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Research Journal of Agricultural Sciences
An International Journal

P- ISSN: 0976-1675
E- ISSN: 2249-4538

Volume: 12
Issue: 05

Res Jr of Agril Sci (2021) 12: 1804–1810

CARAS

Res. Jr. of Agril. Sci. (Sep-Oct 2021) 12(5): 1804–1810
www.rjas.org

Full Length Research Article

Agrotechnology of *Schumannianthus dichotomus* (Roxb.) Gagnepain: A Less Known Rhizomatous Herb of North East India

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Received: 07 Jun 2021 | Revised accepted: 12 Sep 2021 | Published online: 08 Oct 2021

A B S T R A C T

The matcane of tropical Asia, *Schumannianthus dichotomus*, is an underutilized fiber plant of India. In the north-eastern region of India, the plant is grown for mat production. A significant section of the rural people in Assam's Barak Valley area makes a living by producing handicrafts from the plant locally known as '*Patidoi*' or '*Murta*'. However, the profitability and sustainability of such small-scale enterprises is gradually shrinking from the overexploitation of the species causing shortage of raw materials due to lack of agro-technological support to the cultivators. Considering this fibre factory has the potential to be a huge boon to the rural economy, an attempt has been made to collect germplasms of matcane from wild habitats of the region for development of suitable agro-technological interventions for its profitable cultivation in commercial scale. The current study gives details on the species, production and economics of *S. dichotomus*.

***Key words*:** *Schumannianthus dichotomus*, Indian matcane, Agro-technology, Barak Valley

Indian Matcane [*Schumannianthus dichotomous* (Roxb.) Gagnepain] is an under exploited plant but it has enormous economic potential. It belongs to the family Marantaceae [1], having 20 species within the genus *Schumannianthus*. The plant grows sporadically in Northeastern India. The species occurs in the wild also which are normally small and less robust. Very less attention has been given to this plant species for its improvement and development as far as feasibility studies and cultivation in commercial scale. With wonderful market and commercial value, the plant may play a major role in upliftment of rural economy and women empowerment if cultivated on large scale. The genus is distributed in Assam, Tripura, Cooch Bihar, Coromondal coast (South India), Sylhet (Bangladesh), Tennaserim (Myanmar), Thailand, Cambodia, Cochin China and Philippines [2-3]. In India, the species is locally known as "*Muktapata*", "*Madurpata*" in Bengali, "*Patidoi*" in Assamese, or "*Murta*" in Sylheti [4-5]. It is grown from rhizomes that are immediately planted in the field at a distance of 1 m [6]. A long strip of bark from a mature *S. dichotomus* is used as a raw material for various handicrafts, particularly for making traditional bed mats (known locally as "Sital pati") that are both sturdy and pleasant in the heat [7-8]. It is rapidly depleted in its natural habitats mainly due to over exploitation by the traders for supplying raw materials for artisans of handicrafts and cottage industries, which is basically used by rural people. The species may fall under threat species in near future if collected from natural habitat only and no commercial scale cultivation is encouraged. In Barak Valley of Assam rarely it is cultivated in scientific manner though reports of sporadic plantation are available. The present investigation is expected to through a new light on the agronomy of the plant species and its uses in industry. The findings may be economically beneficial for economic boosting of rural people of North East India. Since the handicraft of Patidoi is carried mainly by the village ladies, small scale entrepreneurship development will empower women of the region and they may become self-employed and economically independent. Keeping this in view the present investigation was undertaken with the following objectives:

a) To collect various species of *Schumannianthus dichotomous* (Roxb.) Gagnepain from wild habitats.
b) To develop a proper agro-technique of the plant species for its profitable cultivation in commercial scale.

MATERIALS AND METHODS

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The present investigation on agro-technique development was carried out at experimental garden of Srikishan Sarda College, Hailakandi during Kharif and Rabi season. The species of *Schumannianthus dichotomous* (2n=20) were collected from different habitats of Barak Valley and evaluated. The germplasms collected were assigned the accession number and maintained in the Germplasm collection center of Srikishan Sarda College, Hailakandi. The techniques and material adopted for the study are described.

Morphology of the plant

Chowdhury and Konwar [10] reviewed the detail morphology of *Schumannianthus dichotomus* (Roxb.) diversity found in Assam. The plant is an erect shrub of ca 3.5m tall, 2cm in diameter without any nodes except the apical portion which is dichotomously branched. The leaves are ovate-oblong in shape with variable size of 8-15cm × 3.8-5cm. Inflorescence panicle with 7.5 to 10 cm. in length and it bears small, white flowers which are 2.5 cm in length. The fruits are 1.5 cm in diameter, indehiscent with 2-3 lobed and each lobe contains single seed.

Experimental site

The experimental garden is situated in Hailakandi district of Assam which is one of the comprising districts of Barak valley and falls between 24°8″ and 25°8″ N latitude and 92°15″ and 93°15″ E longitude and an altitude of 39-40 meter above MSL [11]. The valley is a heterogeneous land composed of hills, low lands and plains. Barak valley includes Cachar, Hailakandi and Karimganj districts, covering an area of 2680 sq. miles. The valley is humid and subtropical in nature. Rainy season generally starts from April and continues till September. More than 70% of rainfall is received during May to September.

Climatic condition

The data collected from Weather information center of S. S. College revealed that December was the coldest month and August is the warmest month. Maximum temperature ranged from 19.09°C to 39.00°C and minimum ranged from 12.00°C to 20.92°C. The average rainfall during the crop season was 2328.02 mm. About 75% of total rainfall occurred during May to September. The sunshine hour was relatively low during the months of July to September. Due to cloudiness and high rainfall, the relative humidity is comparatively high during this period. The data represents for 34 weeks is meant for the period from crop sowing to harvest.

Soil characteristics

To ascertain the soil properties and fertility status of the experimental field, soil samples from the top soil up to a depth of 25cm were collected randomly from five different blocks and subjected for mechanical and chemical analysis. The physicochemical characteristics of soil are depicted in (Table 1). The soil of the experimental site was sandy Loam, acidic, rich in organic carbon, low in Nitrogen and medium in Phosphorus content. The pH of the soil sample ranged from 5.50 to 5.65.

Field preparation

The field was prepared thoroughly by ploughing, followed by planking well in advance and good soil filth was made for quick and uniform sprouting. The weeds and grasses were removed. Finally, the field was made well levelled and the experiment was laid out as per the details explained under selection 3.3. The plots were treated with lime @ 2 t/ha as well as organic manure (farm yard manure) @ 5t/ha which was mixed thoroughly with the surface soil and applied two weeks before planting.

Table 1 Physico-chemical characteristics of soil of experimental field

Characteristics		Method employed with references
A. Mechanical analysis		
Sand (%)	65	International Pipette method (Piper [12])
Silt (%)	08	
Clay (%)	25	
B. Chemical analysis		
Available N (Kg/ha)	156.00	Alkaline Paramagnet method (Subhiah and Asija [13])
Available P_2O_5 (Kg/ha)	30.50	Olsen's Method (Olsen *et al.* [14])
Available K_2O (Kg/ha)	250.00	Flame Photometric method (Jackson [15])
Organic carbon (%)	0.60	Walkley and Black method (Walkley [16])
pH	5.5	Glass Electrode pH meter method (Wright [17])

Planting materials

The germplasm for this experiment was collected from different parts of Barak valley and given accession number (Table 2). The plant material has been maintained at the experimental garden of Srikishan Sarda College. The details of six germplasm of *Schumannianthus dichotomus* (Roxb.) Gagnepain along with their accession number taken under experiment is given in (Table 3). The serial numbers 01 to 05 was used for evaluation studies, while the accession number 06 was used to find out suitable agro-inputs.

Experimental detail

To achieve aforesaid objectives three experiments were conducted. In the first experiment, six germplasms were evaluated, while the second experiment was to find out proper planting time and density. The third experiment was to determine optimum dose of Nitrogen and Phosphorus. The details of the experiments are given here under:

Table 2 List of accessions of *Schumannianthus dichotomus* Gagnep.

Collector's No.	Habitat of Collection
TK-001	Vill -Dwarbond (Loharbond) Dist- Cachar.
TK-005	Vill.- Ratanpur. Dist-Hailakandi
TK-008	Vill.- Durlabcherra, Dist-Karimganj
TK-011	Vill-Vairabnagar. Dist-Hailakandi
TK-013	Vill- Kanakpur, Dist-Karimganj
TK-015	Vill.- Dasgram ; Dist -Karimganj

Experiment No. 1: Evaluation of *Schumannianthus dichotomus* for growth and yield.

Treatment details

The six germplasms were grown in randomized block design (RBD) with three (3) replications at experimental garden of Srikishan Sarda College, Hailakandi. The seed material of each genotype is the piece of rhizome

with active buds of 2.5 – 3.0 cm in size. Rhizome planting was done on 25th May, 2010. The spacing between the rows were 30cm and between plant 30cm. Standard agronomic practices as recommended for *Colocasia esculenta* were followed through the growing season.

Table 3 Treatment and corresponding notation

Treatments	Notation
TK-001	V_1
TK-005	V_2
TK-008	V_3
TK-011	V_4
TK-013	V_5
TK-015	V_6
Treatment	06
Replications	03
Total:	18
Gross plot Size	2.0 m × 2.0m.
Net plot size	1.5 m × 1.5 m
Variety	as per treatment

Experiment No. 2: Response of *Schumannianthus dichotomus* to different time of planting and spacing.

Treatment details

The experiment was laid out in factorial randomized block design (RBD) consisting of 12 treatments, i.e., combinations of three date of planting and four spacing as given below. Each treatment combination was replicated thrice (Table 4).

Table 4 Treatment combinations and corresponding notation

Treatments	Notation
A. Time of planting (D)	
25th May	D_1
30th May	D_2
05th June	D_3
B. Spacing (s)	
30cm × 15cm	S_1
30cm × 30cm	S_2
45cm × 15cm	S_3
45cm × 30cm	S_4
Treatment combinations (A × B)	
T_1: D_1S_1	T_7: D_2S_3
T_2: D_1S_2	T_8: D_2S_4
T_3: D_1S_3	T_9: D_3S_1
T_4: D_1S_4	T_{10}: D_3S_2
T_5: D_2S_1	T_{11}: D_3S_3
T_6: D_2S_2	T_{12}: D_3S_4
No. of treatment combinations	12
Replications	03
Gross plot size	2.0m x 2.0m
Net plot size	1.5m x 1.5m
Accession Number	TK-005

Experiment No. 3: Response of *Schumannianthus dichotomus* to Nitrogen and Phosphorus (Nitrophos) fertilizer.

Treatment details

The experiment was laid out in factorial randomized block design consisting of 16 instruments combinations, i.e., four dose each of nitrogen and phosphorus as given below. Each treatment combination was replicated thrice (Table 5).

Table 5 Treatment combinations and corresponding notation

A. Nitrogen dose (N)	Notation
0 Kg. N/ha	N_0
50 Kg. N/ha	N_1
100 Kg. N/ha	N_2
150 Kg. N/ha	N_3
B. Phosphorus dose (P)	
0 Kg. P_2O_5/ha	P_0
40 Kg. P_2O_5/ha	P_1
80 Kg. P_2O_5/ha	P_2
120 Kg. P_2O_5/ha	P_3
Treatment combinations (A × B)	
T_1: N_0P_0	T_9: N_2P_0
T_2: N_0P_1	T_{10}: N_2P_1
T_3: N_0P_2	T_{11}: N_2P_2
T_4: N_0P_3	T_{12}: N_2P_3
T_5: N_1P_0	T_{13}: N_3P_0
T_6: N_1P_1	T_{14}: N_3P_1
T_7: N_1P_2	T_{15}: N_3P_2
T_8: N_1P_3	T_{16}: N_3P_3
Treatment combinations	16
Replications	03
Gross plot size	2.0m × 2.0m
Net plot size	1.5m × 1.5m
Accession Number	TK-015

Observations (Growth and development attributes)

Plant height

The height of the plants main shoot was measured from the ground level to the tip of the longest leaf and the average height of ten plants was calculated and expressed in centimetre (cm).

Number of petioles per clump

The number of petioles produced by ten tagged plant was recorded and the average number of petioles per clump was calculated.

Yield per hectare

Petioles yield per net plot was converted into q/ha by using the following formula:

$$\text{Petioles yield (q/ha)} = \frac{\text{Net plot yield (kg)} \times 10000}{\text{Net plot area (m}^2\text{)} \times 10000}$$

Feasibility studies

In order to workout economic feasibility of using spacing and fertilizer treatment, the economic yield of the crop was subjected to economic analysis, calculating cost of cultivation, gross and net return per hectare and cost benefit ratio.

Cost of cultivation

Cost of cultivation of different treatments was worked out. The requirement of labor and machines for the different operations were calculated per hectare as per the rate prevailing in the local market. The cost of input such as fertilizer and planting material was calculated based on actual doses/ amount applied.

Gross return

The yield of different treatments was converted into gross return in rupees per hectare based on prevailing local market prices.

Net return

Net return was worked out by subtracting the cost of cultivation from the gross return.

Benefit: Cost ratio

To work out the net return per rupee invested, benefit: Cost ratio was calculated as per the formula given below:

$$B:C = \frac{\text{Net return (Rs./ha)}}{\text{Cost of cultivation (Rs./ha)}}$$

Statistical analysis

Average value of each character for which the data were collected during the year was subjected to statistical analysis. The data were analysed as randomized and asymmetrical two factors factorial experiment in randomized block design (RBD). The results have been interpreted on the basis of F test and critical difference (CD) at 5 percent level of significance.

RESULTS AND DISCUSSION

The genotypes of *Schumannianthus dichotomus* collected from different parts of Barak valley have been assigned the corresponding accession no. and their evaluation was conducted. At same time the genotype of *Schumannianthus dichotomus* collected from Dasgram, Karimganj district (TK-015) has been subjected for experiment to develop its agro techniques.

The treatment effect observed during the field experiment has been described separately for evaluation, time and spacing for planting and application of Nitrogen and Phosphorus fertilizers to the crops. In this paper, these are presented and substantiated with the help of data, tables and suitable diagrams.

Experiment No. 1: Genetic evaluation of *Schumannianthus dichotomus* for growth and yield attributes.
Experiment No. 2: Development of suitable time of planting and spacing.
Experiment No. 3: Effect of Nitrogen and Phosphorus on growth and yield attributes

Experiment No. 1: Genetic evaluation of *Schumannianthus dichotomus* for growth and yield attributes.

Growth and development parameters

Sprouting percentage

The data represented in (Table 6) related that there was non-significant difference in sprouting among the genotype during the year of experiment. However, maximum sprouting was noticed with TK-015 while minimum was with TK-008.

Table 6 Response of *Schumannianthus dichotomus* to sprouting percent

Ecotype (Accession Number)	Sprouting (%)
TK-001	95.00
TK-005	97.50
TK-008	93.60
TK-011	96.00
TK-013	95.70
TK-015	98.00
SE(d) ±	2.40
CD (P=0.05)	5.60

Plant height

The plant height was recorded 6 (six) weeks after planting (6WAP). The maximum plant height was recorded in ecotype Accession No. TK-001 and that of the minimum was in ecotype Accession No. TK-015 after 6 weeks of planting. Finally at the end of 18WAP, the maximum plant height was recorded in ecotype Accession No. TK-015 and the minimum plant height were recorded in ecotype Accession No. TK-013 (Table 7).

Table 7 Influence of ecotypes of *Schumannianthus dichotomus* to plant height (cm)

Ecotype	Weeks after planting			
(Accession No.)	6	12	15	18
TK-001	28.0	46.0	59.0	66.2
TK-005	28.1	55.9	62.1	68.0
TK-008	29.0	46.8	58.0	68.0
TK-011	24.0	38.9	46.7	54.8
TK-013	29.3	42.5	52.7	61.9
TK-015	23.4	48.6	58.0	68.5
SE(d) ±	0.88	2.71	2.79	3.40
CD(P=0.05)	1.95	6.10	6.09	7.41

No. of petioles per clump

The No. of petioles per clump was recorded from ten tagged plant species. It was found that the maximum petioles per clump in ecotype Accession No. TK-008 and that of minimum in Genotype Accession No. TK-011 after 6 weeks of planting. At the end of 18 WAP, the maximum no. of petioles per clump were recorded in ecotype Accession No. TK-015, followed by TK-001, TK-011, TK-013, TK-005 and the minimum No. of petioles per clump were recorded in ecotype Accession No. TK-008 (Table 8).

Table 8 Influence of ecotype of *Schumannianthus dichotomus* to number of petioles per clump

Ecotype	Weeks after planting			
(Accession No.)	6	12	15	18
TK-001	6.95	8.84	12.12	12.57
TK-005	7.03	9.48	11.65	12.13
TK-008	7.68	8.77	10.96	11.95
TK-011	6.26	9.37	11.87	12.07
TK-013	6.87	8.14	11.92	12.26
TK-015	6.28	8.81	12.57	12.64
SE(d) ±	0.254	0.097	0.319	0.267
CD(P=0.05)	0.71	0.60	0.215	0.70

Experiment No. 2: Development of suitable time of planting and spacing.

Growth and development parameters

The data pertaining to sprouting of rhizomes (Table 9), plant height (Table 10) and number of petioles per clump (Table 11) as influenced by time of planting and spacing has been presented below:

Table 9 Response of time of planting and plant spacing to sprouting percentage

Treatment		Sprouting percentage
Time of planting	25thMay	98.80
	30th May	96.00
	05thJune	96.50
	SE (d) ±	2.47

	CD (P=0.05)	5.16
Plant spacing (cm)	30 × 15	90.60
	30 × 30	94.60
	45 × 15	94.44
	45 × 30	95.67
	SE (d) ±	2.40
	CD (P=0.05)	NS

Table 10 Response of time of planting and plant spacing to plant height (in cm)

		Weeks after planting			
		6	12	15	18
Time of planting	25th May	21.9	38.1	48.5	59.1
	30th May	19.5	33.8	49.7	62.3
	05thJune	20.8	35.6	49.9	62.0
	SE (d) ±	0.85	0.95	0.49	0.77
	CD(P=0.05)	1.82	2.03	1.04	1.65
Plant spacing (cm)	30 × 15	15.1	30.2	46.6	57.1
	30 × 30	17.9	32.5	46.0	56.0
	45 × 15	16.3	33.3	49.0	58.0
	45 × 30	18.3	32.8	49.7	59.1
	SE (d) ±	0.74	0.49	0.55	0.56
	CD(P=0.05)	1.58	1.04	1.29	1.32

Table 11 Number of petioles per clump in response to different time of planting and spacing

Treatment		Weeks After Planting			
		6	12	15	18
Time of planting	25thMay	2.98	5.90	7.80	8.09
	30th May	4.10	6.00	8.90	9.10
	05thJune	4.09	6.10	8.99	9.20
	SE(d) ±	0.60	0.55	0.56	0.35
	CD(P=0.05)	1.30	1.15	1.20	0.67
Plant spacing (cm)	30 × 15	3.58	6.60	7.31	7.90
	30 × 30	3.70	6.99	8.30	8.49
	45 × 15	3.42	6.50	8.25	8.18
	45 × 30	3.67	6.90	7.83	8.45
	SE(d) ±	0.48	0.61	0.56	0.31
	CD(P=0.05)	NS	NS	NS	0.52

Experiment No. 3: Response of *Schumannianthus dichotomus* to Nitrogen and Phosphorus fertilizers.

Growth and development parameters

The data presented in (Table 12) related that the maximum sprouting was due to application of 50 kg N/ha which was significantly superior to control. The maximum plant height and number of petioles per clump was recorded in 150 kg N/ha after 18 weeks (Table 13-14).

The plant propagates vegetatively either through transplanted rootstock or cuttings. Rootstocks form twice in a year, in April-May and October-November, when there is no stagnation of water. Propagation can also be done through seeds. Seeds are normally collected in June-August, dehusked and dried in sunlight. The nursery is laid in February-March and the sapling grows in April-May. When the saplings turn 18-20 cm. long or attain two to four leaves stage, they can be transplanted. Four to five seedlings per hill are planted at 20-25 cm distance apart in muddy soil. Fertilizers are not needed initially. However, farmyard manure can be used after weeding and it is to be done at the tiller initiation stage. The process is repeated for the second year from the previous year's plant at maturity. Thus, it takes at least two years to produce the raw material.

Table 12 Effect of nitrogen and phosphorus doses on sprouting

Nitrogen (Kg/ha)	
N_0	93.00
N_{50}	97.14
N_{100}	96.60
N_{150}	95.90
SE(d) ±	1.70
CD(P=0.05)	3.40
Phosphorus doses (Kg/ha)	
P_0	94.93
P_{40}	92.80
P_{80}	96.35
P_{120}	92.18
SE(d) ±	1.68
CD(P=0.05)	3.28

Table 13 Effect of nitrogen and phosphorus on plant height (cm)

Treatment		Weeks after planting			
		6	12	15	18
Nitrogen dose (Kg/ha)	N_0	25.3	34.5	44.1	55.1
	N_{50}	28.9	48.7	60.1	70.72
	N_{100}	29.1	48.8	59.1	71.10
	N_{150}	29.5	48.9	55.9	72.10
	SE(d) ±	2.21	2.16	2.35	3.20
	CD(P=0.05)	3.70	4.42	4.79	6.00
Phosphorus dose (Kg/ha)	P_0	23.5	32.9	44.1	58.20
	P_{40}	28.7	45.9	60.1	68.44
	P_{80}	28.9	48.7	61.5	69.10
	P_{120}	28.4	45.7	60.1	69.82
	SE(d) ±	2.20	2.16	2.35	3.21
	CD(P=0.05)	3.59	4.42	4.49	5.80

Table 14 Effect of nitrogen and doses on number of petioles per clump

Treatment		Weeks after planting			
		6	12	15	18
Nitrogen dose (Kg/ha)	N_0	3.00	5.65	6.75	7.77
	N_{50}	3.70	6.23	6.50	8.24
	N_{100}	3.90	6.40	7.40	8.40
	N_{150}	3.95	6.49	7.50	8.45
	SE(d) ±	0.50	0.27	0.14	0.24
	CD(P=0.05)	NS	0.50	0.29	0.49
Phosphorus dose (Kg/ha)	P_0	2.94	5.60	7.05	8.20
	P_{40}	3.01	6.15	7.35	8.29
	P_{80}	3.45	6.30	7.39	8.09
	P_{120}	2.98	6.20	7.57	8.00
	SE(d) ±	0.43	0.26	0.14	0.22
	CD(P=0.05)	NS	0.54	0.29	NS

Multiplication and raising of seedlings are done either through direct sowing of seeds or cutting of one-year old rootstock. In direct seed sowing, it requires two years' time while in later case only one year for establishment of plants. However, rootstock saplings take a little more time than direct seeded plant for their establishment in soil because roots get damaged the cutting and thus saplings become weak. Later on, when new sprouts are grown from these established saplings, they grow very rapidly and become thick and strong. On the other hand, direct sown seed turns

into plants faster but become comparatively thin and slender due to their dense population. These plants are of superior quality since they yield superior and thin splits for weaving of valuable mats. Harvesting of cane yield starts from third year onward after sowing or transplanting. Once the plants got established and started to yield from 3rd year onward, they continue to grow and yield continues for decades unless plants are abandoned. Therefore, regular weeding and tillage in between the hills are necessary every year during the month of March- April. In order to avoid deterioration of the yield in natural condition or to rotate the crop, harvesting may be done during the 6th year, otherwise the plant can be harvested for its selected canes every fifth year which may be continued till it is abandoned.

This semi-hydrophilic species is attacked by a few diseases and pests. However, little recorded information is available on its susceptibility to diseases. Rats create menace to this plant when water is dried up in the field. They make holes in the root zones. Grazing is not a major problem because the leaves are not favored by cattle. The tender plants got damaged when they splash through the unfenced fields. Birds use these plants for their nests and deteriorate the quality of reed then their faeces stain and contaminate the reed. The plant has strong allelopathic effect which prevents any type of weeds to dominate [18]. Split, polished and glossy stems of the mature plant are used for knitting mats, hats, curios, bags, cushions etc. The strips are separated from the stem and are sorted under different grades. Quality and gradation determine the nature of the split and degree of processing. The rhizomatous portion of the plant yields a commercial starch [19].

Costs and benefits of cultivation

The cultivation of the mat cane is a lengthy process. Weeding and tillage between the hills are necessary during the month of March and April every year. The plant starts yielding in the 3rd year onwards of each new plantation. Dey [20] calculated the total economics of the cultivation and production of *Schumannianthus* based on one location and Hore and Sharma [21] on two different locations. In the present study, author had surveyed different locations of Barak Valley, Assam and interacted with farmers. According to market price of 2005-06, the approximate cost of expenditure for cultivation has been shown in (Table 15). This is based on the survey of rural market where it is sold.

Table 15 Cost of cultivation of *Schumannianthus dichotomus* per hectare

Year	Cultural operations	Amount (Rs.)	Total (Rs.)
First year	i) Seedling	25000.00	30000.00
	ii) Cultivation, planting and fertilizer	5000.00	
Second year	iii) Fencing, weeding, fertilizer application and other nursing activities	5000.00	5000.00
Third year	-do-	5000.00	5000.00
			40000.00

Table 16 Production of mats per hectare and returns over six years of crop growth of *Schumannianthus dichotomus*

Year	Production (Material for number of mats × rate (Rs.)	Amount (Rs.)
Third Year	375 × 15	5,625.00
Fourth Year	725 × 20	14,500.00
Fifth Year	1200 × 25	30,000.00
Sixth Year	2500 × 25	62,500.00
	Total	1,12,625.00

The annual return from the crop starts from the 3rd year onwards. As the “hills” become gradually mature the number of reeds also increases in each subsequent year and the peak yield is attained in the 6th year, when the reeds can also be harvested completely. The quantity of production per hectare of raw material and their corresponding rate in terms of per mat including the manufacturing cost have been shown in the (Table 16). Quality wise harvest from 3rd year’s plant is a bit inferior due to non-glazed and stained surface of the reed (fetching a low rate). During the harvest of the 4th year’s plant, the mature plants are extracted only after they are selected. The rate of these culms is a little more than the third year’s harvest due to the degree of maturity. However, the fifth- and sixth-year’s harvested reeds yield best quality, thus fetching superior price in the market. Now plantations can be done in the same field next year after completely harvesting the previous crop. In this process, the cultivation prevents the deterioration of the field.

When the mats are knit, each mat costs roughly from Rs. 30/- (Rupees Thirty) to Rs. 750/- (Rupees Seven Hundred and Fifty) only depending on the quality and design. It was observed that the profit is approximately five to six times over the investment, which includes the processing and knitting cost. The demand is limited locally due to poor purchasing capacity of the rural people, where as in big towns and cities, the mats fetch a lucrative price.

Future prospects

The cultivation of the crop needs to be boosted up on large scale which can promote the cottage industry in the North-eastern region of India and its neighboring tropical countries. Marshy, waterlogged wastelands can be utilized for the cultivation of such crops that require minimum care and attention. Farmers may be encouraged to cultivate such crop by allotting Panchayet wasteland by the Government /authorities along with subsidized loan for cultivation. Cooperative marketing system will be ideal and may be introduced, so that the farmers may get proper market price for their raw as well as manufactured products. The plant yields sufficient quantity of fiber and can be utilized for manufacturing of paper. If the cultivation extended to large scale and production enhanced, this can be a good substitute of mats prepared from the strips of *Calamus* spp.

CONCLUSION

Besides, the preparation of mats, the fiber may be used for making various artifacts, curios, hats, baskets etc. which can earn some foreign exchange too. At present, the marketing scope is confined to the region but it can be extended to other parts of the country and may even be exported outside the country. Marketing scope will then be widened when more people will come to know about its importance and variety of uses.

Acknowledgement

The authors are grateful to University Grants Commission, North Eastern Regional Office for financial grants for this particular project.

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