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RESEARCH ARTICLE

Economic Analysis of Jhum Farming System of West Garo Hills, Meghalaya

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Abstract

This study focuses on the economic dimensions of Jhum cultivation- a traditional slash-and-burn agricultural practice, among indigenous communities in the West Garo Hills District of Meghalaya. By examining production elements, the research aims to identify opportunities for improving farming techniques and enhancing the livelihoods of Jhum farmers. In the study researcher identified that the Darechikgre village has the largest share of Jhum land (24.58%) while Rengsangre has the smallest (15.08%). The participants' literacy levels vary across the study area, with most farmers having completed secondary education. The average cost of cultivation (Cost A1) per hectare differs by village: Rs. 4879.20 in Darechikgre, Rs. 3081.60 in Waribokgre, Rs. 3819.90 in Asanang, Rs. 2996.00 in Rengsangre, and Rs. 4280.00 in Chandigre. Jhum cultivation follows the principles of natural farming and does not incur additional cost for irrigation and manure. Significant variability in production costs, gross yield, total revenue, and benefit-cost (B:C) ratios is observed across the study area, with soil fertility, climate conditions, and agricultural techniques influencing yield differences. Darechikgre, with a B:C ratio of 1.8, is the most profitable, while Asanang (0.5) and Rengsangre (0.6) operate at a significant loss. The overall B:C ratio for the Rongram block is 1.2, indicating that, on average, the regions are operating at a profit. A regression model was used to assess the factors affecting productivity, showing that total Jhum land, Jhum experience, and quantity of seed significantly influence total production.

Keywords: Jhum cultivation, Natural farming, Sustainability, B:C ratio, Cost of Production.

Introduction

Jhum cultivation, also known as shifting cultivation in India, refers to a method of agriculture where land is first cleared for farming, then cultivated for a period, and later left fallow for several years to allow natural forest regeneration. Apart from the plains of Assam, Manipur, Meghalaya, and Tripura, this practice is common among tribes in the hilly regions of India's north-eastern states. Those who engage in this form of cultivation are known as «Jhumiyas» (Choudhury, 2012). Typically, the cycle of cultivation followed by fallow periods spans several years, sometimes even a decade. In the entire North Eastern Region (NER), around 19.91 lakh hectares, which accounts for 83.73% of the total area under shifting cultivation, accounts for 5.51% of the total geographical area (Mandal, 2011). Like its neighbouring states, Meghalaya is also well-known for its practice of shifting cultivation

According to the National Sample Survey (NSS) 70th survey, the 29 states and 7 Union Territories, the North Eastern Region of India, followed by Bihar, Jharkhand, and Odisha, recorded the highest number of families involved in shifting cultivation. The eight states of Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura form the Himalayan region of north-eastern India. This region accounts for about 4% of the country's total population and 7% of its total land area. Approximately 57% of the land in this region is covered by forests, most

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of which are owned by private or public institutions. Agriculture provides the primary means of livelihood for the majority of the rural population. In the mountainous areas of north-eastern India, shifting cultivation, or «Jhum Kheti,» is the predominant farming method according to Wangpan and Tangjang (2012). This agricultural practice is crucial for millions of people connected to the socio-cultural, ecological, and economic aspects of the region's highland tribal communities, who rely on it for their livelihood.

Meghalaya, one of the seven sister states in Northeast India, is predominantly hilly and inhabited by the Khasi, Jaintia, and Garo tribes. Over 80% of Meghalaya's population relies on agriculture, making the majority of the state's residents farmers (Government of Meghalaya, 2022). Estimates suggest that between 2010 and 2011, approximately 8,400 sq. km. in Northeast India was under shifting agriculture, with 448.99 sq. km. in Meghalaya alone (Ramakrishnan 1992; Jeeva *et al.* 2006). A detailed financial analysis of these crops' viability is necessary to fully realize their potential.

The economic analysis of Jhum cultivation helps identify the major and minor fixed and variable costs associated with cultivation. Cost estimation is done using a participant worksheet, which includes details on the farmers' demographics, crops used, seeds, labor, irrigation, intercultural activities, production, marketing, and other operational costs.

Methodology

The study is based on both primary and secondary data. A multi-stage sampling was used. Five villagers were purposively selected and within each village, 10 farmers were randomly selected. Thus, the total sample size consists of 50 farmers. Personal interviews were conducted to gather information on various aspects such as crops grown, duration of practices, production, total land holdings, Jhum land holdings, irrigation, and operations. The information gathered was based entirely on the farmer's recall. Similarly, secondary data for the study were obtained from sources such as the Government of Meghalaya, Population Census Data, Community and Rural Development (C&RD) Blocks, published papers, journals, relevant literature reviews, and annual publications from relevant institutions.

The study area selected is the Rongram Block of Meghalaya, located in the eastern region of the West Garo Hills. Rongram Block covers a total area of 603.7 sq. km and has a population of 58,745. In this region, 100% of the sample farmers practice a combination of Jhum and settled farming (Kar and Mathew, 2016). The Garo people, who live locally, belong to a matrilineal society. The climate is cold in winter, with relatively high temperatures during most of the year, and the average annual rainfall is 330 cm. The area is largely covered by tropical mixed forests, with a small portion consisting of temperate forests. Jhum cultivation is carried out on community land under the authority of the village chief, or Nokma, in each village in the Garo Hills (Das & Das, /cm 2014).

Out of the eight blocks in West Garo Hills, Rongram Block was purposely selected based on data provided by the director of the district's farm science centre and the district forest officer. The selection criteria included the highest density of households practicing Jhum and the extent or intensity of its practice.

Cost of Cultivation of Jhum Cultivation

The cost of cultivation was worked out by using various cost concepts defined by the special committee of the Government of India.

Cost A1

All the fixed costs in production by the owner and all the variable costs, excluding family labour cost, including

Cost A2

Cost A1 + rent paid for leased-in land

Cost B1

Cost A1 + interest on fixed capital (excluding land)

Cost B2

Cost B1 + rental value of owned land + rent for leased-in land

Cost C1

Cost B1 + imputed value of family labour

Cost C2

Cost B2 + imputed value of family labour

Cost C3

Cost C2 + 10 percent of cost C2 as management cost.

Cost of production

The cost of production was calculated by using the following formula:

$$\text{Cost of production/qt} = \frac{\text{Cost of cultivation/ha}}{Quantity\ of\ main\ product/ha}$$

Benefit Cost Ratio

$$\text{B:C ratio} = \frac{Total\ Revenue}{Total\ Cost}$$

The Factors Affecting Jhum Cultivation

In the present study linear regression model was used to study various independent factors affecting the jhum cultivation.

The specific form of the model is set as follows:

$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots\ldots + \beta_n X_n + u$

Where,

y = Total Production of Jhum farming(kg/ha)

x_1 = Age of farmers (years)

x_2 = Jhum farming experience (Years)

x_3 = Jhum land (ha)

x_4 = Quantity of seed (kg)
x_5 = Total labour-man-days
x_6=Education level of Farmer
a = intercept (constant) term
$b_1 – b_5$ = Regression coefficient estimates
u = Random error or disturbance term

The dependent variable is the total production of Jhum farming, while the independent variables will include the Education level, Jhum land (Ha), Quantity of seed, Jhum Practising since (years), age of farmers, and total labour person-days (Shresthaa *et al.*,2021; Tun and Kang, 2015; Shah *et al*., 2020).

Results & Discussions

Table 1 shows the average village-wise cost of cultivation for Jhum cultivation in the West Garo Hills district of Meghalaya. The average cost of cultivation (Cost A1) per hectare was Rs. 4,879.20 in Darechikgre, Rs. 3,081.60 in Waribokgre, Rs. 3,819.90 in Asanang, Rs. 2,996.00 in Rengsangre, and Rs. 4,280.00 in Chandigre. The average cost of cultivation and expenditure on seeds was not calculated for these five villages because Jhum farmers in Rongram Block did not purchase seeds, instead using preserved seeds from the previous season's harvest. Similar findings were reported by Sati (2019), who noted that most agricultural seeds were traditional and saved from past harvests.

According to the study, the average cost of hired labor per hectare was Rs. 4,560.00, Rs. 2,880.00, Rs. 3,570.00, Rs. 2,800.00, and Rs. 4,000.00 for the same villages. As per Government of India (GoI) guidelines, the interest on working capital was charged at 7% for each of the five villages. The high cost of hired labor is attributed to the distance of these villages from the nearest town, Tura, and the main road, as well as the limited transportation facilities.

In costs A2, B1, and B2, the expenses remain similar to those of A1. This is due to the unique land distribution system in Garo communities, where there is no rental value for land. Jhum land is allocated based on family size, with the plot size determined by the amount of food needed and the labor available. The larger the family, the more moral support and hands are available to help rearrange the agricultural plot (Gupta, 2005).

Farmers in the study area rely on the monsoon to cultivate crops on Jhum land. In terms of family labor, when assistance is received from another family, the support must be reciprocated with an equivalent amount of labor on the other family's Jhum plot. According to observations, Chandigre village has the lowest cultivation costs (Rs. 10,687.60 per hectare), while Darechikgre village has the highest (Rs. 19,623.12 per hectare). The main reason for this variance is the differing value attributed to family labor. Villages like Darechikgre and Asanang, which rely heavily on implicit family labor, experience significant cost increases. This underscores the importance of family labor in the cultivation process and its impact on the overall economic burden on farming households.

Jhum cultivation, as a traditional farming practice, incurs no additional costs for irrigation or manure, as it relies entirely on natural processes. Table 2 provides a detailed breakdown of various cost components associated with agricultural practices in the West Garo Hills region. The analysis reveals several critical insights: hired labor costs amount to Rs. 3,562.00 per hectare, which constitutes a significant portion of Cost A1. This finding aligns with the results of Singh and Kaur (2018), who reported that labor costs were the most important variable. The value of hired and family labor is calculated based on the number of hired or family workers, the number of man-days, and the daily wage rates. This indicates that labor is a substantial component of agricultural expenses in this region. The average cost of cultivation (Cost A1) per hectare was Rs. 3,811.34. Additionally, there are no expenditures on hired bullocks, machinery, or manure, suggesting a reliance on manual labor and traditional farming methods.

The cost of land in Garo villages remains similar to Cost A1 due to the absence of rental value for owned or leased land and a lack of interest in capital assets. A distinctive feature of Garo communities is their land distribution system, where Jhum lands are allocated according to family size. Their food requirements and available labor determine a family's cultivation plot size. The larger the family, the more hands are available to assist in rearranging the agricultural plot.

In many villages, particularly in the northeast, lands are divided into different Jhum blocks based on the shifting cultivation cycle of the area or village. In Rongram Block, the Jhum cycle has decreased to 5–6 years, during which plots are assigned to farmers with the restriction that they can only utilize them for farming. This explains the lack of rental value for owned or leased land in these villages or the Rongram Block.

The imputed value of family labor, at Rs. 9,461.00, indicates that family labor plays a crucial role in farming activities. When adding management input at 10% of the total costs, the final cost (Cost C3) amounts to Rs. 14,599.57 per hectare, reflecting the importance of considering management efforts in the overall cost structure.

Table 3 indicates significant variability in the cost of production, gross yield, total revenue, and benefit-cost ratio across the five villages. The cost of production per kilogram varies widely, ranging from Rs. 5.83 per kg in Rengsangre to Rs. 10.56 per kg in Chandigre. Gross yield also shows variation, with the highest yield recorded in Darechikgre at 1,944.44 kg and the lowest in Chandigre at 1,333.33 kg. This finding is consistent with Sati (2019), who reported that the highest production is obtained from ginger and cabbage, while the lowest production comes from pumpkin and

Table 1: Village-ise Estimation of Cost of Cultivation of Jhum Cultivation in West Garo Hills, Meghalaya

Particular	*Darechikgre*	*Waribokgre*	*Asanang*	*Rengsangre*	*Chandigre*
Cost A1					
Value of hired labour	4560.00	2880.00	3570.00	2800.00	4000.00
Interest on working capital	319.20	201.60	249.90	196.00	280.00
TOTAL	4879.20	3081.60	3819.90	2996.00	4280.00
Cost A2					
Cost A1	4879.20	3081.60	3819.90	2996.00	4280.00
Rent paid for the leased land	0	0	0	0	0
TOTAL	4879.20	3081.60	3819.90	2996.00	4280.00
Cost B1					
Cost A1	4879.20	3081.60	3819.90	2996.00	4280.00
Interest on value of own capital assets	0	0	0	0	0
TOTAL	4879.20	3081.60	3819.90	2996.00	4280.00
Cost B2					
Cost B1	4879.20	3081.60	3819.90	2996.00	4280.00
Rental value of own land	0	0	0	0	0
TOTAL	4879.20	3081.60	3819.90	2996.00	4280.00
Cost C1					
Cost B1	4879.20	3081.60	3819.90	2996.00	4280.00
Imputed value of family labour	12960.00	8130.00	9695.00	6720.00	9800.00
Total	17839.20	11211.60	13514.90	9716.00	14080.00
Cost C2					
Cost B2	4879.20	3081.60	3819.90	2996.00	4280.00
Imputed value of family labour	12960.00	8130.00	9695.00	6720.00	9800.00
TOTAL	17839.20	11211.60	13514.90	9716.00	14080.00
Cost C3					
Cost C2	17839.20	11211.60	13514.90	9716.00	14080.00
Value of management input at 10% of total	1783.92	1121.16	1351.49	971.60	1408.00
TOTAL	19623.12	12332.76	14866.39	10687.60	15488.00

eggplant in both years. This explains the higher gross yield in Darechikgre and the lowest yield in Chandigre. Total revenue ranges from Rs. 15,829.60 in Rengsangre to Rs. 32,110.56 in Darechikgre. The variation in revenue is closely linked to the gross yield and the price at which the produce is sold.

The benefit-cost (B-C) ratios in Darechikgre and Chandigre are greater than one, indicating that revenue exceeds production costs, making these operations profitable. In contrast, the B-C ratios in Waribokgre, Rengsangre, and Asanang are less than one, suggesting that production costs exceed revenue, resulting in a loss. Darechikgre, with a B-C ratio of 1.8, is the most profitable, while Asanang and Rengsangre, with B-C ratios of 0.5 and 0.6, respectively, are operating at significant losses. The overall B-C ratio for Rongram Block is 1.2, indicating that, on average, the region is operating at a profit.

These results are consistent with findings in West Garo Hills for rice crops grown on Jhum land, where the net return is highest for Jhum cultivation, and the benefit-cost ratio over total cost is approximately 1.68. This implies that Jhum rice, cultivated organically, is an economically beneficial venture for farmers. According to Sati (2019), Jhum lands may produce less economically, but our socio-cultural identity is tied to shifting farming practices. We find satisfaction in our

Table 2: Inclusive Estimation of Cost of Cultivation of Jhum Cultivation in West Garo Hills, Meghalaya

Particular	*West Garo Hills (Rs. /Ha)*
Cost A1	
Value of hired labour	3562.00
Interest on working capital	249.34
TOTAL	3811.34
Cost A2	
Cost A1	3811.34
Rent paid for the leased land	0
TOTAL	3811.34
Cost B1	
Cost A1	3811.34
Interest on value of own capital assets	0
TOTAL	3811.34
Cost B2	
Cost B1	3811.34
Rental value of own land	0
TOTAL	3811.34
Cost C1	
Cost B1	3811.34
Imputed value of family labour	9461.00
TOTAL	13272.34
Cost C2	
Cost B2	3811.34
Imputed value of family labour	9461.00
TOTAL	13272.34
Cost C3	
Cost C2	13272.34
Value of management input at 10% of total	1327.23
TOTAL	14599.57

significant involvement in Jhum lands, even if production remains minimal.

Table 4 presents the binary logistic regression analysis used to measure the factors affecting the total production of the Jhum farming system in West Garo Hills, Meghalaya. The results of the regression model indicated that jhum land ($\beta = 0.350$, $t = 5.496$, $p < 0.00$), quantity of seed ($\beta = 0.941$, $t = 3.957$, $p < 0.00$), and experience in Jhum cultivation ($\beta = 0.019$, $t = 2.312$, $p < 0.02$) are significantly included in production. This suggests that an increase in these factors leads to a corresponding increase in the production output of the Jhum farming system.

These findings align with previous studies, which reported through regression models that the most significant factors influencing Jhum production were farm size and quantity of seeds, both of which had positive significance, while labor and fertilizers showed negative significance (Ohajianya et al., 2010). This indicates that an increase in the levels of these independent variables will result in a significant boost in overall productivity

The results indicate that Jhum is an indigenous practice passed down from generation to generation. This transfer of experience among Jhum farmers contributes to increased production of Jhum produce. The size of the land used for Jhum farming is a crucial factor in determining the scale of production; larger land areas allow for more extensive cultivation, which can lead to higher production levels. Farmers are using seeds saved from previous harvests, allowing for increased sowing density. With limited land and favourable conditions, this practice may enhance overall yield through high-density planting.

From the results, it is evident that Jhum land, Jhum experience, and quantity of seed, each with *p-values* less than 0.05, show a significant contribution to predicting the total output. In contrast, other variables, such as age, education level, and total labor man-days, which have p-values above 0.05, do not significantly contribute to predicting the yields. Here, it may be mentioned that while age may reflect experience, it does not always correlate with improved production practices or decision-making effectiveness. The education level was reported as 0.676. It is to be noted that the basic education might not directly influence the adoption of advanced agricultural practices unless it is specifically agriculture-related. The total labour man-days were estimated as 0.887. The number of labour days may not indicate the quality or efficiency of labour, which is more critical to productivity.

Table 3: Comparison of total cost of production, gross yield, total revenue and benefit cost ratios

Particulars	Selected Villages					Overall block
	Darechikgre	Waribokgre	Asanang	Rengsangre	Chandigre	Rongram
Cost of production village wise (Rs/Kg)	9.17	6.31	8.45	5.83	10.56	7.24
Gross yield (kg)	1944.44	1777.78	1600.00	1666.67	1333.33	1833.33
Total revenue (Rs)	32110.56	18090.44	16757.45	15829.60	21120.00	15926.81
Benefit cost ratio	1.8	0.9	0.5	0.6	1.5	1.2

Table 4: Regression coefficients for factors affecting Jhum productivity (kg/ha)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	423.853	681.901		.622	.538
	Age	-.684	14.429	-.006	-.047	.962
	Jhum practising since (years)	2.641	13.670	.019	2.312*	.020
	Jhum land (Ha)	1284.508	233.736	.350	5.496**	.000
	Quantity of seed (Kg)	.066	.017	.941	3.957**	.000
	Total labour-man-days	-1.222	8.509	-.022	-.144	.887
	Education level	-35.653	84.813	-.047	-.420	.676

Note: * P< 0.05 and **p<0.01

Conclusion

Jhum cultivation, a traditional slash-and-burn method, remains a critical source of livelihood for many rural households in the region. However, its economic viability is influenced by key factors such as land availability, duration of cultivation cycles, and seed usage. Recent findings reveal significant variability in profitability between villages with better-managed farms and higher returns in areas where farmer literacy rates are higher- highlighting the direct link between education and farming efficiency. Despite its importance, the sustainability of Jhum is under serious threat. The traditional practice of allowing land to fallow for regeneration is no longer effective due to rising population pressure and land scarcity, leading to declining soil fertility and productivity. This trend raises both environmental and economic concerns.

A strategic policy response is needed. There is a need to promote agro-forestry and mixed cropping systems, encourage the integration of trees into farming systems to improve soil health, diversify income sources, and enhance climate resilience. It is also needed to strengthen agricultural education and extension services, investment in literacy and vocational training programs tailored to tribal and rural farming communities. Focus should also be on providing financial and institutional support, facilitating community-based natural resource management to ensure equitable and efficient use of land. There is also a need to implement long-term land management policies and encouragement to land-use planning that balances traditional practices with ecological sustainability. Ensuring the sustainability of Jhum cultivation requires a multi-sectoral policy approach combining agroecological innovation, education, and targeted government support. Such measures will not only improve the resilience of farming systems but also contribute to environmental conservation and rural development goals.

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