

BROOM GRASS BROOM GRASS



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Polybag seedlings of broom-grass



Rhizome cuttings in polythene bags, and rhizome - cuttings ready for plantation

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FOREWORD

Arunachal is blessed with a number of economically important species that are directly useful to the mankind and can form the basis of economic uplift in rural areas. Prominent among them are the Non-Timber Forest Produce (NTFP) like bamboo, canes, thatch, broom grass and medicinal plants.

NTFP can be a means of sustainable land management and a tool for reclamation of wastelands, jhum fallow, etc. Broom grass is one such species suitable for our tropical low hills where land degradation and depletion of forest wealth takes place at a faster pace. This multipurpose grass is indeed a handy species which can thrive in wider and harsher conditions and check soil erosion while improving the habitat and economy of the local people.

Its cultivation has already been successfully taken up as commercial plantations in other states like Meghalaya, Sikkim, West Bengal, etc. Judging from the current trend of its utilization, the demand is steadily growing, and marketing should not be a problem.

The State Forest Research Institute has been exploring to find out forestry crops which can bring immediate benefit to the local inhabitants at the shortest possible time. Based on the researches carried out at SFRI an information bulletin highlighting the cultivation packages for broom-grass and its economics have been prepared. The bulletin deals with all aspects of the crop and will help the interested farmers to take up its cultivation.

I am sure that this publication will be a step toward taking the laboratory findings to the people. There is no doubt that our people who are conservation conscious will accept such economically viable proposition and save the ecology of our fragile hills. While hoping to see more such packages in the interest of the people of Arunachal Pradesh, I congratulate the department for this handy publication.

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THE BROOM GRASS

(*Thysanolaena maxima*)

Vernacular Names: Jhadughas (Hindi), Amliso (Nepali), Taza (Nishi), Kamgang (Adi), Eppane Nani (Apatani), Phool Jhadu (Assamese), Bouquet grass, Tiger grass (English).

INTRODUCTION

Some of the non-timber forest produce species have good potential for generating local employment and can be used for enhancing rural income. Their cultivation is site specific, therefore, selection of a suitable species is very important from ecological and economic point of view. The broom grass is one of such species that can be grown as a cash crop in Arunachal Pradesh for its inflorescences that are used for making brooms. It also provides fuel and fodder during lean period. The brooms of this grass are more durable than those made from other plants such as *Cocos nucifera* and *Phragmites* species. Its cultivation can promote the sustainable use of fragile and degraded lands.

The broom grass (*Thysanolaena maxima* (Roxb.) O. Ktze) belongs to the family *Poaceae*. It is found on the slopes of hills, damp steep banks along ravines and on sandy banks of the rivers. It is distributed widely throughout the country up to an altitude of 2000 m. It grows in tussocks and on an average 4-5 tussocks are found in 10m² area. The culms arise centrifugally during the peak growing season (April to July) and bear inflorescence (panicle) on shoot apex at the end of vegetative growth. The inflorescence that is about 30 to 90 cm long resembles a foxtail and used as broom. This species is very common throughout the North East India.

Morphology

Huge tufted grass, up to 3 m tall, culms solid, leaf-sheaths at least the upper ones, tight, glabrous, terete, smooth, the nodes glabrous, margins with some short stiff hairs towards the throat; blades lanceolate-acuminate, abruptly contracted to a short petiole for a subcordate base, acuminate to a fine point, glabrous, the margins scaberulous, up to 50 cm long and 7 cm wide; ligule a shallow membrane 1-2 mm deep, backed by short stiff hairs; Inflorescence a huge and drooping panicle 60 - 90 cm long or more wide at anthesis, the axis and branches at first rounded, ultimately, capillary, not sharply angled; spikelets numerous, often in pairs on a common peduncle, each pedicel distinct; lower glume clasping, ovate-acute, obscurely 1 nerved, up to 6.5 mm long; upper glume more transparent; lower- lemma lanceolate-acuminate, sub-hyaline, with 1 or 2 long setose hairs near the margin; upper lemma lanceolate-acuminate, 3 nerved, green between the nerves, hyaline thence to the margin, with stiff setose hairs along the hyaline portion on both sides; palea a narrow, 2 nerved, hyaline scale; stamens 2 (3); stigmata 2, plumose; reddish brown, the rachilla continues as a flattened process with an expanded tip, beyond and behind the upper lemma. The aspect of the spikelet's changes with the onset of anthesis when the upper lemma emerges, and its setose hairs gradually adopt a stance at right angles to the lemma's surface.

Natural regeneration

It regenerates through seeds under natural condition. The seeds mature during February to March and disseminate by wind to long distances due to their lightweight. Seed dispersal is also affected by water in some areas. The seed germinates in the beginning of the rainy season.

The seedling establishment and the growth is good on loose and exposed areas such as landslides and freshly disturbed soil especially near road construction sites where light availability is good.

Artificial regeneration

Cultivation of broom-grass is comparatively easy and requires fewer financial inputs. It can be grown on marginal lands, wastelands and jhum fallow. It grows well on a wide range of soils varying from sandy loam to clay loam. The planting can be done by seeds or rhizomes. Some people also collect and transplant the wild seedlings for propagation, but it is always better to get quality seedlings from reputed nurseries.

Nursery techniques

It can be propagated artificially through seeds, rhizomes and wild seedlings transplant. The seeds are generally available in March from senescing panicles. Small mother beds 2m x 1 m are prepared and sowing is done by broadcasting 5 to 10 g seeds in each bed. Seeds are covered with very thin layer of sand and the beds with thatch grass.

Watering is done as and when required. The germination starts after two to three weeks of sowing. The grass cover is removed on germination of seeds and regular weeding and watering is done. After 4 to 6 weeks the seedlings are either transplanted to other beds at a spacing of 10 cm x 10 cm or in the polythene bags filled with a mixture of soil, sand and farm yard manure in a ratio of 1:2:1. Watering and weeding is done regularly till the seedlings are ready for planting in field in the beginning of next rainy season.

The propagules/rhizomes (roots along with culms) are collected by digging of roots from wild or cultivated plants after harvesting the crop during February or March. The culms are cut leaving 15-20 cm long stem with roots and used for raising nursery as well as for planting in the field. Two to three culms along with bud sprouts and rhizomes are separated from clump and planted either in polybags or in field. The mixture of topsoil, sand and farmyard manure in 1:2:1 ratio is used for filling the polybags or pits. During transplanting the soil should have sufficient moisture for plant establishment. The plants are watered as and when required and kept in shade. The rhizomes are easy to transport to long distances for propagation as well as for plantation. The cut ends of culms can be dipped in melted wax to prevent drying and decaying. A small clump of rhizome having culms of 4 to 5 nodes is good for planting and almost cent per cent result is obtained by this method. The sprouted rhizomes are ready within three months for transplanting in the field.

Site development and planting

The planting site must be clean and free from weeds. Thorough jungle cutting should be done before or during March and debris are either burnt or removed from the field. The pits of 30 cm³ are dugout one month before the planting and left for weathering. A spacing of 2.5 m x 2.5 m is the best for plain fertile land and 1600 seedlings are required for planting of one-hectare area. While for jhum lands or hilly areas planting in contour lines or on the bunds of terraces at a spacing of 1.5 x 2.0 m is good and about 2500 to 4000 plants are required for one-hectare area. The farmyard manure and 10% BHC @ 10g per pit are mixed in each pit soil before filling and planting. The spacing may vary with the type of land being used for cultivation. However, good yield can be obtained when it is cultivated on fertile lands. It is generally planted at the onset of monsoon during May - June, when soil has sufficient moisture for plant establishment. Several culms sprout from each plant resulting into a clump of culms from every pit.

It does not require much care after planting. However, 3 to 4 weeding and soil working in the first year and three similar operations in subsequent years are necessary for obtaining good return.

Farmyard manure can be applied in soil during second weeding to get better yield from the first year itself. Fencing is essential to protect the crop from browsing and grazing.

Harvesting and ratooning

Brooms (inflorescences) are harvested on maturity during winter season from January to March. The panicles become tough and its colour changes to light green or red. The harvesting should be done carefully when the brooms have matured properly. The culms are harvested by cutting above the ground, panicles and stem are disjoined. The panicles can also be hand pulled and dried in fields. The woody stem (culms) can be used for fuel, fencing, pulp and paper or other purposes. Young and newly sprouted shoots should not be damaged during the harvest. Brooms (Jhadu) are made by bundling about 30-35 dried inflorescences and sold in the market. It is not a perishable product and can be stored or transported to distant places. The leaves are harvested for fodder once in the middle of monsoon (August) from second year onwards.

The ratoon of this grass can be taken up to 5th or 6th year of planting. Generally, the centre of tussock is devoid of new culms during the 4th and 5th year of planting as they arise from the periphery. To obtain high yield from broom grass, fields are burnt during April after harvesting the crop in 5th or 6th year. The propagules are again planted in June as per the method described earlier. This system is prevailing in hills of Meghalaya and Darjeeling in West Bengal.

Yield

The yield is low in first and fifth year. The highest yield is obtained in the third year. The maximum growth takes place from 2nd year onwards when annual increment in number of culms per tussock is very high. The yield of broom mainly depends upon the quality of planting material, type of land and cultural practices adopted. The yield obtained on plain fertile land at Lathow (Research Station of SFRI) is given in Table 1.

Table1. Growth statistics of broom-grass cultivation

	1 st Year	2 nd Year	3 rd Year	4 th Year
Number of culms per tussock	13-25	54-78	213-275	170-205
Height of tussock (Av.m)	1.56	2.38	3.26	3.10
Inflorescence length (Av.m)	0.95	1.13	1.23	1.15
Dry matter production tonnes/ha.	5.41	8.9	10.4	9.2

Marketing

Brooms are required in each house; therefore, it has sufficient demand throughout the country and marketing is not a problem. The majority of the production is from subsistence farming areas and dispersed collection from the forest, which are inaccessible to transport networks and markets. It is a high-volume crop and there is glut in the market during the harvesting season which reduces the local price. Wholesale trading of brooms is a highly monopolized activity. Major portion of income goes to the traders and middlemen. The farmer gets very meagre amount i.e., about 35% of the retailers' price. Further, its demand in the area of production is very less as other alternatives of brooms are also available locally. Therefore, to improve the economy of people and region, the system of cooperative marketing needs to be developed. The Forest Corporation can play a good role in this venture.

Economics of cultivation

Broom grass cultivation can be a good profitable enterprise. The estimates for cost of cultivation, yield and economic returns of cultivation has been worked out on the basis of experimental plantation raised at Lathow, Namsai (Table 2&3). This information gives a general idea about the economics of cultivation and can be helpful to the farmers and other growers who intends to take up its plantation as a cash crop. However, it varies according to labour efficiency, wages, soil

fertility, cultural practices, market price and demand, etc. The plantation has a rotation of 6 years in which 5 crops are taken annually. Its cultivation can generate approximately ten to twenty thousand rupees in a year from one hectare. The profit can be raised further if brooms (final saleable product) are processed by the cultivator themselves. The planting and establishment costs can be saved to great extent if the individual/farmer and his family members take up the works themselves. The average yield for four years is given in Table 2. The value of the fodder, fuel wood, etc. has not been added in this calculation.

SI.No.	Yield	1 st Year	2 nd Year	3 rd Year	4 th Year
1.	Av. Yield of culms/tussock	18	60	225	180
2.	Total yield of culms (from 1600 tussocks)	28,800	96,000	3,60,000	2,88,000
3.	Total No. of brooms or Jhada (Av. 35 sticks/Jhadu)	822	2740	10,285	8,228
4.	Total income (@ Rs. 4 per Jhadu)	3,288	10,960	41,140	32,912

Other uses

Broom grass is a perennial, high value, non-perishable cash crop for wide range of agro-climatic conditions. It is a multipurpose species which provides brooms, fuel, fodder and has high soil conservation value. It is usually available in large quantities from July to February and is used as cattle feed in the period of fodder scarcity. The decoction of roots of this plant is used as mouth wash during fever. It has the comparative advantage of tolerance to harsh environmental conditions such as steep rocky mountain slopes, shallow soil, drought and high rainfall conditions. Therefore, it is suitable to grow on wastelands, jhum fallow, as well as in homesteads. The fibrous root system of the plant is very useful in checking soil erosion on steep slopes. After the harvest, the broom sticks (stem) are used as wall building material in Assam and other parts of this region. The sticks have also been tried by paper and pulp industries for the manufacture of paper. The cultivation of this grass can wean away the practice of shifting cultivation and reduce the dependence of people on forests.

Table 3. Cost for site development and planting/ ha

SI. No.	Items	Cost in Rupees
1.	Jungle cutting and removal of debris	750.00
2.	Ranging and clearance of lines including stacking for 1600 plants	250.00
3.	Digging of pits 30cm ² , 1600 No's.	750.00
4.	Farmyard manure	500.00
5.	BHC or Gamexine @ 10g/Pit	600.00
6.	Transportation of seedlings and planting	750.00
7.	Weeding and soil working (3 times)	750.00
8.	Harvesting and drying of brooms	500.00
9.	Making bundles, transportation and other expenses	250.00
	Total	5100.00
10.	Cost of seedlings/propagules	3500.00
	Total cost of cultivation for the first year	8600.00
	Maintenance cost in 2 nd and subsequent years	Rs. 2500 per year

Genetic improvement

Genetic improvement is aimed at improving the yield and quality of broom-grass for making it suitable for cultivation and to provide higher economic return. Selection of desirable and superior genotypes is the key of all applied genetic improvement programmes. The objective is to obtain sufficient amount of genetic gain as quickly and inexpensively as possible. All the methods of selection are based on general principle of choosing most desirable individuals for use as parents in breeding and production programmes. The literature on this species is scanty and

no scientific study had been made so far on intraspecific variations, genetic improvement, developing cultivars and cultivation practice, etc. Realizing the problem and importance of this grass for the region, work on genetic improvement and development of suitable cultivation technique was taken up by SFRI, Itanagar. The parameters identified for improvement are: -

- i. sprouting ability of clones or number of culms (tillers) per clump,
- ii. length of panicle or brooms, (ii) height and growth of clumps,
- iii. toughness of rachis and softness of ultimate floral branches, (v) number of floral branches per inflorescence, and
- iv. disease and pest resistance.

A large population of the grass were surveyed in different parts of this region and observations on desirable characters viz., length of inflorescence, total number of shoots, number of new shoots and growth of tussock were recorded. The improvement was made through the selection of desirable type clones i.e. plus tussocks (superior clumps) from a wide population by keeping broad genetic base and following the criteria fixed for each parameter. A total of 94 plus tussocks were selected from Rupai, Kakopathar, Jairampur, Tengapani and Lohit district of Assam and Arunachal Pradesh. During the study considerable variations have been observed in colour and size of the inflorescence and number of culms per tussock, which are the main economic part of the plant. Some plants have strong, brown and short inflorescence and fetch more price to the growers while the other ones with long, green, and slender inflorescence fetch less price in the market. Observations on the different parameters are being recorded regularly to evaluate their performance and facilitate the culling of inferior ones. Most of the tussocks have shown very promising growth during the second and third year of planting. These have been multiplied and distributed to the local growers for planting.

Ex situ conservation

The gene pool of broom grass is depleting rapidly mainly due to biotic pressure and developmental activities. The major causes are seedling mortality due to browsing and grazing, depletion of seed bank and conversion of forest lands for cultivation and construction purposes, etc. Large-scale collection of panicles before senescence and dispersal of seeds from brooms impoverishes the soil seed bank.

To conserve the depleting gene pool of the species, germplasm banks have been established at Lathow and Chessa research centres of the institute in which selected tussocks and other accessions of different areas have been planted. The collections from Meghalaya, Mizoram and other different places are still being added to enrich the germplasm bank.

SFRI has established a demonstration farm of broom-grass at Lathow, Research Range, Namsai under the financial support from WWF. Training programmes have also been conducted for the local people. The response is quite encouraging, and efforts are being made to popularize this species into other parts of the state.



Left: Sprouting of rhizome cuttings in nursery beds at Namsai. Right: Broom and stem cuttings (used for house construction).



Left: Training of local farmers at Namsai. Right: Planting of broom-grass by trainees at Lathow, Namsai