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Promotion of Ramie Fibre Crop in *Jhum* Fallow Area of Wokha District in Nagaland-A New Initiative

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ABSTRACT

Ramie (*Boehmeria nivea* L.) is recognized as the strongest and longest natural fibre having manifold uses. The field experiment was conducted in 2 villages covering an area of 6 ha under the frontline demonstration (FLD) during 2014-2017 to assess the performance potential and productivity of ramie (variety-Hazarika) in the jhum fallow lands of Wokha district in Nagaland. The training cum demonstration programme was conducted on the package of practices of ramie cultivation before initiation of the experiment in the farmer's field. A total of 3, 60,000 numbers of ramie plantlets was planted in farmers participatory approach to cover an area of 6 ha. The result of the demonstration revealed that the ramie performed very well in jhum fallow lands and yield ranged from 16.21 to 18.15 q/ha/year. The average cost of ramie cultivation during the study period was Rs. 18,500/ha. The economic analysis of ramie cultivation revealed an average net annual income of Rs. 39,918 /ha with a B: C ratio of 3.16:1. From the study, it can be concluded that fibre production through the introduction of ramie is not only a viable options for jhumias for income enhancement but also it helps to manage jhum fallow land in a sustainable manner.

1. Introduction

Ramie (*Boehmeria nivea* L.) is considered as the oldest and valuable fibre crop, which is classified as an underutilized fibre. It is one of the strongest natural fibres having rich in cellulose content. Despite of the high potential and unique quality of fibre, ramie has received comparatively less prominence in the world due to various techno-economical reasons. China is the biggest producer of ramie followed by Brazil and Phillippines (Jose *et al.,* 2017). In India, ramie cultivation mainly confined in few areas of North Bengal and Assam and therefore, a huge scope is existing for expansion of area for ramie cultivation particularly in North Eastern Region of India. The cultivation practice of North Eastern Hill (NEH) region, including Nagaland is largely dominated by jhum or shifting farming system. The process of jhum farming involves cutting and burning of forest and finally land left as abundant only after 1-3 years of cultivation for regeneration of soil fertility, which forced them to select a new forest site to repeat the same process. Presently, the system is characterized by low productivity and low income associated with numbers of inherent problems such as soil erosion, loss of nutrients and biodiversity. Of late, such problems accentuating due to reduction of jhum cycle to 3-5 years as compared to 10-15 years in the past. Now, the system is becoming an unsustainable and non-profitable and failure in providing food and livelihood security (Mantel *et al.,* 2006). In spite of several limitations and environmental implications, huge numbers of tribal farmers are still involved in this system. At present, nearly 4.43 lakh tribal families is associated with jhum cultivation to earn their livelihood and a large proportion of land (3,86,900 ha.) is estimated to be brought under jhum cultivation in the North East region every year (Patiram and Verma, 2001; Choudhury and Sundriyal, 2003). Likewise, 1.9 lakh tribal families are still practicing jhum cultivation covering an area of 1.24 lakh ha of Nagaland (ICAR, 2015). Therefore, complete eradication of this method of cultivation is practically not possible.

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Around 3 million hectares of land in the region have come under different types of soil erosion hazards as a consequence of jhum cultivation (Mandal, 2011). Kushwaha and Ramakrishnan (1987) suggested some viable alternative jhum fallow management strategies by involving banana and/or pineapple plantation in the jhum fallow system. Arunachalam and Arunachalam (2002) recommended that the utilization of bamboos in eco-restoration is a viable option for managing 'jhum' fallow system. Tawnenga and Tripathi (1996) also hypothesized that if second year cropping in jhum fields is essentially introduced, the dependence of the shifting cultivators on the forest could be reduced to almost one-half. Whatever possible alternative jhum fallow management suggestions were made by the researchers, most of them are not practically adopted by the tribal jhumias. Hence, an appropriate post jhum management strategy is the paramount importance to be promoted in jhum areas to sustain the livelihood of tribal people. Under this circumstance, cultivation of ramie crop could be a viable intervention for the jhum fallow system because of its perennial surviving ability, extensive life span, 4-6 times annual harvesting and adaptive capability in wide range of soil and agro-climatic conditions. Keeping the above facts in view, a frontline demonstration (FLD) programme was conducted to promote the ramie fibre crop cultivation through a cluster approach in jhum fallow areas of Wokha district in Nagaland to find out the potential productive capacity of ramie, to assess the economic benefits of ramie cultivation and changes in soil fertility status and crop performance.

2. Materials and Methods

2.1 Study area

The experiment was initiated in the year 2014-15 at two different villages *viz.* Humtso and Yithum village of Wokha district on farmer participatory. The location is situated in between 26005'037" N to 26006'437" N latitude and 94012'110" E to 94012'980" E longitude and 527 to 1125 m above the mean sea level.

2.2 Soil status

Soils of the site were clay loam in texture. According to rating limits of soil test values (Muhr *et al.,* 1965; Soltanpour and Schwab, 1977), soil pH (4.22) was extremely acidic in nature, high in soil organic carbon (2.42%) content, low in available nitrogen (177.21 kg/ha) content, very low in available phosphorus (12.0 kg/ha) content and very high in soil available potassium (256.48 kg/ha) content respectively.

2.3 Ramie production technology details

Ramie plantlets (variety: Hazarika) were grown to cover in the targeted area of around 6ha and frontline demonstration (FLD) on improved ramie cultivation technology was conducted during the year 2014-15 in undulating jhum fallows involving 9 numbers of jhum farmers. Before implementation of the FLD, a training programme was organized on production technology of ramie cultivation. The full package of practices was followed with special emphasis on soil and water conservation measures, fertilization based on initial soil nutrient status, maintenance of adequate spacing (30 cm x 60 cm) and planting across the slopes. At the harvesting stage of crop, hands on training cum demonstration programme on ramie fibre extraction were also conducted for 30 farmers using ramie fibre extraction machine at the FLD site.

2.4 Estimation of yield and fibre production

Ramie rhizome yield data was collected from the each demonstrated farmer fields through random plot cutting method in three replications at each and every harvesting stage of the year. After that, fibre was extracted from the cane and data of raw fibre production were also recorded. The fibre production conversion ratio from cane to fibre was also estimated during the period of crop harvest.

2.5 Economic analysis of FLD on ramie

Cost of cultivation of ramie crops, including cost of farm inputs such as fertilizers, pesticides and hiring of additional labour during planting, weeding and post harvesting operations. The family labour and cost of plantlets were not taken into consideration in the present study. The gross and net returns were worked out accordingly by taking the cost of cultivation and raw fibre yield per hectare.

3. Results and Discussion

3.1 Crop performance and productivity

In the present study the cultivation of ramie was found to be a successful technological intervention in the jhum fallow area. It was noticed that the planting time of ramie during the month of February-March was ideal and the crop was harvested in four times of the year successfully. The annual ramie crop cane (ramie stem) yield was recorded to be 17410.67 kg/ha and 19410.67 kg/ha (Table 1) after the 1st year and 2nd year of planting respectively. Similarly, fibre yield was 1621 kg/ha in 1st year and 1815.33 kg/ha (Table 2) in 2nd year. Relatively higher cane and fibre yield was

Table 1. Year and season-wise ramie cane yield

Year	Value	Fresh ramie cane yield (kg/ha) in different cuttings				Fresh cane yield (kg/ha/annum)
		1st	2nd	3rd	4th	
2015-16	Mean	4008.67±148	4497.00±216	4378.33±153	4526.67±205	17,410.67
	Range	3859-4155	4250-4652	4211-4512	4300-4700	16,620-17,813
2016-17	Mean	4467.33±216	4953.33±61	4802.67±115	5187.33±146.5	19,410.67
	Range	4230-4652	4890-5012	4698-4925	5085-5355	19,295-19,552

Table 2. Year and season-wise ramie fibre yield

Year	Value	Ramie fibre yield (kg/ha) in different cuttings				Raw fibre yield (kg/ha/annum)
		1st	2nd	3rd	4th	
2015-16	Mean	382.33±13.57	410.67±4.51	399.67±11.06	428.33±6.51	1621±14.00
	Range	368-395	406-415	388-410	422-435	1611-1637
2016-17	Mean	411.33±10.5	465.67±12.89	462.67±8.02	475.67±10.07	1815.33±13.43
	Range	401-422	455-480	455-471	465-485	1800-1825

Figure 1. Ratio of fibre in ramie cane in 1st year.

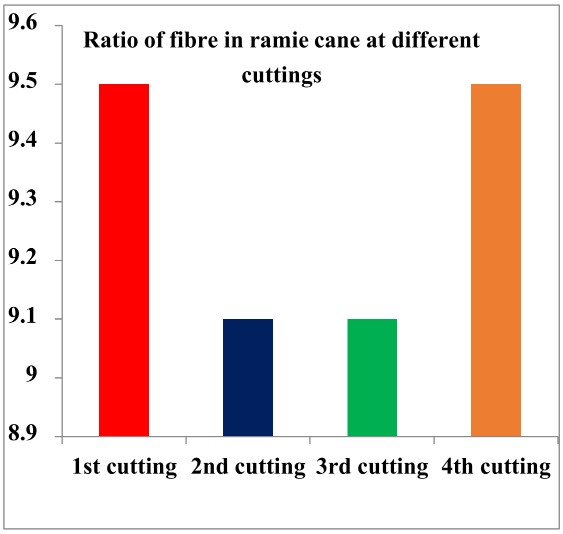
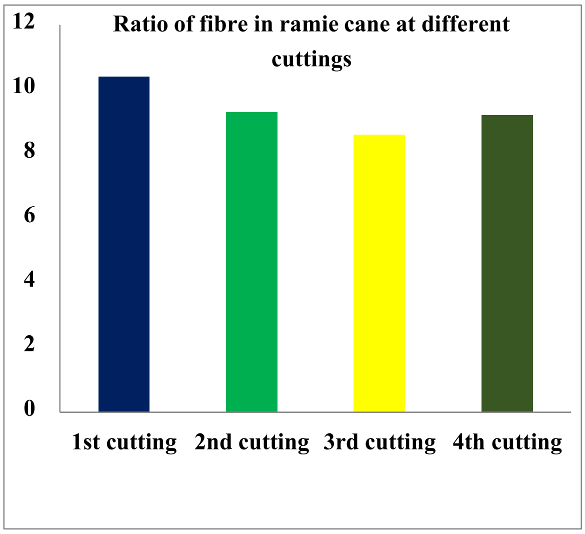


Figure 2. Ratio of fibre in ramie cane in 2nd year.



noticed in 2nd years of harvest. The higher yield in 2nd year might be due to better root establishment that helps to absorb adequate water and nutrients from both the surface and sub-surface soils. Further, it was recorded that the mean cane (ramie stem) yield in each cuttings (harvest) were ranged from 4008.67 to 4526.67 kg/ha and 4467.33 to 5187.33 kg/ha (Table 1) in 1st and 2nd year after planting respectively. Likewise, mean raw fibre yield in each cuttings were also ranged from 382.33 to 428.33 kg/ha and 411.33 to 475.67 kg/ha (Table 2) in 1st year and 2nd year respectively. The highest quantity of cane harvest was recorded in 4th cuttings followed by 2nd cuttings and 3rd cuttings and the lowest harvest was in the 1st cuttings in both the cultivating years.

The cane yield was recorded highest in the 4th cuttings irrespective of the years which might be due to favourable temperature and rainfall distribution during the growing period that creates optimum soil and crop growth environment for better performance as compared to the other growing seasons. The fibre content in ramie cane was ranged from 9.1 to 9.5% (Figure 1) in the 1st year of harvest, whereas in 2nd year these ratios was altered considerably with values ranged from 8.6 to10.4% (Figure 2). Relatively higher percentage of fibre indicated that the better quality of harvest. However, in both the year moderately less harvest was obtained in 1st cutting but the superior quality of fibre was achieved.

3.2 Economic analysis

The cost of ramie cultivation was Rs. 21,300/- and Rs. 15,700/- per ha for 1st and 2nd year respectively (Table 3). The highest expenditure was involved in 1st year of cultivation, which was due to additional manpower involvement for planting of ramie plantlets. The gross returns was found higher in 2nd year (Rs. 61,721/-) than the 1st year (Rs. 55,114/-). This might be attributed to the higher annual production obtained in 2nd year. The two years net revenue varied widely from Rs. 33,814/- (1st year) to Rs. 46,021/-(2nd year) per/ha (Table 3) with average net income of Rs. 39,918/-. The higher net revenue was calculated in 2nd year due to the less cultivation cost and higher fibre production. The average B: C ratio was recorded as 3.16:1 from two years of ramie cultivation.

3.3 Changes in soil health status

The results indicated that the continuous cultivation of ramie in *jhum* fallow plays an important role to maintain the soil fertility status to some extent as compared to the uncultivated *jhum* fallow system. The result showed that soil pH increased significantly (4.52) from its initial soil pH value of 4.22 after two years of planting (data not shown). Implementation of a proper soil and water conservation measures and use of weed biomass as mulching materials also helped to increase soil organic carbon and residual available N content by 0.74 to 12.2%. The residual phosphorus and potassium marginally decreased by 8.2 to 21.6 % of their initial soil P and K value of 12 kg/ha and 256.48 kg/ha respectively.

Conclusion

From the present study, it could be inferred that the cultivation of ramie fibre crop could be a viable technological intervention for management of *jhum* fallow areas leading to an income generating avenue for the *jhumias*.

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Table 3. Economic analysis of ramie cultivation

Year	Raw fibre production (kg/ha)	Cost of cultivation (Rs.)	Gross returns (Rs.)	Net returns (Rs.)	B:C ratio
2015-2016	1621.00	21,300	55,114	33,814	2.59:1
2016-2017	1815.33	15,700	61,721.2	46,021	3.93:1
Mean	1718.17	18,500	58,417.6	39,918	3.16:1