

# Storing Structure for Grains by Using Different Cross Section of Bamboo

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**Abstract**— Recently Bamboos are used to construct low-cost storage structures, due to easily availability and cost effectiveness. But storage structures constructed with bamboo have certain limitations, like low storage capacity, lesser life of structure and not that much efficient ventilation. Presently bamboos are used in such structure are generally entire circular section and half circular section and placed either exactly vertical or exactly horizontal in section for making various components like sides, bottom, roof, and partitions of onion storage structure. There is not too much attention given to selection of alternative cross-sectional shape of bamboo and secondly placing of such sections in various directions rather than exactly horizontal and vertical. By using different cross-sectional shapes of bamboos and placing it in various orientations, use can increase the storing capacity of such Bamboo storage structure, improve natural ventilation capacity, can prove eco- friendly, cost efficient and rural area sustainable alternative for rural areas by using limited available resources.

**Indexed Terms**- Different cross section of bamboo, Existing storing structure of bamboo, Traditional methods for grains, Onions, Potatoes, Bamboo Warehouses

## I. INTRODUCTION

While crops like potatoes and onions are produced over the course of a few months each year, they must be stored properly in order to be available for daily consumption throughout the whole year. Currently, the only option for preserving such crops for an extended period of time is cold storage, but it is more expensive, energy-intensive, and harmful to the environment.

In India, bamboos form rich belts of vegetation in the well-drained parts of the monsoon region at the foot of the Himalayas and also down in peninsular India and along the Western Ghats or Sahayadri ranges.

World's largest reserves of bamboos exist in India, which is represented by 136 species. There are over 136 species of bamboos growing in India. But only few of them are economic importance from viability and utilization point of view. The current harvesting of bamboo exceeds 3.2 million tons (5 million cum) a year, 50% of which is utilized for handicraft/structural uses. additional resource of bamboo may be generated by adopting scientifically advanced practices like improving storage and preservative treatment is about 1.1 million cum which is the adaptation of advanced techniques of bamboo processing. Requirement of bamboo for solid wood and reconstituted wood products was estimated to be 25.72 million cum in India. Out of this, estimated demand for bamboos is about 2.5 million cum. In view of huge gap between production and consumption of timber in India (of the order of 20 million cum), bamboos may be viewed as filling this gap up to some extent.

Regions / States	Area (%)	Gross share
North East	28.0	66
Madhya Pradesh	20.3	12
Maharashtra	5	9.9
Orissa	8.7	7
Andhra Pradesh	7.4	2
Karnataka	5.5	3
Other States	20.2	5

Table 1: Major bamboo growing regions / states

## II. REQUIREMENT OF STORAGE

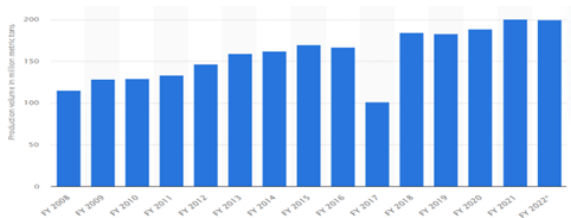
Provide adequate protection from rodents, birds and insects. Provide aeration and fumigation when required. Prevent losses due to moisture and temperature. Permit easy inspection. Facilitate proper cleaning and should be self-cleaning in case of silo.

Economical on unit storage cost basis. Capable to protect the grains from weather, fire and theft. The basic requirements to safeguard food grains from the enemies responsible for losses are: -

1. Modification of the food grains (cooling or drying)
2. Modification of atmospheric conditions of the storage system

Foodgrain wastage	
Year	Quantity (In tons)
2013-14	24695.5
2014-15	18847.2
2015-16	3115.7
2016-17	8775.6
2017-18	2244.74
Maximum wastage	
West Bengal	12,670
Maharashtra	9,370
Odisha	8,219
Bihar	6,184
Andhra Pradesh	4,944
FCI storage depots	
Total covered storage	1,840
Owned by FCI	537
Hired	1,303

Table 2



Graph 1

### III. PROPERTIES OF BAMBOO

#### 1. Tensile Strength

Bamboo is able to resist more tension than compression. The fibers of bamboo run axial. In the outer zone are highly elastic vascular bundle that have a high tensile strength. The tensile strength of these fibers is higher than that of steel, but it is calculable to construct connections that can transfer this tensile strength. Slimmer tubes are superior in this aspect too. Inside the silicate outer skin, axial parallel elastically fibers with a tensile strength up to 400 N/mm<sup>2</sup> can be found. As a comparison, extremely strong wood fibers can resist a tension up to 50 N/mm<sup>2</sup>.

#### 2. Compression strength

Compared to the bigger tubes, slimmer ones have got, in relation to their cross-section, a higher compressive strength value. The slimmer tubes possess better material properties due to the fact that bigger tubes have got a minor part of the outer skin, which is very resistant in tension. The portion of lignin inside the culms affects compressive strength, whereas the high portion of cellulose influences the buckling and the tensile strength as it represents the building substance of the bamboo fibers.

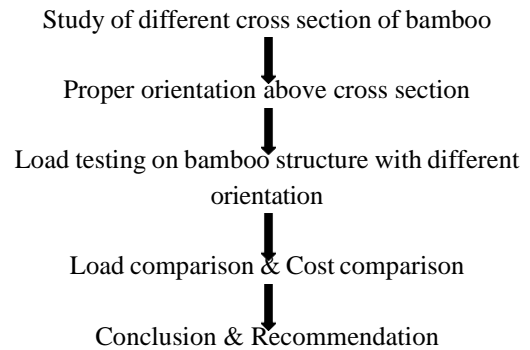
#### 3. Fire resistance

The fire resistance is very good because of the high content of silicate acid. Filled up with water, it can stand a temperature of 400° C while the water cooks inside

#### 4. Anisotropic properties

Bamboo is an anisotropic material. Properties in the longitudinal direction are completely different from those in the transversal direction. There are cellulose fibers in the longitudinal direction, which is strong and stiff and in the transverse direction there is lignin, which is soft and brittle.

### IV. METHODOLOGY



### V. DESIGN OF GRAIN STORAGE STRUCTURE

Proper design of the storage is not only to restrain and properly hold the material but also to minimize the damage to the grain due to moisture condensation or excess temperatures. The storage unit must be so designed as to with stand the change in pressures during loading and unloading. The several aspects to be considered in a storage design are types and

quantities of grain to be stored, location, size and number of bins, handling equipment and methods, structural requirements, conditioning methods and requirements and plans for future use and expansion.

VI. PHOTOGRAPHS OF TESTING



Fig 1. Load testing machine



Fig 2. Load testing on full bamboo (O section)

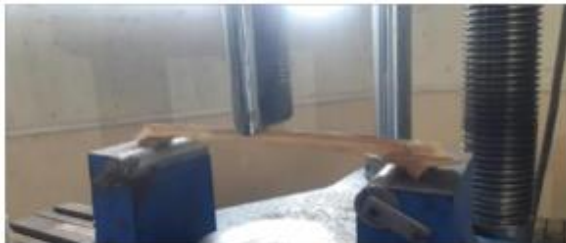


Fig 3. Load testing on c section Bamboo



Fig 4. Load testing on Inverted U Section Bamboo



Fig 5. Load testing on U section Bamboo



Fig 6. Load Testing on Platform Made from full Bamboos



Fig 7. Load testing on platform made up from C section Bamboos

VII. PRACTICAL VALUES OF DIFFERENT CROSS-SECTION





<i>Shape of cross section of bamboo</i>	<i>Max. load taken</i>
	<b>24 KN</b>
	<b>21.65 KN</b>
	<b>21.85 KN</b>
	<b>22.5 KN</b>

Table 3

VIII. STEPS NECESSARY FOR GOOD STORAGE PRACTICE IN RESPECT OF ALL FOOD GRAINS

Stored product pests can be managed either behaviourally (traps viz., probe traps, light traps, pitfall traps etc.,) or with several preventive and curative measures (both chemical and non-chemical methods). Once a facility is obtained, a number of steps are to be taken to ensure safe storage of grains. These steps comprise,

1. Before storage
  - Checking for leakage of rain water and sufficiency of drainage facilities - Cleanliness of the facility and environment
  - Assessment of capacity of the facility
  - Pesticide treatment
  - Security and firefighting arrangements and
  - Repairs to available equipment
2. After receipt of seed
  - Inspection for variety and soundness of quality
  - Inspection carefully for infestation, if any, and when present, for type and extent of infestation,
  - Inspection whether grain has excess moisture, whether it had been heated up in earlier storage and has any musty or rancid odor Any grain rendered wet or damaged to be segregated and salvaged with facilities available and check the weight received
3. During storage
  - Maintenance of cleanliness
  - Ensuring aeration where necessary
  - Checking for leakage after rains
  - Inspection for insects, rats and mites at fortnightly intervals
  - Watch for advancement in deterioration

CONCLUSION

Since time immemorial, bamboo has played an important role in the development of mankind. It has been the backbone of much of the world's rural life and will remain so as the population increases. The realization that bamboo is the most potentially important non-timber resource and fast-growing woody biomass, has evoked keen interest in the processing, preservation, utilization and the promotion of bamboo as an alternative to wood. Its high valued utilization not only promotes the economic development, but also saves forest resources to protect our ecological environment as a wood substitute. The proper grain storage is also important for household purposes in cities crops like potatoes, onion and any other food we cannot be stored in that a fridge that's why we decided to a make a ecofriendly storage structure with optimum use of bamboo cross section. We taking a load test on bamboo also to check its strength on any section of bamboo like cross section,

circular section, u-shape, c-shape. The grain production has been on the rise with better facilities in terms of seeds, technology, fertilizers, pesticides and irrigation but associated is the loss of grains which has also increased. Around Rs 50,000 crores every year are lost due to improper storage of food grains. Naturally of food grains is greatly influenced by environmental factors such as type of storage structure, temperature, pH, moisture, etc. At any given time 60-70% of grains is stored on the farm in traditional structures like Kanaja, Kothi, Sanduka, earthen pots, Gummi and Kacheri.

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