Shouldering the arms of kendo, a Japanese sport taken from ancestral samurai combat, fencers bear slatted bamboo swords through a bamboo grove. Raw material for implements of peace and war, this botanical cousin to rice, corn, and Kentucky bluegrass may be the world's most useful plant.

BAMBOO, THE GIANT GRASS

IN THE SEA GREEN twilight the great jointed stalks of grass stand like jade columns supporting a submerged palace. The foot-thick culms glisten in the submarine light and rise for a hundred feet among dagger leaves that stir with a susurrus like surf on a distant shore. A passing breeze rubs the tapering stems together, and subdued groans, stuttering creaks, and a small scream fall from the moving canopy.

Are you Alice, sipping from the bottle labeled "Drink me," and shrunk to elfin size? Or have you wandered into Gulliver's Brobdingnagian world, where even the grasses of the field reach for the sky?

No, you are of normal size, walking in a grove of bamboo, the giant tree grass that is the most versatile, and to me the most beautiful, plant on earth.

By LUIS MARDEN

Photographs by JIM BRANDENBURG

Bamboo is all things to some men, and some things to all men. It enriches the soil; binds the earth against raging floods and the shocks of earthquakes; gives man tools to work with, instruments to make music, toys to divert his children, and weapons with which to fight his fellow creatures. Bamboo provides us paper, a stylus to set down praise of its own beauty, and the brush to make ink-limned images of its graceful culms and lanceolate leaves.

No growing thing has so many and so varied uses as bamboo; one scientist has even distilled from it a diesel-engine fuel. Scholars have compiled catalogs of well over a thousand applications for the elegant grass, which occurs naturally in every continent except Europe and Antarctica but seems happiest in southern Asia (map, page 506).

In the world there are about a thousand species of bamboo, of some 50 genera. They range from plants the size of field grass to giants of 120 feet in height and a foot in thickness. They grow from the sea-level tropics to 13,000-foot mountain slopes. Though they vary widely in color, shape, and size, they share one common characteristic, the woody culm, or stalk. A few are solid but most culms are hollow, divided by walled septa, or nodes (page 514). The light, stiff, and strong culms are what make bamboo so valuable to so many.

The most striking characteristic of bamboo is its vertiginous growth. No other living thing grows so tall so fast. Near Kyoto a Japanese scientist measured the world's record. A culm of *ma-dake (Phyllostachys bambusoides),* Japan's commonest bamboo, grew almost four feet in 24 hours. By watching closely, one should have been able to see it grow.

An engineer living near Washington, D. C., had a clump of 18-foot-high bamboo growing up a stairwell inside his house.

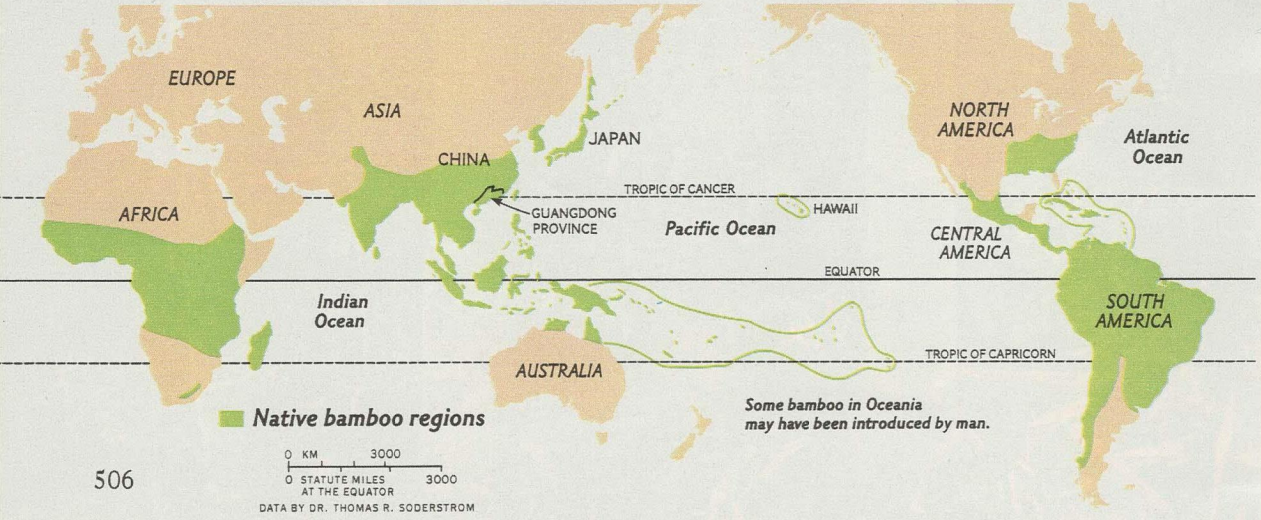
"We would measure the new shoots at the beginning of an evening's bridge session," he said. "When the evening ended, I would say to my partners, 'We have played one and a half inches.' "

The Chinese, precursors in culture and technology, were the first to appreciate the beauty and usefulness of bamboo. Their ancient dictionary, the *Erh Ya,* written a thousand years before Christ, referred to bamboo as *ts'ao,* a grass.

My own interest in bamboo arose many years ago when I was moved to attempt to make a fishing rod of split-and-glued bamboo, and became fascinated by the virtues of the material I was using. A long time ago some nameless genius had the idea of splitting a culm of bamboo into strips, tapering them, then gluing them together to make a strong, slender, and superlatively springy implement that could cast an artificial fly a great distance, even against a stiff breeze.

Here, as in so many other things, the Chinese were far in advance of the West; one book tells of them splitting and gluing

A forest playground *in Nepal climbs like a boy's imagination. Throughout Asia the larger varieties of bamboo have been called "poor man's timber." They are easy to harvest, transport, and assemble as framework, siding, roof tiles, fences, matting, irrigation pipes, and rafts. Fast growing and self-renewing, bamboo can be adapted to a thousand uses with but a few simple tools.*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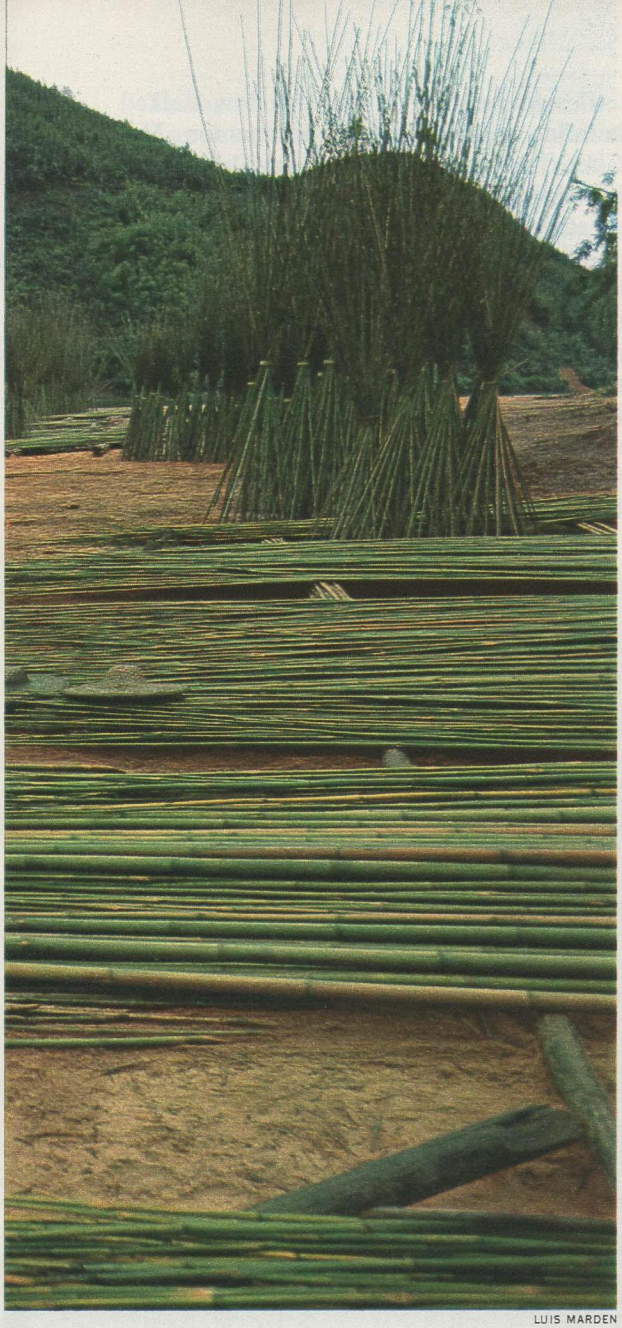


LUIS MARDEN

Beginning and ending by a stream, *the "lovely bamboo," as* Arundinaria amabilis *loosely translates, is the most prized of bamboos for fishing rods. Cleaned by scouring with sand along China's Sui River (**above**), it embodies the virtues of straightness, resilience, and strength.*

*From inches-high species to tree grass rising a hundred feet and more, indigenous bamboos are widely spread (**map left**). Many transplants are cultivated for use or ornament.*

bamboo long before the birth of Christ.

Though now largely supplanted by glass and carbon fiber, the best split-bamboo fishing rods are made from tonkin cane, which, despite the name, comes from southern China. It remains the world's most valuable bamboo species for a variety of purposes.

Dr. F. A. McClure, who at the time of his death in 1970 was a research associate at the Smithsonian Institution and the world's greatest authority on bamboo, traveled to China as a botanical explorer in the 1920s. There he sought the home of tonkin cane. Years later he described his search to me:

"I began by recalling a jingle common round Canton [Guangzhou]:

'Waitsap muk,
Kwong Ning chuk,'

which is to say in Cantonese: 'For wood go to Waitsap [Huaiji], for bamboo to Kwong Ning [Guangning].' Both are places on the Sui River, which flows toward Canton from the northwest. I started upriver, inquiring as I went. As I neared Waitsap, the bamboos on both sides of the river changed. Unlike the graceful, nodding bamboos farther downstream, these were stiff, erect, and spiky. From a distance the plantations looked like young fir trees."

The farmers called it *ch'a kon chuk*—tea stick bamboo.

Now, bamboo has a peculiarity. Most of it flowers only at long intervals—30, 60, or even 120 years apart. At about the same time, all plants of the same species—wherever they are in the world—will burst into flower. Then the drooping branches look like heads of wheat (page 514). When this happens, the culms die, but the groves survive because some rhizomes live on and the fallen seeds take root. For a bamboo seedling to reach full growth and maturity may take five to ten years; meanwhile the growers face economic disaster.

The farmer's misfortune was the scientist's good luck. McClure found whole areas of tea stick bamboo in bloom, and he was able to collect flowering specimens, which, together with branching nodes and sheaths from young culms, the botanist needs to make scientific identification.

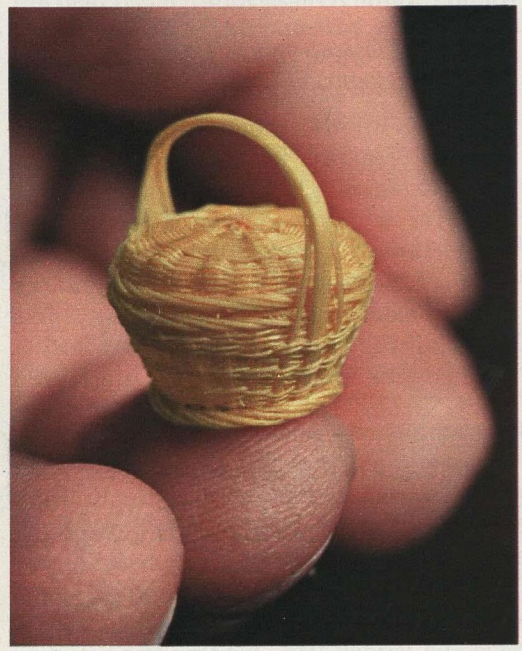
McClure identified it as an *Arundinaria,* a genus named from a type native to the

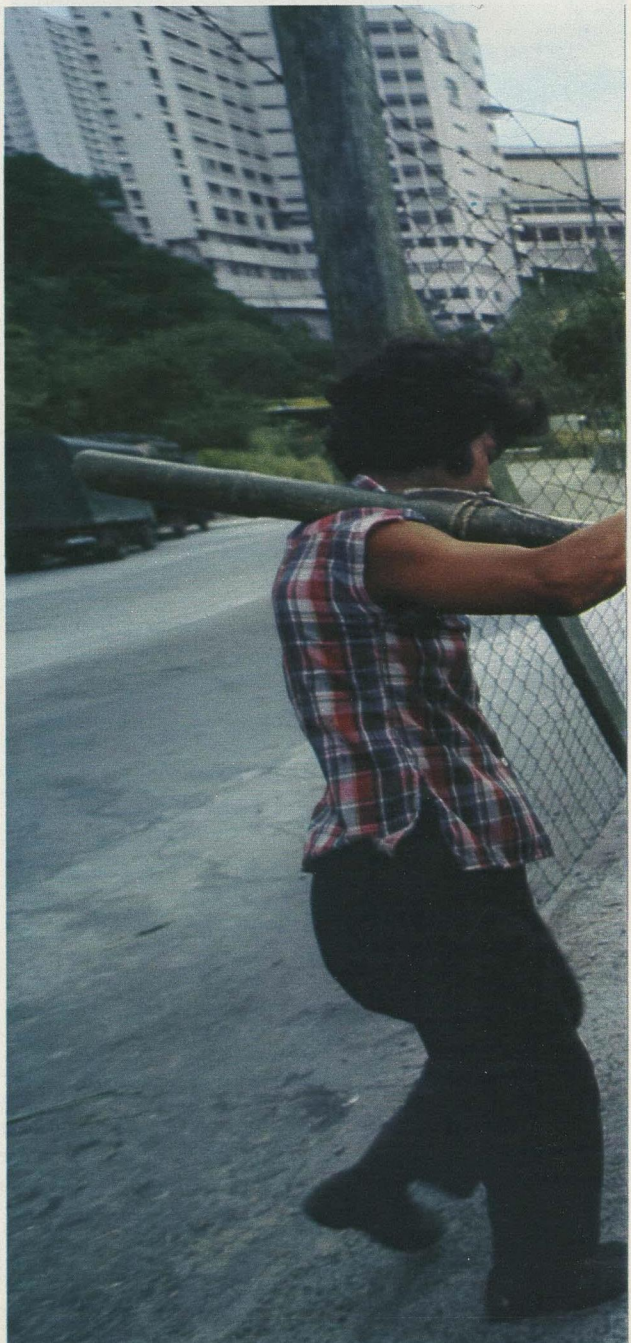
United States, and now he gave his new species the name *amabilis*, lovely. *Arundinaria amabilis* McClure, the lovely bamboo.

NORTHWEST the road ran from Guangzhou toward Huaiji, between paddies diked with red earth. Young rice shoots thrust yellow-green fingers from the brown water, and along the dike a frieze of white geese German-stepped against the sky. Endless rows of pine and eucalyptus, planted in their millions in China's massive afforestation scheme, furred the hills of Guangdong (Kwangtung).

Beside the road clumps of yellow-stalked bamboo nodded, and my companion, Mr. Chen Shu-yu, poetic and hospitable like all his countrymen, said: "The bamboos bow in greeting to you." I bowed in return.

At dusk the road swung closer to the wide, fast-flowing Sui River, and the scattered clumps of bamboo closed ranks and became a dense plantation. Through the gloaming I saw that the bamboo, now dark green, had lost its feathery grace and had grown stiff and upright, standing in serried ranks like Christmas trees: the tea stick, or lovely bamboo, found by Floyd McClure.





Basket for a five-raisin picnic *is woven as a curio for sale on Taiwan and demonstrates how finely and precisely bamboo can be split (**above**).*

*Pigs in a radial poke are hauled down a hillside in Hong Kong (**right**) to be fattened for market. Bamboo's high strength-to-weight ratio ensures most of the load is pork.*

That quality has had loftier uses. The Demoiselle, an early French plane, had a bamboo airframe, as did many gliders of the late 1800s.

In Huaiji, a county seat of gray-tiled-roof houses, I was the guest of the regional Revolutionary Committee. The town lies 165 feet above sea level, but on both sides of the Sui River the hills rose row on row, clothed with bamboo and fading into the gray curtain of whispering rain.

We boarded a riverboat and motored downstream with the current. The river, gliding swiftly and silently, glistened like slate, and a pearl gray mist made ghosts of the bamboo thickets along the shore.

"The best tea stick bamboo grows at heights of 1,500 to 2,000 feet," said Mr. Chi Jui-wu, vice-chairman of the Revolutionary Committee. "The feather-headed bamboo you see along the riverbanks is yellow bamboo, thinner and more flexible than tea stick. We make scaffolding of it. Bamboo, for many purposes, is lighter and stronger than steel.

"We grow eight kinds of bamboo in Guangdong Province, but here tea stick is king. I don't know why we call it tea stick; possibly the pale yellow of the dried culm resembles the color of freshly brewed tea."

In China nature does imitate art. A sandspit at a bend of the river ahead seemed to

hang suspended between earth and sky, and in the flat two-dimensional world of grays and blacks the diagonal slash of a raftsman's pole completed a composition from China's ink-painting masters.

"Before liberation and the establishment of the People's Republic in 1949," said Mr. Chi, "there were only 17,000 acres of tea stick bamboo in Guangdong; now we farm 42,000 acres of it. Our production is about 40,000 tons a year, six times what it used to be. We export about 5,000 tons. Tonkin, as the trade calls it, goes all over the world, but Europeans are our best customers. They use it in horticulture, as supports for tomatoes, melons, hops, and fruits. Scandinavia imports it for ski poles and to mark the borders of roads buried under snow. These are the small, finger-thick sizes. Bigger ones make poles for vaulters, and the largest, as much as two inches in diameter, go to makers of fishing rods and furniture."

In the 1930s tea stick bamboo was introduced into the United States and planted in botanical gardens in Georgia, Louisiana, and Puerto Rico, but it never attained the size and quality of the Chinese parents.

FAINTLY through the curtain of rain I could see figures of men and women among the glistening bamboos on the slopes, felling the mature culms and throwing them down to the river's edge, where they were bound into bundles and laid in overlapping layers like shingles on a roof, forming immense rafts nearly a hundred feet long.

Rounding a bend, we came upon a moving floor of bamboo, hundreds of rafts tied together. Beyond, below the tile roofs of a village, bundles of drying bamboo stood in hourglass columns on the bank.

Ashore on a beach we watched workers seated on small stools in six inches of water, scrubbing each culm with a handful of sand.

"A culm must be three to five years old before cutting," said Mr. Chi. "Bamboo will sprout and reach its full height in six to eight weeks, and then the culms look beautiful, glossy, green, without a blemish. But new culms are mostly water, and if you cut them, they will shrink and crack as they dry."

The man before us circled a culm with a cloth full of sand. Inching the pole from the water, he scrubbed vigorously, turning it as he scoured. The long shaft, blotched and spotted as if from skin disease with black and white patches of fungus and lichen, emerged sage green and shining.

"The culms dry in the air and sun for ten days," Mr. Chi continued. "Then we ship them by boat downstream to Nanhai, near Guangzhou, where they are straightened over a fire and cut to length."

IN CHINA there are some 300 species of bamboo, of 26 genera. Of these, tonkin is the most known and prized overseas, but within China the single most useful bamboo is a large cane called *mao chu,* hairy bamboo *(Phyllostachys pubescens),* from the fine hair covering its culm sheaths. Fully two-thirds of the bamboo China produces is mao chu, which is used to make furniture and even as reinforcement rods in heavy construction.

At the Technological College of Forest Products in Nanjing (Nanking), I listened to Dr. W. Y. Hsiung, China's leading bamboo authority.

"Every day our written language reminds us of the antiquity of China's partnership with bamboo. The radical *chu*—a character indicating sense—depicts two leafed twigs of bamboo." The doctor made rapid brush strokes: 竹. "Chu by itself means bamboo, but this radical enters into hundreds of other words and phrases.

"Our earliest records, long before the invention of paper in the second century B.C., were written on slips of green bamboo. It is easy to scratch or incise on bamboo's smooth skin, unique in the plant kingdom. To make a bamboo book, strips were strung together with silk or ox sinew. One such bundle of 312 slips was recently unearthed in a Han Dynasty [second century B.C.] tomb.

"Why is such importance given to bamboo in China? Because of its beauty and its multiple good qualities. We call bamboo the chief member of the trio of 'winter friends,' bamboo, winter plum, and pine. The three occur together throughout Chinese art and literature as symbols of resistance to hardship. The plum flowers while snow is still on the ground, the pine flourishes in poor soil and clings to precipitous cliffs, and the bamboo remains green throughout the year,

bowing under the weight of winter snows but quickly springing upright again when the snows are gone.

"Philosophers say the smooth expanse between nodes represents virtue, a long distance between faults, and the hollow interior bespeaks modesty and humility."

In the garden of the college I saw culms of a dozen species, some as thin as a pencil; others, like hairy bamboo, almost eight inches thick; yellow bamboo; pale green bamboo; black—really a dark purple-brown—bamboo; another, square in cross section; and a bamboo with internodes that ballooned like grotesquely swollen bottles.

"This is *fu du chu,* Buddha's belly bamboo, *Bambusa ventricosa,* named by your great Dr. McClure," said Dr. Hsiung with a smile. "It is planted purely for ornament."

One prolific bamboo I saw, *Sinarundinaria nitida,* grows in dense thickets high in the mountains of Sichuan (Szechwan) Province and furnishes food for the rare giant panda. In a wildlife disaster still to be fully assessed, Chinese scientists have found 140 dead pandas in those remote interior hills, apparently victims of the inexorable biological clocks of two related bamboo species. Reaching the end of their century-long life cycles, the bamboos have been flowering and dying en masse; it may take several years before the groves have recovered enough to provide a dependable food source again. Meanwhile, experts fear, a significant proportion of the world's panda population—totaling perhaps no more than a thousand—may perish of starvation.

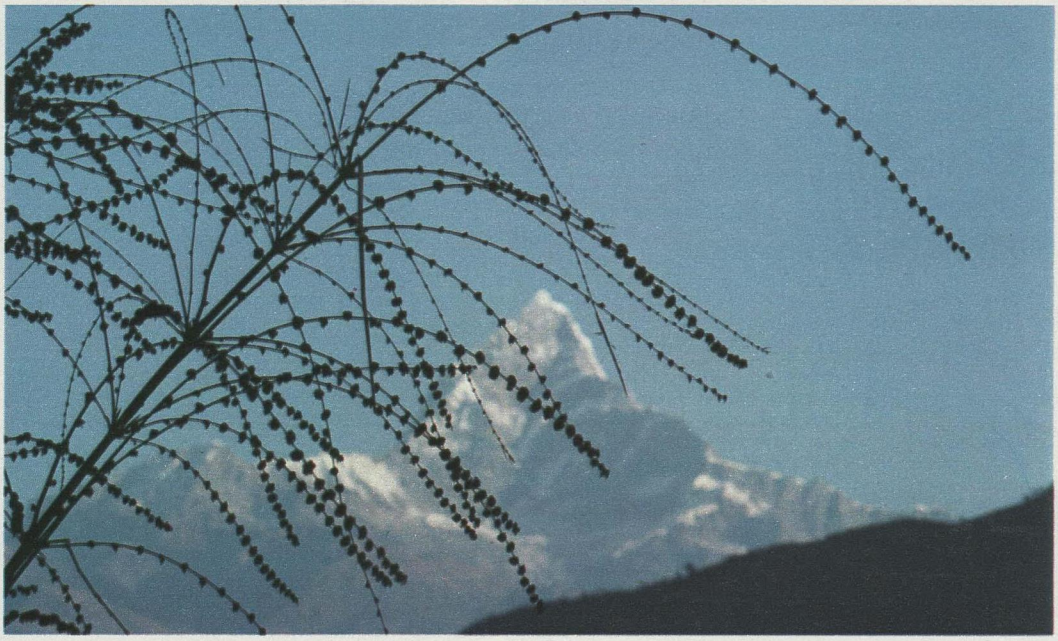
"BAMBOOS FALL into two main categories," Dr. Hsiung said, "first classified according to growth pattern by Dr. McClure as sympodial, or clump, and monopodial, or runner, bamboos. All bamboos come up from rhizomes, underground stems that send up shoots. Clump types multiply symmetrically outward in a circle; the runner kind sends its rhizomes in all directions, throwing up new culms here and there.

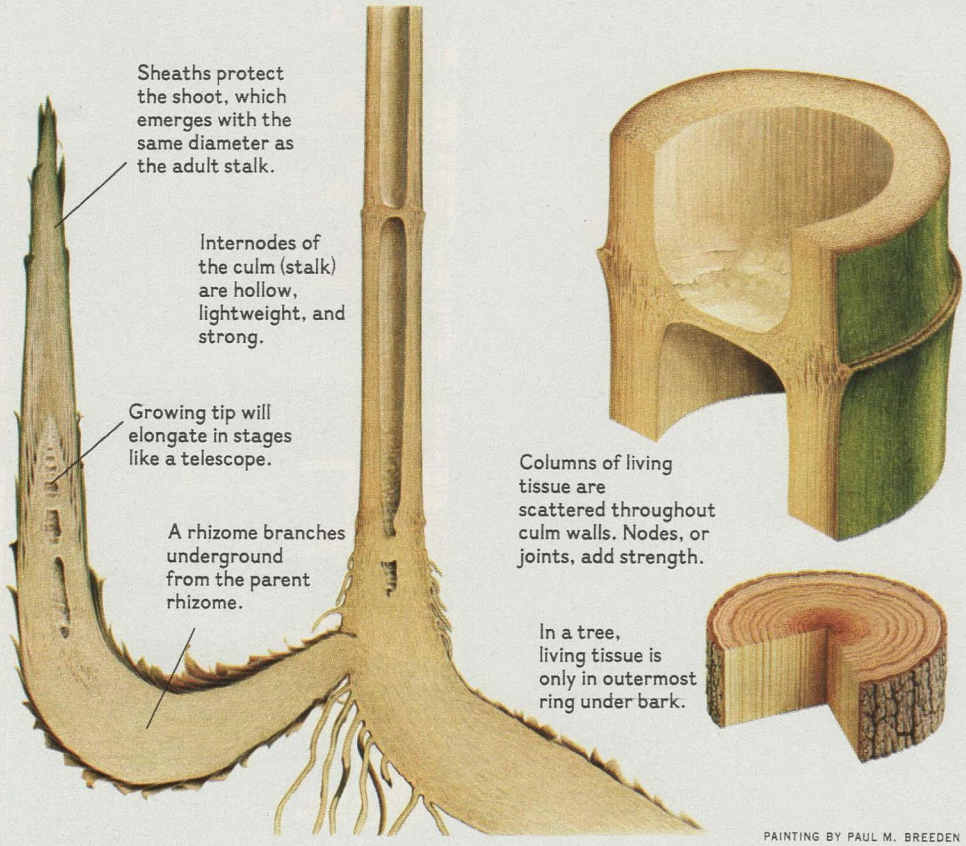
"Clump types are usually tropical, and the runners, temperate zone plants."

In the United States hardy bamboos from China or Japan are used for ornamental plantings. Gardeners struck by the beauty

The fainthearted *need not apply to Hong Kong's guild of high-rise bamboo scaffold riggers* ***(top)****. The guild operates like an exclusive craft union, admitting few apprentices to learn the art of lashing bamboo poles with strips of split bamboo* ***(above)****.*

Scaffolding is tied to building facades, rather than being self-supporting from the ground. It has withstood typhoons when steel framework has crumpled. The result on a warren of apartments is old technology made high technology ***(overleaf)****.*





PAINTING BY PAUL M. BREEDEN

To flower once, then die *is the fate of many bamboos, though some species have a life cycle of 120 years. Each has its own timetable. A plant in the Himalayas (**top**) goes to seed at almost the same time as all others of that species worldwide. Groves are fully reestablished from seeds and the few surviving plants in about five years.*

*Clump bamboo's structure and growth are shown in cross section (**above**).*

of bamboo are eager to plant it, then are dismayed when it runs wild, poking its head up on a neighbor's property. There are remedies: Confine the underground rhizomes by sinking metal or plastic edging down two feet or, when the brittle new shoots come up in the spring, kick them over.

Typically, bamboo sends up new shoots every year; in between, the rhizome develops underground. Unlike a tree, bamboo does not acquire more girth as it grows; the new sprout emerges full diameter. It reaches full height in 60 to 90 days.

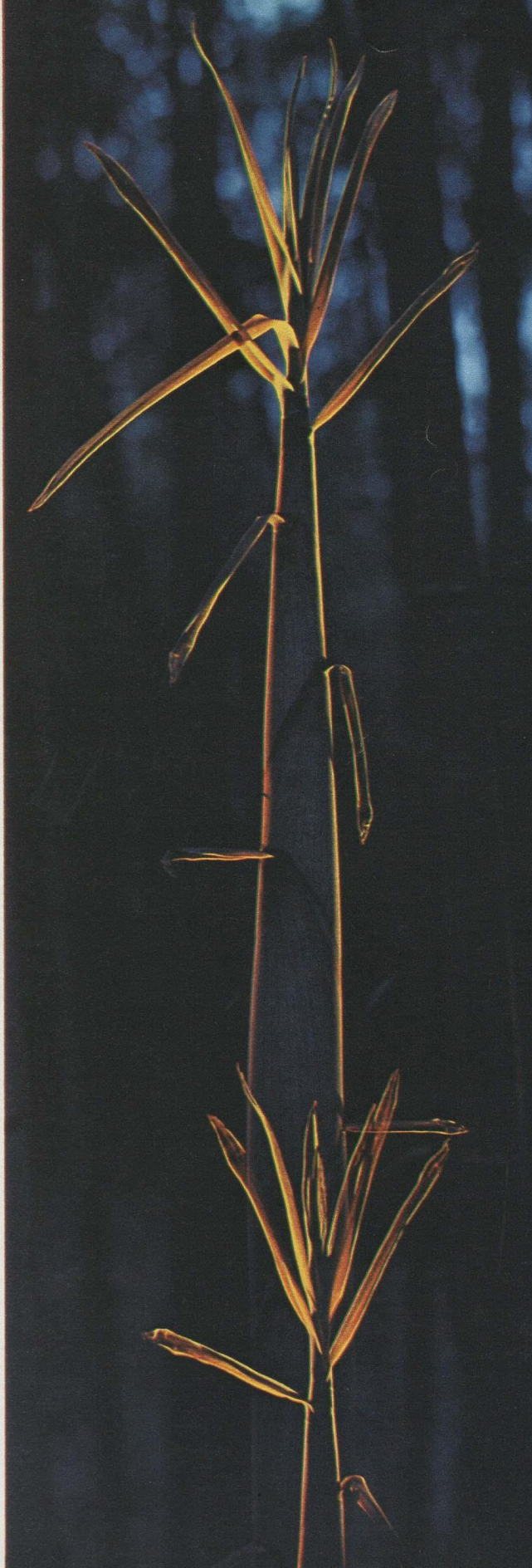
Chinese value bamboo shoots for food because of their crisp texture. "The farmer goes into the bamboo groves in spring," said Dr. Hsiung, "and by walking barefoot over the ground, he can feel the hard bumps of the sprouts. If he wants the tenderest shoots, like blanched asparagus, he piles a little mound of earth round the emerging sprout, so that it never sees the light of day."

I had heard that in the old China there was a spring ceremony or pastime. People would go to the bamboo groves on a quiet night to listen for the audible *pop* of bamboo sprouts bursting their sheaths as they emerged from the ground—a sure sign of spring.

All Chinese hospitals have a department of herbal medicine where ancient remedies are used together with medicines from the Western pharmacopoeia. A Nanjing physician told me that the rhizome of the black bamboo, compounded with other plants, treats kidney ailments.

"If you heat a freshly cut black bamboo and drink the moisture that runs out of it," he added, "it acts as a febrifuge to bring your temperature down. The culm of a bamboo used for bridges, *Sinocalamus affinis,* burned to ashes, will cure prickly heat."

In some tropical bamboos a secretion called tabasheer forms and hardens between the nodes. Chinese, Indians, and other Asian peoples prescribed this for coughs and asthma, as a cooling tonic, and even—



Faster than a speeding beanstalk: *The species* Phyllostachys glauca *was photographed at sunset and again at dawn. The double exposure shows a spurt of 15 inches in 14 hours.*

that Golden Fleece of Eastern medicine—as an aphrodisiac. Since tabasheer is nearly 97 percent pure silica, which is chemically inert, it probably requires an additional large dose of faith. But, as often happens in folk medicine, there is something there, and researchers have recently found that tabasheer acts as a catalyst in some chemical reactions.

As bamboo finds its place in medicine, so does it too in engineering. Chinese bridges, hanging from cables of twisted bamboo, are ancestors of all the world's suspension spans. The use of bamboo cables for towing ships in China was first described by Marco Polo for the 13th-century Western world:

"The cables . . . are made of. . . . the long stout canes of which I have spoken before, fully fifteen paces in length. They split them and bind them together into lengths of fully 300 paces, and they are stronger than if they were made of hemp."

Indeed, stronger. The great bridge over the Min River in Sichuan hangs from bamboo cables nearly seven inches in diameter, wound round capstans so that they can be tightened like tuning a guitar. The Min bridge, still in use after more than 1,000 years, is justly renowned as one of the engineering marvels of the world.

CHINA, the world's oldest continuous civilization, sent much of its culture to Japan more than a thousand years ago.

Most of Japan's 662 kinds of bamboo, of 13 genera, flourish in the mild climate of Kyushu, the southernmost island, but the bamboo capital is Kyoto. Here I met Dr. Koichiro Ueda, Japan's premier bamboo scientist, known throughout the island-nation as "Dr. Bamboo" (facing page).

On Kyoto's outskirts Dr. Ueda led me into a dense thicket of the most curious bamboo I have ever seen. From the ground to a height of four or five feet the nodes seemed to go mad; they zigzagged diagonally up the culm, leaving triangular internodes that swelled in convex blisters.

"*Kikko-chiku*—tortoiseshell bamboo," said Dr. Bamboo, "a variety, *heterocycla,* of the hairy bamboo. We are not sure what causes it, but sometimes the trait is recessive and the culms revert to standard shape. Groves that persistently produce the tortoiseshell form are very valuable; it is much in demand for ornament."

Particularly distorted tall culms of tortoiseshell fetch high prices in Japan.

IN JAPAN, even more than China, people use bamboo for decoration. The classic wood-and-paper Japanese house utilizes bamboo in ceilings, moldings, rainspouts, gutters, and, particularly, as the corner post of the tokonoma, the viewing alcove where works of art are displayed.

In Kyoto an amazing number of things are made of bamboo: baskets, flutes, bows and arrows, dueling staves, plant pots, pipes, boxes, benches, chairs, flower stands, dolls, scarecrows, garden fences, and artifacts for the tea ceremony.

In a collection in Japan I saw for the first time a bamboo wife, invented centuries ago in China to bring solace to hot nights. It is a woven basketwork cylinder about five feet long, which the sleeper embraces and throws one leg over, so that cooling breezes can pass through.

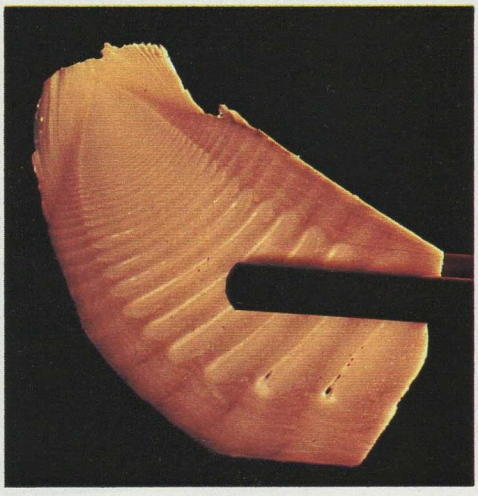
Among the myriad uses of bamboo listed in the literature, I had come across a curious entry: "Torture." Man's inhumanity to man has made use even of mankind's best friend in the plant world. Many bamboos have culm sheaths covered with a down of fine hairs. Beware of touching these! They will get under the skin and produce intense irritation. Bacteria on the hairs could even cause blood poisoning. I had read that in ancient times sheath hairs were mixed with food to get rid of an enemy.

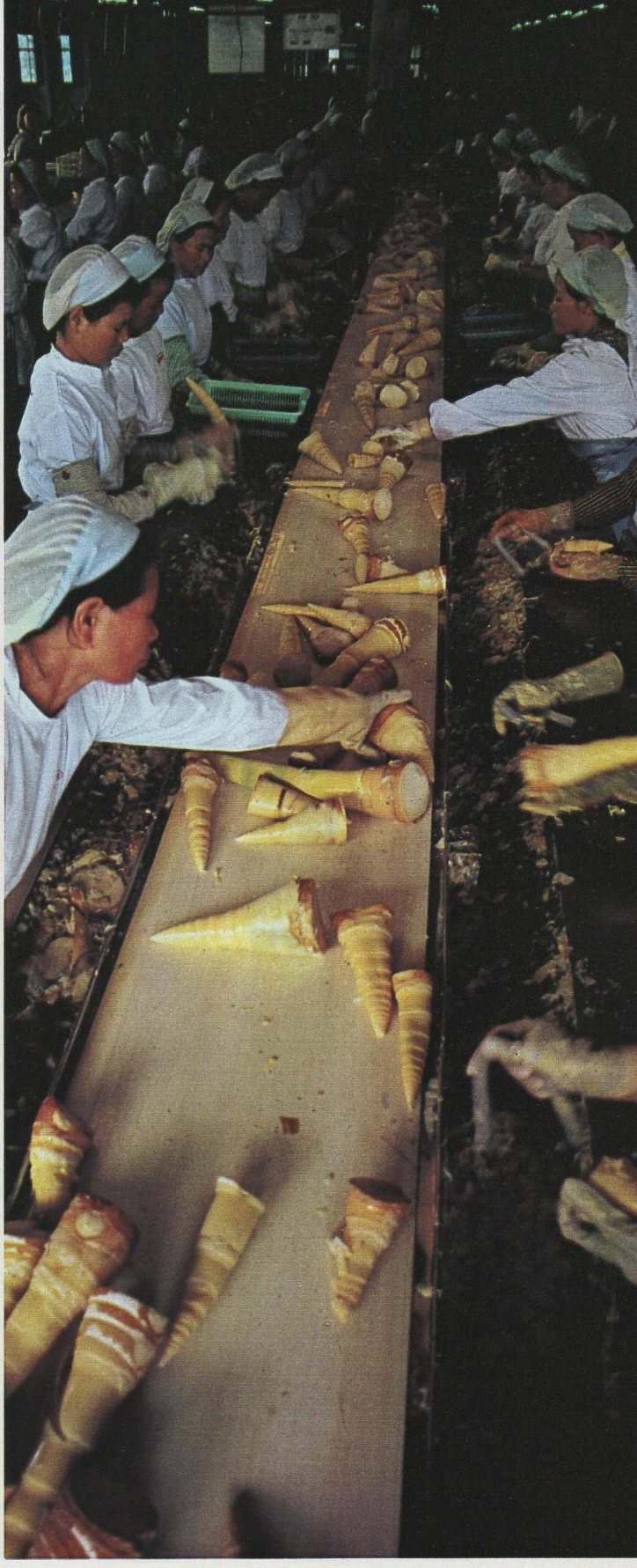
The Order of the Sacred Treasure *was conferred on Dr. Koichiro Ueda of Kyoto for his scholarly work on bamboo. With field journal in hand, he examines distorted culms of tortoiseshell bamboo, whose rare genetic aberration increases its value to collectors. Nowhere have the usefulness and beauty of bamboo been more fully exploited than in Japan.*

The crisp texture *and subtle flavor of bamboo shoots have made them a favored part of Oriental, especially Chinese, cuisine. Grown as an export crop on Taiwanese farms, they are harvested* ***(above)*** *when newly sprouted and tender. Sorted and packed by Sincere Foodstuff Enterprises Co. Ltd.* ***(far right)****, many are shipped to a growing market in the West.*

Most desirable, like the heart of the artichoke, is the innermost growing tip ***(right)****, its embryonic nodes and internodes visible as gently scalloped surfaces. These delicacies are reserved for Eastern markets.*

Giant pandas are the true gourmands of bamboo, their main diet in the wild, and they consume culms, leaves, and all. The recent flowering of umbrella bamboo, one of their staples, has raised concern for the survival of pandas in China, since their environment has already been disrupted by the increasing pressures of human activities.





A bamboo sampler

AMONG the thousand or so species, seven from around the world are shown here. Begin with the specimen on the extreme left.

Green striped (Bambusa vulgaris *var.* striata): *Probably originated in Asia. Most widely cultivated; used in making paper.*

Black (Phyllostachys nigra): *Native of China. Used primarily in decoration.*

Mottled (Ochlandra stridula *var.* maculata): *From Sri Lanka. Natural splotches are simulated in other varieties by scorching or acid-treating the culms.*

Golden (Phyllostachys aurea): *Ornamental species. Internodes compact at base and elongate toward crown.*

Giant (Dendrocalamus giganteus): *Native of Burma. May be a foot across; makes good lumber, utensils, and water vessels.*

Square (Chimonobambusa quadrangularis): *Thorn-like roots project from nodes. Other species are grown in square forms to achieve a similar effect.*

Tortoiseshell (Phyllostachys pubescens *var.* heterocycla): *Resembling turtles cowering head to tail, this mutation can only be propagated from rhizome cuttings.*

PAINTINGS BY PAUL M. BREEDEN

AN EVEN MORE lurid use of bamboo I had heard of was staking a man over a growing bamboo shoot. This would, the accounts said, impale the victim as it grew. In one of Dr. Ueda's books I had seen a picture of a bamboo shoot growing through a sheet-iron roof.

"I took that picture," said the doctor. "The shoot had pushed through a joint. But I do not believe that a shoot would ever grow through a man. It would simply turn and come up beside him, as I have seen it do at the edge of a house."

The doctor had pointed out to me a white waxy substance coating the internodes of first-year culms. In former times in Japan and China this wax made candles to light the homes of great lords. Bamboo continued to give light to man down to modern times.

When Thomas Edison, one of the last of the great empirical inventors, was working on his electric lamp, he tried more than 6,000 materials for the filament: paper, leather, pomegranate peel, spaghetti, cotton, silk, vegetable fiber, even the hairs from a man's beard. The best, he found, were charred fibers of ma-dake, Japan's commonest bamboo, growing around a Shinto shrine, Iwashimizu Hachiman, on a hill in Kyoto.

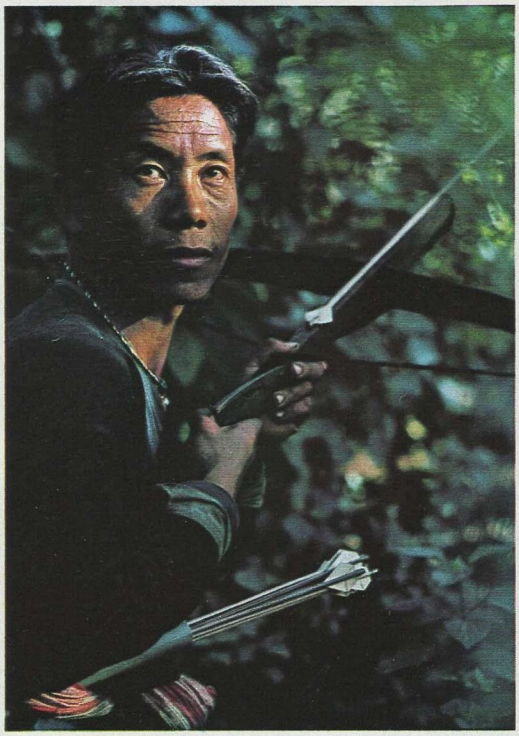
Ironically, when I visited Iwashimizu shrine there was no ma-dake in sight. All the *Phyllostachys bambusoides* in Japan had been flowering and dying for years.

I was prepared for this because the ma-dake growing in Washington, D. C., gardens had been flowering at the same time.

The curious trait of gregarious flowering makes all the bamboo of a given species burst into flower at about the same time. Botanists say the plants have a genetic imprint, as children of one family may all have blond hair and blue eyes.

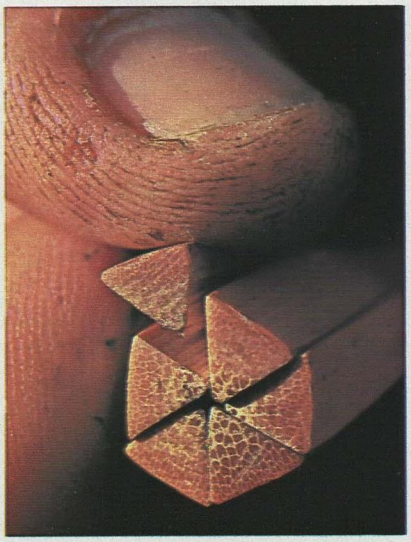
A Japanese scientist has traced the flowering of black bamboo back more than 1,000 years. The first recorded was in A.D. 813, and documents showed it had blossomed every 120 years.

In communities that depend on bamboo, flowering is a disaster. A few culms may survive, but most die, and the grove must carry on from the surviving rhizomes and fallen seeds. Culms from seedlings are small, perhaps the size of a knitting needle, and each succeeding culm is larger than the one before, until maximum size for the species is reached. Most bamboos send up culms every year; meantime, the rhizome extends its growth underground.



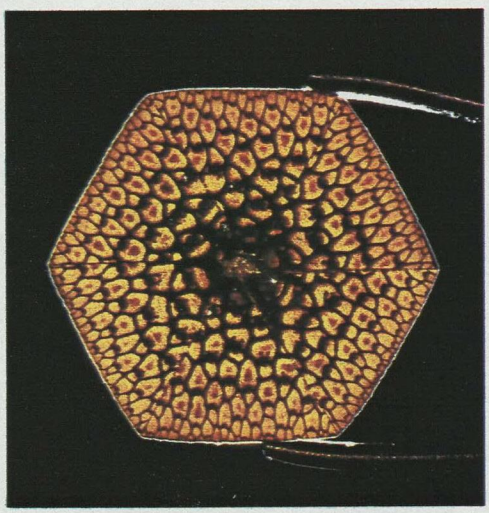
Jungle firepower *of a Hmong tribesman in northern Thailand* ***(above)*** *uses the lethal principle of a modern rifle: high-velocity and lightweight ammunition. Propelled by a crossbow, the bamboo arrow is capable of hitting a target the size of a playing card at 50 feet—more than accurate enough to dispatch a fowl* ***(right)****. The bamboo fletching is folded in a shape similar to that of a high-performance aircraft wing.*

The real tragedy of flowering used to take place in India. Most bamboo fruits look like grains of wheat, but an Indian bamboo, *Melocanna baccifera,* produces a fruit like a small pear. When *Melocanna* flowers at intervals of about 30 years, the big pulpy fruits drop to the ground. Rats devour them and multiply prodigiously. In former times



"Sixty-five hours of honest work" *after Hoagy B. Carmichael begins, he has handcrafted a bamboo fly rod to a customer's exact specifications. Holding a strip in a steel form* ***(left)****, he planes tapers to within a thousandth of an inch. He then mates the triangular strips prior to gluing* ***(above)****. In cross section* ***(below)****, the rod shows little sign of joints or glue, only the fiber bundles that give the rod its flexible strength.*

Carmichael, a former film and TV producer, was apprentice to the late Everett Garrison, the Stradivari of rod makers. He brings as much talent to his art as his father gave to writing such classic songs as "Star Dust."



the rat explosion triggered outbreaks of plague or devastated wheat and rice crops. Thus the flowering of *Melocanna* meant disease, starvation, or both.

On the other hand, flowering of other bamboos has helped avert famine, when the people roasted and ate the seeds.

When I saw *Melocanna* growing in the foothills of the Himalayas, I was disappointed not to find it in fruit.

"The alarm clock is set for 1992," the forest officers told me. "Come back then."

IN NEW DELHI I talked with Mr. S. A. Shah, deputy inspector general of forests for India.

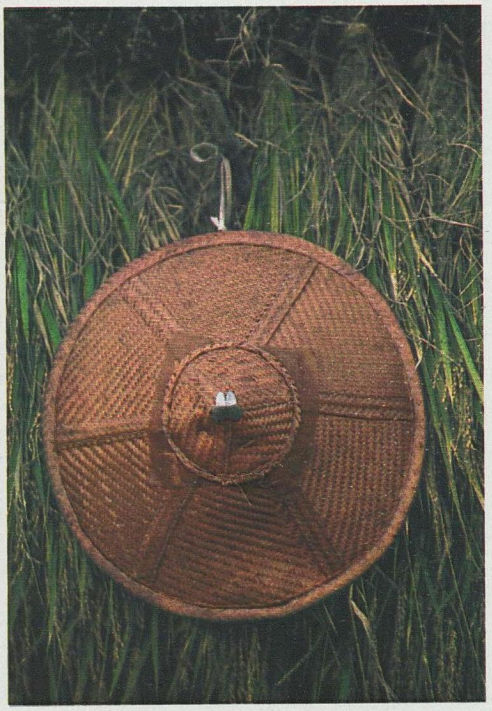
"Bamboo is the poor man's multipurpose timber," he told me. The Indian farmer literally lives with bamboo from birth to death. As in China and Japan, the Indian countryman used to have his umbilical cord cut with a bamboo knife. He is rocked to sleep in a bamboo cradle; as a man, he farms with tools made of it; he feeds it to his cattle, and eats it himself. Ultimately, he is carried to his grave on a bier made of bamboo.

"In India we have the world's largest reserves of bamboo, some ten million hectares [25 million acres]. This is one-fifth of our forest reserves. We cut selectively from wild bamboo stands. But always the countryman has priority, and he is allowed to take what he needs for his daily life. To the Indian farmer, bamboo is literally the staff of life and, in the end, his support in death."

From New Delhi I journeyed north by train to Dehra Dun, site of one of the world's most important forestry research institutes. Founded in 1878, the institute today is an imposing series of buildings on a 1,100-acre campus, some 2,000 feet above sea level in the foothills of the Himalayas.

Mr. R. C. Ghosh, director of forestry research, showed me round the laboratories, workshops, botanical gardens, and museum. At the New Forest campus we walked through bamboo groves of 35 species. Here I saw for the first time the king of bamboos, *Dendrocalamus giganteus,* of Burma, which grows 120 feet high and a foot in diameter. The largest culm I saw was 98 feet high and 11 inches thick; it would weigh more than 200 pounds.

A bamboo from Assam, *Dendrocalamus*



*"**To stir the tea**" in Japan is to stall by marking time. The literal instrument is a bamboo whisk (**facing page**) for whipping green-tea powder into a frothy brew during the ritual tea ceremony.*

*Not quite as simple as it first appears, woven covering for a vase (**left, above**) begins with bamboo solid at the neck, then carefully split to make vertical stringers.*

*Ready to shade a paddy worker, a bamboo hat (**above**) is hung on rice drying over a bamboo frame.*

*A hieroglyph of romance in Kyoto (**left**) links Hiroko and Mitsuo under a stylized umbrella as of November 3, Showa 49, or 1974.*

hamiltonii, once figured in a curious bit of fraudulent trade. For centuries the Chinese have valued rhinoceros horn (really an overgrown hair) as an aphrodisiac and a remedy for impotence.

"The Assamese used to dig up the rhizome," said Mr. Ghosh, "trim it carefully, and ship it to China as genuine rhinoceros horn. It was almost impossible to tell the difference. Whether real or false, the horns still had to be smuggled out, as the Indian species of rhinoceros had been hunted nearly to extinction."

As always happens, the defrauders got greedy; they turned out too many and the trade collapsed.

Less colorful but of infinitely more use to India and to the world were some of the other uses I saw bamboo put to in the workshops and laboratories at Dehra Dun: supplanting steel as reinforcement for concrete; laminated with plastic under pressure to make building walls, windmill blades, and the hulls of boats; replacing steel bolts in construction. Most impressive of all was paper of a dozen kinds, from heavy brown kraft to fine coated printing stock.

In India 66 percent of all paper used comes from the giant grass. The yield of an acre of bamboo does not equal that of a softwood such as pine, but remember that a culm reaches full growth in two to three months and is harvestable in three to four years; a tree might take 20 years. On a paper-hungry planet rapidly being denuded of its forests, bamboo may yet be a savior.

SCIENTISTS on the frontiers of technology, in such fields as aerospace, are making increased use of an exciting new generation of construction materials called two-phase, or composite, materials. These consist of man-made fibers embedded in a matrix that holds them in parallel bundles. Fiberglass has been known for a long time, and, recently, man-grown fibers of boron, carbon, and other elements have produced materials with amazing stiffness and strength-to-weight ratios. Engineers involved in the work call it the "new science of strong materials."

New, did they say? What are these two-phase materials but man-made analogues of bamboo? The strength of the miraculous grass lies in bundles of fibers running the length of the culm held in a matrix of pith, precisely as in the new "strong materials." Here, again, nature anticipated man.

THE PHILOSOPHER SAID that those who are ignorant of history are doomed to relive it. Modern scientists, well knowing their natural history, turn increasingly to bamboo for both instruction and for use. For strength, lightness, stiffness, and, above all else, for cheapness, bamboo can well hold its own with man-made counterparts.

It may prove to be the ideal material for rapidly spinning flywheels that would store noiseless, pollution-free energy, and perhaps someday bamboo may even be put to use in spaceflight and rocketry. The humble grass may yet leave its parent world on a tongue of flame, shielding its inseparable companion, man, even in the unthinkable cold of space.

Until they invented paper more than two thousand years ago, the Chinese wrote their literature and history on bamboo slips. The smooth green skin of bamboo continues to invite inscription, and a few years ago the Orvis Company, a celebrated maker of fishing rods in the United States, found in a shipment of bamboo from Guangdong a culm inscribed with a column of characters. A field worker, knowing the cane he cut would travel across the sea, had scribed:

"Peoples of the brotherhood of man! May our friendship last 10,000 years!"

Bamboo, steadfast friend of man down the centuries, had spoken. □

Though symbol for a bright idea, *the practical light bulb did not pop into mind overnight. A main problem was to find a suitable filament. After trying thousands of materials, Thomas Edison in 1880 hit upon carbonized bamboo. The electric lamp, until then a curiosity, was put into commercial production. A century later, some of those now antique bulbs can still burn with glowing bamboo.*