

PROCEEDINGS NO.6

Sustainable Development of the Bamboo and Rattan Sectors in Tropical China

Edited by Zhu Zhaohua



German Development Co-Operation
Gesellschaft für Technische Zusammenarbeit



International Network for Bamboo and Rattan



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China Forestry
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Foreword

Non-timber forest products were until recently considered only a by-product from the forests. However, they now catch up with or even surpass traditional timber production in tropical forests world-wide. They thus increasingly becoming a critical factor for the development of rural areas. Bamboo and rattan, possibly two of the most significant non-timber forest products in terms of their ecological impact, feasible economic profit and social benefit, have always played an important role among the rural poor.

This is particularly true for nature reserves and their environment, such as in China's most southern Provinces, especially in Hainan and Yunnan. Nature conservation and forest protection can only succeed in these situations by means of development through participatory collaboration with the local people. Local people have to be put in a position to afford and, in this way, to accept any protection approach for their environment.

An International Workshop on Bamboo and Rattan was jointly carried out by the two provinces in April 12-22, 2000 in Haikou (Hainan) and Kunming (Yunnan), the workshop organizers, the German Agency for Technical Cooperation (GTZ) and the International Network for Bamboo and Rattan (INBAR). It aimed at promoting bamboo and rattan in both provinces, where its cultivation and processing, marketing and consumption seemed to be lagging behind the development in general. Much better examples can easily be observed in the so-called Bamboo Provinces of China. This is puzzling because Hainan Province especially, has rich potentials in terms of number of native species, sites for cultivation and people familiar with the handling of both species. Yet these species seem for some reasons to be under-used and even neglected. The workshop was therefore intended to be a kick-off for a renaissance of bamboo and rattan and their many fields of cultivation and utilization.

The workshop heard state of affairs reports from the two provinces involved, technical papers from bamboo and rattan experts from China, India, Malaysia and the Philippines, and engaged in group work as well as fieldtrips through both provinces. Opportunities for exchange of ideas and meanings offered a wide range of know-how and

informations to the participants, which included scientists, government officials, students and farmers as well. The workshop's cornerstones were joint agreements about follow-up measures in both provinces, which already have started.

What remains is to thank all officials in charge for the preparation and implementation of the workshop, from both provinces as well as from INBAR and GTZ, for their commitment and hard work which made his workshop a success.

The prospects to go new ways in the field of bamboo and rattan are favourable: the need for further development of the rural areas in both provinces and beyond that, strong interest from the rural population, a broad range of domestic and exotic species for every special case and an increasing demand for bamboo and rattan products, worldwide!

It is only to unite and start! The success is inevitable!

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Contents

Foreword

- A Development Strategy for Bamboo Resource and Industry in China Lei Jiafu (1)
- The Status and Prospects of Bamboo and Rattan Industries in Hainan Province ... Han Jianzhun (19)
- Sustainable Rattan and Bamboo Development of Yunnan in the 21st Century Hui Chaomao *et al.* (28)
- Bamboo Breeding and Rapid Propagation of Superior Varieties Zhang Guangchu (40)
- Techniques of Cultivation and Integrated Development of Sympodial Bamboo Species Yang Yuming *et al.* (48)
- Biodiversity and Resources Exploitation of Bamboo in China Ma Naixun (67)
- Developing Bamboo Industry to Facilitate Economic Take-off—An Overview of Bamboo Industry Development in Fujian Province Zheng Yushan (83)
- The Current Status and Development Trend of Bamboo Processing in China Tang Yongyu (99)
- The Bamboo-based Board Industry in China Zhang Qisheng (110)
- Rethinking Bamboo in 21st Century M.P.Ranjan (123)
- An Overview on Rattan Research and Development Xu Huangcan *et al.* (135)
- Rattan Resources and Sustainable Development in Yunnan Province Wang Kanglin *et al.* (151)
- Some Considerations in Species Selection and Rattan Cultivation for Sustaining the Rattan Industry Nur Supardi Md. Noor (177)
- Rattan and Bamboo Furniture and Handicrafts Romualdo L. Sta. Ana (188)
- Regional Programs on Industrial Utilization of Bamboo and Rattan in Hainan and Yunnan Provinces of China Maxim Lobovikov (197)
- The Bamboo Industry in Anji County: Development Conditions and Problems Chen Jianyin *et al.* (202)
- The Bamboo Industry of Lin'an Municipality: Problems in Bamboo Shoot Processing

• 2 • Contents

and Utilization, and their Solutions	Wang Anguo (214)
Flourishing Bamboo Industry in Muchuan County, the Homeland of <i>Neosinocalamus</i> <i>affinis</i>	(226)
Cultivation and Utilization of <i>Bambusa textilis</i> in Guangning County	(234)
Summary of the GTZ/INBAR Workshop on Bamboo and Rattan 2000	
.....	Zhu Zhaohua (242)

A Development Strategy for Bamboo Resource and Industry in China

Lei Jiafu

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1 Development Trend of the World's Bamboo Industry and Status of the Bamboo Industry in China

1.1 Development trend of the world's bamboo industry

There are 1 200 species and 70 genera of bamboo in the world, and these are distributed mainly in the tropical and sub-tropical areas. Fast growth and strong regeneration capability of bamboo helped draw focused attention in countries where the plant grows, resulting in the building up of an industry based on bamboo. Through the many years of its development, the bamboo industry has shown the following development trends:

(1) Although forest areas in many countries have drastically decreased, area under bamboo has progressively increased, by almost 3 folds each year. At present, the total bamboo-growing areas of the world add up to 22 million hectares.

(2) The science and technology content in the bamboo industry is steadily increasing, and breakthroughs have been achieved in bamboo cultivation, processing and utilization. Bamboo cultivation technologies—such as bio-diversification of bamboo, laws governing the heredity and heteromorphosis of bamboo, and fast reproduction and cultivation of bamboo—have found extensive application. Technology for upgrading the low-yield moso bamboo (*Phyllostachys pubescens*) has helped increase the yield of bamboo per unit area by many folds. With regard to the processing and utilization of bamboo, the areas of application are steadily widening. For example, papermaking technology using bamboo is near perfection, the annual global output of bamboo pulp has exceeded 2 million tons, and

over 100 kinds of artificial bamboo boards have been developed.

(3) A series of bamboo-shoot food and bamboo health food products have been developed. These products are favored not only by the people of the bamboo-producing countries, but also by the people in North American and West European countries. For instance, the annual per capita consumption of bamboo-shoot products in Japan has increased from 1.2 kg/person in the 1950s to 3 kg/person in the present.

(4) The environmental applications of bamboo are also increasing. As people now have a better understanding of the ecological benefits of bamboo, they are actively cultivating bamboo groves for conserving water, protecting soil against erosion, protecting watersheds, guarding against natural disasters or promoting eco-tourism. There is also awareness about the role of bamboo forests as the habitat of precious and endangered animals such as the giant panda and golden monkey.

1.2 Status of the bamboo industry in China

With over 500 species in 40 genera, China has the richest bamboo resource in the world in terms of number of species, area and reserve of bamboo, and has long been known as the "Kingdom of Bamboo". In the 50 years since the founding of the People's Republic, particularly in the last 20 years since China's economic reforms, the bamboo industry has witnessed rapid development. Currently, it is a major newly emerging sector that incorporates resource cultivation, processing, utilization and export. Bamboo, floriculture, eco-tourism and forest-based food industries jointly form the four "sunrise industries" in the development of the Chinese forestry sector.

1.2.1 Notable achievements

(1) The area of bamboo forests is steadily increasing. Today, bamboo forests extend to 4.2 million hectares, a 1.3-fold increase over the figure for the 1950s and 1 million ha more than that in the 1970s. In the last 20 years, bamboo forest area has grown at the rate of 50 000 ha/year. Fujian Province, which ranks first in terms of bamboo forest area, has registered an increase from 14 000 ha in the 1950s to 820 000 ha at present—a 5-fold increase.

(2) The quality of bamboo forests has been enhanced. With optimized structuring and upgraded management levels, the quantity and quality of bamboo stocks is steadily increasing. The average stock of moso bamboo forests has increased from less than 1 350 culms/ha in the 1970s to 2 070 culms/ha at present, and the yield has risen from less than 79

million culms in the late 1970s to nearly 500 million culms at present. In Nanping Municipality, the bamboo stock reserve has reached 750 million culms, an increase of 350 million culms over that of 1988, while the average culm diameter (at breast height) has increased from 6 cm to 9.2 cm.

(3) Bamboo utilization has spread to more areas. In the old days, the use of bamboo was traditionally confined to construction. Today, it is widely used in the fields of construction, papermaking, food, furniture, packaging, transportation, medicine, health food and tourism. The bamboo industry is now a newly emerging sector that incorporates resource cultivation, processing, utilization, and foreign exchange earning through export. For instance, Longyou County of Zhejiang Province, which used to produce only about ten bamboo products earlier, now produces over 220 types of bamboo products in ten categories. Many enterprises have been established in the county to produce bamboo culm or shoot products such as building materials, food, ply boards, knit-ware, handicrafts, farm tools and papermaking materials. Muchuan County of Sichuan Province has focused on establishing bamboo-based pillar enterprises. The Yongfeng Paper Company of the County is annually producing 35 000 tons of paper, and the profit and tax return to the government have exceeded RMB 18 million yuan.

(4) Scientific and technological support for the industry has been further strengthened. Since the 1980s, bamboo-based scientific research in China has won 21 awards, 6 of which were at the national level and 15 at the provincial or ministerial level. All those research projects were production-oriented, and had given active guidance to enterprises at the grassroots level. The research results have been used in the second-season shooting of *Phyllostachys praecox*, processing of bamboo ply boards and the development of bamboo leaf flavone, to reap substantial economic benefits. the International Network for Bamboo and Rattan (INBAR), an inter-governmental international body, was the very first among the international organizations to set up its headquarter in China in 1997. The organization currently has 21 member countries, and has been actively assisting the developing countries to promote their bamboo and rattan industries. It is also helping China to fully develop bamboo and rattan resources, thus providing the country's bamboo and rattan industries with new opportunities in international cooperation.

(5) The market for bamboo products has expanded. After years of development, the bamboo shoot products have gained a considerable market share in south China, and are gaining popularity in other parts of China as well as in other countries. Earlier, bamboo culm and shoot products were sold mainly to Japan, Hong Kong and Macao. Today, market for the products has expanded to over 30 countries in Southeast Asia, Europe and North America.

1.2.2 Increased efficiency

(1) Substantial economic benefits have been realized. Statistics show that the annual output value of China's bamboo industry totals RMB 17 billion yuan, of which the processing industry accounts for RMB 9 billion yuan and the foreign exchange earning through export is US\$ 500 million. These figures are three times those of the early 1990s. The bamboo industry has shown rapid development. Since the early 1990s, Jian'ou City of Fujian Province has taken the bamboo industry as the key project for upland development and a new economic growth point. In 1998, the GDP of the city reached RMB 846 million yuan, the foreign exchange earning through bamboo product export reached RMB 70.43 million yuan, and the profit and tax earning added up to RMB 469 million yuan. The gross output value by the bamboo industry constitutes 55.05% of the gross agricultural output value. The average per capita income from the bamboo industry of local farmers has risen to RMB 1 455 yuan per year, which comprises 34.3% of their average per capita annual income. The bamboo industry has become a pillar industry for strengthening the local economy and the forestry industry, as well as to help the local farmers to get out of poverty.

(2) Significant social benefits have accrued. As the bamboo industry is resource-dependent and labor-intensive, the bamboo culm and shoot processing yields significant social benefits. In Longyou County of Zhejiang Province, bamboo processing work has provided jobs to about 10 000 farmers. In Anji County, the development of bamboo industry has provided about 15 000 jobs. The growth of the bamboo industry is also expected to exert great influence on the development and application of the bamboo culture. The tourism industry could develop strongly with the support of bamboo forests and bamboo culture. The Hongshan "Bamboo Sea" in Taojiang County, the bamboo seedling garden in Anji County, the "Bamboo Sea" national forest park in Chishui County and the "Bamboo Sea" in Shunan County have all become major tourist attractions.

(3) The ecological environment has been greatly improved. Green bamboo covering the mountain helps to protect the water resources, and bamboo forests help to conserve water and soil. Bamboo forests also help to regulate the climate and improve the ecological environment. In Jiang'an County of Sichuan Province, the bamboo forests have consisted of about 50% of the total forest areas. Those bamboo forests have played a vitally important role to maintain the ecological balance. In the 1990's, natural disasters such as floods and draughts in the County had been cut by 50% compared with those occurred in the 1960's or 1970's. That had provided sure guarantee for bumper harvests and helped to improve people's living environment. Soil erosion in the County had been reduced to less than 1 500

tons/km², whereas area of the seriously eroded lands had been reduced to less than 20% of the County's territory. Since the 1980's, *Dendrocalamus membranaceus* and *Bambusa textilis* were extensively planted in Ganzhou and Yichun areas of Jiangxi Province, and the projects have shown great significance to reduce soil erosion as well as to beautify the environment.

1.2.3 Experiences accumulated in the development of bamboo industry

(1) Strengthening the leadership and making the bamboo industry an important component of regional economic development. Bamboo industry in the key bamboo-producing areas of south China has yielded notable ecological, economic and social benefits. Entering the 1990s, government leaders at various levels in the bamboo-producing areas included the bamboo industry in their agenda of important issues, and this made it become an important component in the regional economic development. Zhejiang Province has taken the bamboo industry as one of the eight key industries in the overall agricultural development. It has listed the bamboo industry in the Long-term Program for National Economic Development in the *9th Five Year Plan Period and the Period up to 2010 for Zhejiang Province*, thus establishing the status of the industry in the national economy and social development. Guangxi Autonomous region has been using bamboo as the key cash crop for evaluating the quality of reforestation and for restructuring the tree species composition. The Province has become one of the 10 economic forest bases of China in the 9th Five Year Plan Period. Guangxi Autonomous region is vigorously developing the bamboo industry as one of its pillar forest industries, while Fujian Province is utilizing it for developing the rural economy.

(2) Exercising flexible mechanisms to bring all social initiatives into full play in developing the bamboo industry. After the "three determines" of the forestry industry in the 1980s, household-based responsibility system was exercised for most bamboo forests in China's bamboo-producing areas. Placing responsibility on individual households, however, caused scattered operations and management inconveniences. Moreover, the system effected unitary input mechanisms, short-run behaviors and difficulties in popularizing new technologies. To rationalize the relationship between ownership, right of use and right of operation, many areas are changing their traditional pattern of operation. By making policies based on specific situations, reforms on the operation pattern of bamboo forests were carried out, including shareholding, leasing, joint venture, subcontracting, mortgaging and auction. Flexible policies were adopted to stabilize the ownership and revitalize the

right of operation. In Hunan Province, the policy of “focusing on large bamboo forests while giving a free hand to the small ones” was adopted, while focus was laid on running well 13 key enterprises. The medium and small enterprises were re-adjusted in accordance with the laws of market-oriented economy. Any pattern of operation was welcome if it was in line with people’s will, favors the development of the bamboo industry, promotes the development of new products and enhances efficiency. These measures motivated people to participate in the development of the bamboo industry. Based on their experiences, the Party Committee and government of Chongyi County of Jiangxi Province drafted the *10 Regulations for Reforming the Leasing of Operation Right of the Moso Bamboo Forests*. The collective bamboo forests were leased out to farmers’ households, based on the principles of “determining rent for different mountain slopes, inviting open bidding, keeping the pre-fixed rate of leasing unchanged regardless of increases or decreases of bamboo output, and leasing the operation right for 20 years without changes”. These measures greatly motivated the operators, and many farmers gave intensive care to the mountain slopes just as they manage their paddy fields. The result was that many poorly managed bamboo forests and bamboo forests with poor transportation facilities were quickly rehabilitated.

(3) Strengthening science and technology input, and continuously upgrading the management level. At the insistence of bamboo-growing areas, the contribution of science and technology in the development of bamboo forests was continuously increased, management level upgraded, economic efficiency boosted and service systems gradually perfected. Starting 1990, Jiangxi Province popularized technologies to increase bamboo yield. Large areas of low-yield moso bamboo forests were rehabilitated, while management was strengthened to increase the number of bamboo culms. As a result, bamboo yield reached 4 500 culms/ha. Lin’an County of Zhejiang Province actively popularized the scientific research achievements. Between 1983 and 1990, the County made intensive studies on high yield technologies for moso bamboo and bamboo grown for shoots. The research results rapidly brought about increased productivity. In 1989, a breakthrough was made in the cultivation of early-shooting *Phyllostachys praecox*. The technology was released in 1991, and experiments were successfully carried out to cultivate *P. praecox* and to advance and prolong shooting time by 100 days. This enhanced the economic efficiency by 5 to 10 folds and the output value per hectare reached RMB 819 000 yuan. In Guangxi Autonomous region, the forestry departments at different levels emphasized improvement of the service systems. Efforts were made to cultivate strong and healthy seedlings, manage bamboo forest efficiently, and prevent and treat bamboo diseases and pest infestations. Each

organizations and the people jointly raised a sum of RMB 46 million yuan for the bamboo industry.

1.2.4 Major problems that hinder the development of the bamboo industry

Viewing from both macroscopic and microscopic points of view, the following problems are seen to be hindering the development of the Chinese bamboo industry:

With regard to macroscopic management, the state-level administrative departments have not fully understood the status and role of the bamboo industry, resulting in poor professional management. For example, the funds invested are far from adequate, as the state and local governments have not earmarked enough funds for the bamboo industry. The heavy taxation on the bamboo industry is another impediment. As many as 13 items of taxes are levied on bamboo products in many areas, and tax constitutes about 50% of the price of bamboo culms. This has seriously discouraged bamboo farmers and, to a certain extent, has negatively influenced bamboo and shoot processing industries. Uniform planning and guidance are also lacking with regard to cultivation, conservation and utilization of bamboo resources. A national plan for developing the bamboo industry has not yet been promulgated, and no restriction has been enforced to regulate excessive and similar bamboo processing enterprises. The function of bamboo associations has also not been fully utilized.

Microscopically, the overall management of bamboo forests needs to be improved. Over 60% of the moso bamboo forests are low-yield ones. Over 95% of the 1 million hectares of bamboo groves are not well managed, or are even perishing. The existing bamboo cultivation technology has not taken into consideration the ecological function of bamboo forests. The bamboo and shoot processing industries still operate at relatively low levels, as most of these enterprises are too small and are producing low-grade products. The ratio of raw material utilization is still rather low, and primary products form a very large proportion. Branded quality products have not yet been developed to win substantial market shares, and the existing products do not show strong competitiveness in the markets.

In general, the potential productivity, value-added processing and ecological function of bamboo forests have not yet been brought into full play.

2 Importance of Understanding Functions of the Bamboo Industry in the Development of National Economy and Social Progress

China is lacking in forest resources, and has problems such as serious soil erosion, weak ecological environment, shortage of timber supply, and underdeveloped economy in the upland areas and poverty among the farmers in several such areas. The bamboo industry is an important component in the construction of the forestry industry. Vigorous development of the bamboo industry is vitally important for enriching forest resources, curbing soil erosion, improving the ecological environment, easing timber shortages, increasing export for foreign exchange earnings, strengthening economy of the upland areas, helping farmers in the upland areas out of poverty, optimizing people's food structure and advocating social ethics. The bamboo culture of China has a long-standing history of over 5 000 years, and nearly every aspect of the people's life is closely linked with bamboo. The *Dream of the Red Chambers*—which is one of the four immortal classics of China—mentions bamboo in over 150 chapters in relation with art, food and drinks, transportation, architecture, gardening, poems, paintings and music. Historically, people have attached high values and important functions to bamboo. Along with social progress and scientific and technological advancements, bamboo, by virtue of its unique natural qualities, will certainly attain increasing importance and wider functions.

2.1 Accelerating bamboo forest cultivation to curb soil erosion and improve the ecological environment

Soil erosion ranks first among the environmental problems of China. To date, areas associated with soil erosion have added up to 3.67 million km², constituting 38.2% of the Chinese territory. On average, the areas suffering soil erosion increase each year by 10 000 km². Along the Yangzi River reaches, soil erosion affects 562 000 km², and 2.24 billion tons of soil is washed away each year. The reservoirs built along the Yangzi River reaches are losing 1.2 billion m³ of capacity annually because of soil sediments: equivalent to abandoning 12 large reservoirs, each with a capacity of 100 million m³. The Yangzi River is now becoming another huge “hanging river” next to the Yellow River. Riverbed of the Jingjiang segment of the Yangzi in Hubei Province is now more than 10 m higher than the

ground. The riverbanks have to be reinforced and made higher each year and large amounts of materials and efforts have to be spent to fight the floods. Besides increasing the financial burden on the government, these measures are also causing the river to become more and more dangerous owing to the steadily increasing height of the banks. The river segment has thus become a great impending peril haunting socio-economic development.

The evergreen bamboo, with its well-developed root and rhizome systems, is ideal for retaining rainwater and conserving water resources. The plant is thus ideal for shelter forests, as each hectare of bamboo forest can retain about 1 000 tons of water. In the summer, the bamboo forest will increase the relative humidity of air by 5%-10% and reduce the temperature by 3-5°C. Permeability of bamboo forest is twice that of grassland, and the average rate of water retention can reach 11%. Because of this, bamboo forests are mostly planted on the uplands along both sides of rivers. It is evident that active development of bamboo forests will help control soil erosion and improve the ecological environment, two important conditions for sustainable development.

2.2 Development of bamboo/rattan materials and bamboo pulp to ease timber shortage

In August 1999, the State Council of China decided to strengthen the ecological reconstruction efforts at the middle and upper reaches of the Yangzi and Yellow Rivers. Consequently, substantial amendments were made to the already started plan for conserving natural shelter forests. According to the plan, overall protection is accorded to the natural and artificial forests in the river reaches starting from the origins of the rivers to the Three Gorge Reservoir on the Yangzi River and Xiaolangdi Reservoir on the Yellow River. Tree felling is completely banned in these areas, while efforts are being made to reforest the barren mountains, and farmlands on mountain slopes are being planted with trees or grasses. The projects have covered over 800 counties in 13 provinces, autonomous regions or municipalities.

With the commencement of the above-said projects, timber shortage is becoming more and more serious. Presently, the annual commercial timber deficit in China is 38 million m³. By 2010, the annual timber shortage for building applications is expected to touch 43 million m³. In recent years, China has been using large sums in foreign exchange to import raw timber or timber products. In the 1995-1998 period, the country's annual timber products import were equivalent to 45.8 million m³ of raw timber. In 1996 alone, US\$ 5.3 billion was spent for the purpose. After 2000, the international communities are expected to

the per-unit-area yields of the farmlands, the only way out is to make better use of the land and water resources for overall development in agriculture, forestry, animal husbandry and fishery so as to open up more channels to get enough food. Since ancient times, the Chinese people have favored bamboo shoots, 500 g of which contain about 15 g of protein—twice the concentration in potatoes—and 18 kinds of amino acids. The fiber-rich bamboo shoots are also good for health and will help prolong life. Bamboo juice is possibly the best drink among the “green beverages” because it contains several of micronutrients. The bamboo mushroom, a by-product of bamboo forests, is acclaimed as the “king of mountain-based foods” for its rich nutrient content and delicious taste. Rattan fruits and sprouts are also rich in nutrients and are among top-quality tropical fruits and forest-origin vegetables. With steadily improving living standards, people are also showing increasing awareness of their health and look for health benefits when selecting food. Therefore, the vigorous development of the food-use bamboo industry is important for optimizing people’s diet structure, increasing effective market supply of foods and ensuring food security for the 1.6 billion Chinese people in the 21st century.

2.4 Development of bamboo handicrafts industry for vitalizing ethnic culture and enriching tourist-oriented products

Bamboo handicraft items are traditional products of China, and include bamboo carvings, knit-ware and musical instruments. Bamboo knit-ware and carvings have refined workmanship and are praised as the “pearl of oriental arts”. Bamboo carving, calligraphy and paintings are ideal indoor decorations, and add to the beauty of interior decoration. Bamboo handicrafts are steeped in cultural traditions and may command very high prices, even a hundred times higher than ordinary bamboo products. They are important items for earning foreign exchanges and occupy a prime place among tourist-oriented products. With its cylindrical shape and excellent physical qualities, bamboo is the most important material for making musical instruments. The bamboo music has always been an important component of the Chinese civilization, and bamboo musical instruments play a vital role in people’s cultural life.

Bamboo groves, with myriad shapes and pleasing appearance, have a high ornamental value and a unique place in bamboo culture. Species such as *Phyllostachys aurea*, *P. bambusoides* and *Bambusa multiplex* var. *riviereorum* are precious ornamental plants ideal not only for household courtyards but also for public gardens. Some other species such as *S. kumasasa* and *P. aurea* are valuable for bonsai landscape. In a number of localities, bamboo