The Effect of Different Methods for Treatment of Common Low Quality Roughages in Egypt on Their Digestibility and Feeding Value.

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A survey was made in some districts in Monoufia Province to estimate the available corn-by-products. These by-products were chemically treated (2.5 and 5% NH_4OH, 3% anhydrous ammonia 4% $Ca(OH)_2$ and liquid feed, LF).

In vitro dry matter and organic matter digestibilities (IVDMD and IVOMD) and in vivo digestibility of untreated and treated materials were determined.

Results of the prelimenary experiment showed that corn cobs was more digestible than corn stover (CS). Improvements in IVDMD of CS due to the treatments were 6.0, 11.8, 13.8 and 25.5% for NH_4OH (2.5 and 5%), 4% $Ca(OH)_2$ and LF, respectively. IVOMD showed the same trend.

Anhydrous ammonia and LF were applied on larger scale and the feeding value were determined in vivo.The improvement in SE and TDN were 51.8, 28.9 and 44.7, 15.2% for ammoniated and LF supplemented-CS, respectively.

Animals fed ammoniated and LF supplemented-CS retained more nitrogen (1.92 and 3.12 g/d vs. -1.60 g/d for the untreated-CS).

Several investigations on the chemical and/or microbiological treatments to increase the nutritive value of some poor quality roughages have been reported (Abou-Raya et al., 1964; Hoeney and Bender, 1970; Coxworth et al., 1977 and Nour et al., 1980).

Today there is a world-wide search for new practical methods to treat low-quality roughages to increase their feeding value. One of the most promising is the ammoniation method. Anhydrous ammonia and solutions of ammonia in water (aqueous ammonia) have both shown a positive effect in improving the nutritive value of low-quality roughages (Sundstøl et al., 1978).

Treating straw with $Ca(OH)_2$ has also been developed and seems promising (Abou-Raya et al., 1984).

Feeding value of low-quality roughages could be also increased by supplementing them with suitable levels of urea and molasses as cheap sources of nitrogen and energy (Abdel-Rahman and Ahmed, 1984).

The objective of this study was to investigate the effectiveness of chemical treatments on improving the in vitro dry matter (IVDMD) and organic matter (IVOMD) digestibilities. Effect of ammoniated- and supplemented-corn stover with liquid feed on chemical composition, in vivo digestibility, feeding value and nitrogen balance was also studied.

Materials and Methods

A survey was made in some districts of Monoufia Province to estimate the available crop residues to be used.

The untreated corn stover and cobs were sampled from different districts and chemically analyzed.

The following treatments of corn stover were made in

plastic bags:
1. Aqueous ammonia at 25 and 50g NH_4OH/kg DM.
2. Calcium hydroxide (4%).
Corn stover was also supplemented with the liquid feed (LF) containing urea, molasses, minerals and vitamins (Abdel-Rahman and Ahmed, 1984).

Samples of the untreated- and treated-corn-by-products were dried, ground and used for determining the chemical composition according to A.O.A.C. (1980).

In vitro dry matter and organic matter digestibilities were conducted using the two stage technique of Tilly and Terry (1963) with slight modification that the incubation time was extended to 72 hrs.

In the ammonia treatment, a stack of rice straw bales 1.5m high, 2m wide and 11m long was made in the open. In the middle of the stack, some bales of rice straw were removed and replaced by chopped corn stover. The stack contained 5 tons of rice straw and 1.5 tons of chopped corn stover. Ammonia was injected at the level of 3kg/100 kg roughage as described by Sundstøl et al. (1978). The stack was opened 4 weeks later as recommended by FAO (1978). Chemical analysis was carried out.

In vivo digestibility trials and nitrogen balance for the untreated, ammoniated and LF-supplemented corn stover were conducted on 9 Osimi rams (3 animals/treatment) according to Maynard et al. (1979).

Results and Discussion

From our survey it was found that each feddan produces about 2-2.5 tons corn stover and about 250-320 kg corn cobs. The corn stover is being sold for about 40 LE/feddan by-product, which equals 17.7 LE/ton, while the corn cobs is being sold for about 8.5 LE/feddan, which equals 30 LE/ton. The approximate estimation made in eight districts of Monoufia Province amounted to 450 thousand tons corn

stover and 54 thousand tons corn cobs annually.

The chemical analysis of untreated corn stover and cobs are given in Table 1. These values are within those reported by others (Abaza et al., 1981 and Abou-Raya et al., 1984).

Table 1. Chemical composition of untreated corn srover and cobs.

Item	Corn stover		Corn cobs	
	as fed	DM basis	as fed	DM basis
	---------- % ----------			
DM	88.18	100	89.88	100
OM	80.08	90.81	87.93	97.83
CP	3.39	3.84	2.80	3.12
EE	1.30	1.47	1.00	1.11
CF	34.51	39.14	30.19	33.59
NFE	40.88	46.36	53.94	60.01
Ash	8.10	9.19	1.95	2.17

The IVDMD and IVOMD (Fig. 1) increased linearly with time of incubation reaching the highest values at 72 hrs. This would suggest using 72 hrs of incubation rather than 48 hrs recommended by Tilly and Terry (1963).

At all times of incubation, corn cobs was more digestible than corn stover. This may be explained by the higher contents of NFE and lower contents of CF in corn cobs than in corn stover (Table 1). Corn cobs also has higher OM percentage than corn stover.

Fig. 2 gives the IVDMD of corn stover as affected by different chemical treatments. It is obvious that both levels of aqueous ammonia improved the IVDMD of corn stover as compared to the untreated samples. However, 5% ammonia caused significantly higher improvement than

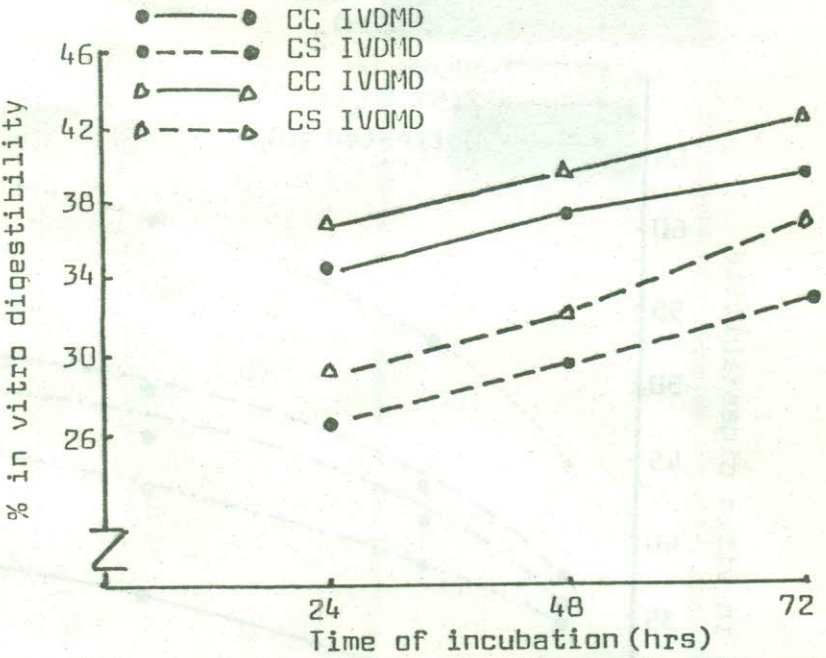

Fig. 1: Effect of time of incubation on in vitro dry matter (IVDMD) and organic matter (IVOMD) of corn stover (CS) and corn cobs (CC) digestibility.

did 2.5%. At 72 hr of incubation the average IVDMD values were 39.05 and 44.82 with 2.5% and 5% ammonia, respectively. Data concerning IVOMD showed similar trend (Fig. 3). Rate of digestion was also higher when corn stover was treated with 5% ammonia than 2.5%. Many investigators reported similar results. Tubei and Said (1981) found that ammonia-treated corn stover increased the digestibility of both DM and OM in vivo. Kiangi (1981) reported that 5% ammonia level was better than 2.5% in improving IVDMD and IVOMD of corn stover. Working with straw, Borhami and Johnsen (1981) reported that ammonia treatment increased OM digestibility. Sundstøl et al. (1978) repor-

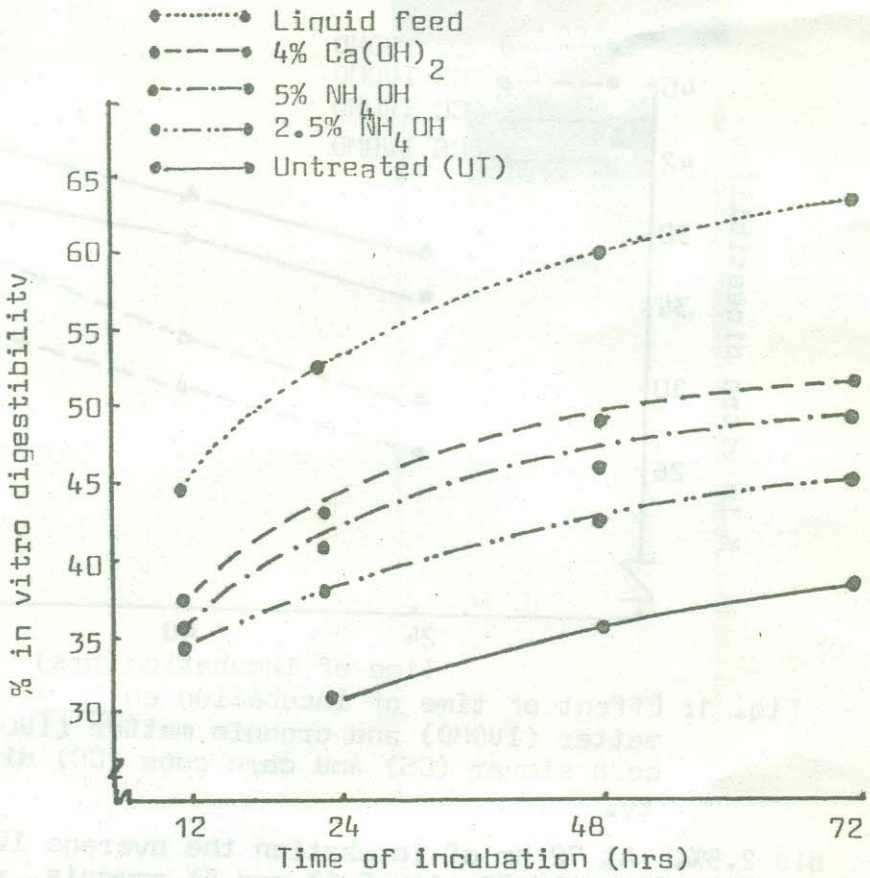

Fig. 2: IVDMD of corn stover as affected by different treatments.

ted that both 5% and 3% levels of ammonia treatment improved the digestibility of straw similarly. Digestibility of barley straw (Sundstøl et al., 1979 and Fahmy and Sundstøl, 1983) and oat straw (Borhami and Sundstøl, 1982) was also improved when treated with higher level of ammonia than lower level. In his review paper, Sundstøl (1981) reported that the optimal results could be achieved when low quality roughages treated with 5% aqueous ammonia

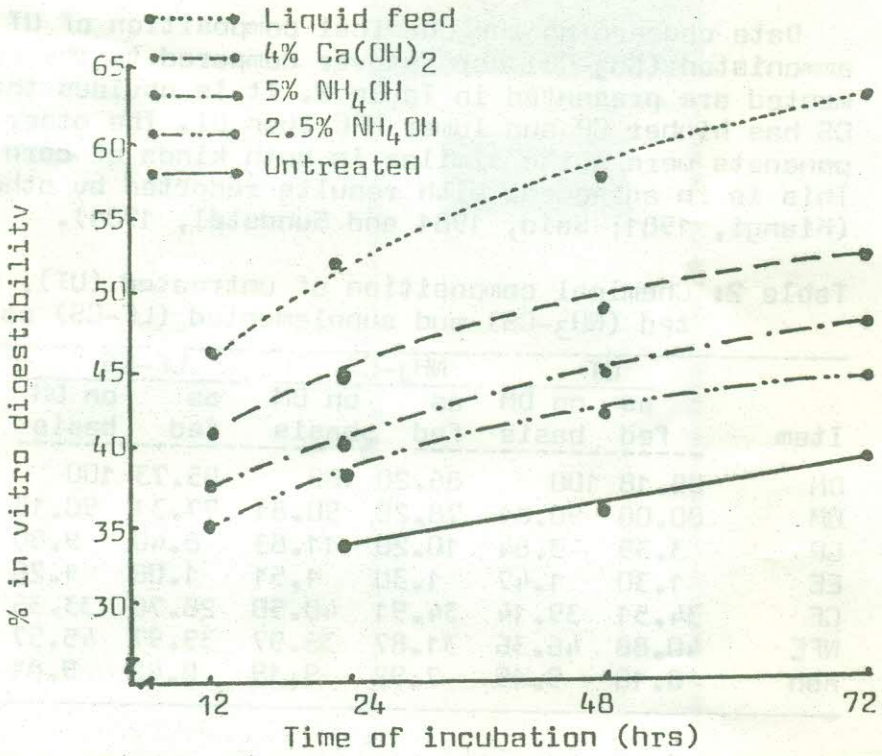

Fig. 3: IVOMD of corn stover as affected by different treatments.

Treatment with $Ca(OH)_2$ improved the IVDMD and IVOMD to 46.78 and 48.75, respectively (Fig. 2 and 3). However, supplementation of corn stover with liquid feed under similar condition gave values of 58.49 and 61.42, respectively.

Borhami et al. (1975) found that corn stover treated with 1.5% $Ca(OH)_2$ improved the TDN value by 36%. Abou-Raya et al. (1984) reported that feeding value, DM, OM digestibilities of maize stalks treated with $Ca(OH)_2$ was increased compared to the untreated. Crude fiber digestibility was also increased. Similar improvement in IVDMD of $Ca(OH)_2$ treated wheat straw (Lesoing et al., 1981) and

barley straw (Sundstøl et al., 1979) was reported.

Data concerning the chemical composition of UT and ammoniated (NH_3-CS) corn stover compared to the supplemented are presented in Table 2. It is obvious that NH_3-CS has higher CP and lower NFE than UT. The other componenets were quite similar in both kinds of corn stover. This is in agreement with results reported by others (Kiangi, 1981; Said, 1981 and Sundstøl, 1981).

Table 2: Chemical composition of untreated (UT), ammoniated (NH_3-CS) and supplemented (LF-CS) corn stover

	UT		NH_3-CS		LF-CS	
	as	on DM	as	on DM	as	on DM
Item	fed	basis	fed	% basis	fed	basis
DM	88.18	100	86.20	100	85.73	100
OM	80.08	90.81	78.28	90.81	77.31	90.18
CP	3.39	3.84	10.20	11.83	8.40	9.80
EE	1.30	1.47	1.30	1.51	1.08	1.26
CF	34.51	39.14	34.91	40.50	28.76	33.36
NFE	40.88	46.36	31.87	36.97	39.97	45.57
Ash	8.10	9.19	7.92	9.19	8.42	9.81

In vivo nutrient digestibilities are presented in Table 3. Data revealed that digestion coefficients of all components were higher in the ammonia treated-CS than both UT and supplemented-CS. However, digestion coefficents of CP was higher in the supplemented-CS than in NH_3-CS Said (1981) reported similar results.

Table 3: In vivo nutrient digestibilities of untreated, ammoniated and supplemented corn stover.

Item	DM	OM	CP	EE	CF	NFE
Untreated	52.4	49.7	-	-	49.1	56.2
Ammoniated	60.6	63.5	63.7	59.2	68.7	57.8
Supplemented	56.2	57.5	66.4	24.9	50.7	61.6

Supplementation of corn stover with molasses or molasses plus urea increased digestion coefficients as reported by Kategile (1981) who found an improvement of 17.9% in DMD when corn stover supplemented with molasses. Supplemental N provided as urea increased organic matter digestibility over that observed when no supplemental N was provided (57.5 vs 49.7%), respectively (Martin et al. 1981).

Table 4: Nutritive value and nitrogen balance of untreate ammoniated and supplemented corn stover (on DM basis).

Item	Untreated	Ammoniated	Supplemented
Nutritive value			
SE, %	22.6	34.3	32.7
TDN, %	45.3	58.4	52.2
NR 1:	-	6.8	7.0
Nitrogen balance, g/d	-1.60	+1.92	+3.12

Compared to the supplemented-CS (Table 4) it is obvious that NH_3-CS has a little more effect on the nutritive value than supplemented-CS. However, from data of nitrogen balance it is clear that animals fed the supplemented-CS retained more N than did those fed ammonia-CS. This could be due to one or more of the following:

1. Most of the N in the ammonia-treated CS are in the form of free ammonia (Solaiman et al., 1979); a large amount of which is being lost through the rumen wall to be secreated back in the urine in the form of urea.
2. Nitrogen content of the supplemented-CS is in the form of urea which is less degradable in the rumen and more available to rumen microorganisms for microbial protein synthesis (Abdel-Rahman and Ahmed, 1984).
3. The liquid feed has vitamins and minerals which will cover the animals requirements for both macro and micr

elements as well as vitamins; those are being essential growth factors.

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تأثير استعمال طرق مختلفة لمعاملة الاعلاف الخشنة الشائعة الاستعمال فى مصر على قيمتها الهضمية والغذائية.

كمال محمد عبدالرحمن و بركات محمد أحمد
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أجرى حصر بمحافظة المنوفية لتقدير الكميات التى يمكن استعمالها من حطب وقوالح الذرة ، وقد أجرى التحليل الكيميائى لهذه المخلفات ، ثم عوملت بمواد كيميائية (٢ر٥ ٠/٠، ٥ ٠/٠ محلول الامونيا ، ٠٣/٠ غاز الامونيا ، ٤ ٠/٠ أيدوكسيد الكالسيوم ، السوائل المغذية).

وقد أجريت تجارب هضم معملية وكذلك على الحيوانات لتقدير القيمة الهضمية للمخلفات المعاملة وغير المعاملة.

وقد دلت النتائج على أن القيمة الهضمية لقوالح الذرة أعلى منها لحطب الذرة ، وكان التحسين فى هضم المادة الجافة لحطب الذرة والناتج من المعاملات هو ٦ر٠ ، ٨ر١١ ، ٨ر١٣ ، ٥ر٢٥ ٠/٠ لكل من المعاملة بمحاليل الامونيا (٢ر٥ ٠/٠ ، ٥ ٠/٠) ، ٤ ٠/٠ أيدروكسيد الكالسيوم ، السوائل المغذية ، على التوالى . وكان للنسبة الهضمية للمادة العضوية نفس الاتجاه .

وقد تم تطبيق استعمال غاز الامونيا أو السوائل المغذية على نطاق واسع فى تجارب غذائية لتقدير القيمة الغذائية وقد أظهرت النتائج تحسنا قيمته ٨ر٥١ ، ٩ر٢٨ أو ٧ر٤٤ ، ٢ر١٥ لكل من معادل النشا ومجموع المواد الغذائية الكلية المهضومة على التوالى.

وكانت نتائج ميزان النيتروجين على الحيوانات التى غذيت على حطب ذرة معامل بغاز الامونيا والسوائل المغذية هو ٩٢ر١ ، ١٢ر٣ جم/اليوم على التوالى مقابل - ٦ر١ جم/اليوم فى حطب الذرة غير المعامل .