

Technology Section

Pakistan J. Sci. Ind. Res., Vol. 26, No. 6, December 1983

IMPROVEMENT IN THE DIGESTIBILITY OF COTTON AND MUSTARD STALKS

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(Received March 27, 1982)

The Dry matter digestibility of untreated mustard and cotton stalks was 29.54 and 18.85 percent respectively. It increased to 64.90 and 36.41 % when mustard and cotton stalks were first treated with 0.5 % calcium hydroxide and subsequently with 5 % ammonia. A three fold increase in non-protein nitrogen was also observed.

INTRODUCTION

Cotton, mustard and rape seeds are important crops of Pakistan. A large volume of crop residues and by-products are derived from these crops. Some of these residues such as hulls, straws, leaves are fed to the cattle. Stalks are of very low nutritive value and are generally used as a fuel. A general feature of all these residues is their high lignification and presence of other contaminants i.e. cutin. The feeding value of these residues can be greatly improved by alkaline or other chemical treatments which result in breaking the bond between lignin and cellulose.

MATERIALS AND METHODS

Cotton and mustard stalks were purchased from the local market and were ground to 20 mesh size. They were treated with 0.5 % calcium hydroxide and then passed through an electrically operated screw press. The material was also treated with ammonia (5 % w/w) and was incubated at $55 \pm 5^\circ$ for 15 days. Analytical methods were the same as reported elsewhere [1].

In vivo digestibility of the treated stalks was estimated according to the rumen techniques [2]. The samples were infused in rumen of cow or buffalo and taken out after 12 hr upto 48 hr. They were washed with distilled water followed by alcohol and finally with distilled water, and then dried at $100 \pm 5^\circ$ to constant weight.

RESULTS AND DISCUSSIONS

Proximate Analysis of Mustard Stalks Treated with Calcium Hydroxide and/or Ammonia

Chemical composition of mustard stalks is given in Table 1. Treatment of the stalks with calcium hydroxide and/or ammonia increased the ash content with a decrease in cellulose component. Garrett *et al.* [3] also reported an increase in ash contents with a decrease in cellulose by

alkali treatment. Ammoniation of the substrate increased nitrogen contents upto three fold (Table 1). Similar results were reported by Weiss *et al.* [4], Han and Anderson [5] who noted an increase in nitrogen contents due to the reaction of ammonia with straw components to form nitrogenous compounds.

Proximate Analysis of Cotton Stalks Treated with Calcium Hydroxide and/or Ammonia

Proximate analysis of the cotton stalks is also given in Table 1. Treatment of the stalks with calcium hydroxide increased the ash contents with a decrease in cellulose component. Ammoniation of the substrate increased the nitrogen content upto three fold.

1. *In Vivo Digestibility of Mustard Stalks.* The dry matter digestibility of untreated mustard stalks was 29.54 percent, which after treatment with 0.5 % calcium hydroxide or 5 % ammonia increased to 36.20 and 46.73 percent respectively (Table 2). Nagi and Kehar [6] found an improvement in the digestibility of straw by calcium hydroxide treatment. Improvement in the digestibility of ligno-cellulosic material by ammonia treatment was also observed by many workers [7-9]. Ammoniation increased the feeding value by breaking bond between lignin and cellulose and unbound residual ammonia could serve as non-protein nitrogen source for protein synthesis in the rumen of animal.

There was a logistic increase in digestibility when mustard stalks were successively treated with 0.5 % calcium hydroxide and 5 % ammonia (64.90 %) as compared to untreated stalks (29.54 %) Table 2.

2. *In Vivo Digestibility of Cotton Stalks.* The dry matter, organic matter, cellulose and mineral digestibility of untreated cotton stalks was 18.85, 17.86, 36.48 and 46.43 percent respectively (Table 2). An improvement in the dry matter digestibility was observed when cotton stalks were treated with 0.5 % calcium hydroxide or 5 % ammonia (Table 2). The increase in the digestibility of dry

Table 1. Proximate analysis of Mustard & Cotton stalks given different treatments.

| Treatments | Ash % | Cellulose % | Nitrogen % | Fibre % | Lipids % |
|--|----------|----------------|---------------|------------|-------------|
| Mustard stalks as such. | 6.78 | 49.9 | 1.09 | 15.0 | 1.01 |
| Mustard stalks 0.5 % Ca(OH) ₂ . | 7.24 | 47.6 | 1.20 | — | — |
| Mustard stalks 5 % Ammoniated. | 6.92 | 43.2 | 3.24 | — | — |
| Mustard stalks 0.5 % Ca(OH) ₂ + 5 % Ammoniated. | 8.23 | 40.1 | 3.16 | — | — |
| Cotton stalks as such. | 6.70 | 54.05 | 0.96 | 44.70 | 0.59 |
| Cotton stalks 0.5 % Ca(OH) ₂ . | 6.91 | 46.87 | 2.89 | — | — |
| Cotton stalks 5.0 % Ammoniated. | 7.76 | 48.51 | 0.99 | — | — |
| Cotton stalks 0.5 % Ca(OH) ₂ + 5 % Ammoniated. | 8.85 | 43.98 | 3.01 | — | — |

Table 2. Rectuleo rumen digestibility of Mustard and Cotton stalks given different treatments.

| Treatments | Rectuleo rumen digestibility percentage after 48 hours | | | |
|---|--|----------------|--------------|--------------|
| | Dry matter | Organic matter | Cellulose | Minerals |
| Mustard stalks as such. | 29.54 ± 1.22 | 29.03 ± 1.57 | 32.19 ± 4.18 | 48.31 ± 1.77 |
| Mustard stalks 0.5 % calcium hydroxide. | 36.20 ± 3.11 | 35.21 ± 1.02 | 42.67 ± 2.46 | 49.66 ± 5.40 |
| Mustard stalks 5.0 % Ammoniated | 46.73 ± 2.40 | 51.41 ± 2.33 | 51.36 ± 2.03 | 50.22 ± 3.49 |
| Mustard stalks 0.5 % Ca(OH) ₂ + 5 % Ammoniated | 64.90 ± 1.56 | 62.87 ± 1.84 | 60.33 ± 3.30 | 69.92 ± 8.15 |
| Cotton stalks as such. | 18.85 ± 1.71 | 17.86 ± 2.01 | 36.48 ± 5.78 | 46.43 ± 1.88 |
| Cotton stalks 0.5 % calcium hydroxide. | 21.72 ± 0.45 | 19.97 ± 3.64 | 52.69 ± 5.61 | 53.78 ± 4.51 |
| Cotton stalks 5 % Ammoniated | 28.26 ± 1.51 | 28.01 ± 3.21 | 58.23 ± 4.50 | 59.76 ± 3.90 |
| Cotton stalks 0.5 % Ca(OH) ₂ + 5 % Ammoniated. | 36.41 ± 3.22 | 35.64 ± 1.02 | 69.14 ± 7.60 | 68.96 ± 2.25 |

matter, organic matter, cellulose and minerals was 36.41, 35.64, 69.14 and 68.96 % respectively when stalks were successively treated with 0.5 % calcium hydroxide and 5 % ammonia (Table 2).

Results clearly indicate that the digestibility of 0.5 % calcium hydroxide + 5 % ammoniated mustard and cotton stalks increases to 64.90 and 36.41 % respectively, with a three fold increase in non protein nitrogen.

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