

Research Paper

Economics of Chakhao (Black Scented Rice) Cultivation in Manipur

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ABSTRACT

The present study was undertaken with a view to estimate the cost and returns of Chakhao cultivation in the study area. The primary data was collected for year 2021-22 from sampled farmers through personal interview method. A total of 140 farmers were sampled from twelve villages and 10 stakeholders which comprises of 2 each of Farmers Producer Company (FPC), millers, wholesalers, retailers and entrepreneurs of two districts namely Imphal West and Imphal East. On an average the per hectare total cost of Chakhao was ₹ 143883.82. The total variable cost accounts for the highest cost of cultivation incurred for all the category of farmers. Among the variable cost the per cent share of hired labour was the highest for all the farmer category which accounts for 30.46 per cent in marginal farmers, 36.38 per cent in small farmers, 37.55 and 32.57 per cent in total cost per hectare respectively for medium and overall farmers. The average per hectare net returns received by the farmers was ₹ 100174.06. The overall total cost per hectare in terms of operation was ₹ 80371.19. Highest operation cost was observed on harvesting & drying process accounting an average of 17.93 per cent in total cost per hectare. Overall input-output ratio obtained was 1.70 depicting a return of ₹ 1.70 for every rupee investment in Chakhao cultivation. And that the cultivation of Chakhao was profitable in the study area.

HIGHLIGHTS

- ① The paper focuses on the economics of Chakhao cultivation in Manipur.
- ② Both input and operation wise cost of cultivation were worked out for different farmers category.

Keywords: Chakhao, cost and return, input-output ratio, organic

Chakhao (black scented rice) is a unique rice variety of Manipur characterised by its special aroma and its glutinous nature which is not commonly found in other black rice grown in the world. It refers to a variety of rice from the species *Oryza sativa* L. Subspecies indica. It has high levels of nutrients, high antioxidant property. It is also known as purple rice, heaven rice, imperial rice, king's rice, prize rice and forbidden rice but commonly known as Black rice. Recently it was referred as "Super Food" (Saha, 2016). It is cultivated in South - East Asian countries. Even though it has a long history of cultivation, only recently Chakhao is recognized for its medicinal values. The dark purple colour of Chakhao is due to the high anthocyanin content,

located in the pericarp layers (Takashi *et al.* 2001). Anthocyanin pigment which is present in Chakhao has been documented as health promoting food ingredients because of antioxidant activity.

It is cultivated in South - East Asian countries. China accounts for 62 per cent of black rice production in the world followed by Sri Lanka, India, Indonesia and Philippines. COVID-19 has initiated some behavioural change in consumer which is directed

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towards plant-based nutrition and reduction in meat consumption. Owing to which Black rice is being prominently imported in Europe because of high protein nature compare to other rice varieties and its anthocyanin content. The extensive research and development in plant-based protein has boosted the demand for black rice protein market. It has also captured the attention of prominent players. China being the prominent producer of the black rice since ancient time has fuelled the market for black rice protein.

In India, though it is not cultivated in large area for commercial purpose as compared to other rice varieties, there are evidences that it has been grown in India for centuries in different states with maximum concentration in North- East region especially in Manipur and some parts of Odisha, West Bengal and Jharkhand. In Manipur it is commonly known as Chakhao, as Kalabati in Odisha, and Kavuni rice in Tamil Nadu. In the recent past, success stories have been coming in from Odisha, Uttar Pradesh and Bihar with farmers not only reaping benefits but also popularizing the crop among other farmers. Further, respective state governments are also encouraging cultivation of the crop primarily for export purposes.

It is a very popular black rice variety cultivated in all the states of North East India. In Assam the government is promoting large scale cultivation for sale as organic produce at premium prices in overseas markets.

Manipur state is one of the largest wild rice growing areas in the world. Semi-wild rice varieties are widely cultivated in the lake areas as well as in the shifting cultivated areas of the state. Among the different traditional semi-wild varieties, there are numbers of scented and multi-coloured rice varieties.

Chakhao, a scented glutinous rice which has been in cultivation in Manipur over centuries with traditional practices, is characterised by its special aroma was recently awarded the Geographical Indication (GI) tag on 20th April, 2020 (GI No. 602). With the allotment of the GI tag it will further contribute in encouraging commercial cultivation and improve market potential of the crop. Chakhao is also known as Poireiton Chakhao because it was first domesticated by king Poireiton in his land of Poi. Poi is the first generation of Manipur society.

It constitutes around 10 per cent of Manipur's total rice production. It is normally eaten during community feasts and is also served as Chakhao kheer. Chakhao has also been used by traditional medical practitioners as part of traditional medicine. It is sold at ₹ 100-150 a kilogram on an average in the Imphal market. From times immemorial Chakhao is considered as a specific variety of rice and cultivated by selected farmers of Manipur. There is black, red and white colour of the rice. The main variety mostly cultivated are Chakhao Poreiton, Chakhao Amubi and Chakhao Anghouba.

The agro-climatic condition of Manipur valley is the lone unique place for sweet scented glutinous and colourful character of Chakhao variety. The government of India is also emphasising on the promotion of organic farming through Parampargat Krishi Vikas Yojana and Organic Value Chain Development in North East India.

2000 ha of area under Chakhao has been fully certified organic under standards laid down & administered in India by APEDA under the MOVCDNER. On 12 August 2021, one Metric Tonne of organic Chakhao has been exported to Europe through MOMA.

In order to make value chain of Chakhao and enhance more positive impact and to help the farmers attain more prospective return through the organic cultivation and marketing of Chakhao, the study was conducted with the objective to estimate the economics of Chakhao cultivation in the study area.

Methodology

The methodological procedure and description of the research methods and procedures adopted in the present investigation are explained as follows:

1. Sampling Design
2. Sampling Plan
3. Data Collection
4. Analytical Tools

1. Sampling Design

The following sampling design was used in the present study.

Selection of study area

The present study was conducted in the state of Manipur. Manipur has a total of 16 district and out of it only major 6 districts contributes to the total area and production of Chakhao in the state.

2. Sampling plan

In order to meet the stipulated objectives of the present study, a two-stage sampling technique was employed. The first stage of sampling plan was the selection of villages and the final stage was the selection of respondent from the selected villages. A total of 140 farmers were selected from twelve villages three each from the four blocks two each of the two districts viz; Imphal West and Imphal East.

3. Data collection

To meet the objective of the present study, both primary and secondary data was collected for analysis and interpretation. The primary data was collected on pre-tested schedule by adopting personal interview method from the selected respondents. The required secondary data for the present study was collected from various published and unpublished information sources of Directorate of Economics and Statistics, Government of Manipur, Manipur Organic Mission Agency (MOMA), Basic Statistics of North East Reason (NER), Department of Agriculture, Government of Manipur, Government of Manipur and Directorate of Settlement and Land Revenue, Government of Manipur, etc.

4. Analytical tools

The data collected through survey method was compiled and analyzed systematically to commensurate with the objectives of the study.

Cost and returns analysis

Analysis of cost and return from the Chakhao cultivation was done by using simple mathematical and average calculation.

- (a) **Fixed Cost:** Fixed cost is the expenditure which is incurred whether or not the production is carried out.

The components are as follows:

1. Depreciation on farm implements and farm buildings
2. Land revenue and other taxes
3. Interest on fixed capital

(b) Variable cost:

It includes the cost of the following items:

1. Value of human labour
2. Value Owned machinery charges
3. Hired machinery charges
4. Interest on working capital
5. Value of manures and organic fertilizers
6. Irrigation charges
7. Value of organic insecticide
8. Value of seeds
9. Miscellaneous expenses

- (c) Total Cost (Gross Cost) = Total Fixed Cost + Total Variable Cost

The following cost concepts were worked out to get the various returns from the Chakhao cultivation which is explained below.

Cost A_1 : It includes—

1. Value of seeds
2. Value of human labour
3. Value of owned machinery
4. Value of hired machinery
5. Value of manures and organic fertilizers
6. Irrigation charges
7. Value of organic insecticide
8. Depreciation on farm implements and machineries
9. Interest on working capital
10. Miscellaneous expenses
11. Land revenue

Cost A_2 = Cost A_1 + Rent paid for leased-in land

Cost B_1 = Cost A_1 + interest on value of owned fixed capital (excluding land)

Cost B_2 = Cost B_1 + rental value of owned land + rent paid for leased in land

Cost C_1 = Cost B_1 + Imputed value of family labour

Cost C_2 = Cost B_2 + Imputed value of family labour

Cost C₃ = Cost C₂ + 10 per cent of Cost C₂ on account of managerial function performed by farmer

Return analysis

1. Gross income (GI) = Total value of main product
= (Quantity of main product × price of main product)
2. Farm business income = GI – Cost A₂
3. Family labor income = Net return + family labour
4. Net income = GI – Total cost / Cost C₂
5. Net return over variable cost = Gross income- total variable cost
6. Input-Output ratio = $\frac{\text{Gross income}}{\text{Total cost}}$

RESULTS AND DISCUSSION

Keeping in view the objectives of the study, the data were analysed using suitable techniques. The results obtained from this study have been presented and discuss critically. Distribution of sampled farmers according to the land holding size are presented in Table 1. The table reveals that majority of the farmers belonged to the marginal farmers which accounts for 87.14 per cent followed by small farmers accounting 10.17 per cent and 4.28 per cent by the small-medium farmers. In the study area none of the farmers were large type of farmers. A total of 140 farmers were sampled for the study from two district namely Imphal West and Imphal East as they contribute the highest percentage in the production of Chakhao in Manipur.

The cost of cultivation of Chakhao production is depicted in Table 2. The estimation of cost helps to know the profitability of crop enterprises. The per

Table 1: Distribution of farmers according to land size holding (Ha)

| Category | Land size holding(ha) | No. of farmers | Total area (ha) | Average area (ha) |
|---------------------|-----------------------|----------------|-----------------|-------------------|
| 1. Marginal farmers | >1 ha | 122 (87.14) | 51.37 ha | 0.42 ha |
| 2. Small farmers | 1 – 2 ha | 15 (10.17) | 16.85 ha | 1.12 ha |
| 3. Medium farmers | 2 - 4 ha | 3 | 6 ha | 2 ha |
| Overall | — | 140 (100) | 74.22 ha | 0.53 ha |

Note: Figures in parentheses are the percentage to the total.

Table 2: Cost of input wise Chakhao cultivation for different category in rupees per hectare

| Particulars | Land size holding (ha) | | | |
|--------------------------------|-------------------------|--------------------------|--------------------------|-------------------------|
| | Marginal farmers | Small farmers | Medium farmers | Overall farmers |
| Hired labour | 41539.10 (30.46) | 57159.05 (36.38) | 63608.33 (37.55) | 46869.36 (32.57) |
| Imputed family labour | 10960.32 (8.03) | 9528.18 (6.06) | 9466.66 (5.58) | 10514.44 (7.30) |
| Hired machinery | 20853.88 (15.29) | 16718.10 (10.64) | 13216.66 (7.80) | 19297.54 (13.41) |
| Owned machinery | 87.59 (0.06) | 747.77 (0.47) | 2833.33 (1.67) | 459.44 (0.31) |
| Cost of Seed | 3279.44 (2.40) | 3288.54 (2.09) | 3360.00 (1.98) | 3288.02 (2.28) |
| Cost of organic insecticide | 15.57 (0.01) | 47.47 (0.03) | 200.00 (0.11) | 37.72 (0.02) |
| Cost of irrigation | 2132.76 (1.56) | 5483.67 (3.49) | 6300.00 (3.71) | 3230.39 (2.24) |
| Cost of organic manures | 3763.96 (2.76) | 4170.32 (2.65) | 4533.33 (2.67) | 3918.41 (2.72) |
| Rent paid for leased in land | 2355.46 (1.72) | 0 (0.00) | 0 (0.00) | 1630.28 (1.13) |
| Miscellaneous cost | 3180.45 (2.33) | 4169.13 (2.65) | 4655.00 (2.74) | 3524.11 (2.44) |
| Interest on working capital | 1175.58 (0.86) | 1350.83 (0.85) | 1442.31 (0.83) | 1236.93 (0.85) |
| Total Variable Cost (A) | 89344.16 (65.37) | 102663.12 (64.61) | 109615.64 (63.78) | 94006.69 (64.95) |
| Rental value of own land | 45312.05 (33.15) | 52447.47 (33.01) | 57600.00 (33.51) | 47925.36 (33.11) |
| Interest on fixed capital | 427.55 (0.31) | 663.03 (0.41) | 723.99 (0.42) | 664.61 (0.46) |
| Depreciation | 551.87 (0.40) | 560.83 (0.35) | 585.00 (0.34) | 556.58 (0.38) |
| Land revenue | 711.11 (0.52) | 750.97 (0.47) | 840.00 (0.48) | 730.58 (0.50) |
| Total Fixed Cost(B) | 47002.58 (34.39) | 54422.31 (34.25) | 59748.99 (34.76) | 49877.13 (34.45) |
| Total Cost (A+B) | 136346.75 (100) | 157085.43 (100) | 169364.63 (100) | 143883.82 (100) |

Note: Figures in parenthesis are the percentage to the total cost.

hectare cost of cultivation of Chakhao was worked out by standard cost concept. The table present the cost of cultivation of Chakhao of different farmers category per hectare. From the table, overall total cost was observed at ₹ 143883.82 per hectare. Marginal farmers incurred a total cost of ₹ 136346.75 while small and medium farmers incurred ₹ 157085.43 and ₹ 169364.63 per hectare respectively indicating positive relationship with the size of the farm. The table depicted that the variable cost accounts for the highest percentage of the total cost on all category of farmers. The observed overall per hectare total variable cost was ₹ 94006.69 (64.95%). The estimated total variable cost per hectare for marginal, small, and medium farmers were ₹ 89344.16 (65.37%), ₹ 102663.12 (64.61%) and ₹ 109615.64 (63.78%). Among the variable cost hired human labour was the major input for all farmers category taking up 32.57 per cent (₹ 46869.36) of the overall farmers in total cost per hectare. It accounts for 30.46 per cent (₹ 41539.10), 36.38 per cent (₹ 57159.05) and 37.55 per cent (₹ 63608.33) for marginal, small, and medium farmer of total cost. The second major input among the variable cost was hired machinery which accounts for 13.41 per cent of the total cost for overall farmers. It was observed that the hired machinery expenses decreased as farm size increases as they indulged their owned machinery in the farm owing to the increased in owned machinery expenses as farm size increases. The total fixed cost was the second major input of the total cost of Chakhao cultivation. The overall total fixed cost per hectare was estimated at ₹ 49877.13 (34.45%). It ranged from ₹ 47002.58 (34.39%) for marginal farmers, ₹ 54422.31(34.25%) for small farmers and ₹ 59748.99 (34.76%) per hectare for medium farmers. The major input of the fixed cost was the rental value of owned land accounting 33.11 per cent (₹ 47925.36) on an average and 33.15 per cent (₹ 45312.05) for marginal, 33.01 per cent (₹ 52447.47) for small and 33.51 per cent (₹ 57600.00) for medium farmers in total cost per hectare. It showed an increasing trend with increased in farm size and the possible reason for higher rental value on large farms might be the higher productivity. The difference in rental value is owed to the difference price range from one particular village to another. Table 3 lays out the various standard cost concepts worked out. The overall Cost A₁ calculated per

hectare was ₹ 83149.12 and ranges from ₹ 77291.35, ₹ 94446.73 to ₹ 101573.97 for marginal, small and medium farmers respectively. The average Cost A₂ estimated was ₹ 84779.41 per hectare. The table showed that there was no leased in land for both small and medium farmers, hence Cost A₂ was estimated as same as Cost A₁. While that of marginal farmers observed a total of ₹ 79646.82 per hectare. The overall Cost B₁ and Cost B₂ incurred were ₹ 83813.73 and ₹ 133369.38 per hectare. The calculated Cost B₁ and Cost B₂ for marginal, small and medium farmers were ₹ 77718.90, 95109.76, ₹ 102297.96 and ₹ 125386.42, ₹ 147557.24 and ₹ 159897.96 per hectare respectively. The table depicted a per hectare total cost of ₹ 143883.82 and ₹ 145322.66 for the overall farmers as in for Cost C₂ and Cost C₃. Cost C₂ ranges from ₹ 136346.75, ₹ 157085.43 to ₹ 169364.63 per hectare for marginal, small and medium farmers. The observed Cost C₃ was ₹ 149981.42, ₹ 158656.28 and ₹ 171058.28 per hectare for marginal, small and medium farmers.

Table 3: Different cost concepts in rupees per hectare

| Cost concepts | Land holdings size per ha | | | |
|---------------------|---------------------------|---------------|----------------|-----------|
| | Marginal farmers | Small farmers | Medium farmers | Overall |
| Cost A ₁ | 77291.35 | 94446.73 | 101573.97 | 83149.12 |
| Cost A ₂ | 79646.82 | 94446.73 | 101573.97 | 84779.41 |
| Cost B ₁ | 77718.90 | 95109.76 | 102297.96 | 83813.73 |
| Cost B ₂ | 125386.42 | 147557.24 | 159897.96 | 133369.38 |
| Cost C ₁ | 88679.23 | 104637.95 | 111764.63 | 94328.18 |
| Cost C ₂ | 136346.75 | 157085.43 | 169364.63 | 143883.82 |
| Cost C ₃ | 149981.42 | 158656.28 | 171058.28 | 145322.66 |

Table 4 depicted the operation wise cost of cultivation of Chakhao. The overall total cost of cultivation per hectare was estimated to be ₹ 80371.19 and that of marginal, small and medium farmers was ₹ 75573.68, ₹ 89636.80 and ₹ 95425.00. The major operation cost indulged in the cultivation of Chakhao was harvesting & drying process which accounts for an average per cent of 17.18 (₹ 14418.00) followed by plucking & transplanting. Marginal farmers incurred a total cost of ₹ 13600.42 (17.99%) while that of small and medium farmers incurred ₹ 16130.56 (17.99%) and ₹ 16608.33 (17.40%) per hectare respectively on harvesting & drying. For plucking & transplanting the overall cost per hectare calculated was ₹ 12953.97 (16.11%). And

the observed cost per hectare for marginal farmers was ₹ 12119.21 (16.03%), ₹ 14509.19 (16.18%) for small farmers and that of medium farmers was ₹ 15733.33 (16.48%).

Table 4: Operation wise cost of cultivation incurred in rupees per hectare

| Particulars | Land size holdings per hectare | | | |
|---|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| | Marginal | Small | Medium | Overall |
| Land preparation | 362.07 (0.47) | 985.16 (1.09) | 1050.00 (1.10) | 559.14 (0.69) |
| Ploughing | 6714.03 (8.88) | 3596.43 (4.01) | 2333.33 (2.44) | 5652.11 (7.03) |
| Plucking & transplanting | 12119.21 (16.03) | 14509.19 (16.18) | 15733.33 (16.48) | 12953.97 (16.11) |
| Sowing | 996.69 (1.31) | 1014.83 (1.13) | 1150.00 (1.20) | 1013.20 (1.26) |
| Weeding | 9241.58 (12.22) | 8741.83 (9.75) | 12616.66 (13.22) | 9400.97 (11.69) |
| Irrigation | 2284.60 (3.02) | 5875.37 (6.55) | 6600.00 (6.91) | 3448.66 (4.29) |
| Organic insecticide & manures application | 1616.35 (2.13) | 1899.10 (2.11) | 1733.33 (1.81) | 1690.00 (2.10) |
| Harvesting & drying | 13600.42 (17.99) | 16130.56 (17.99) | 16608.33 (17.40) | 14418.00 (17.93) |
| Threshing | 10642.08 (14.08) | 13359.05 (14.90) | 12433.33 (13.02) | 11403.71 (14.18) |
| Winnowing | 7659.87 (10.08) | 10320.47 (11.51) | 10458.33 (10.95) | 8490.13 (10.56) |
| Cleaning | 2495.65 (3.30) | 2798.21 (3.12) | 2866.66 (3.00) | 2594.34 (3.22) |
| Packing | 5386.72 (7.12) | 7765.57 (8.66) | 7841.66 (8.21) | 6125.24 (7.62) |
| Transportation | 2454.35 (3.24) | 2640.94 (2.94) | 4000.00 (4.19) | 2621.66 (3.26) |
| Total cost | 75573.68 (100) | 89636.80 (100) | 95425.00 (100) | 80371.19 (100) |

Note: Figures in the parentheses are the percentage to the total.

From the table, the least cost indulged in the operation wise cost of cultivation was the process of land preparation for all farmers category with an overall cost of ₹ 559.14 (0.69%) per hectare in total cost. The estimated cost per hectare ranges from ₹ 362.07 (0.47%), ₹ 985.16 (1.09%) to ₹ 1050.00 (1.10%) in regards to marginal, small and medium farmers. Ploughing cost of operation decreases as farm size increases owing to a more thorough preparation of land in advanced prior to ploughing showing negative relationship with farm size. The calculated

overall cost per hectare of operation was ₹ 5652.11 (7.03 %). As in of marginal, small and medium farmers the observed cost was ₹ 6714.03 (8.88%), ₹ 3596.43 (4.01%) and ₹ 2333.33 (2.44%) per hectare respectively. In case of weeding, small farmers incurred the least while medium farmers incurred the highest cost followed by marginal farmers. The reason being use of manual labour more than machine labour by medium farmers and less manual labour and higher machinery labour in case of small farmers. The overall cost of weeding was ₹ 9400.97 (11.69%) while that of marginal, small and medium farmers was ₹ 9241.58 (12.22%), ₹ 8741.83 (9.75%) and ₹ 12616.66 (13.22%) per hectare. Like wise in threshing the highest cost was in small farmers and least was in marginal farmers since marginal farmers engaged machinery labour more for it and small farmers engaged more manual labour. The estimated overall cost per hectare was ₹ 11403.71 (14.18%). Marginal farmers observed a cost of ₹ 10642.08 (14.08%) while that of small and medium farmers incurred ₹ 13359.05 (14.90%) and ₹ 12433.33 (13.02%) respectively.

Returns from Chakhao cultivation

Net income over different cost concepts in rupees per hectare is depicted in Table 5. The overall net income over Cost A1 per hectare was ₹ 160908.75 and ₹ 153220.76 for marginal farmers, ₹ 173005.39 and ₹ 192759.35 each for small and medium farmers.

Table 5: Different income worked out from various cost (₹/ha)

| Particulars | Land holding size per hectare | | | |
|---------------------------------|-------------------------------|-----------|-----------|-----------|
| | Marginal | Small | Medium | Overall |
| Income over Cost A ₁ | 153220.76 | 173005.39 | 192759.35 | 160908.75 |
| Income over Cost A ₂ | 150865.29 | 173005.39 | 192759.35 | 159278.46 |
| Income over Cost B ₁ | 152793.21 | 172342.36 | 192035.36 | 160244.14 |
| Income over Cost B ₂ | 105125.69 | 119894.88 | 134435.36 | 110688.50 |
| Income over Cost C ₁ | 141832.88 | 162814.17 | 182568.69 | 149729.70 |
| Income over Cost C ₂ | 94165.37 | 110366.69 | 124968.69 | 100174.05 |
| Income over Cost C ₃ | 80530.69 | 108795.23 | 123275.04 | 98735.08 |

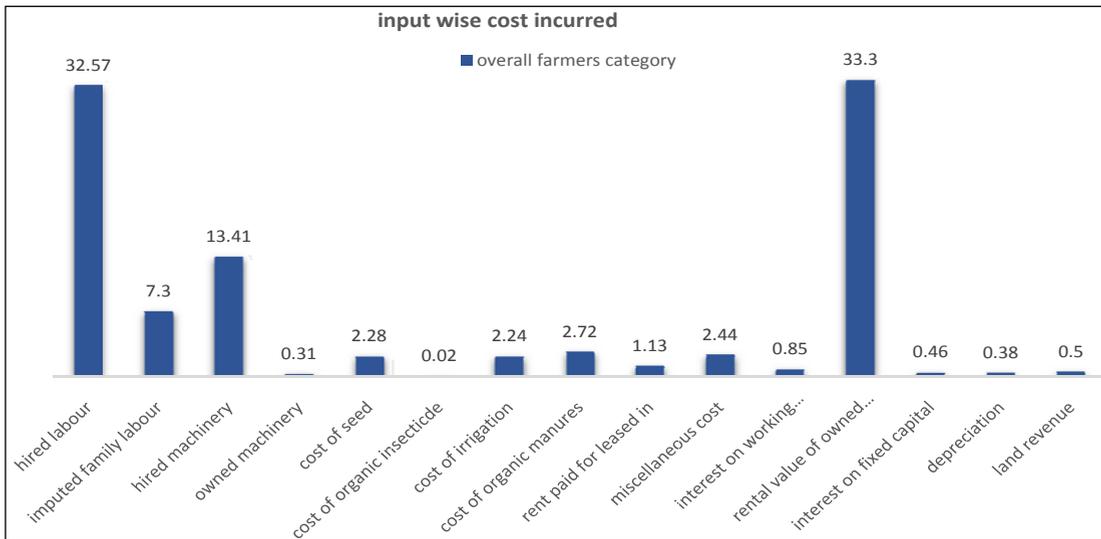


Fig. 1: Schematic representation of input wise cost of cultivation incurred by overall farmers on per cent basis rupees per hectare

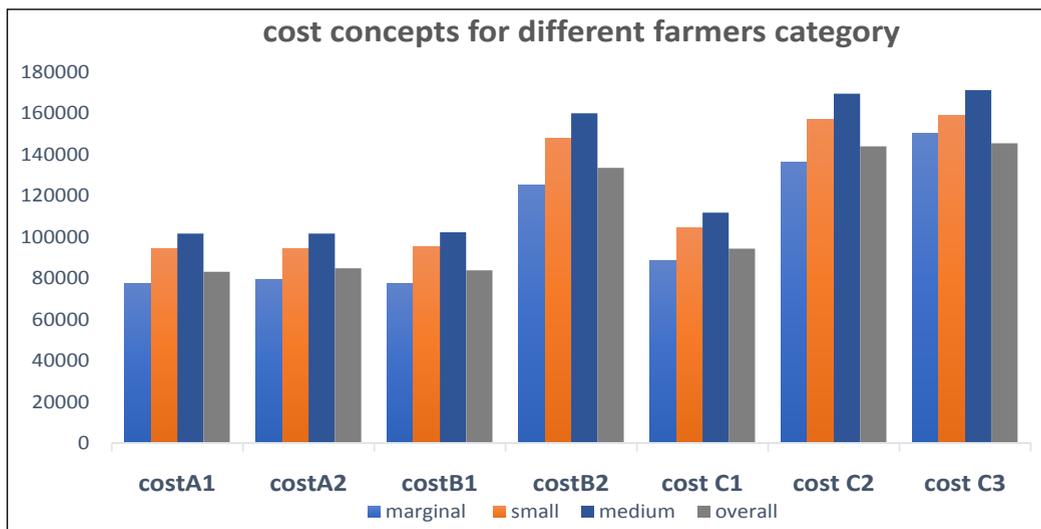


Fig. 2: Schematic representation of different cost concepts in rupees per hectare

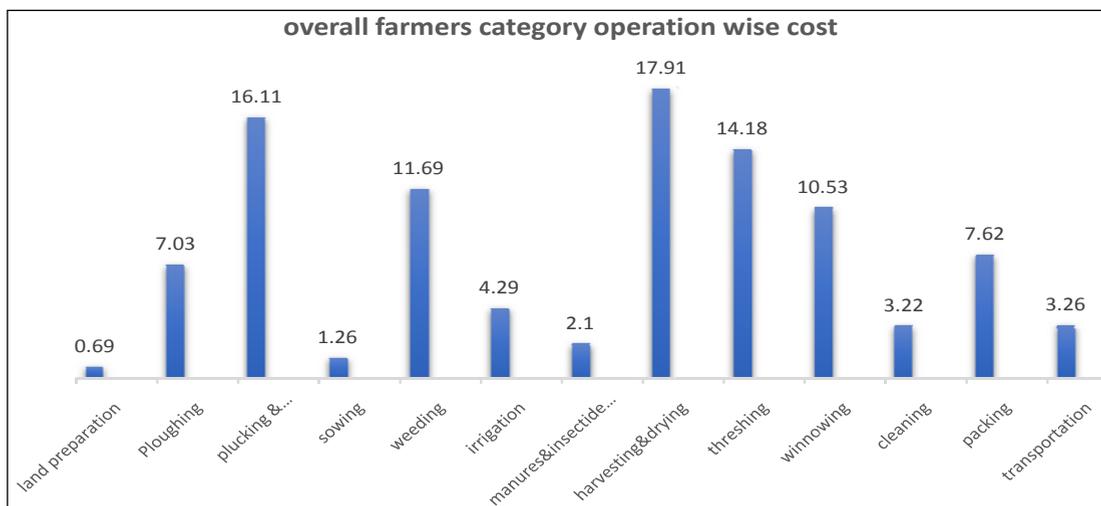


Fig. 3: Schematic representation of overall farmers operation wise cost incurred in rupees per hectare (per cent share)

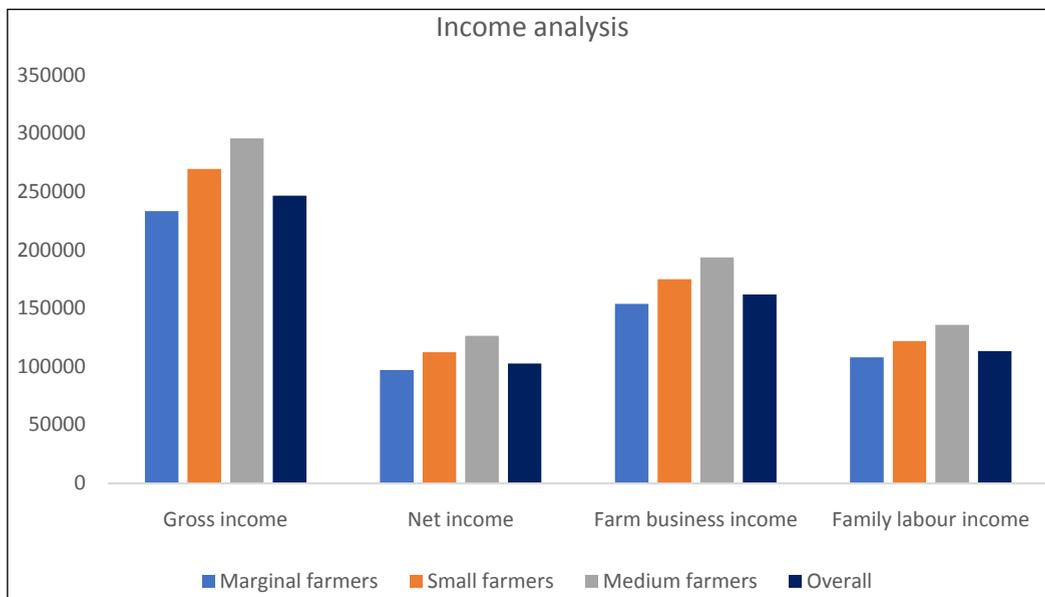


Fig. 4: Schematic representation of different income worked out in rupees per hectare

In regards to net return over Cost A_2 the overall estimated cost was ₹ 159278.46 while that of small and medium farmers remains the same as net return over Cost A_1 as there was no leased in land. And that of the marginal farmers was ₹ 150865.29 per hectare. The observed per hectare overall net income over Cost B_1 and B_2 were 160244.14 and ₹ 110688.50. The net income over Cost B_1 and Cost B_2 ranges from ₹ 152793.21, ₹ 172342.36, ₹ 192035.36 to ₹ 105125.69, ₹ 119894.88, ₹ 134425.36 per hectare with respect to marginal, small and medium farmers respectively. The average income over Cost C_1 and C_2 were ₹ 149729.70 and ₹ 100174.05 while medium farmers obtained ₹ 182568.69 and ₹ 124968.69 per hectare respectively. The table reveals that per hectare net income over Cost C_3 was the least out of all net return calculated for all farmers category. The calculated return per hectare was ₹ 98735.08 overall and ₹ 80530.69 and ₹ 108795.23 for marginal and small farmers and lastly medium farmers obtained a sum of ₹ 123275.04 per hectare.

Table 6 shows the income analysis for different farmer category in rupees per hectare. It was worked out based on various costs. The per hectare overall gross income and net income does obtain were ₹ 244071.78 and ₹ 100174.05. The per hectare net returns received by the farmers was ₹ 94165.37 and ₹ 110366.69 for marginal and small farmers while that of medium farmers was ₹ 124968.69. From Figure 4 it can be concluded that net return per hectare increases with increased in farm size

as medium farmers received the highest net return followed by small farmers depicting direct relationship with the farm size.

Table 6: Different income analysis in rupees per hectare

| Particulars | Land size holding per ha | | | |
|----------------------|--------------------------|-----------|-----------|-----------|
| | Marginal | Small | Medium | Overall |
| Gross income | 230512.12 | 267513.35 | 294333.33 | 244071.78 |
| Net income | 94165.378 | 110366.70 | 124968.69 | 100174.06 |
| Farm business income | 150865.30 | 173005.39 | 192759.35 | 159278.46 |
| Family labour income | 105125.70 | 119894.89 | 134435.36 | 110688.50 |

The reason attributable for this trend might be the endorsement of higher cost of cultivation to yield higher output by the medium farmers resulting in higher gross against lower gross income on other farmers. An average sum of ₹ 159278.46 per hectare was obtained in term of farm business income. And it ranges from ₹ 150865.30, ₹ 173005.39 and ₹ 192759.35 per hectare in accordance to marginal, small and medium farmers. The overall family labour income per hectare received was ₹ 110688.50. Marginal, small and medium farmers obtained a sum ₹ 105125.70, ₹ 119894.89 and ₹ 134435.36 per hectare respectively.

The input – output ratio which is an indicator of economic efficiency in crop production for the crop was worked out. The overall input-output ratio was

estimated to be 1.70. This implies that for every rupee investment in Chakhao cultivation, overall net income realized was ₹ 1.70. Likewise, the input-output ratio of marginal, small and medium farmers was 1.69, 1.70 and 1.73 indicating a net return of ₹ 1.69, ₹ 1.70 and ₹ 1.73 for every rupee investment in Chakhao cultivation.

Input Output Ratio (B/C Ratio) is a comparative between revenue and cost of farming. A value of B/C Ratio more than 1 implies that the farming is profitable to run. Based on Table 7 it showed an average value of B/C ratio of 1.70 in the study area indicating that Chakhao farming is profitable and suitable to cultivate in the study area and shows a direct relationship with the farm size.

Table 7: Input output ratio for various farmers category

| BCR | Farmer category | | | |
|-----|-----------------|-------|--------|---------|
| | Marginal | Small | Medium | Overall |
| | 1.69 | 1.70 | 1.73 | 1.70 |

CONCLUSION

Chakhao may be considered as black gold of Manipur because of its scope for earning foreign exchange. The demand for good quality Chakhao has been increasing in international market because of its organic in character. Naturally, Chakhao is an organic rice variety. It is organic in character as it causes lodging and the nutrient content reduces if chemicals and inorganic fertilizers are applied on it. It has its own fertilization from its environment and it is also resistant from the emergence of insect and pests. Chakhao is now one of the most demanded raw materials for agro based industries in Manipur. The value addition of Chakhao has been increasing in the state. The total land holding of the farmers in the study area is 78.57 hectare. The per cent share of marginal farmers was the highest accounting 87.14 per cent to total number of farmers. The average total cost of chakhao cultivation was ₹ 143883.82 per hectare. Labour was the major input in Chakhao cultivation. The per cent share of hired labour was 30.46 per cent for marginal, 36.38 per cent for small farmers and 32.57 per cent for medium farmers. Rental value of own land was the major factor of fixed cost accruing a total share of 33.11 per cent overall and 33.15 per cent (₹ 45312.05) in marginal farmers, 333.01 per cent

(₹ 52447.7) in small farmers and 33.51 per cent (₹ 57600.00) in medium farmers. Overall Cost A2 per hectare was estimated at ₹ 84779.41. The overall total cost in term of operation wise was ₹ 80371.19 per hectare. The process of harvesting & drying incurred the highest cost followed by plucking & transplanting operation. It accounts for 17.93 and 16.11 per cent in total cost per hectare. The average net income per hectare obtained was ₹ 100174.05. The net income per hectare varies directly with farm size as it increases with farm size with medium farmers receiving a total sum of ₹ 124968.69 per hectare which was the highest of all category. The overall input-output ratio obtained was 1.70. And it ranges from 1.69, 1.70 to 1.73 as in for marginal, small and medium farmers. Among the input-output ratio, medium farmers obtained the highest value of 1.73 indicating that out of all the farmers category, medium farmers have been found to be more economical and profitable.

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