1. INTRODUCTION

Bamboos comprise the most diverse group of plants in the grass family. They are distinguished from other members of the family by having woody culms, complex branching, a complex and generally robust rhizome system, and infrequent flowering.

Bamboos are plants of global interest because of their distinctive life form, ecological importance and the wide range of uses and values they have for humans (Bystriakova et al., 2004). At least one third of the human race uses bamboo in one way or another. They are gaining increased attention as an alternative crop with multiple uses and benefits providing human beings with various living resources. They are intermingled with the tradition and culture of rural and tribal populations from times immemorial due to which they have been variously called as 'The Cradle to Coffin Plant', 'The Poor man's Timber', 'Friend of the People', 'Green Gasoline', 'The Plant with Thousand Faces' and 'The Green Gold'. This 'green gold' is sufficiently cheap and plentiful to meet the vast needs of human populace from the child's cradle to the dead man's bier. As a renewable natural resource, it plays a major role in the livelihood of rural people and is an integral part of our cultural, social and economic conditions (Tewari, 1988; Madhab, 2003). Because of its multifarious utility, both in the traditional way for the rural people as well as in modern society, bamboo is becoming a very important plant worldwide. There are more than 1500 different documented traditional uses of bamboo (INBAR, 1997). At present there are about 3,000 companies around the world engaged in the production of various bamboo based products such as panels, flooring, pulping, charcoal, edible shoots, and other daily use articles (Xuhe, 2003). Bamboos provide food, shelter, medicine, raw materials for construction, wood substitute and paper and pulp industry. They are also used for making furniture, handicrafts, containers, tool handles, poles, musical instruments, bows and arrows, boats, rafts, fishing poles etc. The leaves have been used as fodder for live-stock by the Japanese for
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hundreds of years. It is also a very important food for the giant pandas in China because they survive only on bamboos. Many bamboos are praised because of their beauty and are popularly used as ornamental plants to beautifying home gardens and commercial establishments (Sharma and Singh, 2000).

Bamboos are indeed one of nature’s miracles, and their strength and structure enables them to be put to diverse uses. In Asia, bamboos are the essence of life for many communities, and it is no exaggeration to speak of a ‘Bamboo Civilization’ in the region. Bamboos are extremely useful grasses which are in high demand throughout Asia. However, because of the bulkiness of culms and the high freight-value ratio of bamboo, the radius of economical transport is limited and hence, most bamboo is used near the centers of production. The most comprehensive information of commercial use of bamboo products comes from countries in which bamboo is an important economic asset. The main examples are China, India and Japan. The latest data from China indicate that the Chinese bamboo industry created a value of US$5.5 billion in 2004. The bamboo-based GDP of China grew by 120 percent from 2000 to 2004, while export earnings reached US$600 million, a 20 percent increase (ITTO, 2006).

Because of its extensive rhizome and root system, bamboo is useful for soil erosion control, and road and steam embankment stabilization. Bamboo can be extremely important in providing vegetative cover to deforested areas. It produces leafy mulch on the soil surface, its foliage provides shade and protection against rains, and its habit of producing new culms from rhizomes enables the culms to be harvested without disturbing the soil (Soderstrom and Calderon, 1979). Bamboo forests may yield more raw materials more quickly for rural people than other forests, or even certain forest plantations. Some species of bamboo produce annual yields of over 10 t/ha, though Sustainable yield can generally be assumed to be 2-4 t/ha as under storey and 5-12 t/ha from plantations, with higher values on good soils aided by fertilizers and scientific management (Liese, 1985).
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There are 75 genera and 1250 species of Bamboos distributed in tropical and temperate zones of different parts of the globe (Sharma, 1987). Tropical Asia can be referred to as the main centre of bamboo germplasm with as many as 45 genera and 750 species (Seethalakshmi and Kumar, 1998). A total of 18 genera and 128 species grow in India (Seethalakshmi and Kumar, 1998), out of which 99 species and 3 varieties belonging to 15 genera are native to this country (Kumar and Ramesh, 2001). India is the second richest country in bamboo genetic resources after China. These two countries together hold more than half the total bamboo wealth distributed all over the world. In India the main areas of bamboo distribution include North-eastern states, Western Ghats and the Andaman & Nicobar archipelago. Over 58 species of bamboo belonging to 10 genera are distributed in the north-eastern states of India alone. The bamboos in India cover an estimated 8.96 million hectare of forest area which constitutes 11.7% of the recorded forest area and 14.01% of forest cover of the country (Rai and Chauhan, 1998). Bamboos occupy habitats from sea level to high mountains. In Himalayas, *Arundinaria racemosa* Munro and *Thamnocalamus spathiflorus* (Trin.) Munro, occur at about 3300 meters (Mehra and Sharma, 1975).

However, increasing demands from rural population, urban centers and international trade are leading to declining stocks and hence increasing concern about its conservation. Due to increasing population pressure, natural stands of bamboo are being indiscriminately cut for fuel, wood and furniture, and for obtaining cultivable lands. Slash and burning cultivation/Jhum cultivation, which is common practice in the northeastern states of India, has resulted in genetic erosion of several bamboo species. Also, due to enhanced demands from the industries, the bamboo stock of this country is fast decreasing due to overexploitation. This has also endangered some valuable germplasm. Realizing this, bamboo cultivation, has received increasing attention in many countries and from various international organizations for ecological, economic and social reasons. In Asia,
bamboo industry is closely related to people's daily lives and has an important role in national economics. Bamboo plantation is considered as best option for social forestry. Therefore, need has been emphasized for the introduction of bamboos through plantations in order to compliment efforts to conserve shrinking forest habitats.

Bamboos can be propagated from rhizomes, culm/branch cuttings or by multiplication of nursery-raised seedlings. However, seeds serve as the best material for large-scale plantations, germplasm conservation and improvement of genotype. Seeds in general play a vital role in man's life since they serve as a source of food, fibre, spices, beverages, oils and drugs. Seeds of cereals contribute about 90% of all the cultivated plants, as the source of up to half of global per capita energy. This makes seed biology an important area of research. Bamboo seeds, have very short viability of 1-3 months and are therefore useful as propagules for only a short period of time.

When seeds deteriorate, they lose vigour and become more sensitive to stresses upon germination. Eventually seeds lose the ability to germinate. The factors which determine the rate of this 'ageing' include the temperature and moisture content at which seeds are stored and an ill-defined parameter, the seed quality. While it has been known for many years that manipulation of these factors influences the longevity of seeds, the precise interactions among them are so poorly understood as to preclude the prediction of longevity for a particular seed lot. Concepts from studies of materials and food stability can be applied to seed ageing research, and this may help us take a more integrative approach to understanding the kinetics of seed deterioration. These concepts describe the physical environment of the seed matrix in response to changing water contents and temperature. Water activity models describe the state of water in the seed, while the glass models describe the state of the aqueous solution. Both models presume that changes of state affect the nature and kinetics of chemical reactions. Thus, the physical and chemical environment within the seed is inextricably linked.
The present study was undertaken with an aim to determine the physiological and biochemical factors (i.e. metabolites, enzymes, membrane integrity and levels of growth hormones) that lead to loss of seed viability during storage. The knowledge so generated would be helpful in devising techniques for enhancement of vigour and viability of ageing bamboo seeds.