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UTILIZATION OF ALKALI TREATED WHEAT AND RICE STRAW BY LACTATING COWS

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Sodium hydroxide treated chopped wheat and rice straws were fed to lactating cows and the influence of this treatment on intake and digestibility of straw and milk yield, milk composition and body weight was studied. The straws were treated with 12% sodium hydroxide. After the completion of the treatment, the straw was washed with running water to remove the unused alkali. The cows were fed a fixed amount of concentrate mixture while straw and green berseem were offered according to the body weight requirements. The digestibility of crude fibre increased from 46.1 to 62.0% for wheat straw and from 45.2 to 63.4% for rice straw due to alkali treatment. The milk yield of animals fed treated straw was higher than that of control animals. However, no significant change was observed in milk composition and body weight of the animals. The results revealed that nutritive value of alkali treated wheat and rice straws improved significantly.

INTRODUCTION

The major part of livestock feed in Pakistan is composed of straws of various cereal plants. The annual production of wheat and rice straws is Pakistan is estimated to be 11,531 and 3,368 thousand tons, respectively (Anonymous, 1983-84). Due to high crude fibre content and its lignification, the digestibility of straw is poor, thus, limiting its consumption. Treatment of roughages by various chemicals has been used to improve its digestibility. Among the chemical treatments, use of sodium hydroxide has been reported to improve intake, digestibility and utilization of straw by ruminants.

Improved utilization of wheat and rice straws can contribute a lot to increase the milk production by cows. This project was planned to investigate the possibility of using sodium hydroxide treated wheat and rice straws in dairy

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cow rations to see the effect on intake and digestibility of straws and on production and composition of milk.

MATERIALS AND METHODS

Wheat straw (WS) and rice straw (RS) were chopped and treated with 4% sodium hydroxide solution for 24 hours. The added sodium hydroxide represented 12% of the air dried weight of the straw and the straw liquid ratio was 1 : 3. After 24 hours of the treatment, the straw was washed with running water to remove the unreacted alkali. The washing of straw continued till pH of the water became neutral. The washed straw was sun dried and stored for further use. The treated wheat and rice straws were designated as TWS and TRS, respectively. Four rations were formulated and designated as A, B, C and D (Table 1).

Table 1. *Percentage composition of experimental rations*

Ingredients	Rations			
	A	B	C	D
	WS	TWS	RS	TRS
Cotton seed cake (undecorticated	30	30	30	30
Maize oil cake	15	15	15	15
Wheat bran	15	15	15	15
Untreated wheat straw (WS)	40	—	—	—
Sodium hydroxide treated (TWS)	—	40	—	—
Untreated rice straw (RS)	—	—	40	—
Sodium hydroxide treated (TRS)	—	—	—	40
Crude protein	11.9	11.9	12.0	12.0
Digestible protein	9.3	9.3	9.3	9.3
Total digestible nutrients	61.47	61.47	61.47	61.47

Twelve Sahiwal cows of uniform age and having about the same milk yield were selected from the herd maintained by the Department of Livestock Management, University of Agriculture, Faisalabad. The cows used in the trial were in 4th month of 3rd lactation. The cows were numbered for identification.

Three cows were allotted to each ration in a completely randomized design for a period of six weeks. Preliminary period of one week was allowed to adjust the cows to the experimental rations. The experimental rations and green berseem were fed for production and maintenance requirements according to Morrison (1959). During the experimental period, feed intake, milk production and weekly body weight gain were recorded. The milk samples were taken weekly and analysed for protein, ash, fat, solids-not-fat, and moisture contents (A.O.A.C., 1970).

During the last week of the experiment, the digestibility trial was conducted. Faeces voided daily was weighed, mixed and a representative sample was collected which was dried for further analysis. The dry matter of feed and faeces was determined at 105°C (to a constant weight). The proximate analysis of faeces was made according to the methods of A. O. A. C. (1970). Representative samples of green berseem, wheat and rice straws and concentrate mixture were analysed for proximate composition. The results thus obtained were statistically analysed.

RESULTS AND DISCUSSION

Feed Consumption and Milk Production : The daily intake of green berseem, straws and concentrate and average milk yield are given in Table 2.

Table 2. *Average daily feed consumption and milk yield of cows fed experimental rations*

Description	Experimental rations			
	A	B	C	D
Berseem consumption (kg)	10.9	6.6	10.5	7.4
Straw consumption (kg)	3.8	5.8	3.6	5.2
Concentrate consumption (kg)	2.3	2.3	2.3	2.3
Milk yield (kg)	7.11	8.15	6.38	7.92
Total feed consumed : milk produced (FCR)	.85	.95	.75	.90

The data show apparent variation in feed consumption among animals kept on different rations. These variations are probably due to the variation in the body weights of the animals, because animals were fed according to their body weights.

The milk yield in all groups of animals ranged from 6.38 to 8.15 kg/head/day. The animals fed treated straws had significantly higher ($P<0.01$) milk yield compared to those fed untreated straws. It was further noted that animals on ration containing sodium hydroxide treated wheat straw yielded 14.6% more milk and those fed treated rice straw yielded 24.1% more as compared to respective control animals. However, wheat straw proved to be a better source of roughage than rice straw since animals fed rations containing rice straw had lower total milk yield. But the effect of alkali treatment on rice straw was more than on wheat straw, showing thereby that alkali treatment proved more useful for poor quality roughages. The feed conversion ratio (FCR) was also better (.74—.85) in animals fed treated straw than those of untreated (.90—.95) animals. The improved digestibility of crude fibre of treated straw resulted in higher intake as well as better milk yield. The body weight of the experimental animals remained almost unchanged throughout the experimental period.

Table 3. *Average digestibility values of various nutrients of experimental rations*

Description	Experimental rations			
	A	B	C	D
	WS	TWS	RS	TRS
Dry matter (%)	58.11	59.79	60.45	61.54
Crude protein (%)	67.45	71.42	72.86	74.58
Ether extract (%)	81.12	81.02	82.63	82.00
Crude fibre (%)	46.13*	62.03 [b]	45.20[ac]	63.36

* The values bearing the same letters are not significantly different from each other.

Digestibility : The data regarding digestibility of dry matter, crude protein, ether extract and crude fibre in respect of rations containing treated and untreated wheat and rice straws when subjected to statistical analysis, revealed that treatment with sodium hydroxide did not have any significant effect on the digestibility of dry matter and ether extract (Table 3).

The digestibility results presented earlier by Klopfenstein *et al.* (1972) and Moran *et al.* (1983) showed that digestibility of straw was increased by the alkali treatment due to delignification. Ali (1977) reported that the sheep and

cattle fed rations containing upto 50% treated straw consumed more feed as compared to those containing untreated straw. The increased intake was associated with higher digestibilities of rations.

It may thus be concluded that with sodium hydroxide treatment, the crude fibre fraction of the roughages becomes more digestible in the rumen and the palatability of the ration is increased. Animals fed rations containing higher percentage of treated roughages also drink more water thus increasing the rate of passage of feed from the alimentary tract. This helps in emptying the rumen for more consumption (Ali, 1977). In tropical countries where straws are the major source to meet energy requirements, treatment with sodium hydroxide would result in better feed utilization for production.

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