Effectiveness of Preservative Treatment on Baijja (*Bambusa vulgaris*) and Mitinga (*Bambusa tulda*) Bamboo Sticks in Growing Betel Leaf Plants

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Abstract

Bamboos of different sizes are generally used for fencing, poles and sticks in betel leaf farms. Bamboo sticks are used as climber for betel leaf vine. These bamboo materials have 2-3 years service life because these are being used without having any preservative treatment. After treatment, the service life of these materials can be increased by four to five times. These treated materials are not required to change or to repair every year. A study has been undertaken to disseminate the preservative treatment technology among the common people thorugh the distribution of treated bamboo sticks in the betel leaf farmers. The objectives of the study were to determine the service life of bamboo sticks used in the betel leaf farms and to motivate people for using the treatment technology. In this regard, the bamboo sticks namely baijja *(Bambusa vulgaris)* and mitinga (*Bambusa tulda*) bamboo were treated by soaking methods using water borne preservatives, copper sulphate, sodium dichromate and boric acid (CCB). The treated materials were distributed to the betel leaf farmers in three different areas of Bangladesh. Data were collected at the interval of every six months to determine the durability of the bamboo sticks. It was found that after four years the treated materials were in sound condition. It was observed that the preservative technology would enhance the service life of the bamboo, which will help people to save their hardly earned incomes and conserve forest resources.

সারসংক্ষেপ

বিভিন্ন ধরনের বাঁশ সাধারণত ঘরের বেড়া, খুটি ও পান বরজে ব্যবহৃত হয়। বাঁশের কাঠি পানের লতার উপরে বেড়ে উঠার (climber) জন্য ব্যবহৃত হয়। এই সমস্ত বাঁশের দ্রব্যসমূহ সংরক্ষণী পদ্ধতি প্রয়োগ ব্যতীত সাধারণত ২–৩ বছরের জন্য টেকসই হয়। সংরক্ষণী পদ্ধতি প্রয়োগ করার পর এই দ্রব্যসমূহের আয়ুস্কাল চার থেকে পাঁচ গুণ বৃদ্ধি পায়। ট্রিটমেন্টকৃত বাঁশের সামগ্রীসমূহ প্রতিবছর পরিবর্তন বা মেরামত করা প্রয়োজন হয়না। এ লক্ষ্যে সংরক্ষণী প্রযুক্তিটি সাধারণ মানুষ এবং পান চাষীদের কাছে পৌঁছে দেয়ার জন্য একটি গবেষণা গ্রহণ করা হয়। এই গবেষণাটির উদ্দেশ্য ছিল পান বরজের মধ্যে ব্যবহৃত বাঁশের শলার আয়ুস্কাল নির্ণয় করা এবং পান চাষীদের মধ্যে সংরক্ষণী প্রযুক্তিটি (Preservative treatment) ব্যবহারে উদ্বুদ্ধ করা। এই লক্ষ্যে বাইজ্যা (*Bambusa vulgaris*) এবং মিতিঙ্গা (*Bambusa tulda*) বাঁশের শলা CCB (copper sulphate, sodium dichromate and boric acid) জলীয় দ্রবণে soaking method এ treatment করা হয়। ট্রিটমেন্টকৃত বাঁশের শলা বাংলাদেশের বিভিন্ন জায়গায় পান চাষীদের মাঝে বিতরণ করা হয়। বিতরণকৃত বাঁশের শলার স্থায়িত্ব নির্ণয়ের জন্য প্রতি ছয় মাস অন্তর-অন্তর তথ্য উপাত্ত সংগ্রহ করে পর্যবেক্ষণ করা হয়। পর্যবেক্ষণে দেখা যায় যে, চার বছর পরে ট্রিটমেন্টকৃত বাঁশের শলা ভাল অবস্থায় আছে। এতে প্রতিয়মান হয় preservative treatment technology ব্যবহারে বাঁশের আয়ুস্কাল বৃদ্ধি পায়। ফলে মানুষ অর্থনৈতিকভাবে লাভবান হয় এবং বনজ সম্পদের সংরক্ষণ হয়।

Keywords: Preservative treatment; betel leaf farm; bamboo stick

Introduction

Bamboo is the most important non-timber forest product which plays a vital role in industrial and domestic economics in many developing countries. It produces woody biomass faster than most fast growing trees. It has short maturity period (3–4 years) to yield a woody stem. The low income group particularly in the villages uses bamboo for housing and agricultural implements. In Bangladesh, betel leaf is cultivated in Chittagong, Sylhet, Jessore, Kustia and Barisal. Bangladesh earns foreign currency by exporting betel leaf to MiddleEast and other countries. In the betel leaf farms, bamboo sticks are used as climber support. Bamboos are also used for fencing, shade and poles in the betel leaf farms.

According to Banik (2000) there are more than 30 bamboo species available in Bangladesh. Out of them 18 species are commercially useful described by (Alam, 1982). These are divided into two groups, forest bamboos (thin wall) and village bamboos (thick wall). The most available thick wall bamboos are baijja *(B. vulgaris)* and mitinga (*B. tulda*) which are used for building, scaffolding, constructing bridge, electric poles. Ladder, rickshaw hood, bullock cart, etc. The shoots are also edible. Baijja *(B. vulgaris)* and mitinga (*B. tulda*) is the most common bamboo species cultivated in the rural areas of Bangladesh profusely covering 30–40% area of the homestead (Banik 2000).

Bamboo deteriorates very rapidly by fungi such as white rot, soft rot and borers in 1–4 years (Liese 1980). Younus-uzzaman (2004) reported that *B. vulgaris, B. balcooa, B. nutans, B. tulda, B. polymarpha and D. strictus* have maximum life less than 2 years. Under cover, it may last from 4 to 7 years or more, depending on the nature of its use and the conditions.

Investigations carried out in different parts of the world have conclusively established that bamboo when adequately treated with suitable preservatives becomes resistance to the attack of fungi and insects. Water leaching of bamboo is a protection method, which reduces starch content (Stebbing, 1910). Leaching of starch reduces the chances of borer attack but cannot protect lignocelluloses materials of bamboo from fungal decay and termite attack when used in adverse condition.

Chowdhury (1992) reported the effect of treatment of *B. balcooa, B. longispiculata* and *M. baccifera* by diffusion and sap displacement methods. Akhter (2001) studied CCB treatment of split muli *(M .baccifera) bamboo* by pressure process for outdoor use. Akhter and Chowdhury (2006) investigated the CCB preservative treatment of split muli (*M . baccifera)* bamboo by soaking process for outdoor use.

The present study has been carried out to investigate the optimum retention of preservative chemicals through strips made from baijja *(B. vulgaris)* and mitinga (*B. tulda*), to determine the service life of bamboo sticks used in the betel leaf farms and to motivate people for using the treatment technology. In this regard, sticks of baijja *(B. vulgaris)* and mitinga (*B. tulda*) bamboos were treated by soaking methods using water borne preservatives, copper sulphate, sodium dichromate and boric acid (CCB). After preservative treatment, the treated materials were distributed to the betel leaf farmers in different areas of Bangladesh. Data were collected at the interval of every six months to determine the durability of the treated and untreated bamboo sticks used in betel leaf farms.

Figure 1. Treated bamboo sticks distribution and used in betel leaf farm at Barisal.

Materials and Methods

Baijja (*B. vulgaris)* and mitinga (*B. tulda*) bamboos were collected from from local market. The age of the bamboos was 3.5 and 3 years (approx.), respectively. The length of all baijja and mitinga bamboo samples were 15–18 m and 6–9 m respectively.

The culms were first cross cut into section of the desired length (2.4 m). Then each piece was splitted into 10–12 strips. Then the strips were kept for drying under sun. After drying, the bamboo strips were weighted. The moisture content of baijja bamboo sticks was 30% and mitinga bamboo sticks 20%. Then the strips were treated by soaking into CCB solution. After treatment the samples were dried under shade.

The strips were treated using 5%, 7% and 10% CCB preservative aqueous solution in (2:2:1) by soaking method. The soaking time was 24, 48 and 72 hours. After treatment the samples were weighted. The average uptake and retention were determined by differentiate the weight between before treatment and after treatment of the samples. For each treatment ten replicates were taken out from the solution. After the treatment the samples were allowed to drip out the solution.

After weighing, the samples were split into two portions and chromazurol (for colour test) was sprayed on the samples for the measurement of penetration. The extent of penetration of the CCB preservatives in the treated samples were compared with the IS code (Anon, 1961). The penetration and retention of the treated samples were measured according to British Standards (Anon. 1974). The treatability of bamboo is generally lower than that of wood due to anatomical structure (Liese, 1980). There are no ray cells in bamboo like wood which are responsible for the movement of liquid in the radial direction. Investigations by Wu (1940) have shown a faster diffusion rate longitudinally, and a slightly higher radial rate than tangentially. But anatomical structure may influence the treatment greatly in air-dried samples. Preservative solution can penetrate longitudinally and radially into the bamboo culms due to the breakdown of parenchyma cells during drying (Younus-uzzaman 1998).

Treated bamboo sticks were stored under shade to facilitate further diffusion and fixation of the preservative. After treatment, bamboo sticks were distributed to the betel leaf farmers in Moheskhali, Banshkhali and Barisal. Data were collected at the interval of every six months to determine the durability of the bamboo sticks. It was found that after four years the treated materials were in sound condition.

Results and Discussion

Liese (1985) reported that bamboos mature at about three years and reach their maximum strength. Satter *et al.* (1990) reported that the value of specific gravity is the highest also at the age of three years. Thus the present study was conducted at this age range baijja bamboo 3.5 years, mitinga bamboo 3 years). The penetration and retention of CCB solution through baijja bamboo and mitinga bamboo sticks, were investigated at different treatment durations.

The retention of the preservative chemicals through the sticks of baijja bamboo and mitinga bamboo are shown in (Table 1). Baijja bamboo stick had the retention of 19.0 kg/m^3 and mitinga bamboo 17.5 kg/m^3 with 10% CCB solution. The retention of the preservatives was increased with the increase of time and concentration through the sticks of the two bamboo species. Akhter *et al.* (1994) also reported that retention gradually increased with the increase of dipping duration.

The penetration of the preservatives through the sticks of baijja bamboo and mitinga bamboo is illustrated in (Table 2). The data shows that the penetrations of the preservatives of the stick of both the bamboo species increased with increase of time and concentration. Huda *et al.* (2006) reported that penetrations of preservatives gradually increased with the increase of dipping duration and concentration. Sultani (1985) reported that split bamboo can be treated by soaking process, where the soaking period was seven days. In the present study, after 3 days of soaking, the required retention and almost full penetration were found

through the sticks.

The service test data of bamboo sticks from betel leaf farms were collected and summarized in (Table 3 and 4). It was found that after four years service in betal leaf farms, the sticks treated with 10 % CCB solution were in good condition. The untreated sticks were completely destroyed within one year. Shadhna Tripti (2006) reported that baijja and mitinga was completely destroyed after 24 months of installation in the stake yard bamboo sticks treated with 7% and 5% CCB solution were attacked by wood degrading agents and the treated sticks were destroyed 20 % and 50% respectively after 4 years.

Table 1. Average retention of preservatives chemicals through baijja and mitinga bamboo sticks treated by CCB solution.

Concentration of solution (%)	Retention (kg/m^3) of baijja bamboo			Retention (kg/m^3) of mitinga bamboo		
	Duration (hours)			Duration (hours)		
	24 hours	48 hours	72 hours	24 hours	48 hours	72 hours
5	8.17	10.3	13.2	7.90	10.8	12.4
7	9.05	12.2	15.2	8.97	12.2	14.4
10	10.9	14.8	19.0	10.5	14.3	17.5

Table 2. Average penetration of preservatives through baijja and mitinga bamboo sticks treated by CCB solution.

Concentration of solution (%)	Thickness of baijja bamboo (cm)	Penetration of baijja bamboo(cm)			Thickness of mitinga bamboo(cm)	Penetration of mitinga bamboo (cm)		
		Duration (hours)				Duration (hours)		
		24 hours	48 hours	72 hours		24 hours	48 hours	72 hours
5	1.3	0.6	0.9	1.1	1	0.5	0.7	0.9
7	1.3	0.8	1.0	1.2	1	0.5	0.8	0.9
10	1.3	0.5	0.8	1.1	1	0.6	0.8	1.0

Table 3. Service life of baijja bamboo sticks after four years at Banskhali and Moheshkhali, Chittagong.

Farmers (Nos.)	Treated stick (Nos.)	Size of sticks (cm)	Condition of 5% CCB treated sticks	Condition of 7% CCB treated sticks	Condition of 10% CCB treated sticks	Controlled sample
30	1000	213 x 1.5 x 1.3	50% sticks were destroyed by wood degrading organisms organisms	20% sticks were destroyed by wood degrading organisms	100% bamboo sticks are still in good condition.	100% untreated bamboo sticks were destroyed by wood degrading

Table 4. Service life of baijja bamboo sticks after four years at Banskhali and Moheshkhali, Chittagong.

Farmers (Nos.)	Treated stick (Nos.)	Size of sticks (cm)	Condition of 5% CCB treated sticks	Condition of 7% CCB treated sticks	Condition of 10% CCB treated sticks	Controlled sample
30	1000	213 x 1.5 x 1.3	50% sticks were destroyed by wood degrading organisms organisms	20% sticks were destroyed by wood degrading organisms	100% bamboo sticks are still in good condition.	100% untreated bamboo sticks were destroyed by wood degrading

*5% CCB treated = 300 nos., 7% CCB treated = 300 nos., 10% CCB treated = 400 nos.
*CCB: Copper chromeboric acid solution

Conclusion

The treatment technology does not need complicated equipment and can be operated by unskilled persons. The economic advantages of preservative treatment of bamboo in contact with the ground have been recognized by the betel leaf farmers. Latif *et al.* (1987) estimated that the construction of bamboo house made of bamboo posts, beams, wall and sun grass roofing measuring 55 m^2 cost about Tk.19,500 only. After using treated materials, the costs increased by 30%. The average life of an untreated house was 5 years. The estimated life of a treated house was 15 years. The cost of treatment is affordable by rural people. In fact, wood preservatives benefit the environment in that it protects and extends the life of wood and bamboo products, thus conserving natural resources. Extending the service life of bamboo sticks provides financial and labour savings for betel leaf farms and conserve the nation's of stocks bamboo resources.

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