

## Green Gold

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Characters:

- 1) Male voice
- 2) Female voice
- 3) Manav, a ten year old.

Sound of rain falling

Flute music

FEMALE VOICE:: Oh! What a sweet music...the flute is such a melodious instrument. It cheers up the heart...it is wonderful to hear such sweet music.

MALE VOICE: The flutist is playing the flute very well. The music is washing away my tiredness. The sound of the flute is so sweet.

FEMALE VOICE: But what if there were no bamboo...would we still have flutes, then?

MALE VOICE: I don't think so and I suppose that is why they have an idiom in Hindi that says, No bamboo...no flute! Of course, I don't see why anyone would like to do away with bamboos when the music the flute produces is so sweet.

FEMALE VOICE: Yes, the sweetness of the flute will continue to please us as long as bamboos are still around. Come to think of it, that's where we are going, isn't it? To the land of the bamboo. At about this time tomorrow we will be in Guwahati enroute to Meghalaya by bus.

MALE VOICE: that's right and hopefully; the sound of the flute will cheer us up there as well. By the way, where is Manav?

FEMALE VOICE: He has gone to meet his friends. He said that since he will be away for a whole week he wanted to say goodbye before he left.

MALE VOICE: He is very happy about this trip to the North East, I think.

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Change of scene

Sounds of a moving vehicle—a bus.

Manav: Papa. I can see a bamboo jungle outside my window!

MALE VOICE: Manav, about one third of area given to the bamboo cultivated in India is in the states of the North-East.

FEMALE VOICE: And over half the total produce of bamboo in the country comes from here as well.

Manav: Look...look...the houses here are made of bamboo too.

MALE VOICE: Bamboos are extraordinary. It is used in many countries for constructing houses.

FEMALE VOICE: The bamboo houses in the North-east are simply fabulous.

Manav: Look...look....they even have two –storied houses made of bamboo. This is the first time I have seen a two-storied bamboo house.

FEMALE VOICE: Really, how beautiful these bamboo houses are!

MALE VOICE: Manav, it is not just that bamboos are used only in the North- east; it is used almost everywhere in our country, especially to make windows, doors, ceilings etc.

FEMALE VOICE: The use of bamboo makes it possible for many people to realize their dream of owning their own house. Bamboo shelters them from the strong sun and rain.

Manav: And look how they are using the bamboo as a pipe to irrigate the fields here.

MALE VOICE: The entire North- east region uses bamboo not just as pipes to bring water to the fields, but it is used in many other ways. Many agricultural instruments are made of bamboo.

Manav: Wow! How amazing, the people are wearing necklaces and garlands made of bamboo...how charming!

FEMALE VOICE: Yes, the bamboo ornaments are gorgeous.

MALE VOICE: Manav, did you know that the people here make many different kinds of lovely ornaments out of bamboo?

FEAMLE VOICE: I wish I had some of these novel bamboo ornaments too.

MALE VOICE: Ah! Manav... look your mother has already started placing her requests on record.

Manav: I don't blame her. The bamboo ornaments are so attractive that I think it would tempt just about everyone.

MALE VOICE: Ok then, we'll buy some when we reach Shillong.

Manav: Come to think of it the bamboo hats they are wearing are rather nice too.

FEMALE VOICE: Yeah, the ornaments and the hats are all lovely.

MALE VOICE: You could say their entire attires incorporate a lot of bamboo. This shows just how important a place bamboo hold in their lifestyle.

Manav: Are those pickles that they are selling over there?

MALE VOICE: Yes. Bamboo pickle.

Manav: Do you mean to say we can even eat bamboo?

FEMALE VOICE: Didn't you know that parts of bamboo are edible and are used in many cuisines?

Manav: Edible! You mean we can even eat bamboo!

MALE VOICE: Yes indeed. Apart from pickles, people of the North-east region of India cook parts of bamboo in many ways. Bamboo, particularly bamboo shoot, is greatly relished in these parts. And of course, don't forget that food is often served in utensils made out of bamboo.

FEMALE VOICE: (laughing) So the kitchen is bamboo all the way.

MALE VOICE: Well...not just the kitchen alone... but the war field also is area where the bamboo was extensively used. Think of all those sharpened bamboo weapons!

Manav: Not to forget the stout sticks...we still use these as lathis or *latthas* in villages and as walking sticks for the elderly...not to forget the Hindi saying that he who owns the lathi owns the buffalo...laughs.

MALE VOICE: The bamboo is not just used in warfare you know...the bamboo flute brings with it the message of peace.

FEMALE VOICE: I know. Each time I hear the flute I feel so much at peace.

MALE VOICE: Not just the flute. The bamboo is used to make many other musical instruments too and the melody each instrument creates is mesmerising to say the least. (sound of flute)

FEMALE VOICE: Just think about it. Here we have the bamboo...and from that are made so many musical instruments from each of which we coax out so many different kinds of melodies...

Manav: Looks like the people here depend a lot on the bamboo.

FEMALE VOICE: Isn't the black board in your school made of bamboo, Manav? And the tables, chairs and even your pencil? Of course, it is a fact that the houses here

and even the agricultural implements and the kitchen utensils are made of bamboo; and bamboo items are served as food too. Over and above all these uses, bamboo is used as medicine too.

MALE VOICE: The people here have incorporated bamboo into their attire and use it to make ornaments as well. Joyous celebrations are marked by music made using bamboo instruments. So I think, Manav, that you are right when you say that the bamboo is an indispensable part of life here.

Manav: No wonder they call bamboo, the poor man's timber.

FEMALE VOICE: Manav, bamboo is not exclusively used by the poor you know. Even the affluent use bamboo.

MALE VOICE: Quite right. Bamboo is high on the list of forest produce used extensively in all of Asia and the Pacific region.

FEMALE VOICE: Bamboo is used as raw material in many Industries. It is almost the foundation pillar of the paper and pulp industries.

MALE VOICE: Paper made from bamboo some 1,700 years ago during the times of the Tang dynasty was world-famous. Su Dongpo, the famous poet of the Song Dynasty in China, wrote, "bamboo is used for building houses, for making hats to provide shade, bamboo paper is made for writing, bamboo sheath is used for clothing, bamboo shoes are made for wearing, bamboo shoots are for eating and bamboo fuel is used for fires. Indeed we cannot live without bamboos for a single day."

Manav: No wonder that the useful bamboo is an indispensable part of our lives.

MALE VOICE: Did you know that there are 75 genera and 1250 species of bamboos all over the world and that most are found in the tropics? China is home to about 500 species.

Manav: And how many are found in India?

MALE VOICE: India is home to about 130 species. Of course there are many different species that grow in other countries. For example, 55 species grow in the Philippines, 50 species grow in Thailand, 33 species grow in Bangladesh, 31 species

grow Indonesia, 26 species grow in Papua New Guinea and 12 species grow in Malaysia.

Manav: OK, so there are so many different species of bamboo, but which country has the largest forest area on which bamboo grows?

MALE VOICE: Manav, you will be happy to know that India tops the list of nations with the largest forest area under bamboos. India has 9.57 million hectares of bamboo forests which means 12.8% of the total forest area is under bamboo. The principal bamboo species are *Dendrocalatnus strictus* and *Bambusa arundinacea*. India has an overall annual production of 50 lakh tons.

FEMALE VOICE: It is good news that we top the world when it comes to forest area under bamboo. However, China has 3.4 million hectares are under bamboos, which is a mere 3 % of total forest area and yet it matches India's output of 50 lakh tons. Two- thirds of the Chinese forest area is under the bamboo species *Phyllostachyas pubescens*.

Manav: A major part of the bamboo yield goes to make paper, doesn't it?

FEMALE VOICE: In India, we began industrial-scale production of paper in the 1930s. After independence, there was a rapid expansion of paper factories, and most used bamboo as a source material for making paper. After the Second World War, Sri Lanka and Indonesia set up paper and pulp factories. Recently, China has set up several small-scale paper factories that use bamboo pulp.

Manav: Papa, this must have driven up the demand for bamboo.

FEMALE VOICE: You are absolutely correct, Manav. Previously bamboo used to be considered a perpetual resource which means that we thought it would always be available. However, the increased demands coupled with the dwindling forest area under bamboo means that it will not remain the poor man's timber for very long. The demands of the paper and pulp Industry are contributing towards the pushing the bamboo beyond the reach of the common man.

MALE VOICE: Actually the demand for bamboo is outstripping its supply. The rise in population also translates into greater demand for bamboo as fuel or for use in the

fields. Besides rise in population also means that the forested areas are becoming less and this in turn means that the area available to grow bamboo is diminishing.

Manav: Plus, I don't think that we can make bamboo grow as fast as it is being harvested!

FEMALE VOICE: Yes, that is right, Manav. And this is the reason why, where previously there used to be large tracts of bamboo forests in many countries we have only some scattered areas where bamboo forests still exist. Between 1960-1960, about 50 per cent of the increase in food production in Southeast Asia was achieved by clearing forest land to make way for agricultural plantations. This trend is compounded by the absence of bamboo plantation or inadequate replantation. Add to that the high cost of **(TYAGIJI what is Charai???)** and the damage caused by forest fires.

MALE VOICE: There are other reasons too. For example, all the seeds that are formed after bamboo flowers do not germinate. Those that do germinate are often destroyed by rats, insects and other pests. Plus the ability to germinate is also often lost because of improper storage of seeds.

V: The problem is compounded by a lack of forest cover as well as over-exploitation of the forests, lack of adequate facilities, poor management and inadequate control by the states over the forested areas. No wonder that we are seeing, a loss of bamboo habitats but also a decline in bamboo production. This is a trend that is observable all over Asia. Of course, we have set up the National Bamboo Mission to address these problems.

MALE VOICE: The bamboo Mission supports research on ways and means to prevent diseases that attack the bamboo. It is also involved in studies on traditional and modern technologies to increase bamboo production. Apart from all these activities it also works to encourage the marketing and sales of bamboo products.

Manav: This is a wonderful initiative that we have taken in our country. I hope that along with increasing bamboo production we are also able to integrate the use of bamboo in our daily lives.

Change of scene.

A village in Manipur

Manav: Papa , how beautiful this place is.

MALE VOICE: Yes, Manav this place has been blessed with Natural beauty.

Sounds of the flute

Sounds of commotion and loud musical instrument such as the Horn

Snippets of people lamenting

Oh God...what will happen now...the bamboo is flowering...famine...starvation....

Manav: Famine? All because the bamboo is flowering!!

FEMALE VOICE: Yes, Manav. They say that the flowering of the bamboo is an omen that a famine will follow.

Manav: but why should it be so? Flowers are a sign of prosperity to come...see flowers mean fruits and fruits mean seeds. So how can flowers be associated with famine?

FEMALE VOICE: The reason is that the bamboo is an unusual plant in that it flowers at a predetermined and specific time. All the bamboo in a clump will flower simultaneously, irrespective of whether the plant is 40 or 60 years old. This is why bamboo is called monocarpic. After flowering, the entire clump of bamboo will die.

Manav: I am sorry but I do not understand.

FEMALE VOICE: See Manav, if we take a bit of bamboo from a main clump and graft it using vegetative means of culture, the bamboo plant that will result will be of the same age of the mother or original plant. So if a cultured bamboo plant is grown from tissue taken from a ten year of mother plant, after another ten years both plants will be 20 years old. This is why all the bamboo plants show simultaneous flowering.

Manav (in bewildered tone): So, you mean there will be a famine just because all the bamboo plants are flowering at the same time?

FEMALE VOICE: Manav, bamboo seeds are scattered far and wide and these are a rich source of protein for rats and other rodents. The rats feast on these seeds and

well-nourished rats breed rapidly. The rat population explodes and this often coincides with the time when the bamboo seeds are exhausted. The rodent pests then enter houses and consume and foul stored grains.

Manav: Aah! So that is why people are afraid of bamboo flowers!

MALE VOICE: The unique fact about bamboo is that depending on the species, it flowers once every 40 to 60 years. Irrespective of where you germinate these seeds, the plants that grow from them will flower at the same time and then wither away.

Manav: But will they still behave like this if I plant these seeds very, very far away?

MALE VOICE: If these are the seeds of the same species, then it will not matter how far away you plant them. The resultant plants will all flower at the same time. In 1891 the bamboo flowered in Burma. The seeds were collected and brought to Calcutta and DehraDun...some 1500 km away. In 1940 the bamboo in Calcutta and DehraDun flowered simultaneously. Similarly, the species *Melocarlina baccifera* flowered at the same time in the Garo hills of Assam and in DehraDun.

FEMALE VOICE: This is called gregarious flowering and it is an intrinsic and cyclical phenomenon in bamboo.

Manav: Oh, but this is not good news for bamboo is it? I mean it flowers and then...wham... it dies! I suppose entire forests of bamboo disappear this way.

MALE VOICE: You have spotted the problem. Indeed India has lost plenty of natural wealth in the shape of bamboo because entire clumps have flowered and died. This also means a sharp dip in bamboo production.

Manav: But can we not grow bamboo on a large-scale using grafting techniques?

MALE VOICE: Our experience has shown that bamboo plantations are not the right solution to overcome the dwindling bamboo resources. Grafting bamboo or even propagating it by replanting new plantlets taken from the clump are expensive and time-consuming techniques.

Manav: Ok...then what about growing new bamboo plants from bamboo seeds?

FEMALE VOICE: Yes that is an option. However, for that we need adequate amounts of healthy and viable seeds. This is not always available because the bamboo species set seed just once every 40-60 years. Of those seeds only a very small amount are recovered for planting.

Manav: Oh dear. We seem to be in desperate need for some novel and extremely swift propagation process. This is the age of Biotechnology. Surely there must be some way Biotechnology can help.

FEMALE VOICE: Yes indeed. The Biotechnological process of tissue culture has raised our hopes. This is a technique by means of which we can make an individual cell to grow into an independent plant.

**MALE VOICE:** Haberlandt, a Scientist had pointed out that a zygote, which is the diploid single cell formed after sexual fusion, bears two sets of chromosomes. It has the inherent capability to lead to the formation of the embryo which, when the seed is sown, germinates to give rise to a new plant. Thus under appropriate conditions, an individual cell can give rise to an embryo. This process is called somatic embryogenesis. Active research is going on in India, China, and Taiwan in this area.

Manav: Which are the institutions in our country where work is being carried out in this area?

MALE VOICE: The Botany Department of Delhi University has been successful in propagating bamboo using the somatic embryogenesis technique and other micro-propagation techniques. Micro-propagation techniques can use nodes or other materials from mature, adult bamboo plants to propagate the species

FEMALE VOICE: The application of micro-propagation methods, are still limited. These techniques involve the use of nodes from mature bamboo plants and cloning them. However, the success rates are low. Only about 4-10% of the shoots obtained from mature nodes in culture can be induced to root. The rates vary from species to species. Better success has been noted with seedling material.

MALE VOICE: Some success has been noted in creating seedlings of bamboo using micro-propagation techniques but I have to admit that these have not satisfied the requirements of cloning of high-quality bamboo. Plus the costs are high and the

process is time-consuming. In comparison, somatic embryogenesis is less labour intensive and less costly. It is better suited for large scale propagation of bamboo.

FEMALE VOICE: And now, thanks to the recent research carried out by Delhi University, we do not need mature tissue. We can use immature or mature embryos, mesocotyl, node, leaf sheath, leaf and rhizome or root of the young seedling for raising embryogenic cultures. For large scale propagation of bamboo, embryogenesis techniques are used to mass culture bamboo. Then, the newly raised plantlets are used to re-populate forested areas. Bamboo produced by somatic embryogenesis gives us plants whose age is known and whose flowering can be predicted.

To know more about these processes .....Dr. Usha Rao, Department of Botany, Delhi University:

- 1) Dr. Rao what are the different types of research on bamboo that is being carried out in your laboratory?
- 2) Why did you focus on bamboo?
- 3) What are the benefits that have accrued from your work?
- 4) What are the problems you faced while working on bamboo?
- 5) Would you please share your experiences during the days of research?
- 6) Is there any particular incident or anecdote you would like to share with our audience?

MALE VOICE: Delhi University has successfully used somatic embryogenesis technology to develop three varieties of bamboo species. These are:

*Dendrocalamus strictus, Bambusa arundinaces and Bambusa balcoa.*

Manav: This means that Biotechnology has been successful in creating newer varieties of bamboo.

MALE VOICE: Yes and apart from creating new varieties, Biotechnology is also being used to improve the naturally occurring species and to enhance their yields.

FEMALE VOICE: Ah...so Biotechnology will transform Bamboo into green gold.

Manav: And it will forever remain the poor man's timber and the sweet notes of the flute will sound melodiously in our ears, for ever and ever.