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In Vitro Evaluation of Improvement in Nutritive Value of *Wheat Straw* Using *Buffalo Rumen Inoculum*

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ABSTRACT

The effect of supplementation of leguminous (lucerne) and nonleguminous (guinea grass) fodders on the utilisation of wheat straw by ruminal microflora of buffalo bulls, with or without the presence of energy and protein rich feeds was studied by *in vitro* technique. Two sets of experiments for the various treatment combinations were conducted. The results revealed that the supplementation of lucerne resulted in significant increase in dry matter digestibility at each level. Addition of tapioca also proved beneficial for increasing dry matter digestibility but had no beneficial effect on cellulose digestibility. Production of Total Volatile Fatty Acids (TVFA) also exhibited similar trend as observed in dry matter digestibility. The dry matter and cellulose digestibility of wheat straw was improved by supplementation with guinea grass and it was further increased on supplementation with groundnut cake. Significant differences in the production of TVFA with supplementation of different proportions of guinea grass were observed. It was also noticed that 10 per cent groundnut cake supplementation was found to be more beneficial than 5 per cent pH values remained in normal range in all cases.

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INTRODUCTION

Low grade roughages like cereal straws and mature pasture grasses form the main bulk of ration for the livestock in India. Such roughages do not contain digestible crude protein and are poor in total digestible nutrients owing to more amount of lignified cellulose. They only provide bulk and some energy.

Since in Gujarat State wheat straw is considered as low quality roughage by the farmers and is not generally used for feeding the animals an attempt was made to study the improvement *in nutritive* value of wheat straw on supplementation with leguminous and nonleguminous fodders with or without the presence of energy or protein rich feeds using *in vitro* technique.

Attempts have been made in past in this direction in India by different workers using different coarse fodders (Chhabra, 1965; Ichhponani and Sidhu, *1966; Dave, 1969; and Ludri, Pant* and Roy, 1971).

MATERIALS AND METHODS

The roughages and feeds used during present study were air-dried and ground to pass 1 mm seive. The proximate analysis was carried out as per AOAC (1970) methods and is presented in Table 1. Cellulose estimation was done according to method prescribed by Crampton and Maynard (1938). The different combinations of roughages and feeds for incubation as substrates are presented in Tables 2 and 3 in column 2.

TABLE 1

Chemical composition of feeds and fodders used in the experiments (on dry matter basis.)

Feeds constituents	*Wheat straw*	*Lucerne*	*Guinea grass*	*Groundnut cake*	*Tapioca*
Crude Protein	3·59	18·74	11·46	41·39	3·01
Ether exract	1·28	2·13	1·68	10·05	0·47
Crude fibre	34·46	22·93	23·11	14·02	2·13
N.F.E.	49·73	45·54	49·79	28·80	91·46
Ash	10·94	10·66	13·96	5·74	2·93
Silica	5·50	1·64	5·91	1·95	0·62
Phosphorus	0·10	0·49	0·39	0·67	0·11
Calcium	0·40	1·93	0·89	0·27	0·35
Cellulose	37·46	26·75	30·71	16·30	5·34

Two *Surti* buffalo bulls (castrated) were fistulated and maintained on 5 kg green lucerne and wheat straw *ad lib.* Rumen liquor was collected 5 hours after morning feeding. The sampling was done as described by Pant, Rawat and Roy (1962).

All grass *in vitro* technique recommended by Baumgardt, Taylor and Cason (1962) was followed. Estimation of TVFA was done by standard steam distillation method. pH values were recorded with the help of Systronics expanded pH meter type 331. Statistical analysis of the data was carried out as per Snedecor and Cochran (1968).

RESULTS AND DISCUSSION

The average results of dry matter and cellulose digestibility, production of TVFA and pH values are presented in Table 2 and 3.

Dry Matter Digestibility:

From the results (Table 2) it was revealed that the dry matter digestibility of substrate combinations increased with increasing levels of lucerne. Statistical analysis of the data also revealed that there was a significant difference in the dry matter digestibility. At each 20 per cent addition of lucerne the increase in dry matter digestibility of T_1 was about 12, 23, 35 and 45 per cent, respectively for T_2, T_3, T_4 and T_5. In T_7 and T_8 wherein lucerne of T_3 was replaced by 10 and 20 per cent of tapioca the dry matter digestibility was increased by about 12·5 and 15 per cent over T_3 respectively. It was also apparent that tapioca over 10 per cent has got no beneficial effect on dry matter digestibility.

From the results in Table 3 it was evident that the dry matter digestibility of substrate combinations increased significantly at each 20 per cent addition of guinea grass. The increase over T_1 was about 8, 20, 37 and per cent for T_2 T_3, T_4 and T_5 respectively. The increase in the dry matter digestibility over T_1 was to the tune of about 9 and 19 per cent in T_7 and T_8 wherein guinea grass of T_3 was replaced by 5 and 10 per cent groundnut cake respectively. The treatments T_3, T_7 and T_8 were differing

TABLE 2

In vitro dry matter and cellulose digestibility, TVFA production and pH values of wheat straw, lucerne and tapioca in various proportions.

Treat. No.	*Substrate Combinations (Proportions in mg)*	*Dry matter digestibility (%)*	*Cellulose digestibility (%)*	*TVFA production mg/100 ml of fermentation mixture*	*pH Values*
T_1	Wheat straw alone (1000)	32·68	31·32	121·5	6·80
T_2	Wheat straw : Lucerne (800 : 200)	36·71	38·96	165·0	6·80
T_3	Wheat straw : Lucerne (600 : 400)	40·39	47·38	207·0	6·90
T_4	Wheat straw : Lucerne (400 : 600)	44·12	48·85	243·0	6·90
T_5	Wheat straw : Lucerne (200 : 800)	47·67	53·65	276·0	6·95
T_6	*Lucerne alone* (1000)	50·94	58·67	315·0	6·90
T_7	Wheat straw : Lucerne : Tapioca *(600 : 300 : 100)*	45·36	47·36	300·0	6·95
T_8	Wheat straw : Lucerne : Tapioca (600 : 200 : 200)	46·02	38·18	303·0	6·75
	'F' value for treatments	36·54**	145·46**	629·66**	4·73*
	C. D. for treatments	3·33	2·46	9·46	0·15

* Significant at 5 % level.
** Significant at 1 % level.

TABLE 3

In vitro dry matter and cellulose digestibility, TVFA production and pH values of wheat straw, guinea grass and groundnut cake in various proportions.

Treat. No.	*Substrate Combinations (Proportions in mg)*	*Dry matter digestibility (%)*	*Cellulose digestibility (%)*	*TVFA Production mg/100 ml of fermentation mixture*	*pH Values*
T_1	Wheat straw *alone* (1000)	34·94	34·64	130·50	6·98
T_2	Wheat straw : Guinea grass (800 : 200)	37·92	38·69	158·25	6·98
T_3	Wheat straw : Guinea grass *(600 : 400)*	42·98	45·42	192·00	6·85
T_4	Wheat straw : Guinea grass (400 : 600)	47·85	45·50	222·00	6·96
T_5	Wheat straw : Guinea grass (200 : 800)	53·05	47·88	252·00	6·98
T_6	*Guinea grass alone* (1000)	56·91	50·95	271·50	6·90
T_7	Wheat straw : Guinea grass : Groundnut cake *(600 : 350 : 50)*	45·84	46·14	198·00	6·88
T_8	Wheat straw : Guinea grass : Groundnut cake (600 : 300 : 100)	49·42	47·43	214·50	6·98
	'F' value for treatments	162·02**	25·07**	65·71**	5·00*
	C. D. for treatments	1·95	3·54	19·09	0·078

* Significant at 5 % level
** Significant at 1 % level

Cellulose Digestibility:

Results in Table 2 indicated that supplementation of lucerne has resulted in significantly increased cellulose digestibility. As the proportion of lucerne was increased from T_2 to T_5 the cellulose digestibility increased to the extent of 24, 51, 56 and 71 per cent over T_1 for T_2, T_3, T_4 and T_5 respectively. The supplementation of tapioca at 10 per cent level was not found to be beneficial and 20 per cent of tapioca addition resulted in reduction of cellulose digestibility as compared to wheat straw and lucerne combination (60:40).

From the data in Table 3 it was observed that with guinea grass supplementation the increase over T_1 was about 12, 25, 31 and 38 per cent in *cellulose digestibility* respectively. Cellulose digestibility of guinea grass alone did not differ significantly from that of T_5 and T_6 wherein guinea grass formed *80 and 30 per cent of combinations* respectively. Replacement of guinea grass by 5 and 10 per cent groundnut cake resulted in significant increase in the *cellulose digestibility* indicating thereby a need of nitrogenous matter for the utilization of roughage cellulose in such combination.

Production of TVFA:

TVFA production was the lowest from wheat straw alone and it increased with *the supplementation* of lucerne as shown in Table 2. The increase was more pronounced when tapioca was added to the wheat straw *and* lucerne combination. Treatm effects were also found to be significa

As seen from the Table 3 the TV production increased gradually due supplementation of wheat straw wi guinea grass. The treatment effe were significant. Nonsignificant increa in TVFA production at 5 per ce groundnut cake addition was found b 10 per cent addition resulted in significa increase in TVFA production bei higher than T_3.

pH values in both the experimen were found to be within the norm range for different substrate combination

The above findings are suggestiv of need for some nitrogenous matter e.g leguminous fodder with the poor qualit roughage and it is also felt that there i no further requirement of energy ric feeds for utilization of such combination Whereas there is always need of protei *supplementation when poor* qualit roughage like wheat straw is fed alon with the nonleguminous fodder.

Chhabra (1965), Ichhponani an Sidhu (1966), Dave (1969) and Ludr *et al.* (1971) also observed improvemen in the dry matter digestibility and cellu*lose digestibility* and *production of* TVF of poor quality roughages i.e. straw o cereals with supplementation of legu minous or nonleguminous fodders, wit or without addition of energy or protei rich feeds. The findings of the present experiments are also in general agreemen with the findings of above workers.

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