

Field Trip Report

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1 Introduction

As part of the TD639 course on *Bamboo Construction for Rural Infrastructure*, we had the opportunity to visit **Bhor**, a small town in Satara district, about 150 km from IIT Bombay.

The field trip was an excellent opportunity to step outside the classroom and see real world applications of bamboo cultivation, treatment, and construction practices. We focused on the Madhavi, scientifically known as **Pseudoxanthoxylon madhavii**, bamboo species and learned about the innovative and traditional methods used by local communities.

2 Polyhouse



Figure 1: polyhouse site

We visited the polyhouse site to understand the construction methods and materials used. On site, we observed a polyhouse framework under construction, where bamboo poles were joined together to form the basic structure. The setup was still in progress.

The team has constructed eight polyhouses so far. Through continuous experimentation and fieldwork, they are steadily evolving and improving their designs to meet practical needs.

2.1 Insights Shared

- The bamboo used for the structures is **treated with smoke treatment** to enhance its durability and resistance to environmental damage.
- To ensure that pole junctions can withstand pressure without failure, the **nodes of the bamboo poles are filled with bamboo pieces and adhesive** (fevicol). This technique reinforces the poles internally and was applied throughout the structure.
- Bamboo based polyhouses offer several advantages, including resilience to climate variability, protection from insect attacks, and **better crop management compared to open field cultivation**. The controlled environment allows for growing a variety of crops across different seasons, leading to more stable and higher yields.
- Construction of the current setup required five workers, each working eight hours a day over a span of eight days. The workforce consisted of both local villagers and workers from nearby villages.

2.2 Observations



- Upon closely examining how bamboo poles are connected to each other at the joints of the structure in the images:
 - Figure 2: A metal flat bracket in a cross shape is used to reinforce the perpendicular joint of four bamboo poles, **enhancing structural stability at intersecting points**

- Figure 3: A metal clamp is used to secure the T-joint between horizontal and vertical bamboo members, ensuring rigidity and resistance to bending forces.
- Figure 4: A diagonal support is connected using curved metal clamps, helping to distribute loads and increase overall strength at angular joints.

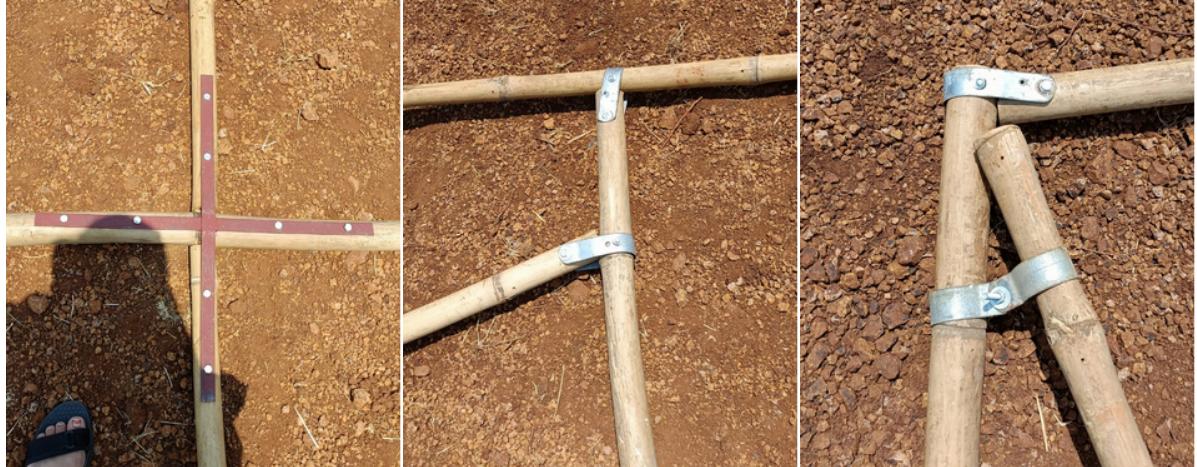


Figure 2:

Figure 3:

Figure 4:

- The base is made of **smoke treated bamboo** stubs buried in the ground, with main poles inserted and secured using concrete for stability and moisture resistance. To make the poles stronger and prevent splitting, they're **filled with concrete up to the first node and then screwed into the base**.



- In earlier projects, some bamboo poles burst due to pressure inside them. After observing this and experimenting, they improved the technique by **filling the poles with a mixture of bamboo and Fevicol** from both inside and outside **to help them withstand the pressure**. The amount of filling varies, some poles are packed tightly, while others are filled more lightly, depending on where they're placed in the structure.



- On land, **coal tar was used for waterproofing to prevent water infiltration and for moisture retention to protect the soil as it's cheap and effective.**

2.3 Learnings

- These **polyhouses protect crops from extreme weather**, allowing farmers to grow year round. Normally, crops depend on seasons, but in bamboo polyhouses, that's no longer a limitation. Even during heavy rainfall, crops inside remain unaffected, while those outside are damaged.
- The **design also keeps pests and diseases away**, resulting in healthier plants and higher yields. Also polyhouses are not only **beneficial for farming but also aid in carbon sequestration**, as bamboo absorbs carbon dioxide, reducing environmental impact.

3 Workshop Visit

Next, we visited a well equipped workshop where bamboo is processed into structural elements and household products workshop contained large quantities of bamboo and wood, along with machinery for cutting, shaping, and assembling.



Figure 5: Madhavii



Figure 6: Machinery



Figure 7: Leftover

3.1 Smoke Treatment



Figure 8: 3.1-Smoke chamber



Figure 9: 3.1-Smoke is generated using neem leaves and bamboo pieces, waste

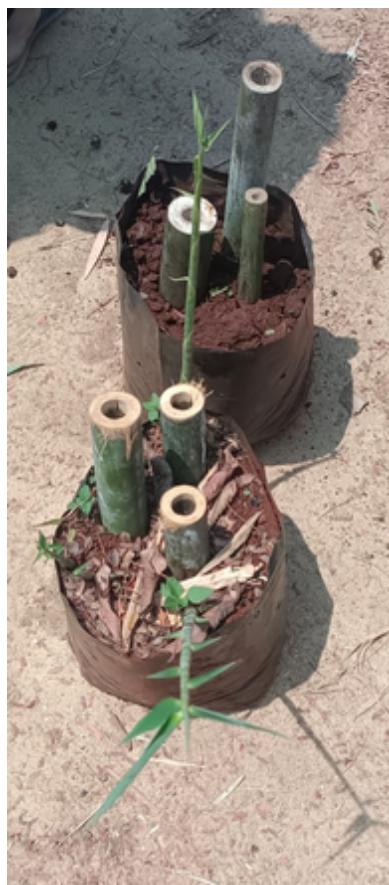
- Bamboo poles are kept inside chamber and exposed to smoke for 6–7 hours and the

chamber was opened the next day. This process **constituted one cycle and a total of five cycles are required** for proper treatment.

- An innovative locally developed method of **burning neem leaves, waste, bamboo pieces to generate smoke** and then sealing the chamber carefully to prevent smoke from escaping
- We were pleased to see the actual implementation of smoke treatment, as it is still an experimental trial. *It will take about two years to fully understand whether this method effectively prevents bamboo damage.*

3.2 Cultivation and Propagation of the *Madhavii* Bamboo Species

- We came across a rare **bamboo species called Madhavi**, which truly felt like the star of our trip. Unlike modern tissue culture methods, this bamboo is **grown using traditional techniques either directly from the mother plant or by vegetative propagation**
- Madhavi bamboo is in great demand and sells at a good price. This is mainly because it **has a strong outer skin and naturally resists fungal infections**. These qualities not only improve the plant's durability but also make harvesting easier.
- To grow more plants, farmers use nodes of the bamboo, which sprout new shoots. These shoots later turn into rhizomes, and **each node has the potential to grow into a full bamboo plant**. On average, each plant is worth about 200 rupees.
- We saw this method being used at Dutta Bhaiyya's farm. He puts special care into the soil during the plant's first year, which is crucial for healthy growth.



3.3 Innovative Bamboo Products at Dutta Bhaiyya's Site

- One of the coolest parts of the visit st Dutta Bhaiyya's place seeing the creative ways bamboo is being used in everyday products. There were sleek pen stands and phone holders that also worked as sound amplifiers, simple yet so smart. The touch of bamboo gave everything this warm, earthy vibe that made them feel really special.
- We saw eco friendly toothbrushes, elegant diaries, and flasks that could keep water or drink hot or cold for a good 6–7 hours. There were even bamboo socks, which are super comfortable and the best part is we can wear them for days without washing and they wouldn't smell unlike our daily socks.
- There were also cute kulfi sticks, bamboo cups, and even shampoo bottles. It really made us think bamboo isn't just about building materials. It's about building a lifestyle that's sustainable, smart, and stylish.



Figure 11: Bamboo based items like socks, kulfi sticks and cups

Figure 10: A display of everyday bamboo products, pen stands & amplifiers, combs, bottles, cups, shampoo, diaries, toothbrushes



4 Bamboo Treatment Facility

4.1 Bamboo Treatment Processes

- At the bamboo treatment facility, we were shown the processes used to extend the life and durability of bamboo for various applications. Discussed about Modified Boucherie Method and Vacuum Pressure Treatment. Both methods **aimed to inject preservatives into the bamboo, protecting it from decay and pests.** In the Modified Boucherie Method, preservatives are directly injected into the bamboo, while the Vacuum Pressure Treatment uses a vacuum chamber to remove air from the bamboo and then applies pressure to force the preservative deep into the fibers, ensuring thorough protection.
- Historical Evolution: The Modified Boucherie Method, developed by Purushottam in 1957, was the first significant advancement in bamboo preservation. By 1993, hand pump pressurized steel tanks were introduced but faced issues such as leakage and rusting. In 2016, stainless steel tanks were introduced, resolving these problems and making the process more efficient. **The latest setup uses a pressurized tank to inject the preservative, beginning with water displacement followed by the chemical treatment, ensuring deep and uniform impregnation of the bamboo.**



Figure 12: Demo shown- Modified modified version of Boucherie Method :)

4.2 Motivational Insights

Along with the technical demo, the manager told us an amazing story about the **Madhavii bamboo**. It's so rare, **even rarer than a tiger, and can only be found between Mahabaleshwar in the north and Musi Dam in the south.** This bamboo really shows the incredible power of nature.

He also shared how bamboo has played a huge role throughout history, shaping civilizations

and having a massive impact on society. The manager was really passionate about the potential of bamboo, saying it could have an **even bigger impact in the future**. He encouraged us to get involved in studying and experimenting with bamboo because it has so much to offer.