

In Search of Sustainable Alternatives: A Comparative Study of Gobindabhog and HYV Rice Cultivation in West Bengal: A Case Study of the State's Rice Bowl

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Abstract

Rice plays a vital role in the socio-economic aspects of Purba Bardhaman district, West Bengal - the 'Rice Bowl' of the State. The glorious past of this district is associated with several indigenous rice varieties and also the direct relation with the livelihood and social status of the farmers. However, after the Green Revolution in the 1960s, High Yielding Varieties (HYV) flourished rapidly at the cost of indigenous rice varieties. Later on, such aggression resulted in less return gradually and the need for another alteration is expected in the advent of the second Green Revolution for better prospects and profitable farming practices. This study tries to analyse the socio-economic viability and associated risk hazards of both Gobindabhog indigenous and HYV's rice cultivation. In doing so, the study attempts to search for the alternative one in the contemporary crisis of agriculture taking into account the farmers' socio-economic issues of the study area. Respondents' interviews with a cross-sectional; multi-layered; semi-structured questionnaire and secondary data were used with both thematic narratives and quantitative techniques using IBM SPSS version 20.0 software to reflect the comparison with ground truth. It might be suggested that the cultivation and spreading of indigenous varieties accompanied with HYV's would be a future solution for both farmers and environmental concerns.

Keywords: Rice Bowl; Purba Bardhaman District; The Green Revolution; Gobindabhog Rice; HYV; Profitable Farming; Socio-Economic Viability; West Bengal; India

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Introduction

Rice plays a critical role in Indian agriculture, occupying about 4.5 million hectares of land and yielding 111.52 million tonnes in 2017-18 (Lalitha and Vinayam, 2020). Evidence suggests that more than 82000 indigenous rice varieties were cultivated in India earlier and 5500 varieties were cultivated in Bengal (Ghosh, 2015). In ancient India, evidence of using rice for medicinal purposes was found in *Susrutha Samhita* and *Charaka Samhita* of about 10000 B.C. (Balachandran et al., 2006). Several indigenous rice varieties are inseparable due to their adaptability and acceptability factors. It also helps create a sustainable form of agriculture (Khairullah, 2020). However, these are now becoming history. In Indian agriculture, the Green Revolution of the 1960s changed the scenario (Hunter, 1877) in many aspects primarily through introducing High Yielding Varieties (HYV). These HYVs replaced traditional local varieties due to their higher productivity and low risk in agriculture (Ghosh and Chattopadhyay, 2017; Bandopadhyay, 2014). As HYV seeds occupied the whole market rapidly, the indigenous varieties being passed into oblivion were placed on the verge of extinction (Niyogi, 2019; Eliazar Nelson et al., 2019; Banerjee et al., 2011).

These changing scenario of Indian agriculture is also reflected in the Purba Bardhaman district of West Bengal. The district is popularly known as India's Rice Bowl (*Dhāner Gola*). Genetically modified seeds have been sown in this 'rice after rice' region at the cost of several valuable indigenous rice varieties. The enormous production of HYV's in a suitable physical set-up will increase the dependency on this sector and allied activities (National Informatics Centre, Purba Bardhaman, 2011; Bureau of Applied

Economics and Statistics, Purba Bardhaman, 2018). Over 58% of the study area population are engaged as agricultural labourers (Figure 1), creating typical agrarian societies and rice-culture in the Purba Bardhaman district (Livelihood zone analysis in West Bengal, FAO, UNO, 2016).

After the 1990s, HYV's performance came into question on several grounds. Factually, the nature of cropping pattern, changes in crop combination and heavy uses of fertilisers, pesticides, groundwater upwelling, etc., badly impacts upon the environment. Moreover, such mono-crop culture (Basu, 2014; Basu, 2017) and massive production automatically reduce the product's price and demand in markets (Das, 2003; Deka et al., 2014). Simultaneously, the farmers' earnings begin to decline, and this slow but steady decline of farmers' earnings directly hits both rural societies and their livelihood. Amidst such critical circumstances, the need for another thrust in rice farming in this district is expected to keep up its old historical fame and combat the emerging problems of HYV's in this region (Verma, 2019).

So the question here is what is an alternative measure to cope with this crisis in this area? Are there any possibilities for redeveloping indigenous varieties as a challenge for emergent problems? How would such redevelopment be viable socio-economically and environmentally in this region?

This study attempts to unfurl the qualities of indigenous varieties, especially Gobindabhog rice and its comparative advantages from HYV's cultivation based on selective indicators in the study region. This study indeed researches the scope of expanding such varieties and the key hindrances associated with it.

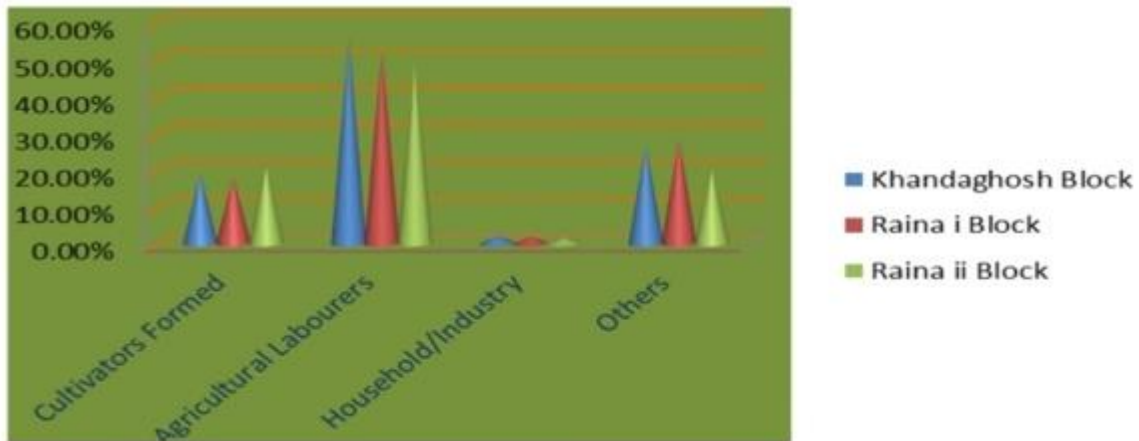


Figure 1: Occupational Pattern in the Study Area (in Percentage)
Source: N.I.C. Purba Bardhaman 2011

Conceptual Framework and Literature Review

Indigenous rice is neglected treasures in India (Ghosh et al., 2015; Pal, 2016). Presently, such varieties are cultivated in a scattered manner in our country (Ghosh, 2015; Nagarajan, 2018). However, indigenous rice has several positive qualities, like stress and iron toxicity tolerance (Das and Das, 2014); these varieties are highly nutritious, and contains a high level of Zinc (Zn) and Ferrum (Fe) (Khairullah, 2020; Radhakrishnan, 2019) and helps to preserve genetic varieties (Deka et al., 2014). Earlier, these were cultivated traditionally (Rizwan and Liyaqat, 2011) with co-operative communication (Bokaria, 2015) and Indigenous Technical Knowledge (ITK) which had a significant impact on the cost of production (Kumar and Sahu, 2018; Atkinson et al., 2018). Now, the System of Rice Intensification (SRI) and modern inputs are also implemented with zero tillage (Huynh et al., 2020; Rizwan and Liyaqat, 2011; Eliazar Nelson et al., 2019; Bokaria, 2015; National Consortium of SRI, 2014; Phapumma et al., 2020; Karforma, 2021; Ghorai et al., 2014). Yet, indigenous rice varieties are neither popular as HYV's nor acknowledged their positivity in agriculture (Pal, 2016).

The present research is mainly concerned with analysing positive feedbacks of indigenous Gobindabhog rice (Figures. 2 & 3) and its environmental and socio-economic viability in

the study region. From the previous works about the Gobindabhog variety, the following has been found:

- It is a native, non-basmati, indigenous aromatic premium variety of rice (Roy, 2019).
- It is followed by the organic way of cultivation (Pal, 2015) and received G.I. tag from West Bengal, like Tulaipanji rice of North Bengal (Blakeney et al., 2020; Ghosh et al., 2015).
- It is a short, white kernels and sticky rice (Mohanty et al., 2011), having a sweet buttery flavour and pleasant aroma with good cooking qualities (Ghosh, 2015).
- It is mainly cultivated in Kharif season as an Aush and Aman (Figure. 2) rice (Mukherjee, 1901; Banerjee, 1972).

Considering these backdrops, it is argued that the existing literature provides the essential plant characteristics and qualities of the Gobindabhog indigenous rice variety, however, these studies have failed to critically analyse the socio-cultural and economic profile of the villagers associated with HYV's and indigenous Gobindabhog rice variety; the various reasons for the increasing engagement of the new generation in indigenous farming. In addition, the study aims to explore the probability of a better alternative one and self-sustained model of agriculture in the advent of the second Green

Revolution phase parallel with modern HYV's. The study, therefore, try to establish the reason for the historical existence of such varieties inspite of the Green Revolution in the 1960s. Our research finds that although the study region uses modern inputs like mechanisation, the new mode of irrigation, etc., it did not change their rice variety like other blocks of the district.

In a way, the research uniquely studies and compare the natural and socio-economic risk hazards scenario between these two varieties.

It also tries to show the ways and measures of expanding the Gobindabhog indigenous varieties in different blocks, wherever possible. Hence, the key objectives of this research are as follows:

- To examine the socio-economic viability of Gobindabhog indigenous rice contrary to HYV rice cultivation in the study region.
- Risk assessment is associated with the cultivation of both HYV's and indigenous Gobindabhog variety and the way to cultivate one along with another.
- To search for the alternative way of farming in respect of HYV's mono-cropping and declining output in agriculture in the current scenario.
- Searching the possibilities and hindrances of spreading of such indigenous varieties in this region and simultaneous scope of farmers' income in the advent of the second Green Revolution phase.



Figure 2: Sample of Govindabhog Paddy (During the Growing Period)
Source: Field Survey 2020-21



Figure 3: Sample of Govindabhog Rice
Source: Field Survey 2020-21

The Study Area

The present research includes the area of three blocks (namely Raina-I, Raina-II, and Khandaghosh) of Purba Bardhaman district, West Bengal (Figure 4), where Gobindabhog rice cultivation has been seen for decades (Table 1). It occupies nearly 22,000 – 24,000 hectares of land in this region (Ghosh, 2015; Niyogi, 2019). Except for these three blocks, neither of the other parts of the country cultivated such indigenous variety, nor branded in the same name. This is the crucial reason for choosing such a micro-level study area. The Government of India recognises this geographical location by

giving G.I. (Geographical Indication) tag in 2017 (Blakeney et al., 2020).

This area is under the Khandaghosh plain region with an average elevation of 31 meters in Raina-I, 25 meters in Raina -II and 49 meters in Khandaghosh block (Bureau of Applied Economics and Statistics, 2018; National Informatics Centre, Purba Bardhaman, 2011). These three blocks lie in the river Damodar's right bank flood plain with alluvial formation (Banerjee, 1972). The river Damodar (known as the river of sorrow) was over flooded in this region and deposited alluvium to form this fertile track (Ghosh, 2015).

The study area lies between 23°00'49" North to 23°12'47" North and 87°41'23" East to 87°54'22" East. The Raina-I block consists of eight Gram Panchayats (Raina, Shyamsundar, Natu, Hijalna, Polasan, Sheara, Narugram, etc.), the Raina II block also consists of eight Gram Panchayats (Painta-II, Arin, Gotan, Poholanpur, Boroboinan, Kaity, Uchalaan, etc.) and The Khandaghosh block consists of ten Gram Panchayats (Berugram, Shakhanri, Khandaghosh, Gopalbera,

Ukhrid, Sogra, Sosanga, Koiyor, Lodna, etc.). The total area of the study region is approximately 758.58 sq.km. (Table 1) and population density is 687.72 persons/sq.km (Census of India, 2011). The region is under a tropical monsoonal climate with a mean annual rainfall of about 248 mm. The annual temperature ranges between 26°C to 33°C and relative humidity varies from 60% to 70% (I.M.D. Kolkata).

Table 1: Administrative Divisions and Production of Rice of Purba Bardhaman District, West Bengal

Subdivision	Police station	C.D.block	Mouza	Inhabited village	Aman (HYV)		Aman (Indigenous)	
					Area(ha)	Production (mt.)	Area(ha)	Production (mt.)
Burdwan-II (south)	Raina	Raina –I	113	111	17000	76500	6700	20100
	Madhab dihi	Raina –II	94	87	12000	54000	8500	25500
	Khandaghosh	Khandaghosh	111	107	16200	72900	5700	17100

Source: D.A.O. of Purba Bardhaman District (2018) and Bureau of Applied Economics and Statistics, Purba Bardhaman (2018)

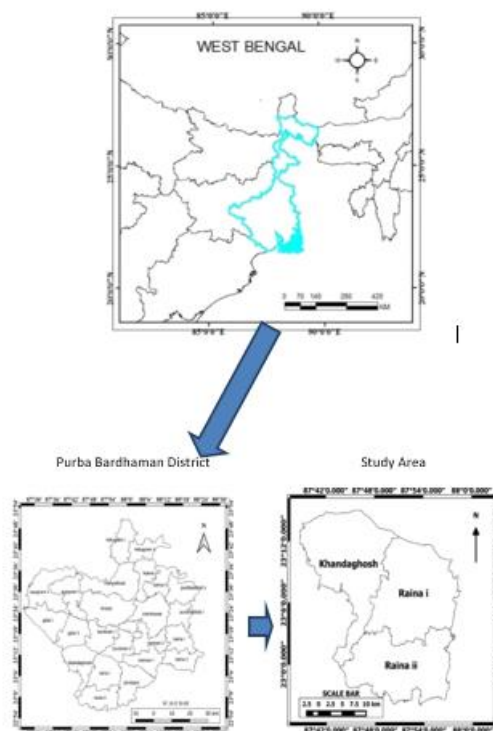


Figure 4: Location Map of the Study Area

Source: Authors

Methodology and Database

To accomplish the study's objectives, mixed types of methodologies were adopted to analyse the primary and secondary data. The various steps of the research are as follows:

Study Design

The study was completed in different phases. In the first phase, available literature and secondary data were collected and studied for relevant information. In the second phase, intensive field visit work was conducted in the study area. To aggregate primary data, a cross-sectional; multi-layered semi-structured questionnaire was framed in Bengali (the local state language) and was surveyed several times accordingly with the help of a local guide. The questions were structured in both open and close-ended to give space to the respondents wherever possible. Two-way closed ended questions (like yes/no) were prepared of different criteria (like costs, profits, losses, problems, etc.) of Gonindabhog and HYV's rice cultivation. A key informant survey was also conducted to gather information for qualitative and quantitative perceptions and views of the farmers about these two varieties and translate accordingly. Initially, some respondent is unwilling to participate in interviews, but later on, few other respondents volunteered to participate in the study.

Choosing of Samples

Ground surveys and respondent interviews accuracy depends on choosing a sufficient number of samples. Therefore, the sample size is a very important aspect of this research. Thirty participants were selected for interviews using random sampling. Ten participants are represented for each block, which are equally distributed (five for each) among the two variables (Gobindabhog and HYV's rice). Covid 19 pandemic rendered hindrance during the field study and therefore, the sample collection remained relatively small.

Techniques

Both qualitative and quantitative techniques were used in this analysis. Qualitative methods based on the thematic narratives were used to show the opinion of the farmers and their families using a semi-structured questionnaire. Again, simple cartographic techniques and student t-test based on the IBM SPSS version 20.0 software were also applied to represent data and check the reality of the hypothesis at a 95% significance level.

Analysis

Based on semi-structured questionnaire and participant views, different indicators were taken for analysis and comparing these two variables. The leading analysed indicators are the cost of production, product output or earnings, risk assessment and ultimate socio-economic development of the farmers (Fernandes et al., 2021; Schimmelpfening, 2018; Rahaman et al., 2019). Student t-test had been applied using IBM SPSS version 20.0 software, and t-score was calculated at 95% significance level for testing different attributes of agriculture. The main attributes taken for the cost of agriculture include the cost of fertilisers, labour, medicines, machinery and irrigations (Nouman et al., 2013; Fernandes et al., 2021). Output or earnings attributes were analysed based on the production of paddy (quintals/bigha), production of straw (INR/bigha) and profit earnings (INR/quintals) from the cultivation (Atkinson et al., 2018; Fernandes et al., 2021). Risk scores were calculated through weighted score techniques and formula (Ibtissen et al., 2015) to reflect the greater importance of average losses among these two variables.

Risk Score = $0.75 * (\text{average severity} * \text{frequency})^{0.5} + 0.25 * \text{worst-case scenario}$

Where, average severity shows in the form of Average Seasonal Loss (ASL) in INR/Bigha, frequency of occurrence indicates the number of months of occurrence and Worst Case Scenario

(WCS) is the maximum limit of losses in INR/Bigha in each attribute for the last five years. **(Medium) = 3, L (Low) = 2 and VL (Very Low) = 1.**

All the attributes are graded into 5 categories like – **VH (Very High) = 5, H (High) = 4, M** and calculated the risk score in Table 2. These are distributed into different attributes

Risk Indicators	Average Severity (Average Seasonal Loss in INR)		Frequency of Occurrence (months)		Worst-Case Scenario (INR)		Risk Score (Calculated)	
	1	2	1	2	1	2	1	2
Crop Pests and Diseases	Low	High	Medium	High	Low	V.high	2.34	4.25
Storm	High	V.high	Low	High	Medium	High	2.87	4.35
Heavy Rainfall	Medium	V.high	Low	Medium	High	V.high	2.84	4.16
Counterfeit Inputs	Low	V.low	Low	V.low	Medium	Low	2.25	1.25
Drought or Less Rainfall	High	Low	Medium	Low	V.high	Medium	3.85	2.25
Price risk	High	V.low	V.high	Medium	V.high	Medium	4.61	2.05
All Other Naturals	Low	Medium	Low	Medium	Low	Medium	2.1	3.0
Post-Harvest Revenue Loss	Low	Medium	V.low	Low	Low	Medium	1.56	2.59
Labour Availability	Medium	Low	Medium	V.low	High	Low	3.25	1.31
Floods	Medium	High	V.low	Medium	High	V.high	2.30	3.85

Index : 1= HYV 2= Gobindabhog
Source: Based on Field Survey, 2020-21.

The risk score is calculated using the following point system

Average Seasonal loss(ASL) (INR/Bigha)	Frequency of Occurrence (months) Within the Last Five Years.	Worst Case Scenario(WCS) in a Season (INR/Bigha)
V. Low(--)= <250	V. Low (++) = >48	V. Low (--) = <2000
Low (-) = 251 to 500	Low (+) = 37 to 48	Low (-) = 2001 to 4000
Medium = 501 to 750	Medium = 25 to 36	Medium = 4001 to 6000
High (+) = 751 to 1000	High (-) = 12 to 24	High (+) = 6001 to 8000
V. High (++) = >1000	V. High (++) = <12	V. High (++) = > 8000

Source: Based on Field Survey 2020-21

Socio-economic development was assessed through analysing the participant's thematic narratives about their livelihood condition, family income, marital status, out-migration from agricultural sectors, educational level, household expenditure and consumption,

building assets, etc. (Ullah et al., 2016; Investment Centre Division, FAO, UN, 2011).

Findings

The study tries to determine the socio-economic and environmental viability of the Gobindabhog variety in the study region. The Student t-test result shows a significant variation between these two variables in major cases (Table 3). These are as follows:

Cost of Agriculture

Comparative analysis of student t-test at 95% significance level reveals that, all the other costs

of agricultural attributes vary significantly (Table 3). It is evident from the ground survey that, in Gobindabhog indigenous cultivation, local labour supply (Figures 4 & 6), uses of bio fertilisers (Pal, 2015), manures and fewer uses of medicines reduce the cost of production of rice. Minimum uses of irrigation water than HYV’s helps to preserve groundwater in Gobindabhog farming (Karforma, 2021). The farmers are very much acquainted with their ancestors’ cultivation techniques (Rizwan and Liyaqat, 2011; Bokaria, 2015). These techniques reduce the cost of production of Gobindabhog rice in many cases.



Figure 5



Figure 6

Use of Local Labourers for Threshing and Collection of Gobindabhog Rice

Source: Field Survey, 2020-21

Table 3: Indicators of Rice Production—M, SD, N and Calculated t-Score of Attributes									
Indicators	N		Mean		SD (Standard Deviation)		Sig. (two tailed) t-value	df (Degree of Freedom)	95% Confidence Level
	1	2	1	2	1	2			
Fertiliser cost	15	15	1611.7	1038.0	235.8	83.59	.0	28	p<0.05
Labour cost	15	15	4902.7	4798.3	247.4	175.1	0.193	28	p<0.05
Medicine cost	15	15	1858.3	1069.0	512.4	280.24	.0	28	p<0.05
Machinery cost	15	15	999.0	906.0	56.09	97.43	0.003	28	p<0.05
Irrigation cost	15	15	1044.7	699.7	99.7	151.99	.0	28	p<0.05
Production of paddy (quintals/bigha)	15	15	11.7	7.13	2.46	3.58	.0	28	p<0.05
Production of straw (INR/bigha)	15	15	301.0	501.66	60.0	134.12	.0	28	p<0.05
Profit earnings (INR/bigha)	15	15	166.06	278.53	25.91	15.77	.0	28	p<0.05

Index : 1 = HYV 2 = Gobindabhog
 Source: Based on Field Survey, 2020 – 21.

Output

Output or production from agriculture is another important criterion for comparing of such two varieties. Student t-test at 95% significance level of these attributes (Table 3; Figures 7 & 8) tallies with the farmers' opinion about the differences of these two variables. It shows, the production of HYV is far better than Gobindabhog rice. However, paddy's demand and market price, including straw (plant residues) and profit

margin, is much higher in Gobindabhog cultivation (Atkinson et al., 2018). Again massive production of HYV leads to a higher supply than demand and result in less market price and profit (Singh et al., 2013). Whereas Gobindabhog rice shows a constant increase in profit margin each year. Its ever-increasing demands, nutritious values (Ghosh, 2015), multi-dimensional uses, etc. are the main reasons for its better profit in the market (Khairullah, 2020; Radhakrishnan, 2019).

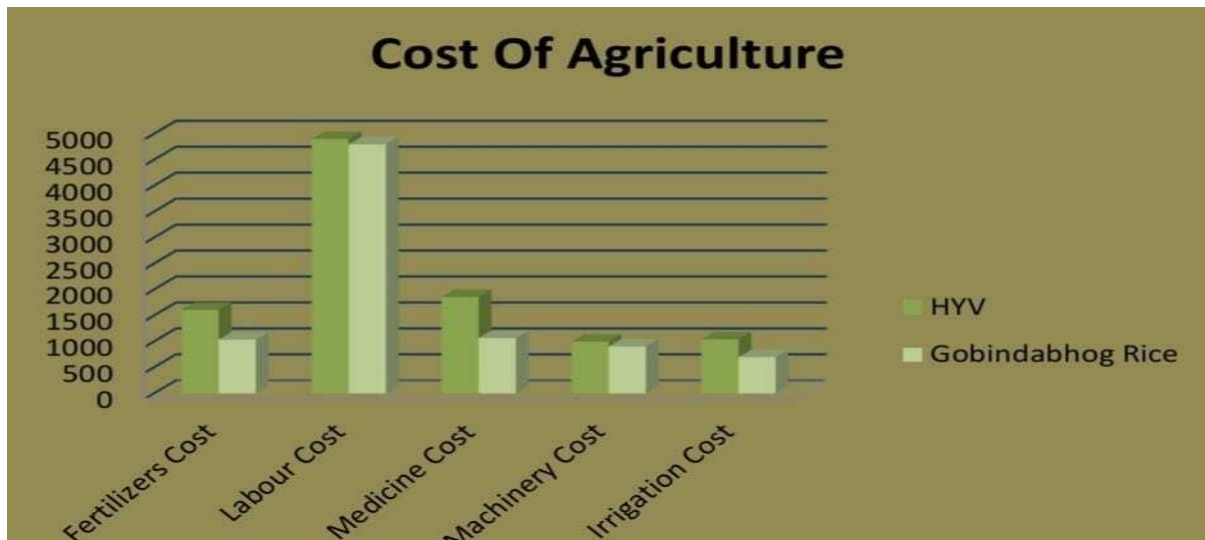


Figure 7: Cost of Agriculture
 Source: Based on the Mean Value of Attributes (Table 3)

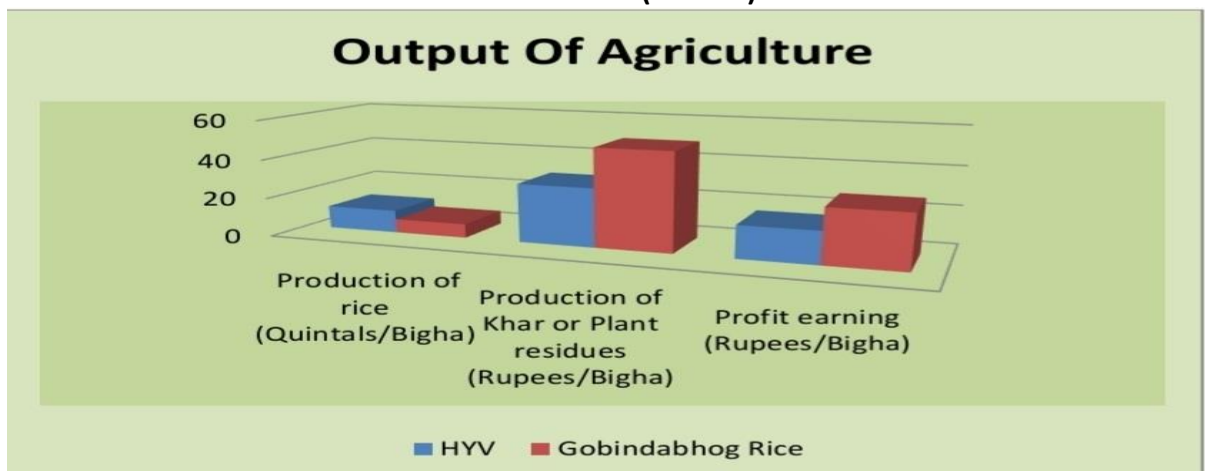


Figure 8: Output of Agriculture
 Source: Based on Mean Value (Table 3)

Risk Assessment

Risk assessment study is a vital tool for cost-benefit comparison and vulnerability (Atkinson et al., 2018). It has been observed from Table 3 that, a risk score of maximum attributes shows a better condition in HYV rice cultivation. But one

thing must be noticeable from the score table that price fall risk and uncertainty and requirement of labourers are comparatively less in the case of Gobindabhog cultivation. The farmers, who participated in the research reckon that the market price of Gobindabhog (Pal, 2016) is much higher with an increasing trend. This is

because of its regional and national market demand. Price fall-risk is less in Gobindabhog rice. Again for fetching higher prices in the market, they preserve it in an eco-friendly way (Figure 9). In contrast, HYV rice price-fall is more common than its hikes. This is due to substantial mono-crop production in the study region and



Figure 9: Eco-conservation of Gobindabhog Rice for Preserving Qualities and Fetching Higher Market Price

Source: Field Survey 2020-21

Impact on Social Status

Social status is a crucial indicator for revealing the development of agriculture in an agrarian society. Social status analysis can be used in a wide range of rural development contexts (Investment Centre Division, FAO., 2011). The thematic narratives of the farmers voices indicate the level of socio-economic development of the study area. It also shows the comparison of earnings and livelihood of the farmers associated with Gobindabhog and HYV's rice cultivation. Family income of the farmers, building of assets, educational attainment, enjoying modern amenities and machinery (Figure 10), etc. may be taken as indicators of socio-economic development of the study area used for cultivation of Gobindabhog rice (Pal, 2016; Ullah et al., 2016).

It has been seen that profit is the main objective above all attributes according to the farmers. One of our respondents (M, 61Y) viewed:

I have practised this variety since 1985 with my father,

its main uses as a staple diet. On the other hand, local labour, ITK. (Indigenous Technical Knowledge) gathered from their ancestors also reduce the necessity of hired labourers in Gobindabhog cultivation (Eliazar Nelson et al., 2019; Pal, 2016).



Figure 10: Use of a Personal Tractor in the Collection of Crops from the Fields as an Indicator of Rural and Agricultural Development

and it is still profitable. Most of our family expenditure and building assets are managed aptly by the surplus profit from Gobindabhog rice. Again, I want to start a business in near town for another source of income depending on its earnings.

Internal household and livelihood dependency on agriculture can be assumed after the voice of a homemaker of a farmer, S.N. (F, 55Y)-

Our household expenditure including the educational expenses of son and daughter, the marriage of a daughter and other basic needs like clothing, fooding, maintenance of the house, etc. solely come from the direct income of indigenous farming, as it is the main occupation of our family. Though we also cultivate HYV

rice, these are mainly for our household purposes (rice, puffed rice).

It has been observed during the interview of a young generation farmer A.R. (M, 22Y); who is joining Gobindabhog cultivation with his family members and viewed:

After graduation, I am interested in cultivation with my father and brother as it is a profitable source and cultivated commercially. Hence, the scope of earnings is more than HYVs cultivation. Therefore, it is suitable for me to join it until I can not get a job. It will save hired labour costs for my family. Its increasing demand and market price are motivating the young farmers.

We argue that the participation of the young generation would restrict the out-migration, whereas it is just the reverse in the HYV's farming field. One of our respondents, HYV rice farmer (M, 51Y) opined-

We are less interested in HYVs farming in the present day due to its diminishing return. Sometimes the cost-profit ratio is the same, but we are bound to cultivate it due to no other option. Otherwise, we have to leave our land uncultivated. Massive productions of HYV rice reduced the market demand and we have to store it long time till the price will hike, but this is not possible for mediocre level farmers like us.

Discussion with farmers also reveals the reasons for the concentration and development of Gobindabhog cultivation in such micro-level areas. A senior farmer (M, 68Y) said that:

Gobindabhog paddy cultivation needs proper caring and nourishment from natural hazards, just like a newborn baby. It also requires a special rice milling process, which is mainly concentrated in these three blocks only.

It is evident from the secondary sources and field survey that out of 379 rice mills in Purba Bardhaman district, we witnessed 155 within these three blocks (National Informatics Centre, Purba Bardhaman, 2015). These milling processes are of utmost necessity for such small-fine grain aroma rice (Roy, 2015). It is one of the critical barriers to expanding such varieties in other regions. The above thematic narratives of the farmers and their family members reveal that the socio-economic status of these blocks is far better than the rest of the district. This is because of Gobindabhog cultivation predominancy compared to HYV's and its ever-increasing profit trend. Socio-economic development can be assumed from the application of modern social amenities, material progress, and the better livelihood of the farmers associated with Gobindabhog rice farming compared to HYV's dominant regions.

Discussions

The above analysis shows that the indigenous Gobindabhog variety is currently more profitable and suitable than HYV's rice cultivation in the study area. Such indigenous variety is eco-friendly and qualitative in nature (Joshi and Singh, 2006; Das and Das, 2014; Khairullah, 2020; Radhakrishnan, 2019). Farmers of this region were suffering from less return or profit through HYV's rice cultivation, especially after the 1990s, and they needed an alternative for better return and reduction of the cost of production. Again, the present analysis shows that the socio-economic risks are less in the Gobindabhog variety (Pal, 2015) and are more demandable (both at national and regional markets) than HYV's (Blakeney et al., 2020).

Gobindabhog rice has a long and independent history of evolution, making this variety more distinct from the modern HYVs rice. The sustainability of the district's agricultural

production in the current environment of climate change, which adversely affects agricultural productivity vis-à-vis the increased cost of production may be tackled through the expansion of Gobindabhog indigenous cultivation (Pal, 2015). Again, this variety has already gained considerable attention in the international market for its uses in multinational cuisines and was also featured in global sporting events (Blakeney et al., 2020). Therefore, the government's support to the farmers' for the propagation of Gobindabhog farming on a small and large scale and administrative measures taken for improving marketing strategies may create a broader scope for the farmers of this region (Pal, 2016).

Conclusion

The fundamental purpose of this study was to show how Gobindabhog rice can be developed as an alternative source of sustainability in the study area. The above analysis and discussions made it clear that indigenous rice farming like Gobindabhog variety can play a vital role in the socio-economic development of the farmers than HYV's in the study area (Ghosh et al., 2015; Pal, 2016). Such farming is also viable from environmental concerns in contemporary situations (Nagarajan, 2018; Sharma et al., 2018). So, cultivation and expansion of indigenous varieties along with HYV's may open a new dimension in this district's 'rice after rice' region. The new generation farmers are liberal in accepting any modern changes which are profitable for them (Ghorai et al., 2014; Bokaria, 2015; National Consortium of SRI, 2014). The research suggests increasing the awareness and encouragement of small and marginal farmers for the expansion of such indigenous varieties along with HYV's and make agriculture economic (Kumar and Sahu, 2018) and eco-friendly.

Limitations of the present study

The research was conducted in the ongoing climate of Covid-19 pandemic. Hence, the study could not include large number of samples. We also faced hindrances in secondary data collection from the offices and local institutions.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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Sabyasachi Chatterjee (corresponding author) conducted the empirical research; searched the literature and other resources; collected references; applied the software and worked on validation of data; also critically analysed the data, developed the maps, tables and figures and wrote the original draft.

Dr Samir Kurmar Samanta actively participated in conceptualisation, methodology, curation; cross-checking of references; editing; reviewing; guidance and administration of the research work.