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REGENERATION TECHNIQUES FOR REEDS

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ABSTRACT

A study on regeneration techniques of reed bamboos in Kerala was undertaken during 1992-95. As a major outcome, nursery and plantation techniques of two important species of reed bamboos, *Ochlandra* scriptoria (Dennst.) Fischer and *O. travancorica* Benth. were standardised through nursery and field trials at Veluppadam and Kollathirumed in Chalakkudy Forest Division. Performance of four different types of propagules viz., seedlings, wildlings, rooted culm cuttings and sprouted rhizome cuttings (offsets) was studied in field trials. Seeds of *Ochlandra scriptoria* and *O. travancorica* were collected, germinated in nursery beds, seedlings raised and planted out. Wildlings of *O. travancorica* collected during north-east monsoon (September-October) were poly-potted and planted out during the following south-west monsoon (June-August) season. Vegetative propagation by raising propagules from rhizome and cuim cuttings was also attempted.

Seedlings and rooted culm cuttings were best suited for field- planting as evidenced from their high survival percentage and maximum culm production. Wildlings were susceptible to biotic interferences and they showed very low recouping power in the field. The propagules raised from rhizome cuttings were massive and heavy and, hence, their transportation to the planting site was uneconomical. The appropriate season for vegetative propagation of reed bamboos was found to be summer months of March-May. Since reed bamboo growing areas are generally prone to damage by elephants, protection of reforested sites is necessary for higher survival. and faster and better field establishment of the outplanted propagules.

A package of nursery and planting practices of *Ochlandra scriptoria* and *O. travancorica* has been developed for assisting practicing foresters to introduce the species in poor and denuded reed growing areas.

1. INTRODUCTION

Reed bamboos are in great demand as they provide valuable raw material for traditional cottage and pulping industries in Kerala.The traditional sector comprises basket and mat-weaving which flourishes as a cottage industry in the State and has become a means of employment (Gnanaharan *et al.*, 1993), and income to the scheduled castes, tribes and other under-privileged communities in the State (Chand Basha, 1991). Reed bamboos provide excellent slivers suitable for basket and mat-weaving. The major reed-based industrial sector mainly consists of paper and pulp industries. The long fibre of reed culms makes it ideal for pulp and paper production.

Stretches of reed bamboos situated at the lower elevations and easily approachable areas are being heavily worked (Asari. 1978) and this is one of the several reasons for the depletion of the natural stands. Such over-esploitation and repeated harvesting without any consideration even during the closure period from June to September hampers the natural regeneration of reeds by preventing the survival and establishment of the new sprouts. Clearance for establishing hydel and irrigation projects, and settlement of landless farmers have also contributed to depletion of the existing reed forests. The socio-economic issues concerning the collection and distribution of harvested reeds for traditional and industrial sectors have been well-documented (Nair, 1986: Chundamannil, 1990; Muraleedharan and Rugmini. 1990).

The present study was undertaken to standardise nursery practices and artificial regeneration techniques of reed bamboos. Emphasis was also given to develop techniques for augmentation planting of poor and denuded reed areas in the State. Though a few other objectives were also included in the project proposal, only the silvicultural aspects could be covered due to the paucity of funds. Similarly, since sufficient number of plantable propagules of *O. ebracteata* could not be raised in the nursery, no field trials were conducted using the species.

2. MATERIALS AND METHODS

Investigations on nursery techniques of three species of reed bamboos were carried out at the Institute's Central Nursery attached to the Field Research Centre, Veluppadam. Seeds of *Ochlandra travancorica* Benth. were collected from Achencoil (Thenmala Range), *O. ebracteata* Raizada et Chatterji from Edapalayam (Aryankavu Range) and *O. scriptoria* (Dennst.) Fischer from Vazhachal (Vazhachal Range). The seeds were sown in the nursery for raising seedlings for field trials. Vegetative propagation techniques like rooting of culm cuttings using growth regulating substances, and production of propagules through rhizome cuttings were also tried to evaluate their performance in nursery as well as in the field. Rhizome pieces and culm cuttings were collected from Kollathirumed (Chalakkudy Range) for raising propagules for planting. Details of different types of propagulcs are given below.

2.1. TYPES OF PROPAGULES

Seedlings: Ripe seeds of all the three species mentioned earlier were either collected from the ground or from clumps during April 1993. The seeds were packed in perforated polythene bags and brought to the laboratory where seed weights were determined following standard procedures (Willan. 19851. The seeds were either sown in wooden boxes containing a mixture of sieved forest soil (5parts) and sand (3 parts) or dibbled in polythene bags of 23 cm x 18 cm. filled with potting mix of 5 parts forest soil, 3 parts sand and 1 part powdered farmyard manure. Seeds were placed horizontally and covered with a thin layer of forest soil. Watering was done twice daily till the seedlings were mature enough for pricking out. Potted seedlings were arranged in the nursery under shade and watering was done twice a day till the onset of monsoon in May-June. The seedling growth was monitored periodica in the nursery.

Wildlings: Wildlings of *O. travancorica* were collected from the ground near the flowered mother clumps at Aryankavu during the north-east monsoon (October 1993). Wildlings of 8 cm to 23 cm length were gently pulled out from the moist forest floor taking care to see that the roots were not damaged. The pulled out wildlings were categorised into two height classes; smaller (height upto 10 cm). and larger (height more than 10 cm, up to 24 cm). and were potted in polythene bags (same size and similar potting mix as used for seedlings). The wildlings were maintained under irrigated condition in the nursery.

Rhizome cuttings: Rhizome cuttings from healthy clumps of *O. scriptoria* and *O. travancorica* were collected during November 1992 to May 1993 from Vazhachal and Kollathirumed Ranges of Chalakkudy Forest Division. Collections were made from five to six year old clumps based on the information from local inhabitants about the previous flowering and fruiting of reed bamboos in the area. The rhizome segments were brought to the nursery, packed in moist forest soil and wrapped with moist gunny bags. These rhizomes were potted. without further delay, in large plastic bags (cement bags of 45 cm x 65 cm) and filled with a mixture of forest soil, sand and powdered farmyard manure in the ratio of 5:3: 1. They were arranged under shade in the nursery and watered twice daily till sprouting. After sprouting, watering was gradually reduced to once daily for the next one month.

Culm cuttings: One to two year old culms were extracted from natural habitat. Their topmost slender portion was discarded. The leaves and side branches were pruned off without causing injury to the nodal buds. The culms were divided into pieces of 1.5 to 2 m length and packed in moist sawdust and wrapped with wet gunny bags so as to keep them fresh, moist and. green during transportation and until1 further processing. As soon as they were brought to the nursery, the culm pieces were again divided into two noded cuttings (KFRI. 1990). A small opening was made at the mid- part of the internode and l00ml of 0.1% Naphthalene acetic acid (NAA) was poured into the cavity. The slit was then closed by tying a polythene stnp tightly around it. These culm cuttings were kept horizontally on treated (Prophylatic treatment against fungus with Bavistin and termites with Chloropyriphos (KFRI. 1990)). nursery beds with the opened portion of the internode facing upwards. A thin layer of sieved forest soil was sprinkled over the treated culm cuttings to keep them embedded in moist soil. Watering was done twice daily up to sprouting and subsequently once a day. During the drier months of March-May shade net was provided in order to protect the sprouts from sun.

2.2. AUGMENTATION OF POOR REED AREAS

Augmentation trials: One hectare of a degraded reed patch at Koilathirumed Range of Chalakkudy Division was identified and demarcated for trial planting. The sparsely vegetated area had very little natural regeneration of reeds and hence looked almost degraded and denuded. The purpose of the trial planting was to study the feasibility of introducing reeds in the area and to evaluate their growth and development in the field. Seedlings (14-months-old) and nursery grown wildlings (8-months-old) of *O. travancorica* were planted at a spacing of 5m x5m in pits of 45cm x 45cm x 45cm during May-June

1994. Fifty seedlings were planted in a plot and four such square plots constituted one block. Another black of 4 plots with wildlings were similarly laid out in an adjacent area.

2.3. ARTIFICIAL REGENERATION THROUGH RHIZOME AND CULM CUTTINGS

Growth performance of rooted culm cuttings and rhizome cuttings was evaluated through another field trial conducted in a degraded site at Kollathirumed adjacent to the augmentation trial plots. Fourteen-month-old nursery grown rooted rhizome cuttings and culm cuttings of *O. travancorica* were used for the artificial regeneration trials. Both types of propagules were massive and heavy and therefore, transportation from the nursery to the planting site was laborious. The rhizome cuttings were planted in square plots with 50 propagules in each plot. Four such plots constituted a block. Similarly a second block of culm cuttings were also planted during the pre-monsoon showers in &lay-June 1994. Planting was done in pits of 45 cm x 45 cm x 45 cm at a spacing of 5 m x 5 m. Both the experiments together extended over an area of one hectare. Assessment of field establishment and growth comparisons were made from the experimental plots.

3. RESULTS AND DISCUSSION

3.1. EVALUATION OF DIFFERENT TYPES OF PROPAGULES

Seedling: Periodic survey during the study period revealed that sporadic flowering and fruiting occurred in **O.** *travancorica* during September-December and in *O.scriptoria* during February-May in 1993 and 1994. Viable seeds of the former species were available from Aryankavu and the latter, from Vazhachal during both the years.

Seeds of *O. travancorica* were dark brown when ripe and oval to oblong in shape. The seeds were the largest in size and 44 seeds weighed 1 kg. The seed length excluding the awn varied between 1.7 cm and 5.2 cm and the pointed awn measured 4.1 cm to 5.7 cm. *O. scriptoria* had purplish brown seeds and 680 seeds made one kilogram. Seeds were comparatively smaller than that of *O. travancorica* and had a length of 2.8 cm to 3.9 cm for the body proper and 2.7 cm to 3.4 cm for the awn.

Seeds of *O. ebracteata* were available from Aryankavu (Table 1) during November and were collected for raising seedlings in the nursery for out-planting. This however could not be done as sufficient number of plantable seedlings were not available in the nursery later at the time of planting. The seeds of *O. ebracteata* were chocolate brown in colour and 222 seeds weighed one kilogram. The seed length varied from 3.2 cm to 4.1 cm and the awn. from 2.9 cm to 3.7 cm.

Fresh seeds are devoid of wrinkles (wrinkles usually develop when the seeds are kept exposed for a long time after collection) gave high percentage of germination (95%) in the nursery (Table 1).

Some seeds of *O. travancorica* exhibited the phenomenon of vivipary. ie.. germination while remaining attached to the mother plant. Usually in *O. travancorica* seed germination commenced from the second day whereas in *O. ebracteata* and *0. scriptoria* germination started only after three days. Germination was over by the 1 1 th day in *O. travancorica,* by 14th day in 0. *ebracteala* and by 17th day in *O. scriptoria*

Table 1. Details on seed collection and germination of different species of *Ochtandra*

Species	Seed collection period	Area of seed collection	Seed weight (no. per kg)	Germination percentage	Germination perod (days)	Plant percentage
O. ebracteata	November	Aryankavu	222	95	2-11	94
O. scriptoria	April	Vazhachal	680	86	3-17	93
0. travancorica	October	Achencoil	44	90	3-14	96

The seedlings being stout and robust, pricking out was possible from the second week of germination. when they had attained 4 cm to 6 cm height. The pricked out seedlings were initially kept under shade and later transferred to the open for hardening. Growth details of reed seedlings from the nursery are given in Table 2.

Table 2. Growth details of *Ochtandra* seedlings in the nursery

Species	Mean height of seedlings at the time of potting (cm)	Mean no. of culms per clump at 14 months after potting	Mean maximum culm height at 14 months after potting (cm)
*O. ebracteata**	5	10	68
O. scriptoria	5	12	73
O. travancorica	6	14	92

'*O. ebracteata* could not be included in the field trials as sufficient number ot plantable seedlings were not available in the nursery.

Comparative growth data at 14 months after potting in the nursery revealed that seedlings of *O. travancorica* showed the maximum culm height as well as number of culms per clump. *O. travancorica* produced a mean maximum culm height of 92 cm with 14 culms per clump whereas *O. scriptoria* and *O. ebracteata* produced lesser number of culms per clump (12 and 10 respectively) and lower culm height (73 cm and 68 cm respectively) during the same period in the nursery (Table 2).

Wildlings

Characteristics and growth: After the sporadic flowering and fruiting of reed clumps, the viable seeds that had fallen on the ground had germinated and formed large number of wildlings. These wildlings were gently pulled out during the North-east monsoon and when usually the soil is moist. They were then potted in polythene bags and used as propagules for outplanting in the augmentation trial plots.

The study revealed that smaller wildlings of *O. travancorica* with a height range of 6 cm-8 cm up to 10 cm were easier to pull out with least damage to the root system. The wildlings have to be potted immediately in polythene bags. With proper shade regulation and timely watenng. the polypotted wildlings of smaller category (average height of 7 cm) recorded 52% survival with a mean maximum culm height of 60 cm after eight months growth in the nursery (Table 3). The 'larger wildlings' (average height of 18 cm) showed poor survival (23%) and establishment, but registered a higher mean maximum culm height and produced more number of culms per clump. However. the mortality rate of 'larger wildlings' in the nursery was high, probably due to the root injury caused while pulling them out from the forest floor. Hence. it is desirable to use the smaller wildlings so as to have maximum number of plantable wildlings in the nursery.

Table 3. Growth details of wildlings of *O. travancorica* in the nursery

Wildling category	the time of potting (cm)	at 8 months after potting	months after potting (cm)
Small (below 10 cm) in height	7	8	60
Large (above 10 up to 24 cm) in height	18	10	62

Rhizome cuttings: Rhizome portions collected during different months (November 1992 to May 1993) and potted in larger plastic sacks in the nursery shoned great variation in their ability to develop new sprouts. Percentage of sprouting was very low during November, December and January in both the

species. However, maximum percentage of sprouting was obtained in rhizome cuttings of *O. travancorica* collected during the summer months of April (63%). May (60%)and March (54%) A similar trend was observed in *O. scriptoria* also though the sprouting ability of the rhizome cuttings was much lower than that of *0. travancorica* was much lower in this case.

The time taken for the emergenceofnew sprouts from potted rhizome cuttings varied considerably in both the species. New sprouts appeared in **O.** *travancorica* from the 11th day up to the 19th day of potting. Faster emergence of sprouts from the rhizomes collected during April-May was also clearly evident. The rhizome cuttings produced new sprouts within 6 days and the emergence was complete by the 14th day. This phenomenon of early sprouting of rhizome cuttings collected during the summer months was not evident in *O. scriptoria.* Further, *O. scriptoria* took a longer period (12-23 days) for sprouting and development as compared to *O. travancorica.*

Even though the rhizome cuttings collected and potted during November 1992-February 1993 produced sprouts, none of them established well or developed into plantable propagules in the nursery. However, the rhizome cuttings collected during March-May 1993 developed into plantable propagules, which recorded higher establishment rates and better growth in the nursery (Table 4).

Table 4. Growth details of *O. scriptoria* and *O. travancorica* propagules raised from rhizome cuttings in the nursery

Month and year of coilection of rhizome cuttings	Period atter potting (months	Percentage of plantable propagules (plant percentage)		Mean number of culms per clump		Mean maximum culm height at 14 months after potting (cm)	
March 1993	15	50	78	16	19	104	120
April 1993	14	53	87	15	20	102	121
May 1993	13	53	83	15	19	98	118

0s - *Ochlandra scriptoria*
0t - *Ochlandra travancorica*

In *O.travancorica* the plant percentage in the nursery at the time of planting (June. 1994) alter 14 months of potting was as high as 87 per cent. These

propagules also developed maximum number of culms per clump and recorded the highest mean maximum culm height during this period. Hence. they were used for field planting. Majority of the rhizome cuttings collected during the months of November to February showed very low percentage of sprouting and they subsequently failed to survive in the nursery. The plgnt percentage was also extremely poor. This indicated that rhizome cuttings collected during November to February may not yield quality planting stock for outplanting.

Culm cuttings: Vegetative propagation through rooting of culm cuttings also followed a similar pattern with maximum rooting and sprouting during the drier months of March-May. Surendran and Seethalakshmi (1985) also reported similar observations. The capacity of culm cuttings to produce maximum rooting and sprouting has been correlated with the high temperature and low precipitation prevailing during the summer months.

The percentage of sprouting was maximum during March-May and less during November-February as in rhizome cuttings. Culm cuttings of *O. travancorica* responded better to hormone treatments and produced more propagules as compared to *O. scriptoria*.

The period between treatment of culm cuttings and the emergence of new sprouts vaned in *O. travancorica* and *O. scriptoria*. During November-March sprouting in *O. travancorica* commenced from the sixth day and continued up to the 13th day. However. during April it took only two days for the sprouts to emerge and no further sprouting occurred after the 9th day from the treated culm cuttings. During May. emergence of new sprouts occurred only on the 5th day and it continued up to the 12th day. On the other hand, the sprouting in *O. scriptoria* was rather erratic and it commenced only after 9 days and continued upto 21 days without any appreciable difference during the summer months of the year.

In nurseries. vegetative propagation by rooting of a single two noded culm cutting can yield upto two plantable propagules under normal conditions. The sprouted propagules from either nodes can be separated and planted as naked or potted plants in the field. Hence, the ultimate number of plantable propagules is much more than that is available from rhizome cuttings (Table 5). This has to be considered as an added advantage of vegetative propagation of culm cuttings for the production of propagules of reed bamboo.

Table 5. Growth details of *O. scriptoria* and *O. travancorica* propagules raised from rooted culm cuttings in the nursery

Month and year of collection of culm cuttings	Period after potting (months)	Percentage of plantable propagules (plant percentage)		Mean number of culms per clump		Mean maximum culm height at 14 months after potting (cm)	
		Os	Ot	Os	Ot	Os	Ot
March 1993	15	97	123	17	17	92	117
April 1993	14	111	131	17	19	92	119
May 1993	13	114	108	13	16	90	111

Os - *Ochlandra* scriptoria
Ot - *Ochlandra travancorica*

Similar to rhizome cuttings maximum plant percentage was obtained from the treated culm cuttings of *O.sriptoria* and *0. travancorica* collected and treated during the summer months of March, April and May 1993 (Table 5). Culm cuttings collected during November-February, though showed some response to the treatments by giving out a few new sprouts, failed to establish as plantable propagules in the nursery. Since the clumps with maximum number of culms were always preferred for field planting (assumingthat they would survive better in the field), in the present study the experimental plots for assessing the field performance of the rooted culm cuttings were planted with 14-months-old propagules.

3.2. AUGMENTATION OF POOR REED GROWING AREAS

Field performance of seedlings and wildlings: Augmentation of poor reed growing areas through artificial regeneration using nursery grown seedlings and wildlings were also attempted. In the case of outplanted propagules of rhizome cuttings and culm cuttings, success of these trial plots greatly depended on the protection of planted area. This is particularly so because reed is a preferred fodder species of wild elephants and majority of the poor reed growing areas lay along their trail paths.

Wildlings proved to be inferior to seedlings in the outplanted site as they were very much sensitive to summer heat and biotic interferences like trampling, browsing and grazing (Table 6).The outplanted seedlings damaged by wildlife

recouped and regained active growth during the succeeding rainy season and this was very rarely observed among wildlings.

Seedlings of *O. travancorica* registered higher field survival of 69% after a span of seven months while wildlings showed only 30% survival during the same period (Table 6). The survival percentage of seedlings and wildlings further declined during the next 21 months, to 40 and 10% respectively in the experimental plots. Mortality of the wildlings was mainly due to the intense summer heat during the year 1995.

Table 6. Field performance of seedlings and wildlings of *0. travancorica* in the augmentation trial plots

Month after planting	Survival %		Mean number of culms per clump		Mean maximum culm height (cm)	
	Seedling	Wildling	Seedling	Wildling	Seedling	Wildling
At the time of planting	100	100	14	8	92	60
7	69	30	19	12	112	64
21	40	10	28	17	152	70

Once established. the seedlings produced more number of culms per clump with maximum culm height (Table 6). One-year-old seedlings proved to be ideal for field planting as their establishment chances and clump growth were evidently superior. Poor establishment of wildlings coupled with poor growth performance in the field, suggest that large scale planting programmes with wildlings should be taken up only if adequate supply of plantable wildlings are ensured.

3.3. ARTIFICIAL REGENERATION THROUGH RHIZOME CUTTINGS AND CULM CUTTINGS

Field performance of propagules raised from rhizome cuttings: Rhizome and culm cuttings potted in plastic bags developed into massive propagules during fourteen months' of growth in the nursery. This made transportation ofrhe planting stock from nursery to the planting site an arduous task. Unlike

the transplanted seedlings or wildlings, these propagules also developed wilting tendencies soon after transplantation, apparently due to the dislodged soil mass and damaged root and rhizome system during transportation. Propagules raised from rhizome cuttings were more susceptible to such damages. However, both type of propagules established well in the field, when planted during the pre-monsoon showers of May-June with sufficient protection from biotic interventions.

Field planting of propagules from culm and rhizome cuttings revealed that culm cuttings showed higher field survival, maximum culm production with better culm length than the outplanted rhizome cuttings in both *O.scriptoria* and O.travancorica The culm cuttings, of *O. travancorica* recorded a maximum survival (72%) in seven months after field planting, whiie rhizome cuttings showed only 49% survival. The rate of culm production was 15% greater in propagules raised from culm cuttings, than those established from rhizome cuttings. The new culms developed from culm cuttings were taller and recorded higher mean maximum height. The same trend continued even after 21 months of field growth with a proportionate increase of 44% in rate of culm production and culm height.

The growth and development of propagules raised from culm and rhizome cuttings of *O.scriptoria* also followed almost a similar pattern as in the case of *O. travancorica*. Initial observations after seven months' field growth showed 52 and 32% survival in propagules developed from culm and rhizome cuttings respectively. The survival declined to 39 and 27% after a span of 21 months. The culm production rate was consistently higher in propagules developed from culm cuttings and was 44% greater than that of rhizome cuttings.

The present study has shown that the propagules developed from culm cuttings are superior and best suited for artificial regeneration of poorly stocked and denuded reed areas. The clumps developed from culm cuttings not only showed better field survival but also produced more number of culms per clump and the individual culms recorded higher mean maximum culm height.

4. SUMMARY

In the present study, four different regeneration methods of reed bamboos have been compared and their field performance assessed. Quality planting stock could be raised in the nursery from seeds, wildlings and, by vegetative propagation techniques like rooting of culm and rhizome cuttings. However, better field establishment, faster growth and, development were always evident when either seedlings or rooted culm cuttings were used for out-planting. The best season for vegetative propagation of reed bamboos is from March-May, the summer months of the year. Artificially regenerated areas are to be protected from elephants for successful establishment of reed bamboo plantations. A package of nursery and plantation practices are given as Appendix 1 for initiating new plantations of reed bamboos.

5. RESEARCH RESULTS OF PRACTICAL APPLICATION

Nursery technique and planting of *O. scriptoria* and *O. travancorica* has been standardised. Step by step procedures are given in the Appendix Successful plantations of reed bamboos is possible provided sufficient protection is given at least during the initial two-three years of field growth.

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Appendix 1

Package of nursery and planting practices of *Ochlandra scriptoria* and *O. travancorica* for introduction in poor and denuded reed growing areas

Four types of propagules viz., seedlings, wildlings, rooted culm cuttings and sprouted rhizome cuttings (offsets) can be used for planting. Although only seedlings and rooted culm cuttings register higher survival and better growth, the other two types of propagules can be considered for field planting depending on the situation.

	Planting material			
	Seedlings	Wildlings	Rhizome cuttings	Culm cuttings
Nursery techniques				
Period for collection	February to May	September to November	March to May	March to May
Method of collection	Fresh seeds either directly from the clumps or uninfected seeds from the forest floor.	From the moist soil beneath the fruited mother clumps.	Rhizome pieces to be collected from pits excavated around healthy mother clumps along with an adjacent culm, cut at the second internode from the soil surface leaving the septum of the first internode intact.	Culms not more than two years and not less than one-year-old to be collected from healthy young clumps.
Criteria for selection	Fresh seeds soon after collection, devoid of wrinkles on the seed coat, not infected or injured.	Wildlings lesser than 10 cm in length, extracted by gently pulling out from the damp forest soil.	The peripheral and young portions of the rhizome system having a number of intact, healthy buds on them.	Portion above the second internode from soil surface up to the sixth or seventh internode depending on the length of the culm. The slender top portion and branches of culms may be excluded.
Method of propagation	Seeds dibbled in polythene bags of 23 cm x 18 cm. Seeds can also be sown in germination beds in which case the seedlings have to be pricked out later to polythene bags.	Wildlings potted in polythene bags of 23 cm x 18 cm. All nursery procedures similar to that followed for seedlings.	The trimmed out rhizome portion along with a culm piece to be potted in large plastic sacks.	The culm pieces prepared into two noded cuttings for growth hormone treatment. Further procedures as mentioned in the KFRI Information Bulletin, 1990.

Following parameters are common for seedlings, wildlings, rooted culm cuttings, sprouted rhizomes

Potting mix	Shade pandal	Watering schedule	Planting material	Planting site	Planting method
The most appropriate potting mix for reed bamboos is a mixture of three parts forest top soil, one part sand and one part dry powdered farmyard manure (3:1:1).	Shade pandal is to be provided in a reed bamboo nursery during the summer months of March to May in order to prevent the scorching effects of hot sunlight.	Watering both in the morning and evening up to the establishment stage of propagules and reduced to once daily and gradually stopped.	One-year-old nursery grown seedlings/ propagules (from culm cutting) are best for field planting as they usually ensure quicker field establishment and better growth.	For artificial introduction of reed partially degraded and shaded sites are best suited though with care and protection it can be introduced in open denuded sites also.	Reed bamboos can be planted at a spacing of 6 m x 6 m in 45 cm x 45 cm x 45 cm cubical pits during the commencement of rainy season in June.