

## Profitability of Black Rice: Evidence from Manipur, India

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### ABSTRACT

The study was conducted in the valley region of Manipur with the objective of analyzing the comparative cost and profitability of black rice and normal rice during the year 2022-23. A sample of 180 rice growers consisting of 120 black rice and 60 normal rice growers was selected for data collection using snowball sampling procedure. The cost of cultivation was estimated using the approach recommended by the Special Expert Committee of Commission for Agriculture Cost and Prices (1979), profit measures and break-even point analysis were applied to achieve the stated objective. The result showed that black rice was found to be highly profitable to the farmers as compared to normal rice. The cost of cultivation of normal rice is estimated to be higher mainly due to higher expenditure on machinery charge, labor charge (hired and family) and fertilizer and manure. The break-even point was estimated to be lower than that of normal rice, which indicates that producers can achieve a no-profit-no-loss situation at a lower level of production than that of normal rice. The benefit-cost ratio of black rice was higher than that of normal rice indicates high profitability of the black rice cultivation.

Since the cultivation cost of black rice is less but high market price of produce becomes it highly profitable for farmers. Therefore, it is suggested that the extension agent should conduct awareness programs to encourage the farmers to produce black rice commercially, which would be helpful in enhancing the livelihood and sustainable income to the farmers.

**Keywords** Black rice, Normal rice, Economic analysis, Cost concept, Profitability.

### INTRODUCTION

Rice is consumed as staple food by almost 50% of the Asian population while South Asia alone is covered figure of 70%. Rice contributes to about 40-43% of the total food grain production in India from one-fourth of the total cropped area and plays an important role in the national food and livelihood security system (Bishwajit *et al.* 2013). It is produced as a sole crop in lowland area and as a mixed cropping with other crops in *Jhum*, upland and dryland areas of Manipur. The rice is produced on around 90% of cultivated area of the state (Chanu *et al.* 2010, Nagamani *et al.* 2022, Kumbhare and Singh 2011). Shifting cultivation, also known as *Jhuming*, is a common practice of rice in several parts of India (Singh and Sadangi 2012 and Patra *et al.* 2014). The black rice (*Chak-hao*) is the indigenous aromatic variety of the rice exhibit wide range of diversity in morphology, color, shape and size of grain, aroma, glutinous or non-glutinous content. It has high anthocyanin content which confers many health benefits and is of special importance to the state's communities (Sharma *et al.* 2023). During the year 2020, the *Chak-hao* has got the Geographical

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Indication (GI) tag due to its high nutritional value, aroma and unique color (Chanu *et al.* 2022). Black rice is cultivated in the *kharif* season which requires warm climatic conditions and a long growing period of about 3-6 months and is available in the market from the month of May to December (Mainuddin *et al.* 2022). Black rice requires less input, is produced organically by most farmers as the use of organic fertilizers and plant protection chemicals has a negative impact on yield. The black rice is cultivated on limited area which has covered 4500 ha area in Manipur during the year 2019-20 (GoM 2021a). Black rice is produced in small area as most of the farmers produce to meet domestic consumption and as gifts to friends and relatives on various cultural occasions of the state. Although the productivity of black rice is still lower than that of normal rice, its market value is much higher, so it generates higher returns per unit area. Keeping all these backgrounds in mind, the problem is identified and the objectives are taken into account to estimate the socio-economic status of rice growers in the study area and to analyze the comparative costs and profitability of black rice and normal rice in study area.

## MATERIALS AND METHODS

The study was conducted in the valley region of Manipur viz., Imphal West and Imphal East districts as these two districts contributed maximum area and production of rice in the state (GoM 2021b). Snowball sampling procedure was applied for selection of respondents from the study area due to non-availability of secondary data on area and production at block and village level. A total of 180 rice growers, including 120 black rice and 60 normal rice growers, were interviewed during the data collection for the year 2022-23. The comparative cost of cultivation was estimated using the cost concept recommended by the Special Expert Committee CACP (1979) as follows:

Cost  $A_1$  was estimated by adding the value of purchased input materials including seeds, fertilizers and manures, hired labor charges, machinery charges, depreciation on agricultural buildings and equipment, land revenue and interest on working capital. Cost  $A_2 = \text{Cost } A_1 + \text{rental value of the leased land}$ , Cost  $B_1 = \text{Cost } A_2 + \text{interest on own capital excluding land}$

value, Cost  $B_2 = \text{Cost } B_1 + \text{rental value of own land minus land revenue}$ , Cost  $C_1 = \text{Cost } B_1 + \text{Imputed value of family labor}$  and Cost  $C_2 = \text{Cost } B_2 + \text{Imputed value of family labor}$ . The return and profitability were estimated using measures such as Net return including family labor = Gross return – Total cost including family labor, Net return excluding family labor = Gross return – Total cost excluding family labor, Farm business income = Gross return – Cost  $A_2$ , Family labor income = Gross return – Cost  $B_2$  and Net farm income = Gross return – Cost  $C_2$ . The total return of rice production was estimated by multiplying paddy yield and market price and straw quantity and straw price in the study area. The benefit-cost ratio (B-C ratio) was estimated by taking the ratio of total return to cost  $C_2$  on rice production. The break-even point (BEP) is the level of output where total cost equals total revenue of the output, i.e., neither profit nor loss. BEP was estimated as follows :

$$\text{BEP} = \frac{F}{(P-V)}$$

Where, F is the fixed cost per ha of paddy, P is the cost of paddy in rupees per quintal and V is the variable cost of paddy in rupees per quintal. The benefit-cost ratio was estimated by taking the ratio between gross return and total cost of production at a farm.

## RESULTS AND DISCUSSION

### Socio-economic status of rice producer

Education is a major feature that helps in right decision making and successful orientation of business. In the study area, most of the producers were educated up to secondary level (38.33%), followed by primary (23.89%), higher secondary (22.78%), higher education (8.33%) and illiterate (6.67%). Black rice growers were observed to be more educated than normal rice growers, which implies that black rice farmers have relatively more opportunities to cultivate black rice commercially. In the study area, both male and female farmers were engaged in rice cultivation, although the share of males (52.22%) was higher than that of females (47.78%). A similar pattern was observed for black rice growers, while about 50% of male and female farmers were engaged in normal

**Table 1.** Socio-economic characteristics of rice producers. Source: Household survey, 2021-23. Note: N= No. of respondents, Percentage figures indicate the share of total respondents;  $\bar{x}$  and  $\sigma$  are indicates mean and standard deviation, respectively.

Variable	Black rice (n=120)		Normal rice (n=60)		Overall (n=180)	
	N	%	N	%	N	%
<b>Education</b>						
Illiterate	7	5.83	5	8.33	12	6.67
Primary	27	22.50	16	26.67	43	23.89
Secondary	47	39.17	22	36.67	69	38.33
Higher secondary	27	22.50	14	23.33	41	22.78
Higher education	12	10.00	3	5.00	15	8.33
<b>Gender</b>						
Male (no.)	64	53.33	30	50.00	94	52.22
Female (no.)	56	46.67	30	50.00	86	47.78
	$\bar{x}$	$\sigma$	$\bar{x}$	$\sigma$	$\bar{x}$	$\sigma$
<b>Family</b>						
Size (no.)	5.56	1.95	5.27	1.58	5.46	1.84
Age (year)	54.08	13.75	52.63	14.14	53.59	13.86
<b>Farming experience</b>						
(year)	9.42	7.03	9.23	6.36	9.35	6.79

rice cultivation. The household size of rice growers was estimated at 5.46 members. The household size of black rice growers was estimated at 5.56 members which was relatively higher than that of normal rice growers of 5.27 members. Generally, larger family size lowers the standard of living of the household as more income is required to meet the requirement of living. On the other hand, larger family size may provide more labor for agricultural operations. The age of rice growers was recorded at 53.59 years, while those growing black rice and normal rice were of 54.08 years and 52.63 years, respectively. Similar finding of age was reported by Prakash and Singh (2010). Most of the rice growers have been producing rice since time immemorial but the cultivation experience has been evaluated according to their personal experience. Rice growers had 9.35 years of farming experience, while black rice growers had older experiences than normal rice growers, which revealed that black rice growers may have relatively higher knowledge about the benefits and loss of cultivation (Table 1).

**Table 2.** Occupational status and dependency ratio of rice producers. (Percent). Source: Household survey, 2021-23. Note: N= Member of total household, percentage figure indicates total percentage of column.

Occupation	Black rice	Normal rice	Overall
Agriculture	31.37	29.78	30.86
Business	8.39	7.21	8.02
Service	3.98	5.02	4.31
Household	23.42	24.76	23.85
Education	32.84	33.23	32.97
<b>Dependency ratio</b>	<b>0.43</b>	<b>0.40</b>	<b>0.42</b>

### Occupational status of the sampled household

The family members of rice producers were engaged in various occupation according to their skills and knowledge. Majority of the total farmers were engaged in agriculture (30.86%), followed by household (23.85%), business (8.02%) and service (4.31%) which implies that agriculture was the major source of income for the farmers family. On the other hand, farmers were aware about education, as a result of which a total of 32.97% household members were enrolled for education. The overall dependency ratio was recorded as 0.42 which indicates that 42% of the members of the sampled household were financially dependent on the earning member of the same household, while the dependency ratio of the black rice household was relatively higher than that of the normal rice household (Table 2).

### Land tenancy and cultivated area of rice growers

Agricultural production is not possible without land, which also acts as a security for the farmers. The farmers were allotted part of the land under various agricultural enterprises according to their own requirement and production demand of the market. Rice growers had an average operational size of land holding of 0.33 ha, while black rice growers had 0.28 ha, which was lower than normal rice growers of 0.37 ha. The rice growers were leased out the average size of land of 0.12 ha and leased 0.06 ha in the study area. The total cultivable area of the farmers was of 0.25 ha, while more area was allocated for normal rice (0.16 ha) black rice (0.35 ha), which may be due to more household requirement of normal rice as compared

**Table 3.** Land holding size of rice producers in study area (ha/farm). Source : Household survey 2021-23.

Land tenancy (ha)	Black rice	Normal rice	Overall
Operational land	0.28	0.37	0.33
Cultivated area	0.16	0.35	0.25
Own land	0.21	0.33	0.27
Leased-in land	0.10	0.13	0.12
Leased-out land	0.03	0.09	0.06

to black rice (Table 3).

### Cost of cultivation of rice

The total cost of rice cultivation was recorded at Rs 52665.60 per ha, with maximum expenditure on machinery charges (18.15%), followed by labor charges (13.38%) and fertilizers and manures (4.02%). Similar pattern of finding was reported by Agarwal *et al.* (2018). In case of normal rice, the cost of cultivation was estimated at Rs 67296.58 per ha, of which the pattern of percentage share of investment was found to be similar with the total cost of rice cultivation.

The maximum cost was incurred by the normal rice growers on machinery charges as most of the farmers used tractors, power tillers, threshers and reaper machines for rice cultivation operations. The estimated value of Cost A<sub>1</sub>, Cost A<sub>2</sub>, Cost B<sub>1</sub>, Cost B<sub>2</sub> and the imputed value of family labor by normal rice growers was of 49.61%, 61.97%, 52.16%, 73.16% and 26.84%, respectively. In case of black rice, the total cost of cultivation was recorded at Rs 38034.62 per ha, where the maximum cost was incurred on labor charges (14.36%), followed by machinery charges (11.38%) and seed cost (4.09%) and fertilizers and manure (2.13%). The similar pattern of finding concluded by Nirmala and Muthuraman (2009). Most black rice farms cultivated black rice using labor rather than machinery and the high market price of black rice seed resulted in the addition of these costs to the overall cost compared to normal rice. Most of the farmers adopted organic production of black rice and the negative effect of chemical fertilizers and plant protection chemicals on the yield reduced the expenditure on these inputs, resulting in lower cost of

**Table 4.** Cost of cultivation of rice in Manipur (Rs/ha). Source: Author's calculation. Note: The percentage figure represents the percentage share of the total cost.

Costs	Black rice	%	Normal rice	%	Overall	%
Labor charge	5462.73	14.36	8625.44	12.82	7044.09	13.38
Machinery charges	4329.51	11.38	14785.37	21.97	9557.44	18.15
Fertilizers and manure	809.20	2.13	3420.12	5.08	2114.66	4.02
Seed	1556.35	4.09	1119.03	1.66	1337.69	2.54
Plant protection chemicals	225.15	0.59	795.50	1.18	510.33	0.97
Irrigation charges (Rs/ hour)	275.52	0.72	1158.59	1.72	717.06	1.36
<b>Working capital</b>	<b>12658.46</b>	<b>33.28</b>	<b>29904.05</b>	<b>44.44</b>	<b>21281.26</b>	<b>40.41</b>
Depreciation on machinery and implements @10%	432.95	1.14	1478.54	2.20	955.75	1.81
Interest on working capital (@7% for 6 months)	715.60	1.88	1766.51	2.60	1241.06	2.36
Land revenue (per 6 month)	240.00	0.63	240.00	0.36	240.00	0.46
<b>Cost A<sub>1</sub></b>	<b>14047.01</b>	<b>36.93</b>	<b>33389.10</b>	<b>49.61</b>	<b>23718.06</b>	<b>45.04</b>
Rent paid for leased in land	5250.00	13.80	8313.00	12.35	6781.50	12.88
<b>Cost A<sub>2</sub></b>	<b>19297.01</b>	<b>50.74</b>	<b>41702.10</b>	<b>61.97</b>	<b>30499.56</b>	<b>57.91</b>
Interest on own fixed capital excluding the value of land	1321.50	3.47	1710.00	2.54	1515.75	2.88
<b>Cost B<sub>1</sub></b>	<b>15368.51</b>	<b>40.41</b>	<b>35099.10</b>	<b>52.16</b>	<b>25233.81</b>	<b>47.91</b>
Rental value of own land less land revenue+ rent paid for leased in land	11239.00	29.55	14138.00	21.01	12688.50	24.09
<b>Cost B<sub>2</sub></b>	<b>26607.51</b>	<b>69.96</b>	<b>49237.10</b>	<b>73.16</b>	<b>37922.31</b>	<b>72.01</b>
Imputed value of family labor	11427.11	30.04	18059.48	26.84	14743.30	27.99
<b>Cost C<sub>1</sub></b>	<b>26795.62</b>	<b>70.45</b>	<b>53158.58</b>	<b>78.99</b>	<b>39977.10</b>	<b>75.91</b>
<b>Cost C<sub>2</sub></b>	<b>38034.62</b>	<b>100</b>	<b>67296.58</b>	<b>100</b>	<b>52665.60</b>	<b>100.00</b>

**Table 5.** Production and profitability of rice in Manipur (Rs/ha). Source : Author's calculation.

Particulars	Unit	Black rice	Normal rice	Overall
<b>Yield of paddy</b>	<b>(q/ha)</b>	<b>16.50</b>	<b>30.72</b>	<b>23.61</b>
Yield of by-product (straw)	(q/ha)	14.80	19.20	17.00
Return on paddy	(Rs/ha)	102850.00	63097.50	82973.75
Return on by-product (straw)	(Rs/ha)	5920.00	7680.00	6800.00
<b>Farm gross income (FGI)</b>	<b>(Rs/ha)</b>	<b>108770.00</b>	<b>70777.50</b>	<b>89773.75</b>
Farm business income (FGI- Cost A <sub>2</sub> )	(Rs/ha)	82908.60	27806.63	55357.61
Family labor income (FGI- Cost B <sub>2</sub> )	(Rs/ha)	64437.10	10346.63	37391.86
Net farm income (FGI- Cost C <sub>2</sub> )	(Rs/ha)	58974.37	1721.20	30347.78
Farm investment income (Farm business income – wages of family labor)	(Rs/ha)	103307.27	62152.07	82729.67
<b>Break-even point</b>	<b>Quintal</b>	<b>0.42</b>	<b>21.62</b>	<b>4.40</b>
<b>B-C ratio</b>		<b>2.86</b>	<b>1.05</b>	<b>1.70</b>

black rice cultivation. The estimated value of Cost A<sub>1</sub>, Cost A<sub>2</sub>, Cost B<sub>1</sub>, Cost B<sub>2</sub> and family labor accounted for 36.93%, 50.74%, 40.41%, 69.96% and 30.04% by black rice growers. The cost of family labor was estimated to be higher than that of normal rice as most operations were conducted by family labor in black rice fields. Therefore, total cost of cultivation of black rice is estimated to be lower than that of normal rice due to higher costs incurred by normal rice growers on fertilizers and manures, plant protection chemicals and machinery charges (Table 4).

#### Yield and economic returns of rice cultivation

The productivity of black rice was estimated at 16.50 quintals per ha, which was almost half that of normal rice at 30.72 quintals per hectare, while the total rice productivity was estimated at 23.61 quintals per ha. The yield of normal rice was consistent with the findings of Singh *et al.* (2012) and Mohanty *et al.* (2016). The low productivity of black rice may be due to the adoption of organic production by most producers. The Farm Gross Income (FGI) for black rice and normal rice was estimated at Rs 108770 per ha and Rs 70777.50 per ha, respectively. Despite the low productivity of black rice, a higher FGI was recorded for black rice as compared to normal rice mainly due to higher market price of black rice and lower cost of cultivation. The net farm income was estimated at Rs 58974.37 per ha for black rice and Rs 1721.20 per ha for normal rice, which indicates that black rice cultivation generated higher profit share to the farmers than normal rice. The break-even point

for production of black rice was estimated to be low (0.42 quintals) as compared to 21.62 quintals for normal rice, indicating that the production of only 0.42 quintals of black rice and 21.62 quintals of normal rice would provide no profit no loss situation for the farmers. The benefit-cost ratio was estimated higher for black rice than normal rice, which is another indicator to show the higher profitability for producers (Table 5).

#### CONCLUSION

Cultivation of black rice was found to be highly profitable as compared to normal rice due to low input cost and high market price of black rice. In case of normal rice, the cost of cultivation was recorded higher mainly due to higher expenditure on machinery charges and labor cost. Furthermore, the marginal cost of fertilizer and irrigation was high for normal rice cultivation, while the requirement of the same factors was low for black rice cultivation due to low water requirement and organic motive for production. The break-even point for black rice was also recorded low, which implies that farmers can achieve a no-profit-no-loss situation at low production levels of black rice. The high benefit-cost ratio of black rice indicates high income opportunities for farmers from black rice cultivation. Therefore, the study recommended that the extension worker should organize awareness programs regarding the huge returns and health benefits of black rice to the farmers which would be helpful in strengthening the livelihood and sustainable income of the farmers in the state.

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