

Traditional Irrigation System: Bamboo Dripping System in Meghalaya

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Abstract: *Traditional Irrigation system proved to be an efficient irrigation system since time immemorial in hilly region of north east India. This region in general and Meghalaya in particular found the method to be the most sustainable one in terms of water harvesting and irrigation purposes. This present study explore the unique traditional understanding of the community in forms of constructing the framework of irrigation system using bamboos. The methodology, mechanism, construction and maintenance of the system from the source to the destination is carefully discussed and emphasised and it is found out that this system that existed 200 years ago in Meghalaya is still practised till today in Southern slopes of Meghalaya and Jaintia hills districts.*

Keywords: indigenous, water harvesting, bamboo irrigation, dripping, resources

1. Introduction

For more than 200 years tribal farmers of Meghalaya, have been using an indigenous technique of bamboo drip irrigation to irrigate their plantation crops. These farmers of the Jaintia and Khasi hill areas have developed this system of tapping springs and stream water to grow betel leaves, black pepper and arecanut. The system is so embedded in the indigenous set up of tribal farmers due to the following factors:

Terrain and water availability

The topology of the region is hilly with steep slopes and rock boulders. The soil depth on these hills is low and has poor water retention capacity. Though the region gets plenty of rain during the monsoon season, irrigation becomes a necessity during the dry season. The terrain imposes a challenge in bringing the water from distant water sources to the plantations. Diverting water through ground channels is not possible. Faced with this need for water, and the challenges imposed by the terrain, the tribal farmers came up with this unique irrigation system.

Bamboos as a resource

Meghalaya is richly endowed with bamboo forests. Its abundance and multiple uses have led bamboo to play a pivotal role in the socio-economic and cultural life of the tribal people of the state. It finds varied uses like construction material, in making of diverse implements for agriculture, fishing and cattle rearing and the simple household items like utensils small furniture etc. Livelihood of significant population in the state is dependent on the handicrafts made of bamboo.

Bamboo forests in the state have diverse species base which include clump forming as well as non-clump forming types. It has been reported that 36 species of bamboo from 14 genera are found in Meghalaya (Biswas, 1988). The important clump forming species include *Dendrocalamus strictus*, *Dendrocalamus hamiltonii*, *Bambusa arundinacea*, *Bambusa pallida*, *Bambusa tulda*, whereas *Melocanna bambusoides* is the important non-clump forming species.

Extent of natural bamboo forests in Meghalaya has been estimated to be 3108 sq kilometers (F.S.I. Inventory Report, 1990), which is about 14 % of the total geographical

area of the state. It has been estimated that the bamboo forest in the state bears 471 million equivalent of sound culms of bamboo. The weight of this Bamboo stock has been estimated to be 2.6 million tonnes. Considering felling cycle of 4 years, the potential yield of bamboo in the state is 2.09 tonnes/ha/year. The abundance bamboo species are of notable economic and cultural significance in the state.

2. Methods

In Meghalaya (one of the eight north eastern states in India), an ingenious system of tapping of stream and springwater by using bamboo pipes to irrigate plantations is widely prevalent. It is so perfected that about 18-20 litres of water entering the bamboo pipe system per minute gets transported over several hundred metres and finally gets reduced to 20-80 drops per minute at the site of the plant. The tribal farmers of Khasi and Jaintia hills use the 200-year-old system.

The system is found in the 'war' areas of Meghalaya but is more prevalent in the 'war' Jaintia hills than in the 'war' Khasi hills. This system is also widely prevalent in the Muktapur region bordering Bangladesh. The region has very steep slopes and a rocky terrain. Diverting water through ground channels is not possible. The land use for cultivation is owned by the clan, and is allocated for cultivation by the clan elders on payment of a one-time rent. The clan elders have the prerogative to decide who should get what and how much land. Once the rent has been paid and the land taken on lease for cultivation, the lease period operates as long as the plants last. In case of betel leaf cultivation, the lease can last for a very long time since the plants are not lopped off after one harvest. But once the plants die, for whatever reason, the land reverts back to the clan, and can only be leased out again after paying new rent.

The water for betel leaf plants is diverted from streams by temporary diversions into very intricate bamboo canal systems. Betel leaf is planted in March before the monsoon. It is only during winter that irrigation water is required, and the bamboo pipe system is used. Hence, these bamboo systems are made ready before the onset of the winter, and during the monsoon no water is diverted into them.

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3. Mechanism

The bamboo drip irrigation system is normally used to irrigate the betel leaf or black pepper crops planted in arecanut orchards or in mixed orchards. Bamboo pipes are used to divert perennial springs on the hilltops to the lower reaches by gravity. The channel sections, made of bamboo, divert and convey water to the plot site where it is distributed without leakage into branches, again made and laid out with different forms of bamboo pipes.

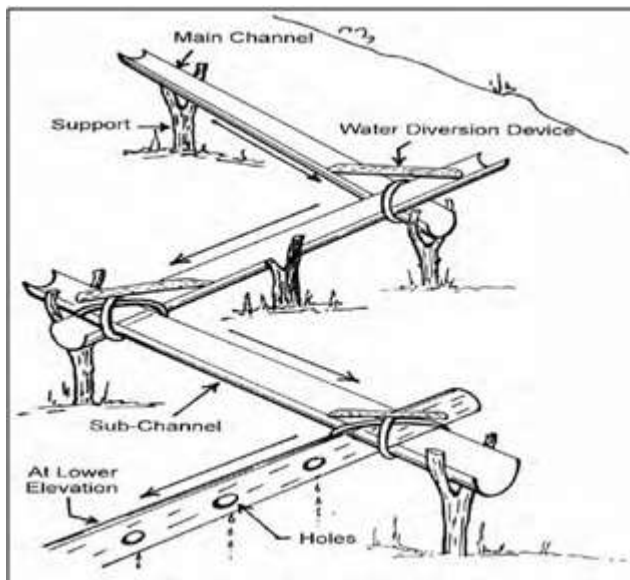


Figure 1: Construction Sketch of the system

Manipulating the intake pipe positions also controls the flow of water into the lateral pipes. Reduced channel sections and diversion units are used at the last stage of water application. The last channel section enables the water to be dropped near the roots of the plant.

The bamboo drip irrigation system is based on gravity and the steep slopes facilitate in implementing it. Water from an uphill source is tapped and brought to the plantation by a main bamboo channel. Usually these water sources are far off from the plantations and the main bamboo channel runs hundreds of meters — in some cases even few kilometers. The water is then regulated through a complex bamboo network of secondary and tertiary channels to all the parts and corners of a plantation, right up to the bottom of the hill.

Bamboos of varying diameters are used for laying the channels. About a third of the outer casing in length and internodes of bamboo pieces have to be removed while fabricating the system. Later, the bamboo channel is smoothed by using a dao, a type of local axe which is a round chisel fitted with a long handle. Other components are small pipes and channels of varying sizes used for diversion and distribution of water from the main channel.

These bamboo networks usually have 4-5 diversion stages [Figure 1] before water is delivered at base of the plant (1, 2). 18-20 liters per minute of water from the main channel gets reduced to 10-80 drops per minute at end of the network [Figure 2],

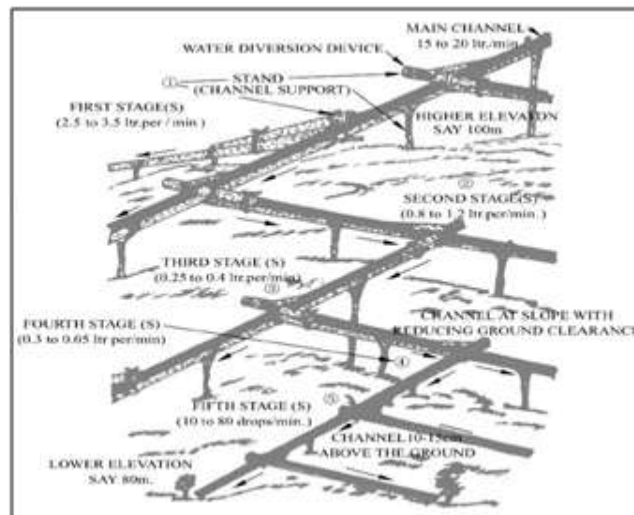


Figure 2: Principle of water distribution in bamboo drip irrigation system

After this long journey, the water trickles or drips drop by drop at the base of the plant. Sometimes water is diverted to distant houses for domestic use.

4. Construction

Bamboos of varying diameters are used to build the channels, support structures, diversion pipes and strips [Figure 2]. Channels are held above the ground by bamboo or wooden Y shaped sticks. One stretch of channel is lashed to another by thin bamboo strips. Indigenous tools like a dao, a type of local axe, and chisels of various shapes and design are used to build the bamboo network. Two labourers can construct a network covering 1 hectare of land in 15 days. They are built with such skill that water wastage by leakage is minimal. The construction is based on a simple rule of thumb — the ratio of diameter of primary channel to tertiary channel determines the quantity of water which will reach the trees. It is a subtle skill which comes with years of observation and experience.

Cost and maintenance

The cost involved in building the system is minimal. Bamboo is available freely in this region. Usually the farmer himself sets up the system in his plantation with some help from 1 or 2 labourers. The region gets heavy rain, so as a result each installation lasts for about 2-3 years. After the rainy season the undergrowth is cleared and reinforcements are provided. Old bamboo is left to rot, which over time returns to the soil as humus.

Cooperatives are formed and each farmer provides his skill and labour to build and maintain the system. The distribution of water from one plantation to another is done by diverting water at fixed timings. This avoids the occurrence of conflicts between various farmers. By this method the whole community works harmoniously — sharing the limited resources judiciously.

Maintenance of the pipes and supports is done by the farmers themselves. A cooperative has been formed, and each farmer provides his skill and labour to maintain the system. Repair work is undertaken as and when required.

Distribution of water is carried out by diverting water from one field to another at fixed timings.

To divert the water, a short bamboo with a hole at the bottom is placed across the main lines. This blocks the main water pipe and diverts the water.

Attempts have been made to introduce modern pipe systems but farmers prefer to use their indigenous form of irrigation. The new systems have met with suspicion. Local farmers do not trust the new materials nor the people who supply them.

Advantages of Bamboo drip irrigation

The advantages of using bamboo are two-fold: it prevents leakage, increasing crop yield with less water, and makes use of natural, local, and inexpensive material. As water is applied locally, leaching is reduced (fertilisers/nutrients loss is minimised). Weed growth and soil erosion is highly controlled and soil infiltration capacity is increased.



Disadvantages of Bamboo drip irrigation

The disadvantage of this system is that bamboo stem is vulnerable to wet climatic conditions, bamboo pipes are not perfectly mobile therefore limited to certain types of crops

5. Conclusion

Although Meghalaya is characterized by heavy rainfall, yet the concentration of precipitation is primarily limited to few months from May to September. Due to hilly topography most of the rain water is wasted as runoff and lot of soil erosion also occurs. Shifting cultivation is practiced in the state. The irrigation system in the state has not been developed yet. The application of chemical fertilizer application and use of HYV etc. are still not practiced by the tribal farmers. The various indigenous techniques of soil and water conservation developed by the local people are based on local conditions and resources. The system existed in the state since time immemorial which are socially accepted and suited to local condition too. It is a sustainable base for tribal communities in the state. However, there is still scope for

improving efficiency/productivity of this system using modern scientific methods. Before developing or recommending any new farming practice/technique in the north eastern region in general and Meghalaya in particular, researchers and planner should consider these indigenous techniques of soil and water conservation into account for better implementation at field condition.

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