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Manual and Mechanised Processing Aspects for Bamboo Artisinal Technologies

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Abstract

The present write up includes the aspects of mechanization in the field of bamboo processing. Mechanization can also go a long way in estimating product outputs from round bamboo of different diameter (ø) and wall thickness beside length. A schematic CFC layout has also been proposed in the present write up to make a beginning of mechanization in bamboo sector.

Keywords: Bamboo, diameter (ø), CFC, tools, Jewelry, cft, board feet.

Introduction

Obtaining replicates is the essence in material and statistical sciences for respective outs of precision. In broader sense obtaining pieces of uniform dimensions is the prime requirement everywhere. The term "board feet", "running feet", and cubic feet are frequently used in saw milling and wood based industry. Log volume tables are used everywhere by the saw-millers to sell the logs. The output of the sawn material could well be predicted with a great precision discarding sawdust and wastage of off cuts.

Such a situation, however, is far from reality in case of bamboo processing. Only lengths (l) even ignoring diameter (ø) are used in trade and the term Rft becomes insignificant. The terms grade sawing and throughput sawing are also absent in bamboo processing.

The artisan working on bamboo, say mat forming, thus is unable to predict the requirement of round bamboo even for 2m x 3mmat area. The prime reason for this is absence of mechanization in this sector. Particularly in this country. An attempt is being made here to highlight the role of mechanization in this sector beside conventional bamboo processing tools in vogue in different parts of the continent.

Importance of mechanization

Mechanization has been recognized as a major activity to "upgrade" working skills and obtain precise outputs leading to quality products. The up gradation of working skills is thus achieved, the products can withstand quality control measures and may meet stringent measures of global competitiveness.

The inherent benefit of mechanization are enumerated below: Increased output of quality product. Less fatigue to the operator, mechanist and co-workers. Encourages the operators towards work while machine is in motion.(running). The Laker off is fully occupied in the work and concentration towards work is full. Continuous feeding of material ensures quality replicates of identical dimension. Safer to operate as hands are at sufficient distance from the cutting edges. Less experienced operators can also run the machine once machine is set. This aspect trigger in a hidden patent mechanism of self-learning and trained manpower is generated within the unit avoiding extensive training. A short term training in such cases suffices to certify the operator's worthiness. Mechanization is desirable for dangerous operations. Ergonomics is improved because of appropriate working posture and workshop hygiene. The worked surfaces suit well to subsequent finishing treatments due to absence of fuzz, deep cuts, and poor surfaces frequented in case of hand tools. Certain jigs and postures could be incorporated to work with different diameters, width and species of bamboo. The manual operational intentional bias of various kind are eliminated as machines do not accept them. Sequential layout based flow lines are possible which makes the process faster in working, fabrication, assembly and finishing lines. Hand tools seldom contributes towards chips-dust removal from worked surfaces. Whereas mechanized tools and machines take care of this aspect and chip and dust are blown out in a proper way from cutting site to facilitate subsequent cutting and cleaning. Species wise tool machine interaction, segregation of material as outer-middle-core, or from root to top variations can very well be evaluated and "grading" of output is possible. Such R&D invitation within the species and between the species will go a long way towards end uses and product development.

Bamboo as a raw material

We are slowly moving on towards other alternatives since wood is getting scarce, this substitution drive will become more effective and environment friendly if we start using bamboo rather than using metals or plastic or any other alternative[1].

There are two processes followed in proper bamboo processing, these include the primary processing and the secondary processing. Primary processing of bamboo includes harvesting, transporting, preservation and seasoning and secondary processing includes fabricatin of value-added products[2]. The only demerit in using bamboo effectively is the use of age-old tools in secondary utilization of bamboo. The age-old tools like hammer, axe etc. have been replaced by modern and new tools like frame saw, band saw, chipper canter and many more. Similar approach and effective development is the requirement for proper utilization of bamboo[3].

Characteristics of bamboo

Bamboo is utilized successfully in different parts of the country. North-eastern India is the chief participant in this utilization. Among all the other states, Tripura is utilizing bamboo as a main raw material. It is rich in both resources and craftsmen for development of handicraft industries[4]. Bamboo is so successful due to the following reasons:

The strength to weight ratio in the various bamboo species is relatively very high. Slats may be cut in vertical direction and laminated together for use in solid dimensional lumberand for veneers. The color of bamboo is usually different with different harvesting processes followed and the different growing conditions, initially it is blonde and darkens with time. A number of grain patterns and colors may be observed on the same panel which increases the chances of mis-match of the colors and design palate of the adjacent doors and windows, all natural. The fast growing property and the high strength property makes bamboo the most demanded building material for centuries. Growth in bamboo is very rapid and fully completed within a duration of few months. During its growing stages the lignifications varies in the various heights of one single culm[5]. It is also used for musical instruments, boats, weapons, fabric, toys and even making paper. Bamboo shoots in some stages are taken as food. It also acts as a food beloved food source of many wild dwellers.

Specific gravity and mechanical properties

The specific gravity alters within a culm from top to bottom and along the radius. Both the mechanical property and the specific gravity are inter-related to each other. Bamboo is superior in relation to the various properties and is treated as a premium material in relation to both constructional and furniture purposes. The various properties differ according to the fibre content, this provides with a suitable explanation for the varying strength properties and specific gravity. At the base, for example, the bending strength of the outer part is 2-3 times that of the inner part. The differences however, decline with an increase in height. As the culm wall thickness decreases the specific gravity and mechanical strength of the inner parts increases since these contain less parenchyma and more fibres. The various properties vary at a much greater rate in horizontal portion then it does in vertical direction[6]. The resistance to compression parallel to the grain does not vary, it is seldom affected by the height of the culm. The properties like bending strength and modulus of elasticity possess higher values at higher heights[7].

Bamboo can be compared to the various other basic constructional materials and can be proven superior in numerous aspects like production aspects, ease of availability and so on. The outcome of the comparison places bamboo well ahead for construction purposes.

Diverse range of hand tools used in processing of bamboo

Harvesting: For harvesting of bamboo and its complete and best utilization few principles have to be followed, i.e. the bamboo culm has to be at its highest strength stage and the sugar content in the culm has to be at its lowest stage. Major tools used for bamboo harvesting are: Crook Stick. Slasher, Bill Hook, Axe, Japanese Hatchet, Thai Harvesting Blade.

Scraping: This outstanding and extravagant method is the one in which the fellow artisans do the carving with hand on the wood or bamboo floor. The outcome is the appearance is the classic and marvelous beauty. It involves traditional hand tools like: Half-round scraper, Pull scraper, Japanese scraping knife, Scraping knife, Phillippine knife 'parang'', Short plane, Round bottom plane, Clipping knife.

Length sizing: Common hacksaw, Adjustable hacksaw, Chinese hacksaw, Chinese bowsaw, L-shaped saw, Hand saw, Coping saw, Hunter's saw, Indian cane-frame saw.

Splitting radial: Assam dhau, Manipuri dhau, Tripura dhau, Machete, Chinese broad knife, Round knife, 4 Blade radial splitter, 8 blade radial splitter, 12 blade radial splitter, 16 blade radial splitter, Splitting cross, Splitting wedges, Split axe, Lath maker's split axe, Chinese machete, Chinese cleaving knife, Chinese small splitter.

Strip making: The culm subsequently cut into strips until the last two strips are obtained. A sharp knife and a mallet are the primary tools, the knife has to be held perpendicular to the round edge of the culm, a hard tapping has to be given so as the knife penetrates into the culm, the knife blade is twisted in a circular direction as opposed to prying to left or right, it is stopped forcefully when the cut is few inches long. The culm is now gripped with hands to the sides of the stripas closely as possible and the pieces are pulled apart. The following instruments can be used in the above discussed process:

Double edged cleaving knife, Tripura dhau, Chisel edge cleaving knife, Cleaving knife, Indian foldable knife, Indian splitting knife, Balinese splitting knife.

Shaping: Profile knife, Profile blade, Stick rounding plate,

Stick rounding tool, Stick rounding tin, Balinese chisel, Balinese furniture knife, Bevel edged chisel, Scooping chisel.

Mechanised bamboo processing machines

Bamboo chopstick making machine: Bamboo cutting and splitting machine / crosscutting machine, bamboo sizing machine, bamboo chopstick forming machine, bamboo shaving machine, chopstick polisher, chopstick printing and wrapping machine.

Bamboo incense stick making machine: Auto bamboo splitter. Bamboo slicing machine. Bamboo forming machine. Incense stick polisher. Hand splitter.

Bamboo plywood and bamboo plate processing machine: Bamboo multi rip saw, Bamboo inside knot removing and slicing. Bamboo slicing machine, 'SUGII'Glue mixer. 'SUGII' glue spreader. Bamboo cross cutting machine. 'KITAGAWA' Hot press machine, 'KITAGAWA' table lifter capacity. Double saw.

Conclusion

Like in the field of wood working in the bamboo processing also a large variety of machines exist. Some of them are specific and specialized for a particular job like chopsticks, ice cream, spoons/sticks, toothpicks, incense sticks. A CFC of bamboo processing center of mechanized nature is given below in Figure-1. It is evident from the flow of material that diverse range of material and quantification of dimension as well as the product in a collective way can be estimated. In other words diameter based out puts (or wall thickness based outputs) can well be evaluated as in the case of sawmilling (economic conversion of logs). Economization or economic conversion of bamboo material is thus possible through mechanization. Once bamboo based artisanal technologies are established on the above basis the same can find application for cane and coconut leaves and shell crafts being akin in nature.Regardless of above the part played by modern technology will benefit "rural India", rural craftsmen and will broaden the outlook and scope of area from local to global in multifacilitated way.

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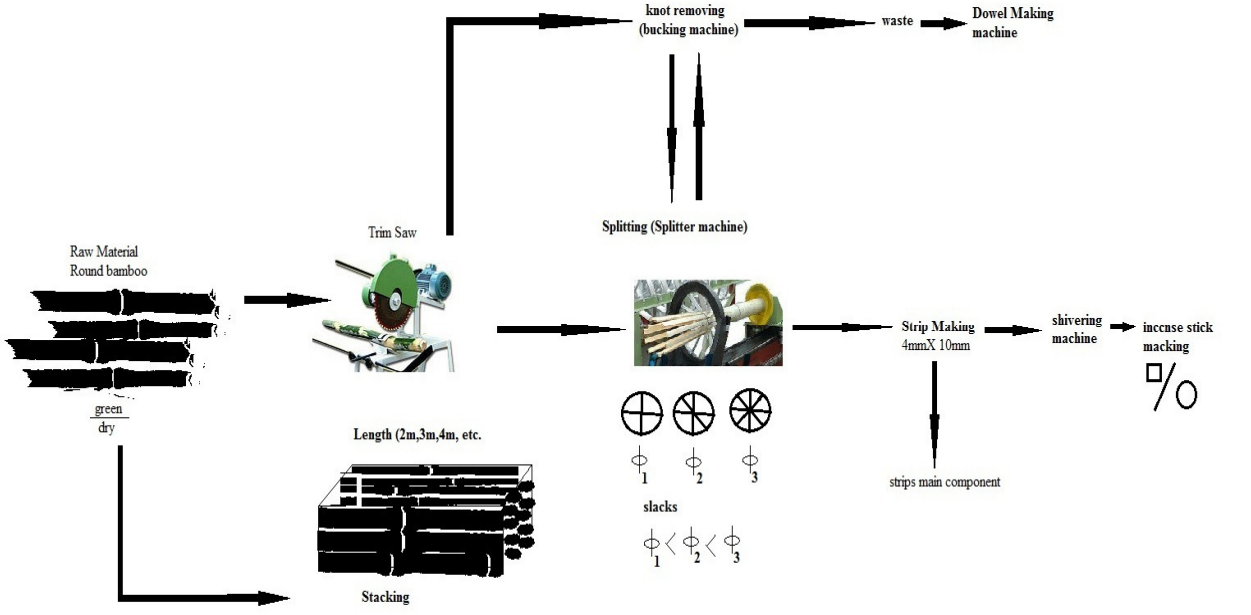

Figure-1
CFC of bamboo processing center of mechanized nature

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