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Chandrashekhar S
Department of Sericulture, College of Agriculture, University of Agricultural Sciences, GKVK, Bengaluru, Karnataka, India

Divyashree HJ
Department of Sericulture, College of Agriculture, University of Agricultural Sciences, GKVK, Bengaluru, Karnataka, India

Corresponding Author:
Chandrashekhar S
Department of Sericulture, College of Agriculture, University of Agricultural Sciences, GKVK, Bengaluru, Karnataka, India

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Evaluation of mulberry based silages for their quality as animal feed

Chandrashekhar S and Divyashree HJ

Abstract
A Study was conducted during 2016-17 at College of Sericulture, Chintamani, University of Agricultural Sciences, Bengaluru to evaluate the different silages prepared by using mulberry, the sole food plant of silkworm *Bombyx mori* L., maize and napier grass and their six combinations for physical parameters (Colour, odour, pH, mould growth, dry matter content) and palatability for ruminants. The present study revealed that, all the silages including their combinations recorded acidic p^H ranging from 5.3 to 4.3 and had dark green to light green colour with sweetish o dour. The Palatability test of the silage was done on sheep, where their acceptance was found to be more in the silages prepared by mixing 75 per cent mulberry shoots with 25 per cent maize. It is palatability was 85 per cent while that of sole mulberry leaves was 80 per cent. The silage prepared from 100 per cent Napier grass was found to be the least accepted silage by sheep and palatability was 40 per cent. The study showed that, the mulberry can also be used as alternate good silage crop in raising the livestock with combination of other forage crops. Thus it opens up a new arena for utilization of mulberry as silage crop beyond it is use for the silkworm rearing.

Keywords: Mulberry, maize, Napier grass, Silage, nutrition.

Introduction
Mulberry is distributed throughout the world as it has enough plasticity to survive under disruptive environmental conditions. Due to its high vigour, biomass and high nutritive status it opens up a new arena for its utilization beyond the silkworm rearing and cocoon production. In recent times, the mulberry has been re- evaluated for other purposes, such as medicinal, fruit and animal production. Hence the present study was conducted to prepare and evaluate mulberry based silages for raising livestock.

Material and Methods
An investigation was carried out during 2016-17 in the laboratory conditions at College of Sericulture, Chintamani, Chikkaballapura district, Karnataka, India to evaluate the mulberry based silages for their physical quality. The experiment thus consisted of nine treatments (Table-1) with three replications each, laid out in a Completely Randomized Design. The analysis of the resultant silages was carried out for p^H and other physical parameters.
All the silages were analyzed and the observations were made on physical parameters *viz.*, odour, mould growth, p^H and dry matter content and palatability to know the acceptability of silage by ruminants (sheep).

Methodology
The silages were prepared, fermented for eight weeks and analyzed for their visual and physical qualities. The prepared silages were sampled and offered at random to two sheep and restricted to concentrate on feeding in order to assess the palatability of silage by visual

observations of animal response. The quantity of silage offered to animals from all the treatment groups was same. Therefore, the quantity of feed offered was taken as 100 per cent. The remaining left over feed and feed consumed were calculated and finally expressed in terms of palatability percentage. The best accepted and palatable silage was identified.

Results and Discussion

The colour of silage prepared from mulberry varied from light green to dark green. The observations of silages in the silo bags were recorded after 45 days of filling. The silages with 100 per cent mulberry, 75 per cent mulberry leaves with shoots +25 per cent maize, 75 per cent mulberry leaves with shoots +25 per cent Napier grass, 50 per cent mulberry leaves with shoots + 50 per cent maize and 25 per cent mulberry leaves with shoots +75 per cent maize were dark green in colour, where as those of 100 per cent Napier grass, 50 per cent mulberry leaves with shoots + 50 per cent napier grass and 25 per cent mulberry leaves with shoots +75 per cent napier grass was light green in colour (Table-1).

The Above results indicated that, the silages which contained higher percentage of Mulberry and maize with less or zero percentage of Napier grass were dark green in colour whereas the silages with relatively higher percentage of Napier grass were light green. This may be due to comparatively less chlorophyll content in Napier grass than mulberry and maize. The silage prepared with 100 per cent maize was fresh green in colour as also observed by Huhtnen *et al.,* (2002).

Silage derived from 100 per cent maize was sweetish in taste and the same was observed in silages prepared with 100 per cent napier, 75 per cent mulberry leaves with shoots+25 per cent maize, 50 per cent mulberry leaves with shoots+50 per cent napier grass and 25 per cent mulberry leaves with shoots+75 per cent maize. While the silages of 50 per cent mulberry leaves with shoots+50 per cent maize and 25 per cent mulberry leaves +75 per cent napier grass were moderately sweetish. The silages resulting from 100 per cent mulberry and 75 per cent mulberry leaves with shoots+25 per cent napier grass showed the presence of bitter taste (lightly odd).

The above results indicated that, the silages with higher percentage of mulberry showed lightly odd of bitter odour than other silages. This may be due to the presence of more moisture content of mulberry leaves during fermentation process and release of undesirable substances during the process. The silages with less or no mulberry leaves had sweetish odour.

Less to more mould growth was observed in silages of 100 per cent mulberry, 100 per cent napier grass and 25 per cent mulberry+75 per cent napier grass. There was no visibility of fungus or mould growth among the silages corresponding to 100 per cent maize, 75 per cent mulberry leaves with shoots+25 per cent maize, 100 per cent napier grass, 75 per cent mulberry leaves with shoots+25 per cent napier, 50 per cent mulberry+50 per cent maize, 50 per cent mulberry+50 per cent napier and 25 per cent mulberry+75 per cent maize.

All the silages prepared from mulberry showed acidic p^H ranging from 5.3 to 4.3. Higher acidity was noticed in the silage *ie.*, 50 per cent mulberry + 50 per cent maize (4.30) which was found on par with the silage prepared from sole mulberry leaves *ie.,* 4.43 followed by 100 per cent maize silage (4.47) and all the other silages were relatively less acidic (Table-1). The values were comparable with those of Kung (2001) [3] and Selgar (2003)

The palatability values for all the mulberry based silages was found more. The highest palatability of 85 per cent was observed in the silage prepared with 75 per cent mulberry+25 per cent maize (85 per cent) followed by 100 per cent mulberry (80 per cent) and the lowest palatability of 40 per cent was noticed in silage of 100 per cent napier grass. The remaining silages showed average palatability of 50 to 75 per cent. The difference in palatability among the silages may be due to appearance, odour and taste of the silage. The above results are in confirmity with those of Wilkinson (2005) as per whom, the silage material sweetish in taste, smell with no mould growth was more accepted by the animals.

The Dry Matter (DM) content of silages prepared from mulberry ranged from 21.22 to 31.30 per cent which did not reduce significantly compared to raw material used for silage production (26-46 per cent). Weinberg and Muck (1996) [5] also reported that the DM loses are low and can be about two to four per cent. Whereas in silage with high activity of undesirable microorganisms means DM losses can be much greater.

Table 1: Physical Parameters of Mulberry Based Silages and Their Palatability

Treatments	Colour	Odour	p^H	Mould growth	Dry matter (%)		Palatability (%)
					Fodder	Silage	
100% Mulberry.	Dark green	Lightly odd	4.43	Minute growth	30.00	31.30	80^d (8.97)
100% Maize.	Fresh green	Sweet	4.47	Nil	35.00	26.76	70^c (8.40)
100% Napier.	Light green	Sweet	5.23	More mould growth	29.00	25.59	40^a (6.36)
75% Mulberry shoots +25% Maize.	Dark green	Sweet	4.50	Nil	36.00	28.53	85^e (9.25)
75% Mulberry shoots +25% Napier grass.	Dark green	Lightly odd	5.30	Nil	31.00	22.15	75^d (8.69)
50% Mulberry shoots + 50% Maize.	Dark green	Moderate sweet	4.30	Nil	27.00	25.91	70^c (8.40)
50% Mulberry shoots + 50% Napier grass	Light green	Sweet	5.27	Nil	26.00	22.22	50^b (7.11)
25% Mulberry shoots +75% Maize.	Dark green	Sweet	4.80	Nil	37.00	23.50	67^c (8.22)
25% Mulberry shoots +75% Napier grass.	Light green	Moderate sweet	5.07	Minute growth	46.00	21.22	50^b (7.11)
$SEm_{\pm}$			0.10				1.46
CD at 1%			0.40				5.95

Conclusion

The present study showed that, the mulberry leaf is a good feedstuff for sheep due to high crude protein in mulberry silage making it superior to those of the other forage crops. Therefore mulberry can be used as supplement to other silage crops. Mulberry supplementation in animal feed not only provides the fermentable energy, but also fermentable protein. Thus mulberry can serve as a substitute to other forage crops without producing any negative effect on animals.

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