Little Bag Silage

Ian R. Lane

Ian Lane Associates, Lower Kenfield Cottage,
Petham, Canterbury, CT4 5RN, UK.
Tel & Fax: +44 1227 700 772
Email: ianlaneuk@aol.com

1. Introduction

This paper summarises the development of "Little Bag Silage" (LBS) during 1988 – 92, while the author was fodder and livestock consultant on development projects in northern Pakistan and in Nepal. It relates to the mechanics of ensiling on a small scale, and how this fits within the overall livestock and farming system. While working in northern Pakistan, the problem was how to improve the nutrition of farmers' milking animals when each family keeps only one dairy cow or buffalo? During the cold continental winter the major fodders available were maize stover and wheat or rice straw, together with very poor quality hay made from mature summer hillside pastures after the rains have ended. Although loans were made to farmers for the purchase of high yielding improved buffaloes from the lowlands, farmers were disappointed that yields soon fell to those of local stock as a result of feeding the same rations as before. As a minimum it was essential to provide a green fodder supplement to enhance rumen function for these animals. One course was to develop winter fodder crops, but this still left 3 months without green feed. Strong plastic shopping bags were available in the lowlands, and it was found that these had a minimum capacity of 5 kg of fresh chopped

green fodder sorghum. If these were used for silage, it would mean that one buffalo could be fed one bag of silage a day, providing the minimum of 5 kg green fodder needed as a supplement. This was the birth of the concept of "Shopping Bag Silage", or "Little Bag Silage" as it became known.

2. Methods

The same basic method for making LBS was used in both N. Pakistan and Nepal:

- Strong high density plastic shopping bags with a capacity of 5 kg chopped green fodder and with no obvious holes in the seams were purchased in packs of a hundred;
- At least 100 kg of summer fodder crop such as multi-cut fodder sorghum was cut and carried to the chopping floor. The fodder was either hand chopped with a large knife against a wooden chopping block, or chopped through a chaff cutter with a rotating blade;
- 5 kg of chopped green fodder was carefully packed into one of the shopping bags so as to avoid making any holes in the bag;
- The bag was gently but firmly squeezed by hand to expel air, and while compressed the neck of the bag was twisted then turned over and tied with twine [it is possible to close bags by tying the two handles in a knot, but this does NOT result in an air-tight closure];
- The bag of silage was then inverted into a second empty shopping bag, which was also closed and tied;

- The bag of silage was then inverted into a third empty shopping bag and sealed. Each bag of silage was therefore triple wrapped, and seams which might be expected to leak air were doubly protected;

- The bags were carefully stacked in a room protected against rats, mice and other pests;

- After a minimum period of one months LBS was fed to buffaloes at a rate of one bag per head per day.

- The outer two plastic bags of each LBS were kept for re-use.

3. Results

In N Pakistan the method was initially developed with a farmer/store-keeper who had a couple of Nili-Ravi dairy buffalo and who had planted 0.1 ha to Sadabahar, a local multi-cut Sorghum x Sudan grass hybrid. 120 kg of fodder chopped with a chaff cutter made as LBS and stored under the farmer's bed was compared with 120 kg of fodder conserved in a single bag made from heavy gauge plastic. Both lots of fodder ensiled well, and the farmer was pleased with milk yields from the buffalo fed silage, although no records were kept. He was especially pleased with the LBS, since it was much easier to feed individual bags, instead of having to untie and re-tie the large bag of thick plastic. His practice was to feed half of each Little Bag in the morning and the remainder in the evening. Neighbouring farmers were impressed that at a time when they had only dry fodders this farmer had green fodder. In response, our entrepreneur was planning to plant up much of his land with Sadabahar, so that he could make sufficient LBS to sell it to his neighbours in the following winter!

The first trial of LBS in Nepal was on-station. Leafy Paspalum grass was harvested at Kathmandu, chopped and ensiled. Bags were well conserved, although the fermentation was not strongly lactic acid. Results were good enough to proceed.

In the second station trial in Nepal LBS was made from Napier grass in the Terai (100 m.a.s.l.), and from maize grown for fodder harvested at the soft dough stage with chopped cobs included at Kathmandu (1,250 m.a.s.l.) and at Jiri (1,800 m.a.s.l.).

After two months excellent lactic acid fermentation resulted from all lots of LBS, and undamaged bags kept well for six months with little fungal spoilage. However LBS from fodder maize appeared to attract every mouse from a km radius, and when the door to the store was opened to remove a bag mice were seen to leap in. Once in, mice could easily hide between the bags. Mice then chewed through the plastic bags, and most of the bags were lost as aerobic spoilage ruined the silage.

The third trial in Nepal was an extension trial with Livestock Development Groups at three locations. In Kathmandu there was a small factory making bags, using machinery from Thailand and plastic prills from the Gulf; special bags of thicker gauge and without loops cut out to make handles were ordered. At each site kits were issued to 20 farmers. Each kit included a pack of 100 high strength plastic bags, an illustrated guide to making LBS, and a record sheet. The making of LBS was demonstrated to each Group by project staff, and the local livestock technician assisted farmers during the trial. Details on the crop to be conserved, the look and smell of the silage, and the milk yield of the selected cow or buffalo before and during a thirty day feeding period were recorded by each farmer.

At Pokhara (800 m.a.s.l.) the farmers were delighted with the bags for a hundred and one uses, but since they were already growing irrigated winter fodder oats making LBS was not one of them! At Jiri (1,800 m.a.s.l.) farmers used wet mature summer grasses, which unfortunately turned to compost! Within Kathmandu Valley, however, there were peri-urban milk producers who stall-fed buffaloes and who had to purchase all their feeds, including padi straw. In the Valley there was also a tradition of threshing padi while it was still green, with the production of a cooked beaten rice which was sold as a snack food. These milk producers made LBS from the green padi straw, and found their traditional buffalo could eat one bag of silage a day in addition to their normal ration of dry straw and bran. As a result milk yield increased by fifty percent, from 2 l per day to 3 l. The extra litre of milk, sold in Kathmandu diluted with water, was worth Rs 20. It had cost Rs 3 to produce, being the cost of 3 plastic bags @ Rs1 per bag, plus the minimal cost of 5 kg of green padi straw. With care, two of the three bags could be re-used, reducing the total cost for the extra litre of milk to little more than Rs 1.

4. Discussion

Making LBS is labour intensive, and does need care and attention for success. It has to fit the local livestock and farming systems, and having expenses has to be linked to semi-commercialisation of production. The place of LBS within the overall strategy for fodder development in N Pakistan and Nepal has been described elsewhere (Lane, 1999).

The quality of bags for LBS is important. High rather than low density plastic reduces potential for tearing. The seal must be without holes, and this may relate to factory practice. If holes are

present along the seal, sticky tape or tar/mastic may be used to repair seals as the bags are tied. Inner bags do tend to get damaged, but the thicker gauge bags used for the extension trial in Nepal were less damaged to an extent where two rather than three layers of bags may have been sufficient. Initially commercially available shopping bags were used. These happened to be strong enough for the purpose. Some bags are thin and flimsy, as found in China, and these would not be suitable. As in Nepal, discussions with local plastic bag makers will be useful. It happened in Pakistan and Nepal that shopping bags could readily hold 5 kg of chopped green fodder; if larger bags are available, or if handles are omitted, larger quantities could be made per bag. This will reduce the costs of bags per kg silage stored, and reduce losses from damage and surface moulds. However the amount stored per bag should relate to feeding practices, although it is easy to reseal little bags so that feeding of silage from individual bags could readily be spread over 1-2 days even in hot climates.

Fermentation characteristics of LBS depend on the fodder being conserved, and the old saying "Rubbish in, Rubbish out" applies equally to silage made in little bags. Fodder with high sugar content, whether from specialised temperate or tropical fodder crops or from temperate leafy pasture, will conserve well. Fodder with low sugar content is more likely to rot than ferment, and this has led to a bad reputation for silage in general in the tropics, LBS included. Problem fodders include mature C4 pasture grasses harvested in the rains, legumes in general, and possibly tree fodder. Wet grasses must be partially dried before ensiling, under shelter if it is still raining, and legumes should also be wilted.

The example of peri-urban dairy farmers making good LBS from green padi straw is important, since many crop residues loose much of their soluble carbohydrates during the final stages

of grain ripening, and while the residue is left to dry in the field. Under smallholder systems padi is frequently harvested comparatively green, and the crop sun-dried in the field with loss of nutrients from the straw; heating in the stack before threshing completes the loss of sugars. In the Sudan, M. Wade encouraged the ensiling of maize stover in trench silos on commercial dairy farms to improve fodder value of the stover when fed to cows; while maize with stay-green fodder characteristics has been widely adopted by farmers in N Pakistan. Improved utilisation of crop residues through ensiling needs further attention.

A key feature of LBS is that it allows conservation of available fodder in small quantities over a long period of time. This strongly contrasts with traditional silage making techniques where large amounts of fodder must be harvested and chopped at one time. Thus a small-holder family might be able to conserve a couple of bags of LBS a day over a 100 day growing season, which would allow their milking animal to be fed one bag of LBS a day over a 200 day dry season. This fodder might include leafy grass weeds harvested from the crop fields, terraces and bunds, which could readily be partly air-dried under shelter a little at a time before chopping and ensiling. In Nepal, leaves were progressively removed from maize plants as they commenced to senesce, and these would make excellent LBS.

Although summer fodder crops were frequently used in the trials above, they take land away from food production and would only be financially attractive to families in commercial animal production. Lane (1999) allocated them to high cost systems likely to be adopted by only 25 per cent of farmers. A range of fodder sorghums and millets were, however, grown in trials in both N. Pakistan and Nepal at three sites in each country, and fodder yields were doubled by application of 200 kg N per ha. In

the Mediterranean countries conservation of temperate fodder crops for feeding in the dry summer is relevant, and this also applies to countries in monsoonal zones. In 1976 the author working in Tanzania carried out small scale ensiling trials with cassava, and produced silages from chopped cassava root, leaves, and root + leaf mixtures. Although the fermentation characteristics differed between the silages, they were all edible by sheep. These feeds could easily be ensiled as LBS, and allow cassava to be fed throughout the dry season when harvesting is difficult due to hard ground and when leaves have been lost.

In common with silage making in general, there is interest in the use of additives to assist conservation of the problem crops outlined above. A small station trial was made with sodium bisulphate, but as maize fodder was used no benefit resulted. Any compound for smallholder use must be cheap, non-toxic, non-corrosive and easy to apply. While various additives used in industrialised countries might be reduced in scale and packed in individual sachets for use on individual 5 – 100 kg lots of fodder, they do not meet the above criteria. Even molasses, which does, is not widely available. It was concluded that sugar, in the cheaper less refined brown lump form, would be most applicable. However, it would still be relevant to partly dry the fodder to reduce the amount of sugar required for effective conservation, and to reduce the quantity required relative to the actual quantity of fodder being preserved. Where very difficult crops are to be ensiled, the use of common salt (NaCl) as a straight preservative also needs evaluation, as many livestock are also deficient in salt as a nutrient.

Essential for success with LBS is protection of the bags, for up to 4-6 months. This has been a major weakness, but may be related to the crop being ensiled. As noted, maize fodder with

chopped cobs was a major problem, but green crop residues may be less attractive. Fodder sorghums do still produce HCN in LBS, which may be a deterrent to pests, and no problems of damage by mice was reported in N. Pakistan. Otherwise some form of construction may be required. This might be within an existing store such as large cement or clay storage jars with strong lids. Alternatively, specialised buildings might be constructed, with legs to keep the store off the ground and shaped to prevent rats and mice climbing in, such as the mushroom shaped stones traditionally used in England for grain stores, or protected with metal horizontal discs or downward facing cones. In Nepal a relish for human consumption known as "Gundruk" is made by fermenting wilted cabbage leaves in air-proof clay pots. Thus the actual nature of the vessel used for making small quantities of silage is open to local variation and adaptation of available items and materials.

For harvesting pastures, rather than fodder crops, the Swiss scythe has been successfully introduced into the hills of Nepal, and is used by contractors for making hay along with the hay fence technique. Unfortunately the grass is cut when over-mature but while the rainy season continues, so that the hay is moist when stored and is of little fodder value. Swiss farmers now use a system of a two-wheeled mechanical mower with a tedder and hay rake, and this range has now been extended to a mini-round baler and a bale wrapper for making silage. In hay the bales weigh about 20 kg, in silage following wilting about 50 – 60 kg. Many of the benefits of LBS would result from use of this equipment with young leafy wilted pasture crops, and it would be relevant for commercial dairy farmers with 5 – 20 cows, such as in the highlands of Kenya.

5. Reference

Lane, I.R. 1999. Fodder development for smallholder dairying in Azad Jammu and Kashmir and Nepal. Tropical Agricultural Association Newsletter, 19 (1): 23-27.

6. Acknowledgements

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Further details and a copy of the reference are available on request from the author.