

## Traditional knowledge, economic prospects and conservation issues on Giant Reed (*Arundo donax* Linnaeus) in Manipur, Northeast India

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[Received 31.10.2015; Revised 22.12.2015; Accepted 23.12.2015; Published 31.12.2015]

### Abstract

Giant reed, *Arundo donax* Linnaeus of Poaceae is regarded as a weed everywhere except in Manipur where it is important plant resource used to prepare ranges from household items to firewood substitute, fodder, mattress, house walling, musical instruments, live fence, winnowing fan, various types of mats for thrashing grains mainly paddy and for false partition. The most expensive item made of giant reed is the thrashing mat that costs from ₹ 2200 – 3000 per piece. The species is associated with various religious functions and also used as medicine to treat wounds, fever, typhoid, pneumonia and asthma and as de-worm for children. The plant was extensively cultivated in private lands and plays vital role in local cottage industry. Due to changes in lifestyle, fragmentation of land holding and availability of modern synthetic amenities, many of the traditional knowledge system associated with the giant reed are fading away and declining this plant resource to a great extent.

**Key words:** Giant reed, *Arundo donax*, Traditional uses, Economy, Vanishing plant, Manipur

### INTRODUCTION

The *Arundo donax* Linnaeus (Poaceae) is commonly known as Giant Reed or Giant Cane or Spanish Cane or Arundo. It is a wild tall shrubby grass of the Indian Subcontinent and its native range extends from the marshes of Eastern Europe to Indo-China and it is now found in most temperate and tropical climates throughout the world ([http://en.wikipedia.org/Arundo donax](http://en.wikipedia.org/Arundo_donax)). Giant Reed is the largest member of the genus and is one of the tall grasses (Poaceae) of the area except bamboos. It is well distributed in lower Himalayas; from Kashmir to Nepal, ascending to 1100 m; and from the Punjab to Sylhet (Bangladesh), the Naga Hills, 1500 – 2400 m amsl, Myanmar and Manipur (Polunin & Stainton 1984).

It is a perennial reed of the fresh water marshes and forms dense thickets on disturbed sites, sand dunes, in and riparian habitats. Overall, it resembles an outsize common reed (*Phragmites* sp.) or a small bamboo. The rhizomes are tough and anastomosing, form knotty spreading mats that penetrate deep into the soil up to one meter (Alden *et al.* 1998; Mackenzie 2004). Pieces of stem and rhizome, less than 5 cm long and containing single node readily sprouted under a variety of conditions (Boose & Holt 1999). This vegetative growth appears to be well adapted to floods, which may break up individual giant reed clumps, spreading the

pieces, those may sprout and colonize further downstream. It uses large amount of water from its wet habitat to supply the rapid rate of growth upto 5 cm per day in spring (Perdue 1958). It is very space-competitive, capable of growing in dense stands, which may crowd out other plants and prevent their recruitment.

Giant reed stems and leaves contain a variety of harmful alkaloids which protect it from most insects herbivores and deter wildlife from feeding on it (Mackenzie 2004; Bell 1997; Miles *et al.* 1993). Grazing animals such as cattle, sheep and goats may have some effect on it, but are unlikely to be useful in keeping it under control (Dudley 2000). The *Arundo donax* has been cultivated throughout the Asia, Southern Europe, Northern Africa, and the Middle East for thousands of years. Ancient Egyptians wrapped their dead bodies with the leaves of giant reed. The cane contains silica, perhaps their reason for durability and have been used to make fishing rods, walking sticks and paper. The stem is both flexible and strong and enough to be used woodwind instruments like *oboe*, *bassoon*, *clarinet*, *ney* and *saxophone*. It is also used to make *flutes* for over 5000 years ([http://en.wikipedia.org/Arundo donax](http://en.wikipedia.org/Arundo%20donax)). Its stiff stems are also used as support for climbing plants or for vines and other climbing vegetable crops.

The giant reed is extensively used for various purposes by Meitei community of Manipur ranging from household items, house construction, life-fence, soil binder, firewood substitute, as medicine, cage for livestock rearing, religious and is a source of local economy. The present study aims to document the traditional knowledge system and uses of Giant Reed (*Arundo donax* Linnaeus) by the Meitei community of Manipur.

### Study Area

The Indian state of Manipur is situated falls within the “Indo-Burma Biodiversity Hotspot” of global significance (Myers *et al.* 2000). The state is situated in the extreme northeastern part of India and extends between 23°50' N to 25°41' N latitude and 92°59' E to 94°47' E longitude with an area of 22,327 sq km. The state is blessed with abundant natural resources, unique landscapes and rich and diversified cultural heritage.

The area has prevailing monsoon rainfall with an annual average of 2100 mm and average air temperature range from -1° C to 38° C in a temporal cycle. The mean of the daily humidity is highest during the months of July – September, which varies from 80 – 96 % and differs from place to place. Generally humidity is recorded lowest in March (45 %).

The state is inhabited by 30 various ethnic communities. The Meitei/ Meetei, Naga and Kuki are the dominant communities. The total population of the state was 2,570,390 (2011 Census) with a population density of 115 per sq km and 18.6 % decadal population growth rate ([http://e-pao.netSubPageExtractor.asp?src=manipur.Census\\_of\\_Manipur](http://e-pao.netSubPageExtractor.asp?src=manipur.Census_of_Manipur)). Majority of the population are cultivators. The household industry workers comprise of 8.17% of the total member of workers in the rural areas of Manipur ([http://e-pao.netSubPageExtractor.asp?src=manipur.Census\\_of\\_Manipur](http://e-pao.netSubPageExtractor.asp?src=manipur.Census_of_Manipur)). The household industry is an industry which is carried out by one or more members of the household at home or within the village in rural areas. The making of different Giant Reed products comes under this type of industry where the items are made by one or more members of the family at home. It is a means of livelihood in some section of the rural populace of the state.

The people of Manipur, particularly the rural populace of the valley areas have been cultivating giant reed in their homestead and other private lands. They have a very rich traditional knowledge system of cultivation, harvesting, processing and making varieties of products of giant reed.

## MATERIALS AND METHODS

The present study is on traditional knowledge system and economic aspects of giant reed (*Arundo donax* Linn.) locally called 'Yeng-thou' or 'Yeng-tou' in Manipur state of northeastern India. The study was conducted during 2008 – 2009 in the four districts of Manipur namely, Imphal West, Imphal East, Thoubal and Bishnupur. Interviews were conducted to 10 resource persons from each district by visit to the respective resource person (3 times each spending 4 hours in every visit) and data were collected through structurally developed questionnaire format based on the objective of the study. The data were cross-checked amongst the resource persons and fixed the standard sizes of the products/items made of the *Arundo donax*. Personal observations were also made during fabrication of the items to authenticate the information provided by the resource persons. Market survey was conducted at Imphal (8 shops) for recording the local market prices. The plant samples (stem, inflorescence, roots, etc.) were collected and the scientific identity of the species (*Arundo donax* Linnaeus) was identified through available literature (Singh *et al* 2003; Sinha 1996). The purpose of the data collected was informed to the resource person and got their consent for publication in the form of Thesis/Scientific papers. The specimen is preserved in the CSIR-NEIST Branch Laboratory, Imphal.

## RESULTS AND DISCUSSION

### Botanical characteristics of Giant Reed

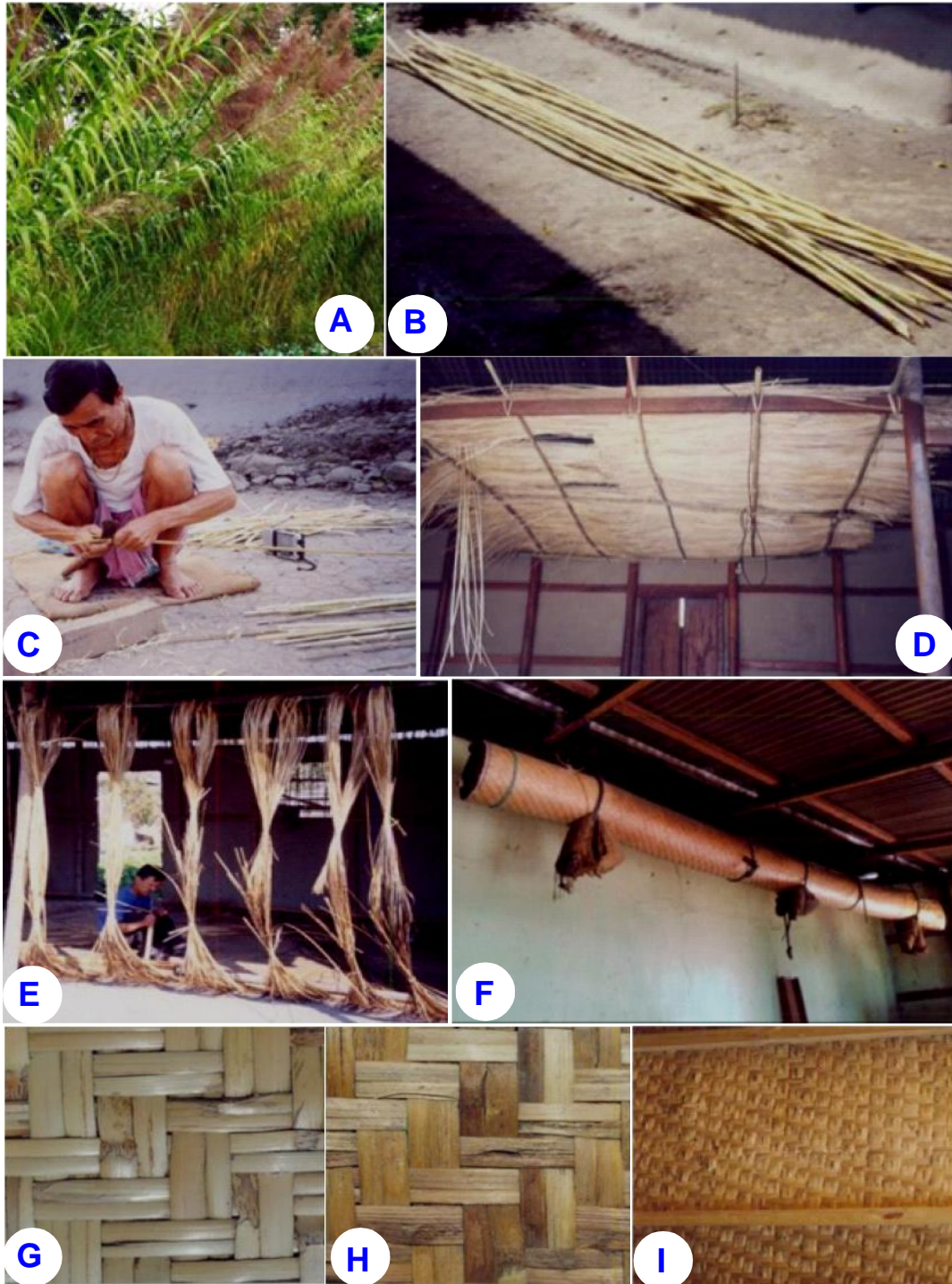
Giant reed often grows 4 – 6 m tall, rarely to 10 m, with culms 2 – 4 cm in diameter (Plate IA); leaves strongly distichous, distributed rather uniformly along culm, 30 – 60 cm × 2 – 6 cm, entire, long acuminate, grey-green, with ligule forming a hairy tuft at the base; sheaths longer than internodes and strongly overlapping, coracious, 45 – 60 cm long, 4-6 cm wide, ciliate along the margins; panicles 30 – 60 m, branches scaberulous, erect or drooping, spiklets ±1 cm long.

### Processing of raw materials of Giant reed for product making

Harvesting is usually carried out after the flowering season that generally falls during October – November when the stem of the plant turn deep shining greenish yellow. If over-matured, many sprouts developed at the nodes and the stem become brittle which is unsuitable for making quality products. Cut off the inflorescence and removed the node ring with the help of a sharp knife. The stems are piled up together in a dry and shady place (Plate IB). Direct exposure to sunlight is avoided to retain its original colour.

The stem is longitudinally split into 8 equal halves. Then the thin smooth and shining outermost layer is peeled off properly and uniformly by a thin and sharp knife (Plate IC). These smooth and long peels are locally called 'kanam paya' or 'kanam'. The peels are dried completely in the sun for about 15 – 20 days and then smoked for 1 – 2 months by putting horizontally above the fire place in the kitchen at home (Plate ID). Smoking is very essential as it reduces the incidence of insects/mites attack and increases the durability and to enhances aesthetic look. Now, the seasoned peels are ready for making varieties of beautiful and expensive products.

After taking out the outermost smooth layer, the remaining inner part of the stem is again peeled off into one more layer. The inner layer is locally called 'kabook' which is rough and inferior in quality as compared to the outermost layer. The innermost layer which is rough and un-uniform is used as firewood. These long peels are tight together into bundles and then dried under the sun. These are now ready to be made into different products. The



**PLATE - I. *Arundo donax* Linnaeus (Poaceae):** **A.** Habit of giant reed; **B.** Harvested stem ready to split; **C.** Splitting of stem; **D.** Seasoning of splitted stem; **E.** Making of thrashing mat; **F.** Rolled up thrashing mat hanging from the house roof; **G & H.** Dorsal & ventral views of thrashing mat; **I.** False partition wall.

'kabook' is softer and easy to make products faster but the products are less durable and cheaper as compared to the products made of 'kanam'.

## PRODUCTS MADE OF GIANT REED AND OTHER USES

- i. Thrashing mat:** In Manipur, mats made of giant reed stem have extensively been used for thrashing paddy or other food grains since ages. It is locally called as 'phaklen' or 'yeina-phak' and is made with the outermost smooth peels. The thrashing mats are generally available in two different standard sizes. The first one is of the size  $4.27 \times 6.4$  m, which requires about 450 to 500 giant reed plants and about 13 – 15 days by 2 male labourers. The other size is  $4.11 \times 7.01$  m which requires about 500 – 550 plants and takes about 15 – 18 days by 2 men labourers. The craftsmen making this type of mat are trained and skilled. Every person does not have this skill.

The two borders of the width of the thrashing mat is framed with two overlapping splits of some good quality bamboos like *Bambusa nutans* Wallich, *Bambusa strictus* Nees in the form of sandwich, tied together with splits of cane (*Calamus* spp.) at an interval of about 10 – 15 cm. This helps in keeping proper shape of the mat as well as enhances its durability.

The cost of one thrashing mat ranges from ₹ 2200 – 3000. The thrashing mats are also rented in many places where its rental charge is about 80 – 100 per day. A properly maintained mat may lasts for 15 to 18 years. Traditional method of making thrashing mat is shown in Plate IE. The thrashing mats after harvesting of crops are rolled up properly and tied with a rope and then hanged horizontally from roof of houses (Plate IF). The dorsal surface of the thrashing mat is very smooth and shining (Plate IG) while the ventral surface is rough (Plate IH).

- ii. False ceiling / Partition mat:** In Manipur, it is traditional and royal to fix roof ceilings in houses with mats of giant reed. Due to modern concrete houses which need no ceiling, the use of reed mats has now been reduced to a great extent in the urban areas but still it remains as a popular ceiling material in rural areas. The house with ceiling of giant reed is very pleasant throughout the year due to its bad conductivity of heat that controls the room temperature.

Two types of ceiling mats are available. The first one, which is of finer quality, is made of the outermost layers 'kanam' of the stem. The design and pattern of knitting in the two different mats is same. The sizes available are  $1.83 \times 3.66$  m and  $2.44 \times 3.66$  m. The first size mat requires about 100 to 120 plants and takes about 2 days to finish by 2 male laborer. It is sold in Imphal market at the rate of ₹200 – 280 per mat. The second size i.e.  $2.44 \times 3.66$  m requires about 130 to 150 plants and takes about 2 or 3 days by 2 male laborers to make a mat. It cost about ₹250 – 300 per mat. This can also be made according to the size and design in demand. If such type of order is given, then they make the mat better and it may cost about ₹53 – 54 per sq m. The ceiling mat can also be used as a false wall partition by providing wooden or bamboo frames (Plate II).

The second quality is made of inner layers of the stem of giant reed which is cheaper and less durable as compared to the previous type. It is available in two different sizes. The first one is of  $1.83 \times 3.05$  m and costs ₹100 – 110 per piece. In making this mat it requires about 30 – 35 plants and in a day a person can make 2 or 3 mats. The second size is of  $1.83 \times 3.66$  m costing ₹110 – 130 per piece. It requires about 35 to 40 plants and an artisan can make two mats a day.





**PLATE - II.** *Arundo donax* Linnaeus (Poaceae): **J.** Rolled-up ceiling / partition mats; **K.** Traditional granary; **L.** *Phoura* – grain drying circular mat; **M.** *Kharai* – gauge-type circular mat; **N.** A basket; **O.** Winnowing fan made of peduncle; **P.** Cow-dung wrapped traditional firewood; **Q.** Poultry cage

The mats are rolled and sold in markets (Plate IJ). This type of mat is useful in many purposes like house roof ceiling, false wall partition, temporary toilet/urinal wall, soil covering during heavy rainfall and landslides, drying of vegetables and food grains, cage for poultry, walling of cow shed during severe winter and summer month, etc.

- iii. **Granary:** In Manipur, every house maintains granary mainly to store paddy. These granaries are locally called '*kot*'/'*kei*' and mainly made of giant reed (Plate IJK). Now-a-days in the urban areas the granary made of giant reed is substituted by tin or wooden planks or even cemented walls. There are two types of granaries; one is big and elongated basket type locally called '*ningei*' which can be shifted from a place to the other, while another type is fixed one which is square or rectangular. A thin cover made of giant reed is also fitted at the top of the granary to protect the grains from rats and insects.

It is available in three different sizes but it may also be ordered according to choice and demand. Generally, granaries are not sold in the markets but can be ordered or may be fabricated. The first size of granary is of about 4.11 m in circumference and 1.82 m in height with storing capacity of about 10 full bags of paddy/grains and it cost ₹280 – 320. It requires about 60 giant reed plants and one granary can be made in a day by an artisan. The second size is of about 5.03 m in circumference and 1.83 m in height (locally called "*lam-ahum*") with storing capacity of about 15 bags of paddy and it cost ₹300 – 380. It requires around 80 giant reed plants and takes about 2 day to make by an artisan. The third size is about 5.79 m in circumference and 1.83 m in height (locally called '*lam-ahum-thagai*') with a storing capacity of about 25 bags of paddy and it cost between ₹320 and 400. It requires about 100 giant reed plants and takes 3 days in making such a granary by an artisan. Before storing paddy or grains, the inner wall of the granary is coated with a thin film of cow-dung to fill the pores, which smoothen the wall and for enhance its durability.

- iv. **Drying Mat / *Phoura* / *Laa* / *Kharai*:** The outermost layer of the stem of giant reed can be used for making a circular type of drying mat which is locally called as '*Phoura*' (Plate IIL). Generally, its size is 1.52 to 1.83 m in diameter with 0.08 m raised border. The border of the mat is tied together with two thick bamboo splits in a sandwich manner by rattan splits at an interval of 10 – 15 cm. It requires about 100 giant reed plants and takes about 2 to 3 days in making a mat by an artisan. A thin layer of cow dung is generally coated at the upper surface of the mat to fill the pores and also to enhance its durability lasting upto 12 years. It is sold between ₹400 – 500 per mat.

'*Kharai*' (Plate IIM) is a circular gauge / sieve type of mat mainly used for drying of red chilies, fishes, fruits and other vegetables. The diameter of standard-sized is ranged from 0.30 - 0.61 m. It is sold in markets fetching between ₹40 – 60 per piece. Bigger sizes are also available in the market.

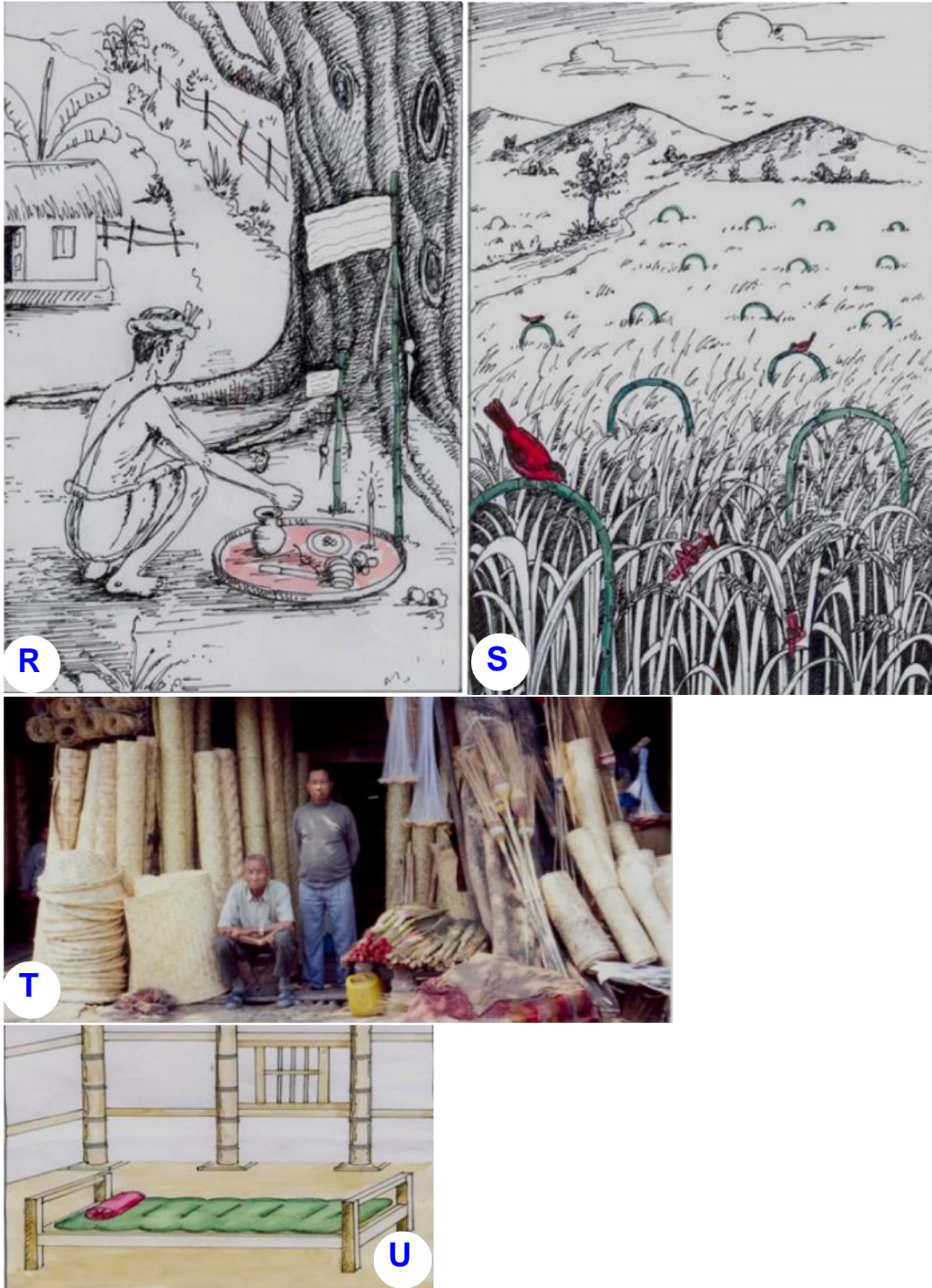
- v. **Baskets:** Varieties of carrying baskets, locally called '*thumok*' are also made from the stem of giant reed. These are generally made from the outer layer of stem. The baskets are generally circular at the top and rectangular at the bottom (Plate IIN). Two sticks of bamboo are fastened at the bottom of the basket in cross pattern to give proper shape and strength to the basket. The upper rim of the basket is also framed with bamboo splits to provide a circular shape, strength and smooth handling. This type of basket is not marketed in large scale due to its less durability as compared to the baskets made with split bamboo.

- vi. **Winnowing fan:** The peduncle of the inflorescence of the Giant Reed is traditionally been used for making winnowing fan (locally called '*humai*' or '*phou-humai*') which

is used in Manipur for winnowing of grains (Plate IIO). This type of winnowing fan is very light and highly efficient. Their standard size is  $0.45 \times 0.61$  m and requires about 20 to 25 inflorescence stalks to make a fan. Each stalk of inflorescence is first longitudinally split into two equal halves. Then the split stalks are knitted nicely and firmly in the same pattern as that of the thrashing mat. Three sides of the fan are bordered with two bamboo splits in the form of sandwich and tied by rattan splits at an interval of 10 cm. An artisan can make 4 – 5 winnowing fans a day and costs ₹80 – 100 per fan.

- vii. **Fuel:** In Manipur, cow dung sticks (Plate IIP) are popularly used as substitute of firewood in which stems of giant reed is used. Some paddy husk can be mixed with the cow dung to have better ignition. The most suitable length of the fire stick is 0.61 m. These fire sticks are tied into bundle and piled up in a shed to protect from rain. These are generally used during rainy season and other scarcity period. Giant reed is an ideal biofuel (8000 BTUs/lb) that produces methanol from gas diffusion as a bi-product in manufacturing of cellulose. The option to gasify this product is to produce independently a valuable energy product. It is possible to utilize new high efficiency gasification systems to convert giant reed into multitude of different energy source, such as syngas, standard steam turbine electrical generation, ethanol and biofuel (<http://en.wikipedia.org/Arundo donax>).
- viii. **Poultry / Livestock cage:** Poultry cage (locally called 'yen-gon' by making gauge is made of giant reed plant (Plate IIQ). This is movable and can be shifted from one place to another. A poultry cage may last for about 3 – 4 years. This product/item is generally not sold in markets but made in home, more commonly by Muslim families of Manipur. The size of the cage may vary depending on the requirement.
- ix. **Pillow and bed mattress:** The dried flowers / inflorescence of the giant reed are used as cushion filling material for pillow (locally called 'mon') and mattresses (locally called 'mon-pak' (Plate IIIU). It was very popular and extensively used in the olden days but now-a-days due to availability of modern synthetic, light and comfortable pillows and mattresses, the use of such products has been reduced drastically. But it is still prevalent in rural areas. The mattresses are sun dried every year that regain the bouncing nature of the flowers / inflorescence. It is traditionally believed that sleeping on such pillow and bed mattress cures back-ache, head-ache, etc. and helps to keep the spinal cord straight.
- x. **Fodder:** In Manipur, the leaves and tender shoot of giant reed is occasionally given as a fodder for cows, buffalos and goats during scarcity period. Giant reed stems and leaves contain a variety of harmful chemicals, including silica and various alkaloids, which protect the plant from insects, and herbivores from feeding on it (Mackenzie 2004; Bell 1997; Miles 1993).
- xi. **Musical instruments:** Some traditional musical instruments (locally called 'khongnaba-jantra' or 'basi') are also made from the mature stem of giant reed. The stalk of inflorescence is made into traditional flutes played by children. The durability of these musical instruments reed is very less as compared to those of made with bamboo, hence, not preferred and frequently used by local people. Giant reed stem is both flexible and strong enough to be used for woodwind instruments such as the oboe, bassoon, clarinet, ney and saxophone. The giant reed has been used to make flutes for over 5000 years (<http://en.wikipedia.org/Arundo donax>).
- xii. **Hedge plant:** In rural Manipur, giant reed has been cultivated extensively as hedge plant around the houses and private farm lands due to its rapid and gregarious growth and quick maturity and also due to its multipurpose uses. Without much manpower,





**PLATE - III. *Arundo donax* Linnaeus (Poaceae):** **R.** A *maiba* performing a ritual to remove sad/bad omens from family where the flag-sticks are made of giant-reed culm; **S.** Traditional system of insect control in paddy fields with bent stem of giant reed for birds to seat; **T.** A stall at Imphal market selling variety of products made of giant reed; **U.** Traditional bed and pillow cushion filled with the flowers of giant reed

labour and investment, the hedge plants quickly become a thick and compact band thereby forming a good and strong fencing. This live-fencing not only protects the boundary from thorough fare by trespassers and livestock but also breaks the gusting wind blow. Giant reed plant is also planted in the bank of ponds and drains as a good soil binder due to its profuse fibrous roots.

- xiii. Medicinal uses:** In Manipur, tender shoot of giant reed is used to treat various cattle diseases. The tender shoot decoction along with little honey is given to children to de-worm and to reduce fever. The paste of tender shoot is applied externally as bandage on boils and burns. When a foreign body (like metal, spines, glass piece, etc.) is embedded in the muscle of the body, the paste of fresh tender shoot of giant reed is applied as bandage which results to early suppuration and helps to take out the foreign bodies (Singh *et al* 2003). Extract of the fire-roasted young shoots of giant reed is applied to treat ear-ache and ear infection. It is also useful in typhoid, pneumonia and asthma (Sinha 1996). The tender rhizome boiled in wine, along with little honey is used for the treatment of cancer and dropsy ([http://en.wikipedia.org/Arundo donax](http://en.wikipedia.org/Arundo%20donax)). The shoot infusion of giant reed is regarded as anti-galactagogue, depurative, diaphoretic, emollient, hypertensive, hypotensive, and sudorific (Duke & Wain 1981). The tender shoot of giant reed is very bitter in taste.
- xiv. Religious uses:** In Manipur, giant reed plant is used in many religious rituals. On the last day of one of the very popular festivals of the state, the '*lai haraoba*', a ritual known as '*hijing hirao*' is performed. During this ritual, 14 stems of about 1.67 m long of giant reed are used representing the oars of a boat. In another ritual called '*leirai yu-khangba*', some quantity of local wine/ liquor is put inside the hollow stems of giant reed (one end is hollow while other end is blocked by solid a node – representing a cup) and perform to drive away the evil spirits.

The winnowing fan made of the stalk of inflorescence of giant reed is used during a ritual called '*phou-gouba*' which is performed in the paddy field just before harvesting. Here the fan is made as a seat for the goddess '*phou-oibi*' (the Manipuri goddess of rice/paddy).

A puja is generally performed when some calamities or omens are detected in a family. A flag made of white cotton cloth and post with stem of giant reed are put nearby river banks by performing pujas (Plate IIIR) to get relief from the harmful effects.

It is a customary for the Meitei ethnic people of Manipur to hang an earthen pot at the funeral and burial place of a person just after the cremation is over. The stem of giant reed is made to bend in an inverted U-shaped and the two ends are firmly inserted into to the ground of funeral place and an earthen pot is tied / hanged from the middle. In another way, the stem of giant reed in one end is split into 4 equal halves upto 3.05 m length and an earthen pot is rested after expanding the splits. Agarbati/dhoop is burnt inside the earthen pot and erected it on the funeral and burial place. Ancient Egyptians wrapped their dead bodies in the leaves of *Arundo donax* ([http://en.wikipedia.org/Arundo donax](http://en.wikipedia.org/Arundo%20donax)).

- xv. Insect control measures:** The people of Manipur have a good traditional knowledge system of insect control in different crops fields. In the fields, the split stem of giant reed bent U-shaped are fixed firmly onto the soil by its two ends. It provides a good resting place for birds which catches various insects from the crops (Plate IIIS). This method of controlling insects from paddy or crop fields is widely practiced in Manipur since long and is practicing even today. The excessive use of synthetic insecticides in the crop fields can be replaced by this novel and rewarding method of insect control.
- xvi. Miscellaneous uses:** The remaining parts after peeling off the 2 outer layers are used as fuel. This left out part can also be used as a substitute for soda (sodium

bicarbonate) which is used for cooking a local delicacy called 'ootti'. For the purpose, the left out biomass is burnt completely and the available ash ('oott') is neatly collected in a bamboo basket. Then clean potable water is poured slowly above the ash and the filtrate is then collected in a vessel and is used directly for cooking 'ootti'. In olden days the filtrate was used for washing dirty clothes as detergent. Now, this system has been slowly substituted by modern chemical detergents. In the olden days, clothes were stored in beautiful traditional boxes made of giant reed stem. The boxes used to store clothes for ladies are called 'phirubak' and for that of men is called 'taboo'. Both these boxes are made of the outer smooth layer ('kanam') of the stem of giant reed. The boxes have detachable lid-covers.

The stem of giant reed is extensively used as support for climbing vegetable crop plants like varieties of beans, cucumber, *Luffa* spp., *Momordica charantia* Linnaeus, *Pisum sativum* Linnaeus, goa bean, etc. Due to silica deposition at the stem, giant reed plant is used in water as support for the cultivation of *Neptunea oleracea* Loureiro plant (popular water vegetable 'ishing-ikaithabi'). A variety of products made of giant reed are sold in Imphal market (Plate IIIT). The mat made of giant reed is generally used as lining for casting of cement structures mostly in house construction. The cement cast on the giant reed mat has the imprint of the knitted pattern of the mat. This design is very good looking and artistic. Besides, the zig-zag patterns of the surface makes the additional and final plaster on it is better fastened and thereby enhances the longevity of the cement plaster. The size, number of plants required, time required for making the products/items and pricing of the important products/items made of giant reed are presented in Table 1.

**Table 1.** Some of the important items made of giant reed (*Arundo donax* Linnaeus), its dimension, number of plants required and pricing

Products ( <i>local name</i> )	Size	No. of plants required	Time taken & no. of labourer	Market price (Rs/piece)
Thrashing mat ( <i>Phaklen/Yeina-phak</i> )	4.27×6.4 m	450 – 500	13-15 days/2 labourers	2200 – 4000
	4.11×7.01 m	500 – 550	15-18 days/2 labourers	2200 – 4000
Ceiling mat ( <i>Kanam phak</i> )	1.83×3.66 m	100 – 120	2 days/2 labourers	180 – 200
	2.44×3.66 m	130 – 150	2-3 days/2 labourers	200 – 230
Drying mat ( <i>Phoura/Laa</i> )	1.83 m in diameter	100	2-3 days/labourer	400
Partition mat ( <i>Kabuk-phak</i> )	1.83×3.05 m	30 – 35	2-3 mats/ day/labourer	80 – 90
	1.83×3.66 m	35 – 40	2 mats/ day/labourer	90 – 100
Granary ( <i>Kot</i> )	4.11×1.83 m	50 – 70	1-2 granary/day/labourer	130 – 170
	5.03×1.83 m	70 – 90	1 granary/day/labourer	200 – 250
	5.79×1.83 m	100 – 120	2 granary/days/ labourer	250 – 300
Winnowing fan ( <i>Humai</i> )	0.46×0.61 m	20 – 25	4-6 fans/day/labourer	50 – 60

## PROPAGATION, CULTIVATION AND CONSERVATION

The giant reed is helophytic in nature, growing along lakes, streams, drains and other wet and marshy areas but also grows well in land having good moisture content. The giant reed grows very easily from the vegetative parts such as stems, rhizomes or young shoots. It is also traditionally practiced in Manipur that the mature plant of giant reed just after cutting down is float on water. After about two weeks, many young shoots / sprouts arise from the nodes of the stem. When the sprouts are 15 – 20 cm high the stem of giant reed is cut at the internodes and the pieces having at least one sprout can be used as planting material.

The giant reed plant is traditionally grown near the boundaries of houses or private lands. The most favourable time for cultivation of giant reed is during the rainy season when the soil remains highly moist. During this season, the sites where the plants are to be grown are cleaned, and then the soil is dug out into small pits at about  $30 \times 30 \times 30$  cm at an interval of 1 – 1.3 m. Some organic manure is mixed with the loose soil and filled the pit after putting the planting material in  $45 - 60^\circ$  inclination. Then, they are properly covered with the soil from the surrounding areas. Sufficient quantity of water is also irrigated over the newly planted areas. The plants gradually grow into tall and healthy mature plants within months. In a few years time, successive generations of the plant spreads the whole area turning into dense growth clump of the giant reeds. The plants become mature after two years of plantation and then they are ready for harvesting.

Now-a-days, the cultivation of giant reeds is more confined to the rural areas. Traditionally, the planting of giant reed and bamboo is done by elderly men. The younger people are prohibited from doing so. There is a belief in the society that if the plants are cultivated by young people, the plant will not grow properly and if it grows also, then the health of the person may deteriorate seriously. Cutting down of this plant is also done by elderly persons on selected days only. Cutting down on Thursdays and Saturdays are prohibited. All such tradition and restriction prevent the plant from cutting down at random by children and young people thereby helping in conservation of these resources (Dhiren 2009).

Though the giant reed plant is highly useful for wide range of purposes and commercially rewarding, it is observed that its population is declining considerably. Loss of its habitat and least attention are the two major factors responsible for its declining population. The rapidly increasing human population and different developmental activities like expansion of residential areas, road construction, extension of agricultural sites, etc. are responsible for such habitat loss. Though people of other parts of the world regarded giant reed as a weed, in Manipur it is largely and extensively used for various purposes and hence no question of its control, rather encouraged to cultivate. It matures in short time with maximum biomass, so large scale cultivation can be initiated in marshy places and other wasteland areas which are not productive for other uses. This plant has very good employment opportunity by setting up cottage industries and a good scope for exporting the products to other places thereby earning significant revenue for the state. Besides, giant reed helps in checking soil erosion, act as wind brakes and also supplementing fodder for livestock during scarcity period and as fuel for the poor rural villagers. The role of giant reed in cottage industry and rural economy can further be strengthened.

### Acknowledgements

The authors are deeply indebted to all the local artisans/craftsmen/healers of the four valley districts of Manipur (Imphal West, Imphal East, Thoubal and Bishnupur) for sharing their valuable knowledge on giant reed plants and its products and consent to publish the shared knowledge in books/journals. The shopkeepers of Imphal market who have provided the market information related to the products made of giant reed plant are thankful. The Director CSIR-NEIST, Jorhat is thankful for providing the facilities during the study period.

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