degradability (Table 3) for untreated or treated bagasse with different treatments agreed well with those reported for IVDMD. *In Situ* DM disappearance of bagasse increased significantly ($P < 0.01$) with different treatments at almost all incubation periods. *In Situ* DM degradability was nearly similar for the three treatments used. The IVDMD and *In Situ* DM disappearance values obtained for sodium hypochlorite + T. V. treatment were slightly greater than those of the other two treatments used. This may have been related to the lower CF and ADL contents of this treatment than other treatments used (Van Soest, 1967 and Horn *et al.*, 1979). The results obtained for sodium hypochlorite + urea treatment support the conclusion of El-Torky (1979), who suggested that a combination of NaOH treated bagasse plus urea supplement would be beneficial to the nutritive value of such products.

Table (3): In Situ DM disappearance (%) of bagasse untreated or treated with different methods at different incubation periods.

Treatment	Incubation periods, hr.					Overall mean
	4	8	12	24	48	
Untreated(control)	6.0	10.3	10.5	18.8	27.1	14.5 A
SE	±0.1	-	±0.3	±0.8	±0.6	
Sodium hypochlorite+urea	15.8	19.3	24.9	45.7	50.6	31.3 B
SE	±0.8	±0.5	±0.8	±0.1	±3.7	
NaOH + T.V.	13.8	19.2	26.9	39.2	47.8	29.4 B
SE	±0.8	±1.2	±2.2	±0.2	±2.9	
Sodium hypochlorite+T.V.	16.6	18.5	25.8	49.6	57.2	33.5 B
SE	±0.5	±0.8	±0.1	±2.0	±0.8	

A, B Means with different superscripts are significantly ($P < 0.01$) different.

SE = Standard error of the means.

The present study suggested that the chemical composition and nutritive value of bagasse can greatly be improved by the two fungal treatment methods used in particularly for sodium hypochlorite + T. V. treatment. A similar improvement can be achieved by spraying sodium hypochlorite treated bagasse with 4% urea solution. Work now is in progress and it is hoped the future course of work will comprise *In Vivo* evaluation of the different products obtained either from chemical treatment or biological treatment of bagasse. Yet, the spray of urea solution to untreated or chemically treated bagasse will also be evaluated using the *In Vivo* method.

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زيادة القيمة الغذائية لبعض مواد العلف الخشنة الفقيرة فى علائق المجترات :

١ – تأثير المعاملة بالرش باليوريا بالمقارنةبالمعاملة الميكروبية على القيمة الغذائية لمصاصة قصب السكر

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فى هذه الدراسة تم معاملة مصاصةقصب السكر اما بايدروكسيد الصوديوم أو بهيبوكلوريت الصوديوم وعومل المنتج بفطر التريكودرما فاردى (تخمير)، ومن ناحية أخرى تم رش مصاصة قصب السكر المعاملة بهيبوكلوريت الصوديوم بمحلول يوريا ٤٪ (على أساس المادة الجافة للمصاصة) وتخزينها لمدة اسبوعين . وتم دراسة تأثير الثلاثة معاملات السابقة على القيمة الغذائية للمصاصة .

وتشير النتائج الى ان جميع المعاملات المستخدمة قد ادت الى زيادة محتوى مصاصة قصب السكر من البروتين الخام زيادة كبيرة وخفض محتواها من الالياف الخام والهيميسليولوز واللجنين و NDF ومستخلص المواد الخالية من الازوت ، بينما لم يتأثر محتواها من السليولوز و ADF بالمعاملات المختلفة . وقد ادت المعاملة بالفطر بالطريقتين الى زيادة محتوى المصاصة من الرماد الخام .

وقد اوضحت النتائج الى ان الثلاثة معاملات المستخدمة ادت الى زيادة معدل اختفاء المادة الجافة المقدرة اما باستخدام طريقة الكرش الصناعى In Vitro او باستخدام طريقة تحضين الاكياس الداكرون فى كرش الاغنام على فترات زمنية مختلفة (٤، ٨، ١٢، ٢٤، ٤٨ ساعة) In Situ وكانت أكبر زيادة فى حالة المعاملة أولا بهيبوكلوريت الصوديوم ثم الفطر وان لم تظهر فروق معنوية بين المعاملات الثلاثة المستخدمة .

وبصفة عامة فان النتائج تقترح امكانية زيادة القيمة الغذائية لمصاصة قصب السكر بالمعاملة بفطر التريكودرما فاردى وخاصة مع استخدام المعاملة بهيبوكلوريت الصوديوم وكذلك يمكن احداث تحسين مشابه باستخدام المعاملة بهيبوكلوريت الصوديوم مع الرش والتخزين باستخدام محاول اليوريا ٤٪