

Potential Good Practice Note

Willow Silage: An Alternative to Winter Fodder

Introduction

Bhutan has a traditional farming system within which livestock production plays a very crucial role. Availability of adequate quality feed and fodder, therefore, is the single most important factor in livestock development in Bhutan (NFFDP¹ 2006). The importance of trees as fodder sources is well established, and, especially for Bhutanese, tree fodder remains an important resource, providing approximately 20% of the fodder requirement. Tree fodders used vary with elevation and other climatic factors, but mostly consist of *Ficus*, *Bambusa*, *Quercus* and *Salix* species (Roder 1992). In Bhutan, Willow (*Salix babylonica*) is the most popular species, which is found in abundance throughout the country at elevations ranging from 800 to 3,000 masl. It is by far the most important tree fodder species at elevations above 2,500 m (Roder 1981). In fact, it is the most common species in high altitudes throughout the Himalayas. In Leh, an Indian state of Kashmir, it is the only tree available and a very important source of fodder for ruminants.

Willow grows well under harsh climatic condition and even in poor soil type over a wide range of altitudes starting from sub-tropics to alpine areas. The plant normally grows up to the height of 8 – 12 meters and branches well with clustered long leaves. One of the reasons for its selection as fodder tree is that it can survive well under both dry and wet conditions and produce more biomass for silage making. Beside fodder, the tree is widely used for live fencing, protection of river bank and preventing soil erosion. The easiest way of propagation is through semi hard cuttings of desired length. Prior to planting, the cuttings are dipped in water to prevent desiccation under dry condition.



¹ National Feed and Fodder Development Programme

The new flush of branches is ready for harvest after three years. However, due care needs to be taken while harvesting fodder leaves to avoid damage to the new branches and subsequent biomass yield. The species is widely promoted in Thimphu valley of Bhutan and other regions with similar agro-climatic conditions.

Following an initial survey carried out in 1981 in Bumthang district (2,600 – 3,000 m) in east central Bhutan, *Salix babylonica* was clearly the preferred fodder tree species (Roder 1982). Farmers surveyed had planted an average of over 17 plants per household and the number increased by 24% during the year of the survey (Roder 1981). Similarly, in eastern Bhutan, farmers indicated their preference for this species (Wangdi 1992). No other tree fodder species are presently planted by farmers in temperate areas. Willow is a fodder of excellent quality with milk production potentials equal to that of white clover. While a number of research studies indicate the potential of willow leaves as a nutritious fodder resource in the Himalayan belt, the making of willow silage in Bhutan was only started in 2005.

During the winter season, because of fodder shortage, farmers allow cattle to graze freely in forest areas, which contravenes the Forest and Environment Act, 1955, as the cattle are alleged to cause widespread damage to tree regeneration. This write-up talks about the package of practices of growing willow and ensiling willow twigs and leaves. The technique of silage making is simple, affordable, replicable and user friendly.

The study was undertaken with objectives to propagate willow and promote biomass ensiling technique at farmers' level with an ultimate aim to address fodder shortage in winter.

Method of Silage Making

The method is simple as the new flush of willow branches becomes ready for making silage during late autumn. In order to establish the usefulness of the technique in the field, trials were conducted for three consecutive years from 2005 at 5 different locations at Genekha, Tsaluna and Khasadrapsu under Thimphu. Information was also gathered through consultations and interactions with interested farmers. The technique used in the process of silage making is as under:

- ★ In each location, pits were dug to a size of 4m³ for two pits and 6m³ for one pit. Depth of each pit is suitably maintained to facilitate easy compaction of twig and leafy material and to ensure minimum aeration.
- ★ Pit filling: To protect ensiled material from moisture and air, a thick polythene sheet is spread evenly on the floor and along inner walls of a pit. A good quality polythene sheet is reusable twice.
- ★ The harvested willow twigs and leaves without chopping are then evenly laid in the pit. Each time when the material is laid to a height of 2 ft, it is pressed manually. The process is repeated until the compressed material reaches to the brim of the pit (silo).
- ★ The pit is then covered with polythene and gunny bags followed by bamboo mats/ planks. The pit thus covered are further compressed by heavy stones or sealed by earth of 1 ft thickness. The pit is compacted once again by stamping on it. This is to expel the remaining air from the pit.
- ★ Temporary sheds are prepared to protect the pit from rain and sunlight. The time required for silage to be ready for feeding the animals is one month.

Table 1: An Overview of Main Motives for Planting *Salix Babylonica*^a

Uses	Respondents (%)
Fodder	80
Fencing	77
Fuel	77
Erosion Control	3
For Sale (branches for planting)	6

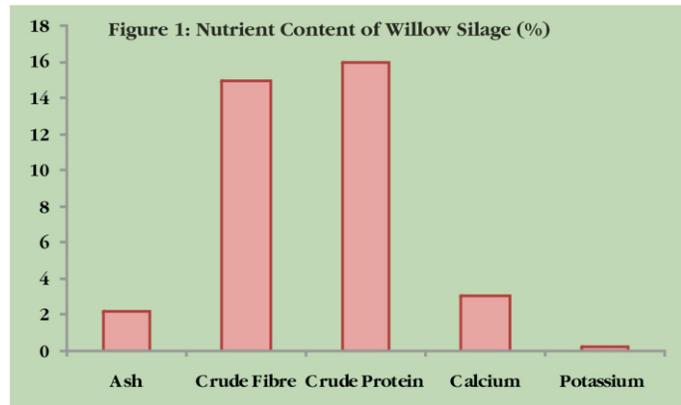
^aData from Willow Survey 1995, n = 35 Farmers

Findings

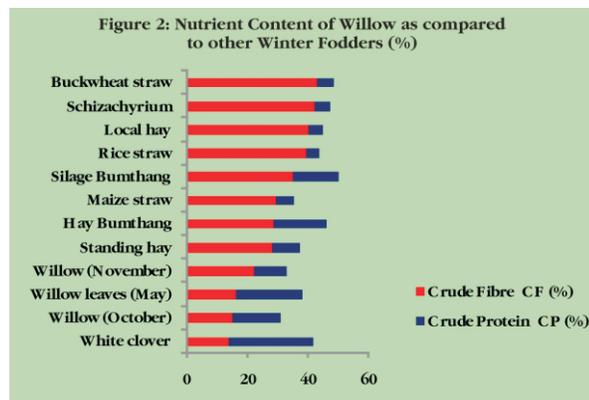
Most willow cuttings of less than a meter height failed to survive the cold and dry winter. However, those that survived continued its growth into the next season although the dry matter yield was poor. In order to ensure better feeding quality of silage, the best time observed for ensiling the willow twigs and leaves is between mid October and end of November. This is the time when dry matter yield and fodder quality of willow are maximum.

Willow leaves generally contain high protein, low crude fibre and high acid detergent fibre (Nasi 1984). Various studies have confirmed that *Salix babylonica* leaves have high nutritional quality comparable to common forages such as Lucerne (*Medicago sativa*) and that they can be fed to ruminants without any adverse side effects.

To determine the nutritive value of the silage, samples from all the locations were analysed. It was found that the silage contained 87.89% dry matter. The nutrient content of dry matter is as presented in Figure 1.



The nutrient content of a good willow silage is comparable to that of green willow biomass according to the findings of



Wangchuk et al. (2008). The fodder quality of willow silage is better when compared with other commonly used winter fodders as presented in Figure 2 (Wangchuk et al. 2008). Further, the feeding of willow silage saved other fodder resources, which are fed during late winter.

The detailed cost benefit ratio is not calculated since data from the trials over the last three years is yet to be collected and analysed. However, expenditure for producing 900 kg of silage *in-situ* is presented in Table 2.

Average total end product (silage):

Silo size: 4.5 m³

Kg silage/m³ = 200 kg

4.5 m³ x 200 kg = 900 kg

The production cost per kg of silage is Nu. 2.79/-

Table 2: Production Cost of Willow Silage (per kg)

Parameters	Nos	Rate (Nu ²)	Amount (Nu)
Excavation of earth	2 men	200/day/head	400
Construction of temporary shed	1 man	200/day	200
Polythene sheet	9 m	35	315
Local labour for harvest/transport/ensiling	8 men	200/day/head	1,600
Total Expenditure			2,515

² Ngultrum (Nu) is the currency of Bhutan with an approximate exchange rate of 1 US\$ = Nu 47.14

Recommendations for use

For successful establishment of willow, cuttings of more than a meter height should be used for planting. If the soil is dry during establishment, provide sufficient irrigation till the cuttings are adequately established. Initial care from stray cattle during establishment is crucial. Once established, willow requires less inputs for fodder production. The best time to harvest willow leaves and twigs is from mid October till end of November. The preserved willow leaves owned by a family help to meet the requirements of their livestock for the period December to February.

The process of ensiling should be completed within a day. Similarly, rainy and cloudy weather needs to be avoided while ensiling. Silage should be closed properly every time after use for feeding. If the tree height is maintained short, cattle can graze the standing tree, thus saving manpower for lopping branches. Farmers often lop branches of big trees for the cattle to graze beneath the trees.

Willow silage is increasingly gaining importance as an alternative winter fodder. One important point to note is that the production of willow silage is an eco-friendly venture and application of inorganic fertilizers is discouraged. There are presently 25 households involved in this practice and this number shall double to 50 households by autumn of 2009. The farmers are aware of the potential of willow silage. The Royal Government of Bhutan is assisting farmers by providing them some required material (polythene sheets) and guiding them during the ensiling process.

Feeding of silage to milking cows has improved milk production by 50% per animal per day (Pers commn 2007). It is observed that this technology is gradually spreading in the field. Most farmers involved in this practice are active members of the Peri Urban Farmers Association who have direct access to profitable markets in Thimphu.

Silage Making



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Suggested Citation: SA PPLPP (2009) Code: BHGP13, “Willow Silage - An Alternative to Winter Fodder”. Potential Good Practice Note, Delhi, India

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SOUTH ASIA Pro Poor Livestock Policy Programme

A joint initiative of NDDB and FAO

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