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Original Article

Analysis of Ginger and Chili Cultivation in Champhai District, Mizoram, India

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Abstract *- Ginger and chili are important crops for farmers across the state of Mizoram. This paper presents the economic analysis of ginger and chili in Mizoram. Multi-stage random sampling was used to select the respondents. A questionnaire survey, face-to-face interviews, and key informant interviews were used to collect primary data in the study area. Secondary data were obtained through reviewing various peer-reviewed journal publications and government reports. This study reveals that ginger cultivation has a B-C ratio of 2.19, while chili cultivation had a B-C ratio of 5.98. It has also been observed that the cost of seeds was the highest among the various costs of ginger cultivation, accounting for 20% of the total cost, followed by weeding and maintenance, which accounted for 17 per cent while in the case of chili, the cost of harvesting accounts for the lion's share. The study further reveals that lack of credit facilities, disease and insects are the major problems associated with ginger and chili cultivation in the study areas.*

Keywords *- Benefit-Cost, Chili, Ginger, Production. Productivity Problems.*

I. INTRODUCTION

Ginger and chili are valuable cash crops in the State of Mizoram. Mizoram is one of the major producers of ginger and chili in India. As per the report of the Directorate of Arecanut and Spices Development (DASD), Mizoram is the 11th largest producer of ginger in India during 2019-20. The state also occupied the 13th position in chili production among the 26 producing states in India during the same period. In terms of volume of production, Mizoram is one of the hubs of ginger and chili production in Northeast India. According to DASD, the state accounts for nearly 12 per cent of the production of ginger and 25 per cent of the production of chili in Northeast India. The area and production of ginger for the year 2019-20 was 8553 hectares and 61001 tonnes, while chili covered an area of 11196 hectares with a total production of 10918 tonnes.

When the states are ranked based on the volume of production, Mizoram is above the national average in both ginger and chili. However, when ranked in terms of productivity (i.e. production/area), its position was drastically fallen. This is a disheartening result for the state as it reflects inefficient utilization of land resources in the region. Among many factors, the main reasons for low productivity in the state are the prevalence of outdated farming methods and heavily dependent on rainfall. In Mizoram, a considerable number of farmers still practice old and traditional farming methods in which application of fertilizer, irrigation facilities, mechanization of farming techniques are absent.

The present study is an attempt to examine the trend of production and productivity of ginger and chili in Champhai district, Mizoram. The study also estimates the annual growth rate and analyses the profitability of ginger and chili cultivation. Apart from that, the study also tries to identify some of the major problems faced by farmers when cultivating ginger and chili. The paper is divided into five sections. Section-1 shows an overview of ginger and chili production in Mizoram, while section-II presents the area of study, survey design, method, and tools analysis. Section III interprets and discusses the findings. Section-IV gives the conclusion of the study, while section-V is related to references.

II. METHODOLOGY

A. Study Area

Champhai district is one of the eleven districts of Mizoram in India. The district is bordered on the north by the Churachandpur district of Manipur, on the west by Saitual and Serchhip districts, and on the south and east by Myanmar. The total area of the district is 3185.83 sq. km. The administrative centre of the district is Champhai town. It is a rapidly developing venue on the Indo-Myanmar border. Agriculture and border trade are the mainstays of the economy of the region. Champhai is also the main trading centre of Mizoram, with goods like clothes, silverware, and electronics imported from Myanmar through the trading post in Zokhawthar. It has a flat land for wet rice cultivation that is 113 kilometres long and 48 kilometres wide and can produce 19,200 quintals of rice per year. 10,000 quintals of grape were cultivated in 2011 alone, yielding 20,000 bottles a year.

B. Survey Design and Data Collection

In this study, we used a multi-stage sampling technique. In the first round, the district was chosen from among Mizoram's eleven districts. Two rural development blocks were chosen to represent the district in the second stage, out of three rural development blocks. The third stage involved choosing three villages at random from each block. The required data were collected at random from households in each village in the final stage. To collect primary data from the randomly selected farmers, the researchers used a systematic semi-structured questionnaire. Face-to-face interviews and key informant interviews were used to gather this information. Secondary data was obtained from peer-reviewed journals and government reports.

C. Interview Schedule Design and Field Survey:

The interview schedule was designed to capture vital information on the production of ginger and chilly within the district. The questionnaires were developed in the local language to extract reliable information from the farmers. The required data was then collected using a simple random sampling technique over six years, starting in 2015-16 and ending in 2019-20.

D. Methods and Techniques of Data Analysis

a) Cost of production

The variable cost components were taken into account while calculating the cost of production. This is because agriculture in Mizoram is still traditional, with no large machines or tools being used in the agriculture system. Moreover, the nature of the agriculture system is mainly shifting cultivation under which labour, seed, fertilizer, pesticides, irrigation, and weeding are the main cost components. Keeping this, expenditure on seed, land preparation, fertilizers and manure, pesticides, weeding, irrigation, harvesting, labour are included in the variable cost, while the fixed cost was left in the analysis since it has no considerable share in the cost structure. The total cost of production was calculated by adding all the expenditures on variable inputs and can be expressed as:

$$\text{Total cost} = \sum \text{Cost incurred on all the variable items}$$

b) Benefit-cost Analysis

For benefit-cost analysis, the total cost of production of the selected crop and total gross return from produce was used. The income from produce sales was taken into account when calculating gross return. So, the B/C ratio was calculated using the formula:

$$\text{B/C ratio} = \text{Gross Return/Total Cost.}$$

c) Profitability Analysis

Profit is defined as the difference between total revenue and total costs incurred. Any farm business's net profit can be written as

$$\Pi = TR - TC$$

Where Π is the net profit, TR is the total revenue, TC is the total cost.

d) Indexing / Scaling

For finding the importance of different production problems five-point scale was used based on the farmer's perception of them. It assigns a value of very high importance, a value of high importance, a value of normal importance, a value of less importance, and a value of least importance to various problems. The most important problem was assigned a scale value of 5, followed by high importance with a scale value of 4, and so on. Production problems were ranked using the following formula:

$$\text{Iimp} = \sum \frac{SiFi}{AN}$$

Where, Iimp is the index of importance, Si is ith scale value, Fi is the frequency of ith importance given by the respondents, A = highest scale value and N denote the total number of respondents.

III. RESULTS AND DISCUSSION

A. Production and Productivity of Ginger and Chili in the Study Area

Owing to the vast chunk of plain lands and hills with a gentle slope, wet rice cultivation and terrace cultivation are very popular across the district. As a result, ginger and chili are produced exclusively in a few villages. Furthermore, the district being a growing hub for Indo-Myanmar border trade with economic diversification necessitate some villages along the border area to abstain from farming activities. With this backdrop in mind, the purposive sampling technique was adopted since it would make more sense than a random selection of villages in the district. Thus, we selected villages that are still engaged in chili and ginger cultivation within the district. For ginger cultivation, six villages were selected from the Khawbung block, while the other six villages were selected from the Champhai block for chili cultivation. Trends in the production and productivity of ginger and chili for the last six years in the study area are shown in table 1.

As presented in table 1, both ginger and chili have shown a gradual increase in terms of production and productivity over the years, with a CAGR of 10 per cent and 23 per cent, respectively, despite certain fluctuations. The mean production and productivity of ginger are significantly higher than the mean production and productivity of chili during the reference periods. However, this does not mean that ginger is more profitable than chili. Profitability is a different concept from that of production volume and productivity since it requires further consideration of cost and the prevailing market price of the product. As such, profitability analysis is kept for the coming section.

Table 1. Production and productivity of ginger and chili

Years	Production (in quintal)		Productivity	
	Ginger	Chili	Ginger	Chili
2015-16	10361.7	1080.9	5.29	0.74
2016-17	11086.8	1546.4	5.36	0.89
2017-18	12358.4	1970.6	5.67	0.93
2018-19	13492.6	2314.1	6.05	0.98
2019-20	15315.9	2719.1	6.62	1.04
2020-21	16405.1	3207.5	6.90	1.10
Mean	13170.08	2139.77	5.98	0.95
Standard Deviation	2368.96	775.63	0.66	0.13
Coefficient of Variation	0.18	0.36	0.11	0.13
CAGR (in per cent)	10	23.17	5.6	6.86

Source: Field Survey

Regarding the coefficient of variation (CV), ginger has a lower value of CV than chili in both production and productivity, indicating a lower degree of fluctuations over the years. A huge fluctuation in chili production and productivity indicates that there are certain factors that effectively influence the production and productivity of chili while the lower CV of Ginger infer that the production and productivity of ginger are very unresponsive to a change in some factors.

B. Cost of Cultivation

In this study, the cost of cultivation for both ginger and chili covered expenditure on seed, land preparation, fertilizers and manure, pesticides, weeding, irrigation, harvesting, hired labour, and imputed costs incurred by the owner of the farm. Costs such as depreciation on implements and buildings, interest on working capital, the rental value of own land, and expenditure on other fixed assets were excluded as such expenses are not relevant in Mizoram. In Mizoram, with a low population density, land for agricultural purposes is not an issue since each village has community land that can be cultivated at no cost. Moreover, the practices of shifting cultivation and the adoption of traditional methods also make expenditures such as interest on working capital, the rental value of one's land, and expenditure on fixed assets irrelevant.

Given the above conditions, the average cost of cultivation of ginger and chili is estimated for one hectare of land for the simplicity of our analysis. The total cost of cultivation consists of 11 items for both ginger and chili. It should be noted here that self-owned inputs such as family labour and owned implements are converted into their monetary value based on the statutory wage rate or the actual market rate.

C. Cost of Ginger Cultivation

Table 2 demonstrates the components of cost of cultivation, the monetary value of each component, and the percentage share of each component for one hectare of land in the study area in 2019-20. As evident from Table 2 cost of seed topped the list with 20 per cent of the total cost, followed by weeding and maintenance with 17 per cent. A farmer generally kept a certain amount of ginger produced as seed for the next period. If a new farmer wants to start growing ginger, he must buy it from the local market at the prevailing price. In both cases, the amount of ginger used as the seed is multiplied by the market price to get the cost of seed for ginger cultivation. Regarding weeding and maintenance, we take into account expenditure for hiring labour as well as the imputed value of owned services rendered by the family.

Harvesting costs are the third-highest cost of ginger farming in the study area. It accounts for 15 per cent of the total cost of cultivation. Ginger harvesting necessitates arduous manual labour, including digging the ginger, cleaning, packaging, and storing it in a storehouse.

Table 2. Cost of ginger cultivation

Sl.No	Cost Items	Expenditure per Hectare (in Rs)	Percentage Share
1	Land Preparation (Slashing of Forest)	7800	7.72
2	Cleaning of Debris	5600	5.54
3	Construction of Storage	8600	8.51
4	Seed	20000	19.78
5	Fertilizer and Manure	4000	3.96
6	Tools	1500	1.48
7	Sowing/Planting	7200	7.12
8	Weeding and Maintenance	16800	16.62
9	Irrigation	2000	1.98
10	Harvesting	15600	15.43
11	Transportation	12000	11.87
12	Total	101100	100.00

Source: Field Survey

Transportation of ginger from the farm to villages is another cost item that induced farmers to incur huge expenditures. In general, there are three basic modes of transportation from a farm site to a local location: head load, hiring horses, and vehicles. In most cases, transportation was done by head load due to the absence of motorable road connectivity and lack of abundant horses and bullock carts. In any of the above scenarios, the cost of hiring labour, horses, or vehicles is counted as a transportation expense. It is vital to note that the cost of transportation includes the imputed cost of family labour engaged in transportation work.

The costs of slashing of the forest, building a jhum home, and sowing or planting are roughly the same, accounting for 7-8 per cent of the overall cost of cultivation in the study area. These cost items are expected to increase with an increase in the size of jhum land as larger size requires more labour to complete the work.

Agricultural practices being traditional and non-mechanized, the cost incurred by the farmers on irrigation, tools, and implements has a negligible share in the overall cost of cultivation, as shown in Table 2 above. In Mizoram, where shifting cultivation prevailed, farmers are heavily dependent on rainfall, and proper irrigation is not available in such a system. Furthermore,
the farmer usually used outdated tools such as a hoe, do, sickle, etc. As a result, expenses on tools and implements are low compared to other states where the agriculture system is a little advanced.

Due to the traditional and non-mechanized nature of agricultural activities, the cost of irrigation, tools, and implements incurred by farmers has a minor role in the overall cost of agriculture. Farmers in Mizoram, where shifting farming is prevalent, are primarily reliant on rainfall, and proper irrigation is not used in this method. Furthermore, farmers typically used antiquated instruments like the hoe, dao, and sickle. As a result, expenses for tools and implements are relatively inexpensive compared to other states with a more established agricultural system.

D. Cost of Cultivation of Chili

Although the method for estimating the cost of cultivation for chili and ginger is similar, there is a slight difference in the percentage share of cost components in the total cost of cultivation. The fundamental difference in cost of cultivation between ginger and chili farming is that ginger is grown as a monocropping crop, whereas chili is grown as a mixed cropping crop. As a result, chili farming takes up more space than ginger farming. Furthermore, the nature of sowing and harvesting ginger and chili differs significantly. Table 3 illustrates the components of the cost of chili cultivation, the monetary value, and the percentage share of each component for one hectare of land in the study area during 2019-20.

As shown in table 3, the cost of harvesting has the highest share in the total cost with 23.68 per cent of total costs, followed by weeding and maintenance. These two items are significantly higher than the rest of the cost items accounting for about half of the overall cultivation costs. Harvesting and weeding are more expensive in chili cultivation than in ginger production because the area under chili cultivation is frequently larger, necessitating more labour during the busy season like harvesting and weeding.

The third and fourth largest cost items are slashing of forest and construction of jhum house respectively. The percentage share of the rest of the cost components is between 7.10 per cent and 1.80 per cent, with irrigation costs being the lowest share.

Table 3. Cost of chili cultivation

Sl.No	Cost Items	Expenditure per Hectare (in Rs)	Percentage Share
1	Land Preparation (Slashing of Forest)	9200	10.37
2	Cleaning of Debris	6300	7.10
3	Construction of Jhum House	8700	9.81
4	Seed	6000	6.76
5	Fertilizer and Manure	4000	4.51
6	Tools	1800	2.03
7	Sowing/Planting	3200	3.61
8	Weeding and Maintenance	18900	21.31
9	Irrigation	1600	1.80
10	Harvesting	21000	23.68
11	Transportation	8000	9.02
12	Total	88700	100.00

Source: Field Survey

E. Return and Profitability Analysis of Ginger and Chili Cultivation.

Monetary return on any type of cultivation depends upon several factors, including the variety of seeds, agro-climatic conditions, soil quality, disease, cultural practices, market prices, cost of cultivation, etc. Since these factors vary regionally, so is the return across the country. A crop that yields a high return in one state might not offer a high return in other states. Thus, profitability analysis is very crucial before starting any type of farming.

In this section, per hectare annual gross return, net return (profit), and benefit-cost ratio (B-C ratio) of ginger and chili were estimated for the last six years beginning from 2015-16 to 2019-20. Gross return is simply the market value of production, whereas net return implies the difference between gross return and total cost of cultivation. It is important to note that the market value of production was estimated by multiplying the quantity of output with the prevailing market price in that particular year. Apart from that, per hectare cost of cultivation and production were also estimated by taking per hectare average production from different villages in the study area. Table 4 depicted per hectare average cost of cultivation, average gross return, the net return, and B-C ratio in the study during 2015-16 to 2019-20.

From the results presented in Table 4, it is clear that the average cost per hectare has fluctuated in both ginger and chili cultivations. However, the degree of fluctuation is more in chili cultivation than in ginger. Cultivation. The cause of the high fluctuation in chili cultivation is that farmers in this area have grown chili as an intercrop in paddy fields (jhum land), whereas ginger is treated as a monocropping crop in the region. Thus, chili as mixed cropping in jhum land is more likely to be affected by any policy change in the states since policy changes have greatly affected jhum area under cultivation, making up for any loss in the cost of cultivation of chili.

As regards gross income, the study revealed that gross income from ginger and chili cultivation has consistently increased over the years. In 2015-16, the gross income from ginger production per hectare was Rs 144432, which increased to Rs 208311.90 in 2019-20, a 1.5-fold increase in just 6 years. Similarly, chili experienced a similar trajectory, with a gross income per hectare of Rs 207931 in 2015-16 rising to Rs 383662.13 in 2019-20, representing an increase of more than 1.8 times in 6 years.

High gross income is a heartening result, yet it does not show how profitable the cultivation is. The net income and benefit-cost ratio are the indicators of profitability. The net income and benefit-cost ratios are shown in the fourth column of Table 4. The net income of ginger and chili cultivation increased significantly over the years. The net income of ginger was Rs 52390.35 in 2015-16, but it more than doubled in 2019-20. The net income of chili cultivation shows a more robust result which increased from Rs 90676.54 in 2015-16 to Rs 319569.20 in 2019-20, which is more than three times the initial value.

Table 4. Cost, return and B-C ratio

Year Column-1	Average Cost (in Rs) Column-2		Gross Return (in Rs) Column-3		Net Return/Profit (in Rs) Column-4		B-C ratio Column-5	
	Ginger	Chili	Ginger	Chili	Ginger	Chili	Ginger	Chili
2015	92042.49	117254.93	144432.8	207931.47	52390.35	90676.54	1.57	1.77
2016	95171.36	100694.58	134601.5	229896.59	39430.11	129202.00	1.41	2.28
2017	99506.76	83828.52	157832.2	266862.29	58325.48	183033.80	1.59	3.18
2018	94376.99	74186.48	180282.2	273861.78	85905.26	199675.30	1.91	3.69
2019	92112.59	70988.92	215654.1	319953.77	123541.54	248964.90	2.34	4.51
2020	94925.69	88700.00	208311.9	383662.13	113386.21	294962.10	2.19	5.98

Source: Field Survey

The benefit-cost ratio in the last column reveals that chili cultivation is relatively profitable compared to ginger cultivation. During the reference periods, the average B-C ratio of chili was 3.56, while the average B-C ratio of ginger was only 1.83. The higher B-C ratios of chili cultivation are because while chili cost of cultivation per hectare declined from Rs 117254.93 in 2015-16 to Rs 88700 in 2019-20, its market price per kilogram has dramatically increased from Rs. 264.77 to Rs 360.23 during the same period. Such situations have not been observed in ginger cultivation, where, despite rising cultivation costs, the market price was relatively stable over time, hovering around Rs 26-31.

As a result of the analysis, we found that chili cultivation is relatively more profitable and less expensive than ginger cultivation. The average ginger product for the study periods was 6357.10 Kg, whereas the average chili product was 915.34 Kg. Although chili
has a lower average product, it has a far higher market value than ginger. From 2015-16 to 2019-20, the market price of chili climbed by 36.05 per cent, while the price of ginger increased by only 6.5 per cent. This indicates that chili cultivation is more viable and promising than ginger cultivation in the study area.

Farmers in the study area adopted the traditional method with outdated tools and implements. The absence of a proper irrigation system, lack of fertilizer, the prevalence of shifting cultivation combined with poor road connectivity would undoubtedly present several challenges and harm the profitability of ginger and chili cultivation. Despite these issues, farmers who have no other options may be able to make a good earning. Farmers in the study area will almost certainly be able to earn a higher net return and thus contribute to the state's welfare if the competent authority pays attention and provides incentives to them.

F. Production Problem in Ginger and Chili Cultivation

Identification of problems relating to production is the most important single factor for further improvement in the agriculture sector. Once the problem is known, the government can develop strategies and policies to effectively address the issues and launch specific interventions in the most critical areas. This will ensure that policies are developed and implemented effectively. In this study, problems relating to production are measured using a five-point Likert scaling technique by taking relevant production problems such as disease, fertilizer, skills of the labour, irrigation and availability of credit facilities. Results of the rank scale for ginger and chili cultivation is presented in Table 5 below.

The value derived from the rank scale revealed that lack of credit facilities had an index value of 0.82 in ginger cultivation and was ranked as the most serious problem, followed by disease and insect problem; fertilizer was ranked as the least significant problem with an index value of 0.35. Disease and insect have the highest index value of 0.83 in chili cultivation, followed by credit facilities with an index value of 0.70. One can observe that the top two problems in ginger and chili cultivation are interchange. The relative seriousness of the problems experienced by the ginger growers followed the sequence of lack of credit facilities, disease, and insect problem, skilled labour, irrigation, and fertilizer, while chili has a sequence of disease and insect problems, credit facilities, lack of skilled labour, fertilizer, and irrigation.

Table 5. Relative Importance Index (RII) of production problems

Items Column-1	Total Score		A*N		Index		Rank	
	Ginger (Column -1)	Chili (Column -1)	Ginger (Column -1)	Chili (Column -1)	Ginger (Column -1)	Chili (Column -1)	Ginger (Column -1)	Chili (Column -1)
Disease and Insects	1338	1338	1770	1610	0.76	0.83	2	1
Fertilizer	617	762	1770	1610	0.35	0.47	5	4
Irrigation	873	671	1770	1610	0.49	0.42	4	5
Skilled Labour	1033	1039	1770	1610	0.58	0.65	3	3
Credit Facilities	1450	1129	1770	1610	0.82	0.70	1	2

Source: Field Survey

According to ginger growers, the absence of easy credit for farmers has put lots of hardship for raising production and productivity. Farmers, for example, have three peak seasons in shifting cultivation, forest slashing and debris clearing, weeding, and harvesting. All these seasons necessitate a high number
of labour forces. Thus, farmers must hire labour to finish the task on time, or else production and productivity would suffer. Farmers, in such situations, require loans not only for productive purposes but also for family consumption. As a result, if credit access is not available, all farm activities are not completed on time, resulting in low production and productivity.

The problem of disease and insects is a common problem for poor farmers not only in Mizoram but throughout the country. The low index value of fertilizer and irrigation in both ginger and chili cultivation indicates the agro-climatic conditions in the study area. Since Mizoram has good rainfall with the predominance of shifting cultivation, the proper irrigation system is not considered as the problem in ginger and chili cultivation. Likewise, the farming systems being organic and soil being fertile, the farmer did not give a lack of fertilizer as a serious problem.

IV. CONCLUSION

Cultivation of ginger and chili is one of the major livelihood options in Mizoram. As per the results of the analysis, production and productivity have gradually increased during the study periods. While ginger production has increased at a CAGR of 10 per cent during the study period, chili production increased at a CAGR of 23.17. When measured in terms of quintal per hectare, ginger productivity is much higher than chili productivity, but the profitability of chili cultivation is more than double that of ginger cultivation. While the B-C ratio of ginger cultivation is 2.19, it is 5.98 in the case of chili cultivation. The main problems for farmers are lack of credit facilities, disease, and insects. In the case of ginger cultivation, farmers consider 'credit facilities' to be the number one problem, while chili growers consider 'diseases and insects' as the main problem in their cultivation. The findings of the studies are expected to have an impact on policy-making aimed at uplifting the socio-economic status of farmers not only in the Champhai district but also in Mizoram as a whole.

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