FEEDING VALUE OF MOTT GRASS AND ITS SILAGE IN LACTATING SAHIWAL COWS

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The present study was conduced at the Livestock Experimental Station, Department of Livestock Management, University of Agriculture Faisalabad to determine the effect of feeding mott grass, mott silage and their combinations on the production performance of lactating Sahiwal cows. Treatments were MC= Mott grass without molasses, SC= mott silage without molasses, OM= mott grass supplemented with molasses, MM= 75% mott grass + 25% silage ensiled with molasses, MS= 25%mott grass + 75% silage ensiled with molasses and OS= 100% mott silage ensiled with molasses. Dry matter intake (DMI) ranged from 9.46 to 10.08 kg/day. Maximum intake was in cows fed mott grass in green form supplemented with molasses and minimum in those fed silage ensiled with molasses. Dry matter intake as a percent body weight ranged from 2.69 to 2.80. However, difference in DMI was non significant. Daily CP intake varied from 1.21 to 1.30 and NDF intake ranged from 7.08 to 7.60 kg. In the present study, the concentration of CP in all experimental diets was almost similar and variation in CP intake was attributed to variation in DMI. Milk yield (4% FCM) ranged from 7.84 to 9.06 Lt/day. Maximum FCM yield was in cows fed mott grass/silage in combination and minimum in those cows fed mott silage in which no additive was used. Statistically, difference in milk yield was non-significant ($p>0.05$) in cows fed mott grass alone and mott silage alone. Milk composition of cows fed experimental diets remained unaltered. Fat content ranged from 4.20 to 4.80%, protein from 3.20 to 3.62, total solids from 13.20 to 13.90 and solids not fat from 9.07 to 9.20%. Maximum dry matter digestibility (62.20-62.84%) was found in cows fed mott grass/silage in combination and minimum (58%) in cows fed silage in which no additive was used. NDF and CP digestibilities ranged from 46.90 to 48 and 70.60 to 71.35%, respectively. Statistical analysis indicated that there was non significant difference ($p>0.05$) among digestibilities of mott grass /silage based diets in which molasses was used but these differ significantly from mott grass/ silage where no molasses was used (Control). However, a non significant difference in NDF and CP digestibilities was found across all treatment means.
Keywords: Mott grass, mott silage, feeding value, dry matter intake, milk production, milk composition, digestibility.

INTRODUCTION

In Pakistan, animal production is increasing at a slower rate compared to human population resulting in deficiency of animal protein in the diet of people. The annual milk production is over 34 million tonnes because of which Pakistan is rated as the forth largest milk producer in the world, but still the country has to import milk and milk products to fulfil the domestic demand. This import costs a huge amount of foreign exchange. Therefore, low dairy sector productivity requires to be enhanced to meet not only the dietary needs of human population but also to produce surplus to earn foreign exchange through exports. There are many factors responsible for low livestock productivity but inadequate availability of quality fodder is the most important one. A consistent supply of quality forages in sufficient quantity is universally considered essential for efficient dairy production. In Pakistan, there are two evident fodder scarcity periods, one is during winter months (December to January) and other is during summer months (May to July), but during rest of the year fodder availability is fairly regular and abundant. This abundance if not properly managed, amounts to wastage of fodder resources. This situation calls for the exploration of different means to improve quality and quantity of roughages without sacrificing the area under cash crops. Manipulating this surplus fodder can bridge the gap between supply and demand. Introduction of high yielding fodder varieties such as mott grass and silage making are important options in this regard.

The main goal of silage making is to preserve as much of the nutritional value of the original crop as possible. Preservation is achieved by acidity and by maintaining oxygen free (anaerobic) environment (Ranjit and Kung, 2000).Acids are produced by bacteria that convert fermentable carbohydrates into organic acids, predominantly lactic acid and acetic acid. As fermentation progresses, more acids are produced, pH drops, and eventually the acidity level is adequate to inhibit or kill most bacteria and other microorganisms. At this pH, if protected from exposure to air and water seepage from rain, silage can be preserved for a long period (Iqbal *et al.*, 2005).

Mott grass (*Pennisetum purpureum*) has relatively low buffering capacity and low concentrations of fermentable carbohydrates. Therefore, pH decline is not rapid and final pH is usually high. Any fodder which has sufficient amount of fermentable carbohydrates can be ensiled (Woolford, 1984). However, mott grass can be used for silage making provided that a source of fermentable carbohydrates is added before ensilation (Yang *et al.*, 2004).

Because of being palatable, succulent, mott is one of the most practical fodder for preservation and silage is the most effective substitute for green fodder especially during scarcity period. The use of silage as a substitute for green fodder is not common in Pakistan, whereas it is fed to the dairy animals as a routine feed in many countries of the world.

The scientific evidence regarding feeding value of mott grass silage in dairy animals is limited. Therefore, present study was undertaken with the aim to determine the impact of feeding mott grass, its silage and their combination on dry matter intake, milk yield, milk composition and digestibility in Sahiwal cows.

MATERIALS AND METHODS

Silage making

Mott grass was cut from the field of the LES Dept. of Livestock Management and chopped. A weighed quantity of fodder was put layer by layer in the pit and thoroughly pressed. Molasses was added @ 3% of fodder dry matter. For pressing, both tractor and human labour was used. After filling, the whole pit was covered with plastic sheet. The plastic sheet was then plastered with a blend of wheat straw and mud to avoid any cracking while drying .It was presumed that plastic sheet and mud plastering provided anaerobic conditions for proper silage making. Another silo was also filled but no molasses was used.

Feeding trial

Eighteen Sahiwal cows having almost the same stage of lactation (3-4 months post calving) and parity (2-3) were selected from the LES herd. These animals were divided into 6 groups in such a way that the average milk yield and body weights were almost the same. Deworming of all animals was done. One weak adjustment period was provided. Animals were shifted to following treatments at random:

MC = 100% mott grass without molasses; SC= 100% mott silage without molasses; OM= 100% mott grass ensiled with molasses; MM=75% mott grass + 25% mott silage ensiled with molasses; MS = 25% mott grass + 75% mott silage ensiled with molasses; OS = 100% mott silage ensiled with molasses.

MC and SC acted as control. The combination of MM and MS was on dry matter basis. Silo pits were opened after 30 days and samples were taken for analysis. An amount of silage was taken out just sufficient for one day's feeding. After being taken silage from the pit, the plastic sheet was put back to keep the silage pit sealed. Concentrate was provided @ 1 kg / 2.5 litre FCM yield. Diets were mixed daily and fed once a day ad libitum. Except MC and SC (Control), all the diets were made iso-nitrogenous and iso-caloric. The trial lasted for ten weeks with first week for dietary adaptation and 9 weeks for sample collection. Daily feed intake and milk production were recorded and averaged over 9 weeks. During last week, milk samples were collected daily and were analyzed for fat, protein, total solids and solids not fat using the methods described by AOAC (1990). During last week of the study, a digestibility trial was also conducted. Faecal grab samples were taken four times daily for three days so that a sample was obtained at every two hours interval over 24 hours time period (12 samples). These samples were kept in an air tight container during collection and composite samples from each animal collection were taken for further analysis. Lignin was used as digestibility marker in the study.

Percent DM, NDF, CP and lignin in feed and faeces were determined using methods described by AOAC (1990) and Van Soest and Wine (1967). The samples of all diets were taken and analyzed for DM, CP, NDF, ADF by methods of AOAC (1990) and cellulose and hemicellulose by methods of Van Soest (1991). Feed offered and orts were sampled and composited for analysis.

Statistical analysis

The data collected on various parameters (feed intake, milk production, milk composition and digestibility) were subjected to statistical analysis according to Completely Randomized Design. Duncan's multiple range test was applied for comparison of means where necessary (Steel *et al.*, 1996).

RESULTS AND DISCUSSION

Chemical composition of mott grass, mott silage and their combinations is given in Table 1. A minor increase in dry matter (DM) and crude protein (CP) was found when mott grass was ensiled with 3 % molasses (OS). However, a different trend was found in case of neutral detergent fibre (NDF), acid detergent fibre (ADF) and cellulose.

Dry matter intake

Average daily dry matter intake (DMI) by cows fed various experimental diets is given in Table 2. Daily dry matter intake ranged from 9.46 to 10.08 kg/day. Maximum intake was in cows fed mott grass in green form supplemented with molasses and minimum in

Table 1. Chemical composition of experimental diets

Treatments	DM	CP	Ash	NDF	ADF	Cellulose	Hemicellulose
MC	24.00	10.50	11.00	75.42	45.95	41.86	29.47
SC	22.50	11.02	11.12	75.00	44.90	40.96	30.10
OM	24.46	10.50	11.10	75.40	45.90	41.86	29.50
MM	24.05	10.85	11:15	75.27	45.38	41.41	29.88
MS	23.25	11.57	11.26	75.01	44.35	40.53	30.66
OS	22.86	11.94	11.32	74.89	43.85	40.10	31.04

MC = Mott grass without molasses
OM = Mott grass supplemented with molasses
MS = 25% Mott grass + 75% silage ensiled with molasses
SC = Mott silage without molasses
MM = 75% Mott grass + 25% silage ensiled with molasses
OS = 100% Mott silage ensiled with molasses

Table 2. Average daily dry matter intake by cows fed different diets

Treatments	Fodder	Concentrate	Total	DMI % B.W
MC	7.08	2.72	9.80	2.80
SC	6.98	2.55	9.53	2.71
OM	7.28	2.80	10.08	2.84
MM	6.97	2.89	9.86	2.78
MS	6.76	2.90	9.66	2.76
OS	6.61	2.85	9.46	2.69
Std. error of mean	0.09	0.05	0.09	0.02

MC = Mott grass without molasses
OM = Mott grass supplemented with molasses
MS = 25% Mott grass + 75% silage ensiled with molasses
SC = Mott silage without molasses
MM =7 5% Mott grass + 25% silage ensiled with molasses
OS = 100% Mott silage ensiled with molasses

those fed silage ensiled with molasses. Dry matter intake as a percent body weight ranged from 2.69 to 2.80. However, difference in DMI was non-significant. These results supported the findings of Castle *et al.* (1981) who found that when silage alone or in combination with other feeds was offered to lactating animals, DMI remained unaltered. Similar findings were reported by Motta *et al.* (1980) who offered green forage and silage to Holstein Friesian and Gir cows and reported no difference in DMI. The possible reason for no difference among various diets in DMI may be that the contents of NDF in all treatments were almost the same and NDF is the factor responsible for DMI in ruminants (Martin, 1980). This was also supported by Sarwar *et al.* (1995) who reported that the NDF content of forage is used to predict DMI for ration formulation in dairy animals.

In this study, a minor decrease in DMI with silage based diets was possibly because of the presence of fermentation products (Thomas and Thomas, 1985). The DMI of silage had a negative correlation with silage pH, concentrations of acids (Rook and Thomas, 1982) and moisture content of the silage (NRC, 2001). Moreover, the silage moisture contents might have depressed the intake when silage based diets were fed to lactating cows (Dado and Allen, 1995; Rooke, 1995). Nelson and Satter (1986) also indicated that daily DMI was about 3 kg higher than hay. Gomid *et al.* (1987) fed dairy animals maize, mott silage and hay. They found that DMI was the highest with silage as compared to hay. The lack in difference in DMI in the present study may be due to the use of green mott grass instead of hay.

Cell wall concentration is negatively related to intake of ruminant consuming high forage diets because cell wall can affect intake by contributing to ruminal fill (Shaver *et al.* 1988). Van Soest (1994) evaluated data on the effect of dietary crude protein concentration below 8 %. In the present study, the crude protein of mott grass, its silage and their combinations was more than 8%. This indicates that feeding of mott grass will not depress DMI in animals and consequently will not affect the productivity even if fed mott grass alone.

Daily nutrient intake

Daily CP intake varied from 1.21 to 1.30 and NDF intake ranged from 7.08 to 7.60 kg (Table 3).

Table 3. Average daily nutrient in take by cows fed experimental diets

Treatments	DMI	CP intake	NDF intake
MC	9.80	1.22[b]	7.39
SC	9.53	1.21[b]	7.14
OM	10.08	1.26[a]	7.60
MM	9.86	1.27[a]	7.42
MS	9.66	1.30[a]	7.24
OS	9.46	1.29[a]	7.08
Std. error of mean	0.09	0.01	0.07

MC = Mott grass without molasses
SC = Mott silage without molasses
OM = Mott grass supplemented with molasses
MM = 75% Mott grass + 25% silage ensiled with molasses
MS = 25% Mott grass + 75% silage ensiled with molasses
OS = 100% Mott silage ensiled with molasses

In the present study, the concentration of CP in all experimental diets was almost similar and variation in CP intake was attributed to variation in DMI. The NDF intake was not significantly different in cows fed experimental diets. These results are supported by Ruiz et al. (1992).

Milk production

Average milk yield as affected by various experimental diets is presented in Table 4.

Table 4. Average daily milk yield (Lt) by cows fed different diets

Treatments	As such	FCM
MC	7.60	8.00[b]
SC	7.00	7.84[b]
OM	7.80	8.20[b]
MM	8.20	9.06[a]
MS	8.00	8.82[a]
OS	8.00	8.24[b]
Std. error of mean	0.17	0.19

MC = Mott grass without molasses
SC = Mott silage without molasses
OM = Mott grass supplemented with molasses
MM = 75% Mott grass + 25% silage ensiled with molasses
MS = 25% Mott grass + 75% silage ensiled with molasses
OS = 100% Mott silage ensiled with molasses

Milk yield (4% FCM) ranged from 7.84 to 9.06 Lt/day in all cows. Maximum FCM yield was in cows fed mott grass/silage ensiled @ 3% molasses in combination and minimum in those cows fed mott silage in which no additive was used. Statistically, differences in milk yield were non significant between cows fed mott grass/mott silage in combination but differed significantly from all other diets. The difference in FCM yield may be attributed to difference in digestibility. Except MM and MS groups, FCM yield remained the same. It is consistent with Bacvanski *et al.* (1976), Oshima and Sogo (1984) and Lusk *et al.* (1984) who reported no change in milk production by cows fed diets containing silage. Oshima and Sogo (1984) and Lusk *et al.* (1984) fed sorghum and maize silages to dairy cows and reported that milk yield was unaffected. Ruiz *et al.* (1992) fed corn silage and Mott grass silage to cows and found no difference in milk yield. Similarly, Wilson (1985) also found non-significant difference in milk yield when fed rye grass in silage and green form. Broderick and Maignan (1997) studied the effects of feeding silage on milk production and reported no difference in yield.

Milk composition

Milk composition of cows fed experimental diets remained unaltered. Fat % ranged from 4.20 to 4.80, protein from 3.20 to 3.62, total solids from 13.20 to 13.90 and solids not fat from 9.00 to 9.20% (Table 5). The results of the present study are in line with those reported by Esperance *et al.* (1980), Castle *et al.* (1981), Wilman *et al.* (1992) and Broderick and Maignan (1997) who found that there was no significant difference in milk composition by silage feeding. Castle *et al.* (1981) found that when silage alone and in combination with other feeds was offered to lactating animals, fat percentage did not change due to treatments. Ruiz *et al.* (1992) compared the mott grass and corn silage as dietary forages for lactating cows and found no change in protein and fat contents due to forage based diets.

In this study, no change in protein may be attributed to similar CP contents of all experimental diets. This justification was also supported by Sutton (1989) and Khorasani *et al.* (1993) who reported no change in milk protein when cows were fed fodder based diets having the same CP contents. The possible reason for no difference in the fat percentage may be that all the diets supplied ample amount of effective fibre due to which the acetate to propionate ratio remained constant.

Digestibility

Maximum DMD (62.20-62.84%) was found in cows fed mott grass silage in combination and minimum (58%) due to feeding of silage where no additive was used (Table 6). Statistical analysis indicated that there was significant difference between mott grass /silage based diets in which molasses was used and control diets. Difference in DMD between control diets was non-

Table 5. Average milk composition (%) of cows fed different diets

Treatments	Fat	Proteins	Total solids	Solids not fat
MC	4.40	3.50	13.47	9.07
SC	4.80	3.26	13.77	8.97
OM	4.30	3.34	13.22	8.92
MM	4.70	3.20	13.90	9.20
MS	4.60	3.45	13.70	9.10
OS	4.20	3.62	13.20	9.00
Std. error of mean	0.09	0.06	0.11	0.04

MC = Mott grass without molasses
OM = Mott grass supplemented with molasses
MS = 25% Mott grass + 75% silage ensiled with molasses
SC = Mott silage without molasses
MM = 75% Mott grass + 25% silage ensiled with molasses
OS = 100% Mott silage ensiled with molasses

significant. In cows fed mott grass/silage in combination, comparatively higher digestibilities of DM, NDF and CP were found but within combined diets, difference was non-significant. However, a non significant difference in NDF and CP digestibilities was found across all treatment means. In the present study, improved digestibility might be due to molasses and some associative effects between the two forage sources (mott grass and silage).

Table 6. Average *in vivo* digestibility of nutrients as affected by experimental diets

Treatments	DM	NDF	CP
MC	59.20[c]	46.90	70.85
SC	58.00[c]	47.13	70.60
OM	60.42[b]	47.40	71.30
MM	62.84[a]	48.00	71.35
MS	62.20[a]	47.90	71.20
OS	60.00[b]	47.00	71.00
Std. error of mean	0.74	0.19	0.11

MC = Mott grass without molasses
SC = Mott silage without molasses
OM = Mott grass supplemented with molasses
MM = 75% Mott grass + 25% silage ensiled with molasses
MS = 25% Mott grass + 75% silage ensiled with molasses
OS = 100% Mott silage ensiled with molasses

The other possible explanation for the increased DM digestibility may be that these animals consumed greater amount of concentrate feed which might have improved the ruminal fermentation, resulting into enhanced digestibility of DM and fibre. In case of silage feeding, low digestibility may be due to increased rate of passage as the animals fed mott silage alone voided loose faeces compared to other animals. Martin (1980) and Varga and Hoover (1983) reported that the NDF contents were negatively correlated to the apparent digestibility of the forages. The depression in the digestibility of silage-based diets was due to lower ruminal pH, which might have depressed the growth of cellulolytic bacteria in the rumen (Torotich, 1992).

CONCLUSIONS

Based on the findings of the present study, it can be concluded that mott grass silage is the best substitute of green mott. Mott grass silage alone or in combination can be used in dairy animals without any negative impact on dry matter intake, milk production, milk composition and digestibility. However, ensiling mott grass @ 3 % fodder dry matter and feeding mott grass/silage in combination are beneficial.

ACKNOWLEDGEMENT

This study was supported by Pakistan Agricultural Research Council, ALP, Islamabad.

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