**CHIRANG HILL IRRIGATION PROJECT  DAMPHU**

# IDENTIFICATION OF BAMBOOS AND POTENTIAL FOR INCORPORATING THE PLANTING OF BAMBOOS INTO EXISTING AND POSSIBLE ACTIVITIES

**Chris Stapleton**
**Bamboo Specialist**
**Forestry Department**
**Research Division**
**Taba**

**April 1989**

**Contents**

**Summary**

With the aim of improving agricultural production this project has a substantial watershed management component which is presently managed by forestry department staff. Work has concentrated so far on labour intensive terrace construction, and the planting of group fodder and fuelwood blocks. Whether the component remains the same or is expanded to include contour strip terracing and substantial private planting by individuals as recommended, bamboos are highly suitable for inclusion in planting programs. Two thousand seedlings have been raised in the nursery this year and farmers are keen to plant them on their land. Other propagation techniques are discussed, with the traditional technique appearing the most suitable for adoption on a large scale. Possibilities for expanded use of bamboos in the district are discussed. Construction of fences and orange boxes could use considerable quantities of bamboo in the future. A checklist of species is given as the first step in providing an illustrated guide to the bamboo species.

## 1. Project objectives and implementation

Despite the name of the project, its main objective is not to repair and construct irrigation channels, but to increase agricultural productivity and rural income. The project appraisal report (1985) identifies watershed degradation and inefficient agricultural support services as constraints to the achievement of this objective once the irrigation channels are improved.

In the background information dealing with the project area the appraisal report accurately specifies the precise environmental problems : changes in stream behaviour because of increased run-off, and fodder deficits. These two problems are the direct results of the reduction in useful vegetation that occurs when an area reaches the limits of extensive, rather than intensive, land-use. Reduced stream flows in the dry season, damage to irrigated terraces by erosion and deposition of gravel during monsoon stream discharges, and lower productivity from shortages of FYM can easily outweigh the advantages of improved irrigation.

To address these problems, soil conservation works and watershed management activities were rightly envisaged as one of the three main components of the project. The project description prescribed technical solutions and included the targets of 480km of contour terracing, with 48,000 trees planted on the terrace risers, nursery production of 40,000 fodder trees, 40,000 orange trees, and the planting of 75ha of fuelwood plantation.

## 2. Problems in implementation

Since the initiation of the project the watershed management component has encountered certain difficulties.

**2.1** The terracing program, aiming to reduce run-off and loss of fertility from steep bari-land, has fallen far behind target because of the unpopularity of the prescribed technique of ditch and bund construction.

**2.2** The tree planting program has encountered problems, partly through reluctance of landowners to plant up areas, and specifically in the establishment of fodder trees because of poor quality fencing and high grazing pressures.

At the same time considerable experience has been gained concerning the attitudes of farmers to their environmental problems and their receptiveness to particular technical solutions. On the international scene, the processes of watershed management are now better understood, (eg Carson, 1985), and developments in methodology have been made in other areas which suggest that different approaches could be attempted and evaluated in Chirang, complementary to the present programs.

There have also been important changes in the country with regard to matters such as labour availability which alter the appropriateness of certain techniques. Further changes are also likely in forest policy and legislation which may improve the uptake of group forestry and may allow community forestry to begin at some time.

Therefore it is felt that there are likely to be substantial changes in the watershed management component. The role of bamboos is considered in the light of such possible changes, as well as the present programs.

## 3. Potential additions to the watershed management component

### 3.1. Terracing

Alternative technical solutions to the problem of steep unterraced bari-land could be explored. Weigel et al (1987) in their manual of soil conservation measures recommend the planting of strips of permanent soil retentive vegetation along the outlines of desired terraces. This permanent vegetation, principally fodder grasses, will accumulate soil and build up natural terrace risers, while at the same time producing a valuable crop of fodder, fruit and miscellaneous products.

This technique could be more acceptable to farmers than ditch and bund now that there is a serious labour shortage. The World Bank has identified a deep-rooting grass which is apparently highly suitable for terracing in certain areas. Local farmers already plant local grasses for this purpose. Other well known fodder grasses are also available. Accumulation of eroding soil and build up of terrace riser heights of up to 50cm per year have been reported using this technique.

The production of a large quantity of fodder grass cuttings (possibly one million plants per year) would be best suited to staff trained by the Department of Animal Husbandry as they have considerable expertise in this subject. Small scale trials of

different grasses could be set up on steep land and terrace risers on the project farms and in farmers fields at different altitudes to assess their value.

To back up fodder grasses on contour strips/terrace risers a mixed variety of useful plants could be included according to local popularity and usefulness. Plants used elsewhere in addition to fodder grasses include Thysanolaena maxima, (Amlisso, kucho grass); Musa paradisica, (Kera, banana); Desmodium intortum and distortum, Stylosanthes guyanensis, Leucaena leucocephala, (Leguminous fodder herbs and bushes), Drepanostachyum spp (nigalo/padang, small bamboos), Saccharum officinarum, (Ukhu, sugarcane), Ananas commosus (Bhuikatar, pineapple), Themeda anatheda, (Katarakhar, thatch grass); Adhatoda vasica, (Assuro, Malabar nut); Maesa chisia (Bilauni) and other locally useful species of grass, bush, and tree, according to altitude, markets, local use, ease of propagation etc. Many plants can be propagated directly by the farmer. Others can be supplied by expanded and more comprehensive nurseries and multiplication areas.

### 3.2. Individual private planting

Unproductive and eroding land can be categorised according to ownership as a broad generalisation. The three categories are privately owned land contained within the landholding of a individual farmer, land which borders on the property of others, and land which is government owned.

The emphasis so far in Chirang has been upon the second category, with establishment of group forest on land which is owned by at least three adjacent landowners. This certainly reduces the cost of barbed-wire fencing and no doubt establishes useful cooperation. As yet the project has not been concerned with government land, but if the FAO community forestry project around Phuntsholing is successful its models could eventually be adapted to Chirang.

In the first category of land, however, there is still great scope for planting small groups of useful plants by individual farmers. Barbed wire fencing is not always necessary for the establishment of useful plants. Small seedlings and cuttings can be, and are, individually protected on private land using thorny branches and bamboo guards. Large livestock-resistant cuttings of trees and bamboos are also widely planted. Small areas can be protected by the use of live fencing plants, such as Erythrina spp, (Phaledo); Garruga pinnata, (Dabdabe); Sapium insigne, (Khirro); Agava americana, (Kettuke), Salix spp, (Bainsh), etc. Some of these grow

from tall poles and can also be used as live barbed wire fencing in group forests.

Many small streams used for rice irrigation arise on such individually owned areas which are not eligible for group forestry operations. Planting of useful trees, bamboos, cardomom, etc around and above the sources can help to ensure the timely flow of these streams. Gulleys taking these streams down to the khetland can be planted with trees, shrubs, and bamboos to avoid erosion en route and the development of a heavy sediment load. Bamboos are particularly suitable as the combination of deep and surface rooting with a bulky rhizome 'retaining wall' is extremely effective in the prevention of soil erosion in gulleys, even when there is little ground vegetation because of grazing.

## 4. Potential scope of the watershed management component

An expanded program of watershed management activities, which might be both more acceptable to farmers, and more effective in meeting the project objectives could include the following activities in addition to a limited amount of ditch and bund terracing:-

### 4.1. Terracing by contour strips

Contour strips of soil-retentive vegetation on steep newly cultivated land to trap and accumulate eroding soil and nutrients and build up productive terrace risers, using fodder grasses raised by Animal Husbandry-trained personnel and a wide variety of other plants raised by Forestry Department-trained staff with expanded nursery facilities, planted by teams of fieldworkers under supervision of agricultural extension staff. Weigel et al (1988) give more details of this technique.

### 4.2. Supply of plants to individual farmers

Distribution of productive and protective plants to individual farmers to enhance the productivity of individually owned uncultivatable or marginal land, and stabilise streams and eroding gulleys, using newly trained fieldworkers under watershed management supervision. Range of plants according to farmers' wishes with a little suggestion.

### 4.3. Multiplication and planting of plants by farmers

Encouraging propagation of plants by farmers themselves, especially live fencing plants and bamboos, by subsidy if necessary, or as a condition for agricultural inputs.

### 4.4. Group forestry program

Distribution of productive plants, principally fodder and fuelwood trees, to cooperating groups of farmers for planting in group forests to reduce ratio of fencing to planted area, using preservative-treated fence posts, and live fencing plants to replace them, under watershed management supervision.

### 4.5. Other activities

To facilitate these expanded activities, it would be necessary to undertake a little preliminary research into the uses of local cultivated plants (eg live fencing and local fodder sources), and the potential of some new crops (eg pineapples, sisal), and to demonstrate their value on the project farms.

In the future community forestry activities would be feasible and necessary to fulfill the objectives of this ambitious project. Considerable forestry research would be necessary before it could start, including studies of present legal and illegal forest use, forest composition, regeneration capacity, biomass productivity, and impact of uses on wildlife.

## 5. Suitable bamboo propagation techniques

Assuming that the objectives and implementation methodology above were taken up, three methods of propagation could be appropriate : seed, traditional rhizome and pole cuttings, and culm cuttings. A mixture of bamboo species should always be planted, and they should be included with a variety of other plants.

### 5.1 Seed

Raising seedlings is by far the most efficient way of producing bamboo plants in any quantity. Unfortunately the availability of

seed is unpredictable, and it cannot yet be stored for more than one year. Seed could be collected now within the district from presently flowering Chile bans. Seed of appropriate species (not Dendrocalamus strictus or Bambusa arundinacea) from India may also be available in coming years. The 2,000 seedlings of Dendrocalamus hamiltonii raised in the Chirang nursery this year with seed supplied by the Forestry Department Research Division, and the 20,000 raised in Gaylegphug, demonstrate the effectiveness of this method of propagation when it is possible.

Seedlings are best planted by individual farmers with individual protection for each plant, as, like fodder trees, they are very susceptible to grazing. The best protected group forestry areas are also suitable, as respectable preliminary success rates with fodder trees can be seen in some of these, but unpreserved fence posts are not likely to last long enough for the seedlings to outgrow the reach of grazing animals in areas with termites.

### 5.2 Traditional technique

The traditional technique of planting a 2 m pole after digging out its rhizome is highly suitable in small unfenced areas, or in gulleys, and should be encouraged or subsidised using locally available material. This method of propagation is also more amenable to planning as a regular component of activities.

### 5.3 Culm cuttings

If a better nursery site is found, culm cuttings of local species (all except Bambusa nutans) could theoretically be planted in the nursery, but the advantages of this technique over the traditional method of planting are marginal if subsidies can be paid for planting by the traditional method. Bambusa vulgaris could be especially successful when raised using this technique, and a small trial could be established if a larger nursery is considered.

## 6. Potential areas for expanded use of bamboos in the district

Because of the many present uses of bamboos in the district and their great value in reducing surface soil erosion it is not necessary to establish new uses in order to justify planting them. However, there is always room for improvement.

Bamboos are the principle source of renewable fencing in Bhutan. New cropping systems, especially the planting of leguminous crops before the rice, or winter wheat, often involve a closer proximity between crops and grazing animals. One of the most striking features of Chirang district is the almost total absence of any form of fencing anywhere. This must be leading to substantial crop losses, and surely should be an area which requires attention. Bamboos, at 2 Nu per pole, are the most obvious source of fencing material. Agricultural extension workers could push bamboo fencing as an extension message, and develop its use on the demonstration farm.

Another potential beneficial contribution of bamboos in the district would be their use for making improved wirebound orange boxes. The timber mechanics branch of the Forest Research Institute in Dehra Dun has recently confirmed the superiority of wirebound bamboo boxes over wooden ones, (Tandon et al 1988). The production of good packaging material in Chirang district would reduce damage during transportation, especially if Assam is not open, and the need for repacking in Phuntsholing. It would also increase the revenues accruing within the district, and help to make marginal land more productive and thus less liable to abuse and erosion. The project could at least sound out STCB as to the problems involved.

The potential of bamboo shoot production as a canned cash crop has not been mentioned because of the need for substantial infrastructural food processing plant which had not been deemed appropriate in Chirang district as yet.

## 7. Identification of species

The species encountered are listed in order of overall abundance in the district in the attached checklist. Features for their field recognition have been documented and will be published in the illustrated guide presently under production. Forest species from the forests bordering on Sarbhang district have not been studied yet.

## 8. Need for introduction of new bamboo species

The variety of bamboo species already in the area is comprehensive and covers most end-uses adequately. The only shortcoming is the lack of a smaller Drepanostachyum species such as D khasianum or D intermedium (tite nigalo) which would be more suitable for

production of weaving material on terrace risers than D hookerianum, which can grow a little too large and shade crops. If preservation of bamboo shoots were to be considered, either as a cottage industry or as an industrialised concern, a comparison would have to be made between local and exotic species.

## 9. Checklist of locally cultivated bamboo species

| Botanical name | Local name | Main uses |
|---|---|---|
| *Bambusa vulgaris* | Singhane bans, jhushi | construction, fodder |
| *Bambusa sp* (*clavata*) | Chile bans, pagshi | construction, weaving, fodder |
| *Bambusa nutans* | Mal bans, jhushi | construction, fodder |
| *Dendrocalamus hookeri* | Bhalu bans, pagshi | construction, weaving, fodder |
| *Dendrocalamus hamiltonii* | Choya bans, pattsa | shoots, weaving, fodder |
| *Drepanostachyum hookerianum* (*Himalayacalamus hookerianus*) | Padang | weaving, fodder |

## 10. References


Carson, B. (1985) Erosion and sedimentation processes in the Himalayas. *ICIMOD Occasional Paper* No 1. Kathmandu.

Tandon, R. C., Singh, J. B., & Singh D., (1988). Wirebound boxes from bamboos *Indian Forester Bamboo Special* 114 (10) 693-700

Weigel, G, Shrestha, R, Meyer, W P, & Berg, C (1987). *Vegetative Soil Conservation Measures: A Field Manual.* Helvetas GTZ FB 121 PN: 76.2173.3